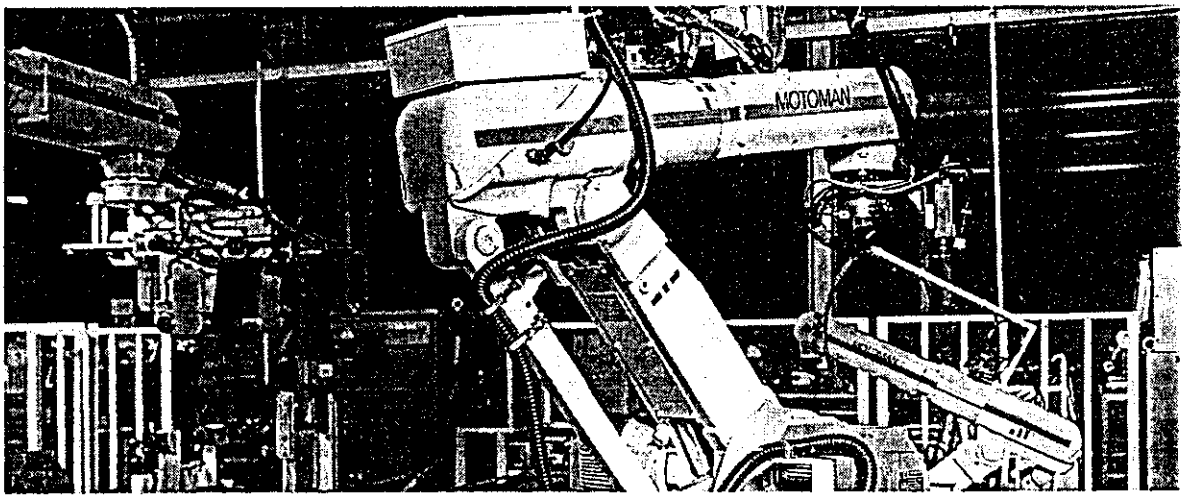
INSTRUCTIONS

EXTERNAL AXIS SETTING

YASNAC MRC CONTROLLER FOR INDUSTRIAL ROBOT MOTOMAN



Before initial operation, read these instructions thoroughly, and retain for future reference.

YASKAWA

HW9481098

CONTENTS

1. INTRODUCTION

MRC performs external axis control by software servo as well as by basic robot axes.

This instruction manual describes the rotary switch and shorting pin settings which specify the axes to be used for the SERVOPACK and MSV01 board. It also shows the combination of motor type and SERVOPACK type in the table and describes how to set motor constants and servo constants which are required for MRC external axis control.

2. HARDWARE AXIS SETTING

When external axes are used in the YASNAC-MRC, it is necessary to set rotary switch and short pins for the SERVOPACK and servo control board MSV01.

2.1 SERVOPACK Axis Setting (Rotary Switch Setting)

It is necessary for each YASNAC-MRC SERVOPACK to specify axes (number of axes it is using) disregarding to 1-axis collection or 3-axis collection. This paragraph first describes the 1-axis collecting SERVOPACK and then the 3-axis collecting SERVOPACK.

2.1.1 1-axis collecting SERVOPACK axis setting

Set the rotary switch shown in Fig. 1 (a) according to the following table.

Axis Used	Setting of Rotary Switch	Connection with MSV Board
External 1st axis	0	Connected to CN01
External 2nd axis	1	Connected to CN02
External 3rd axis	2	Connected to CN03
External 4th axis	0	Connected to CN04
External 5th axis	1	Connected to CN05
External 6th axis	2	Connected to CN06

Example) When external 1st axis is used, set the rotary switch to "0".

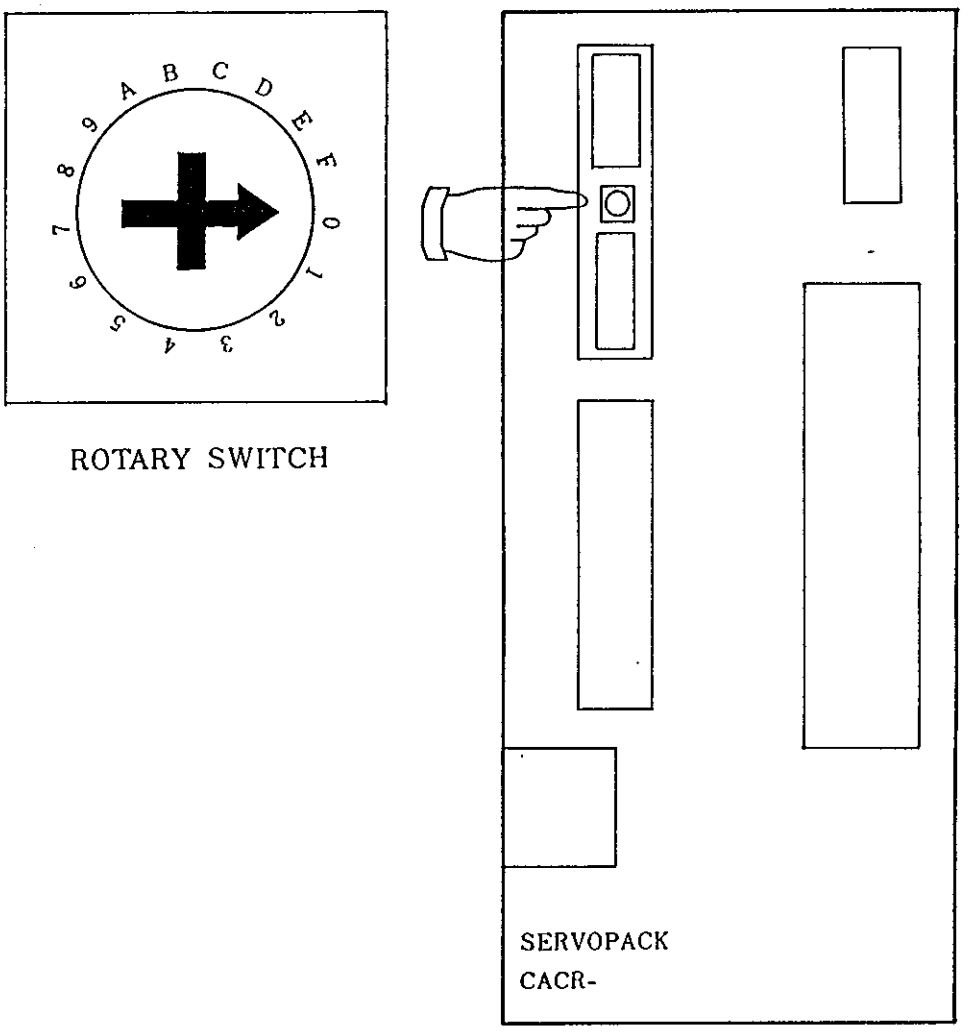


Fig. 1 (a) Rotary Switch Setting of 1—axis Collecting SERVOPACK

2.1.2 3—axis collecting SERVOPACK axis setting

Set the rotary switch shown in Fig. 1 (b) according to the following table. 3—axis collecting SERVOPACK can make other combinations of many types of axes in addition to the following table. However, basically, set the rotary switch according to the table.

Number of External Axes Used	Axis Used			Setting of Rotary Switch
	1st Axis	2nd Axis	3rd Axis	
1	1st external axis	Not used	Not used	6
2	1st external axis	2nd external axis	Not used	F
3	1st external axis	2nd external axis	3rd external axis	0

Then the 1st external axis is connected to MSV board CN1, 2nd external axis to MSV board CN2 and 3rd external axis to MSV board SN3.

Example)

When 3—axis collecting SERVOPACK is used for the 1st external axis and the first axis is used as 1st external axis, set rotary switch to "6".

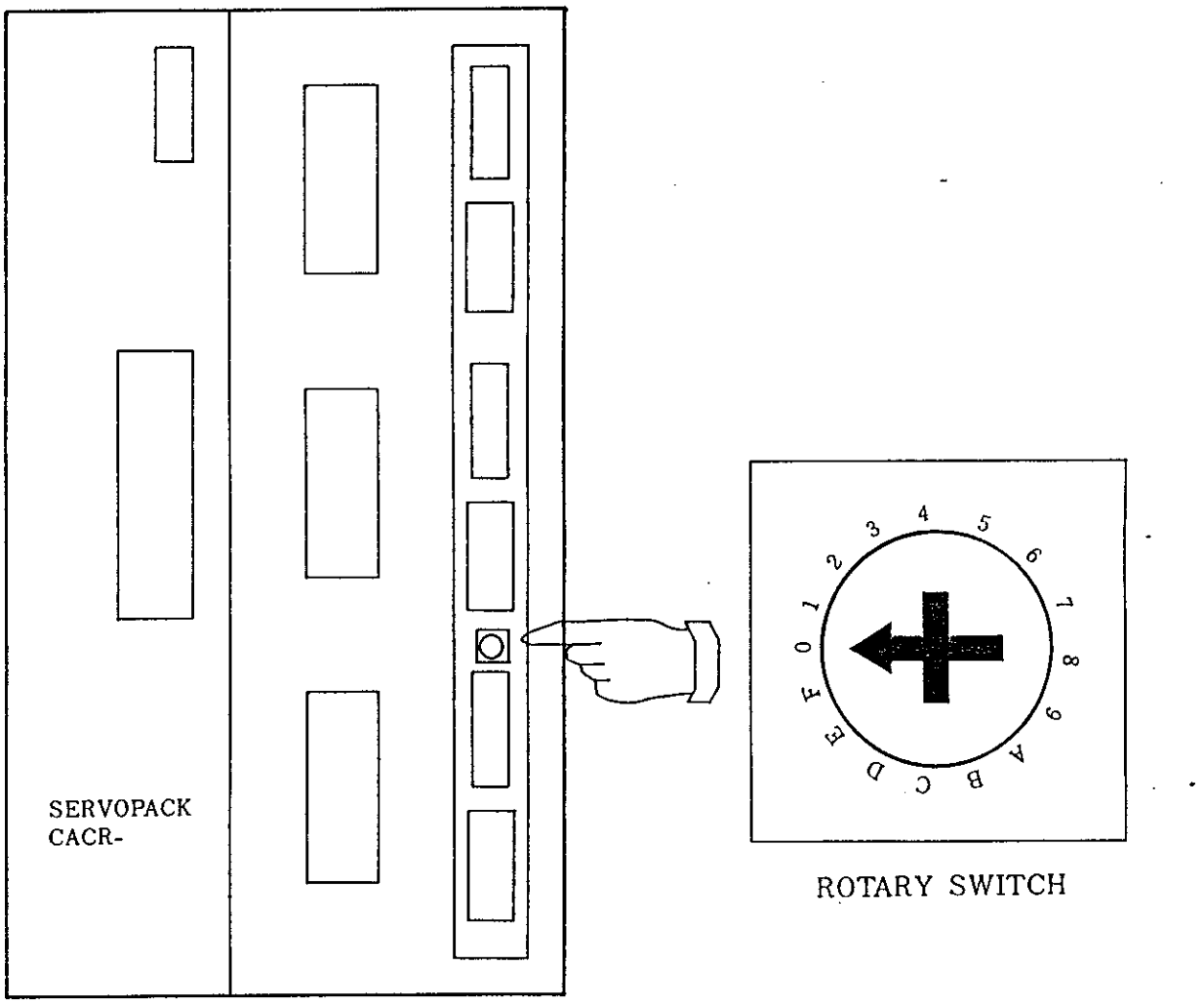


Fig. 1 (b) Rotary Switch Setting of 3—axis Collecting SERVOPACK

2.2 MSV01 and MSV02 Board Shorting Pin Setting

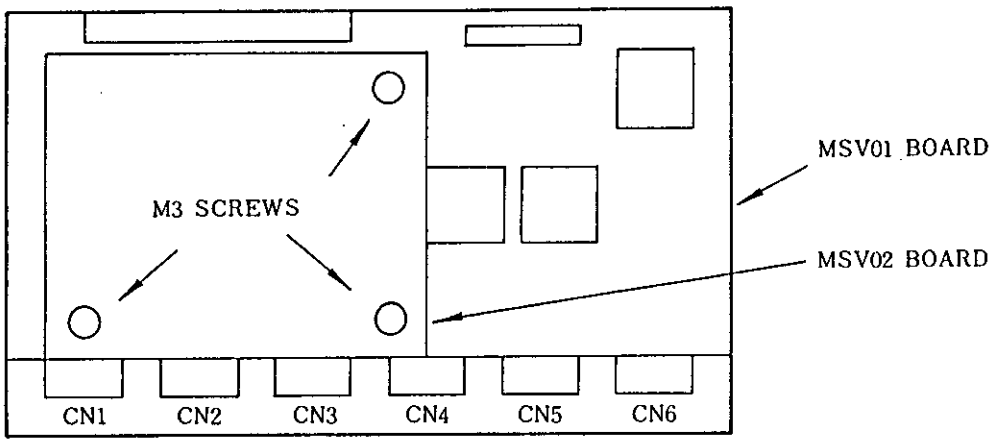
When external axes are used, the axis control CPU board is needed for external axes.

For one to three external axes, the MSV01−1 board is used. Each four to six external axes are used, MSV01−2 board and MSV02 board are used. Each board controls three axes. Therefore, when one external axis is used, the control circuits for the remaining two axes are not connected. The remaining two axes are unused axes.

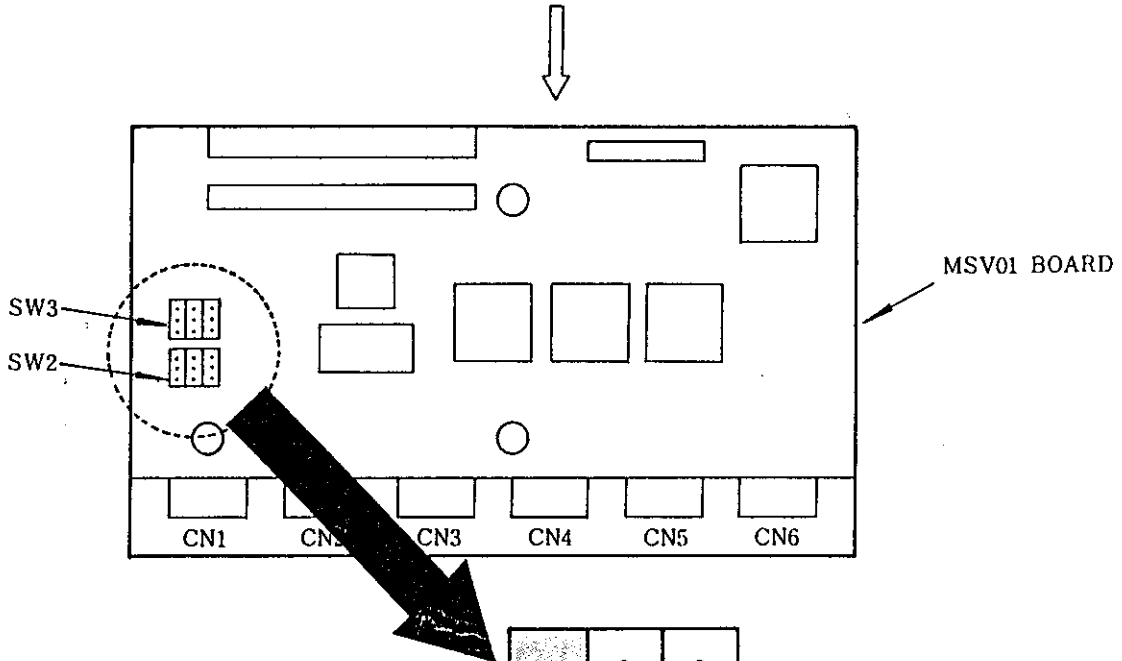
For unused axes, shorting pin setting is needed for the MSV01−1 board or MSV01−2 board.

Shorting pin setting method is described below.

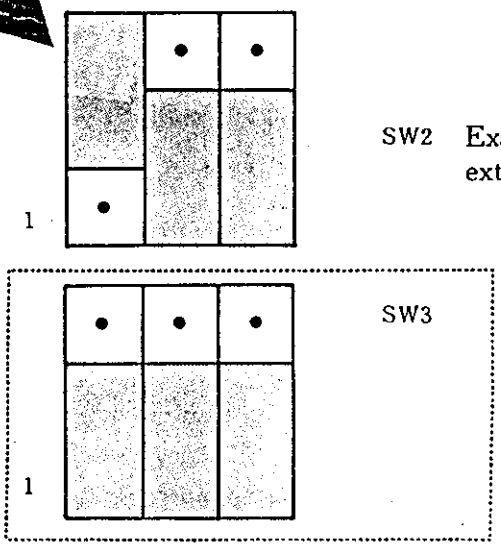
If shorting pin setting is not made for unused axes, alarm status is entered internally and the servo power supply cannot be turned ON. (When the servo ON button is depressed, "alarm 1040: SYSCON section system error (1)" occurs and the servo power supply cannot be turned ON.)



Remove M3 screws with which the MSV02 board is mounted on the MSV01 board, and remove the MSV02 board. (Only MSV01−2 board is needed.) Since the MSV01−1 board is used for up to three external axes, the above operation is not needed.

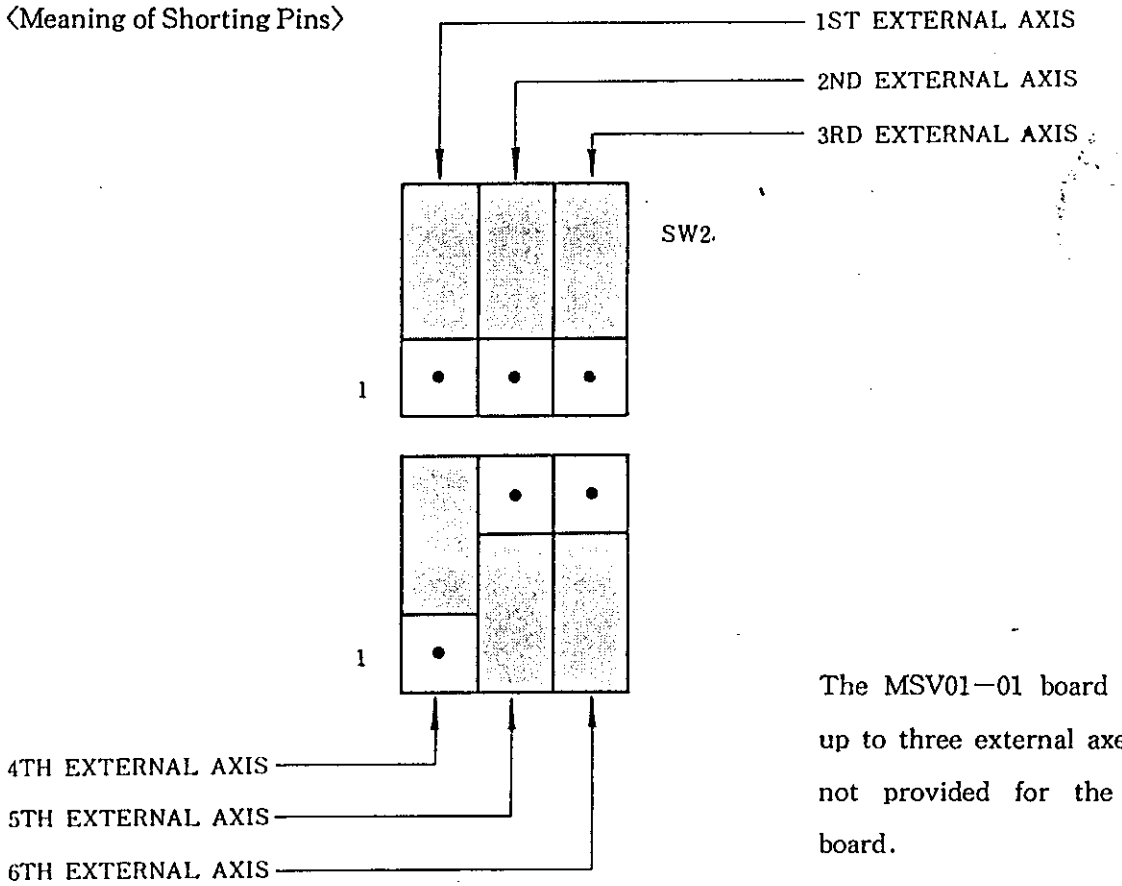


The MSV01−01 board is used for up to three external axes. SW3 is not provided for the MSV01−1 board.



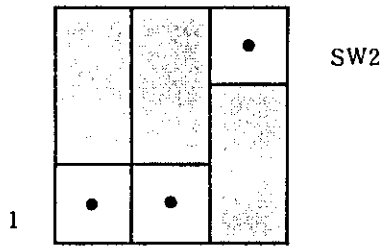
SW2 Example: One external axis used

〈Meaning of Shorting Pins〉



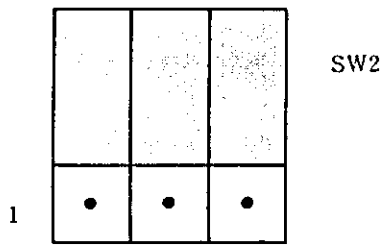
The MSV01−01 board is used for up to three external axes. SW3 is not provided for the MSV01−1 board.

〈Typical Setting〉



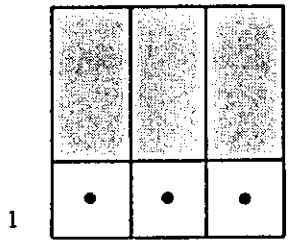
When two external axes are used

(Since the MSV01−1 board is used, SW3 is not needed.)

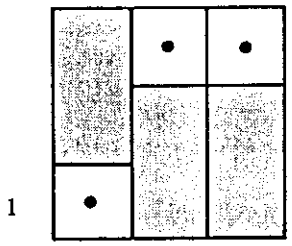


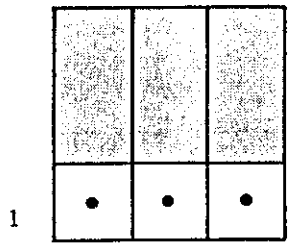
When three external axes are used

(Since the MSV01−1 board is used, SW3 is not needed.)

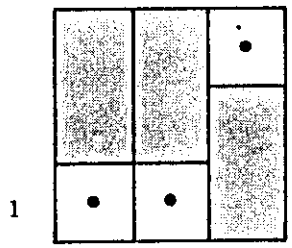


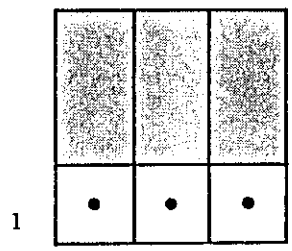
When four external axes are used



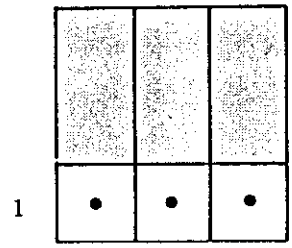


When five external axes are used





When six external axes are used



3. COMBINATION OF MOTOR TYPE AND SERVOPACK TYPE

Motor Capacity (kw)	Motor Type	SERVOPACK Type CACR-	No.of Encoder Bits
0.1	USAREM-01YRW11	IR01SFB	12
0.2	USASEM-02YRW11	IR02SFB	12
0.5	USASEM-05YRW11	IR05SFB	12
0.8	USASEM-08YRW11	IR10SFB	12
1.3	USADED-13YRW11	IR15SFB	12
1.5	USASEM-18YRW11		12
2.2	USADED-22YRW11	IR30SFB	12
3.2	USADED-32YRW11	IR44SFB	12
4.0	USADED-40YRW11		12
4.5	USADED-45YRW11		12

NOTES

1. Use the motor and SERVOPACK combined as shown above. For any combination other than those shown above, contact your YASKAWA representative.
2. Normally, 3-axis collecting SERVOPACK is not used for external axes.

4. MOTOR CONSTANT PARAMETER SETTINGS

(SYSTEM CONFIGURATION)

For the YASNAC−MRC, it is necessary to set servo constants according to the motor used for external axes. Servo constants are set by registering them from the table of the motor characteristics to the SVC parameter. However, motor constants of the main models have already been registered in PROM. By specifying the motor model to be used on the programming pendant by the system configuration at system startup, parameters are automatically set.

The following describes the system configuration method.

4.1 System Configuration

It is necessary to set parameters according to the external axis system configuration in order to use external axes with the YASNAC−MRC. This is called "system configuration".

System configuration is enabled in the interactive method in the "system configuration" screen in the maintenance mode.

Parameters can be set automatically by the system configuration function for any external axis system of standard combinations.

The following describes the items to be set by the system configuration for the external axis system:

- Number of robots, bases and stations
- Robot model
- Model of base and each axis motor
- Model of station and each axis motor

For the system configuration, various settings are enabled in addition to the above. In this paragraph, only sections related to the external axis system will be described.

NOTE

When any external axes are added or changed, job data obtained up to that time cannot be used. (After completion of setting, initialize the job file.)

4.1.1 Preparation before setting

Before performing system configuration, the following must be prepared.

① Record of changed parameters

Record parameters of which soft limit value, etc. have been changed from the initial values.

② Verification of robot model

Verify the model of robot used. When one MRC controller controls two robots, verify the model of both robot 1 and robot 2.

③ Batch save of CMOS

To return to the former status in case of a wrong setting or the like, load CMOS batch saved before changing operation.

For batch save of standard CMOS, one floppy disk (2DD, 2HD) is needed.

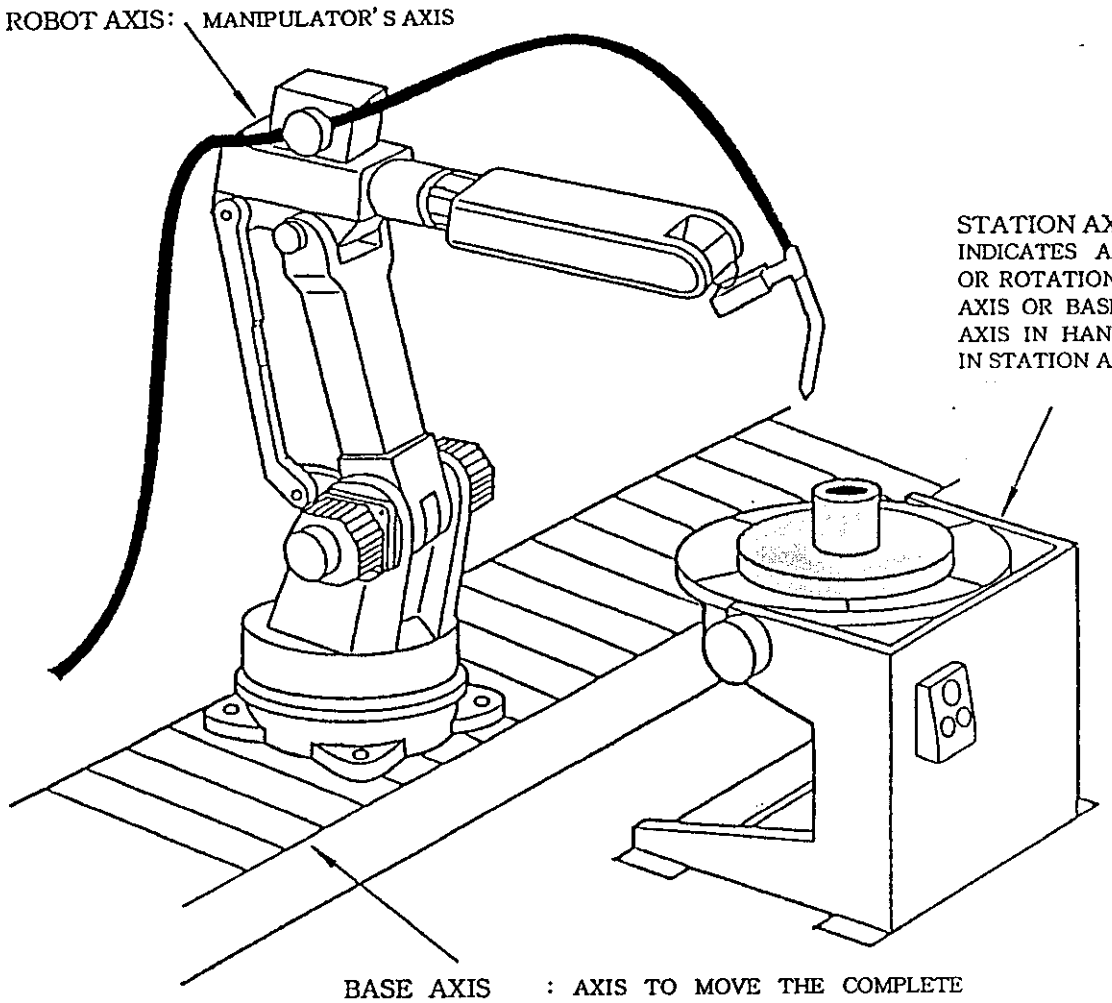
4.1.2 Type of external axis system

In the system configuration, the user determines whether his external axis system is to be defined as a station axis or base axis in the YASNAC—MRC and assigns each axis to the base or station to be set.

The YASNAC—MRC has two bases and six stations; up to three axes can be set to one base and one station, totaling up to 21 axes. Therefore, various settings are available according to the user's external axis system.

4.1.3 Definition of station and base

The following shows the station and base.



4.2 Setting System Configuration

Turn OFF the control power supply and set the MCP01 board rotary switch to "7". Then turn ON the control power supply again. The following "maintenance mode" screen is displayed.

By depressing [ENTER] in each screen shown below after completion of setting, the screen changes automatically to the next one.

However, "model selection screen" or "motor selection screen" is not always displayed depending on the setting of "control axis configuration screen".

By depressing [CANCEL], the setting is invalidated and the screen is returned to the previous one.

〔Maintenance Mode Screen〕

```
  MAINTENANCE MODE

  SETUP SYSTEM
  SYSTEM VERSION
  HARDWARE DIAGNOSTICS




SEL BY ↑ ↓ /EXEC BY <ENTER>
```

To perform system configuration, select "SETUP SYSTEM" and depress [ENTER].

↓

〔System Setting Screen〕

```
  SETUP SYSTEM

  SYSTEM CONFIGURATION
  INITIALIZE FILES
  INITIALIZE ROM FILE




SEL BY ↑ ↓ /EXEC BY <ENTER>
RETURN BY <CANCEL>
```

Select "SYSTEM CONFIGURATION" and depress [ENTER], and the screen shown below is displayed.

↓

〔System Configuration Screen〕

```
  SYSTEM CONFIGURATION

  INITIALIZE
  MODIFY
  DISPLAY




SEL BY ↑ ↓ /EXEC BY <ENTER>
RETURN BY <CANCEL>
```

Select "DISPLAY" and depress ENTER .

↓

〔Display Screen〕

```
  DISPLAY

  LANGUAGE
  CONTROLLED AXES
  APPL
  IO MODULES
  SENSOR FUNCTION
  CMOS MEMORY


SEL BY ↑ ↓ /EXEC BY <ENTER>
RETURN BY <CANCEL>
```

Select "CONTROLLED AXES" and despress ENTER .

↓

〔Controlled Axes Screen〕

```
  CONTROLLED AXES

  ROBOT
  BASE
  STATION




SEL BY ↑ ↓ /EXEC BY <ENTER>
RETURN BY <CANCEL>
```

Select "ROBOT" and depress ENTER .

↓

〔Model Display Screen (Robot)〕

```
ROBOT

ROBOT-1          ->K30-A00
ROBOT-2          ->NONE




RETURN BY <CANCEL>
```

The currently set model is displayed. In this example, K30-A00 is selected for robot 1; robot 2 is not provided.

In the above screen, write down the robot model names for robot 1 and robot 2. In this example, write down "K30-A00" for robot 1 and "NONE" for robot 2.

After writing, return to the system configuration screen. Each time CANCEL is depressed, the previous screen is displayed. Repeat this operation until the system configuration screen is displayed.

4.3 Change of Control Axis Setting

To add external axes, execute "MODIFY" in the following procedures.

Select "MODIFY" in the system configuration screen.
↓
Select "CONTROLLED AXES" in the modify screen.
↓
Axes configuration screen
↓
Model selection screen (robot 1)
↓
Model selection screen (robot 2) : Only when two robots are provided.
↓
Model selection secreen (base 1) : Only when base 1 is provided.
↓
Motor selection screen (base 1) : Only when base 1 is provided.
↓
Model selection secreen (base 2) : Only when base 2 is provided.
↓
Motor selection screen (base 2) : Only when base 2 is provided.
↓
Model selection screen (station 1): Only when station 1 is provided.
↓
Motor selection screen (station 1): Only when station 1 is provided.
↓
Model selection screen (station 2): Only when station 2 is provided.
↓
Motor selection screen (station 2): Only when station 2 is provided.
↓
Model selection screen (station 3): Only when station 3 is provided.
↓
Motor selection screen (station 3): Only when station 3 is provided.
↓
Model selection screen (station 4): Only when station 4 is provided.
↓
Motor selection screen (station 4): Only when station 4 is provided.
↓
Model selection screen (station 5): Only when station 5 is provided.
↓
Motor selection screen (station 5): Only when station 5 is provided.
↓
Model selection screen (station 6): Only when station 6 is provided.
↓
Motor selection screen (station 6): Only when station 6 is provided.
↓
Verification of execution
↓
Completion (Return to the modify screen.)
↓
Completed
(Return to the system configuration screen.)
↓

Verification of setting results
↓
Initial setting of job file

≪Example 1≫
When one robot is provided and the external axis is one station axis, take the following procedures:

Select "MODIFY" in the system configuration screen.
↓
Select "CONTROLLED AXES" in the modify screen.
↓
Axes configuration screen
↓
Model selection screen (robot 1)
↓
Model selection secreen (station 1)
↓
Motor selection screen (station 1)
↓
Verification of execution
↓
Completion (Return to the modify screen.)
↓
Completed
(Return to the system configuration screen.)
↓
Verification of setting results
↓
Initial setting of job file

≪Example 2≫
When one robot is provided and the external axis is one base axis, take the following procedures:

Select "MODIFY" in the system configuration screen.
↓
Select "CONTROLLED AXES" in the modify screen.
↓
Axes configuration screen
↓
Model selection screen (robot 1)
↓
Model selection secreen (base 1)
↓
Motor selection screen (base 1)
↓
Verification of execution
↓
Completion (Return to the modify screen.)
↓
Completed
(Return to the system configuration screen.)
↓
Verification of setting results
↓
Initial setting of job file

The description hereafter will be given with the following example:

Robot : K30-A00, one unit
Station : 1 axis
Motor used: USASED-13-YR21

4.3.1 Modify screen

By selecting "MODIFY" in the system configuration screen, the screen is changed to the following screen.

〔Modify Screen〕

```
  MODIFY

  LANGUAGE
  CONTROLLED AXES
  APPL
  IO MODULES
  SENSOR FUNCTION
  CMOS MEMORY


SEL BY ↑ ↓ /EXEC BY <ENTER>
RETURN BY <CANCEL>
```

Select "CONTROLLED AXES" and depress ENTER.

The screen is changed to the control axis configuration screen.

4.3.2 Control axis configuration screen

In this screen, set the number of robots, whether base provided/not provided and number of stations.

〔Controlled Axis Configuration Screen〕

```
  AXES CONFIGURATION

  ROBOT COUNT      1      2

  BASE  1          OFF    ON
  BASE  2          OFF    ON

  STATION COUNT    0  1  2  3  4  5  6


SEL ITEM BY ↑ ↓ /SEL OPTION BY ← →
CONFIRM BY <ENTER>/ABORT BY <CANCEL>
```

ROBOT COUNT : Set the number of robots to be used.

BASE 1 : Set "OFF/ON" of traveling axis to move robot -1.

BASE 2 : Set "OFF/ON" of traveling axis to move robot -2.
When robot-2 does not exist, base-2 cannot be set to "ON".

STATION COUNT: Set the number of stations to be used. For example, when the number of stations is selected as "3", stations-1 to-3 are set.

Select the number of robots, base ON/OFF and number of stations, and depress ENTER.
The screen is changed to the model selection screen.

If the combination is not proper, an error occurs.

Since one robot and one station axis are provided in the example, move the cursor to the number of robots "1" and the number of stations "1" and depress ENTER.

4.3.3 Model selection screen (robot)

In this screen, the model name of the robot to be used is selected and set. When one robot is used, set the model name of the robot to be used for robot 1.

When the robot operated immediately before the system configuration, verify that the robot model is recorded in "4.2 Setting System Configuration" has been set, and depress only ENTER.

〔Robot Model Selection Screen〕

```
  SELECT MACHINE
  ROBOT1          ->*
 K6-A30     K60C-A10  *          *
 K10-A00    K100-A00  *          *
 K10SB      K100C-A10 *          *
 K30-A00    *         *          *
 K30-A41    *         *          *
 K60-A00    *         *          *


SEL BY ↑ ↓ ←→/SEL NEXT PAGE BY <MORE>
CONFIRM BY <ENTER>/ABORT BY <CANCEL>
```

The list of the registered robot models is displayed.

Select the model and depress ENTER. By setting the control axis configuration screen, either screen of "4.3.4 Model selection screen (bases 1 and 2)" or "4.3.5 Model selection screen (station)" is displayed.

Since the robot is K30-A00 in the example, move the cursor to K30-A00 and depress ENTER.

When two robots are used (when "ROBOT COUNT = 2" is selected in the control axis configuration screen), assign the corresponding robot models to robot 1 and robot 2, respectively. However, since assigning method depends on the controller to be used, verify the specifications of the controller before assigning the corresponding robot models to robot 1 and robot 2, respectively. If the specifications of the controller are not clear, contact your YASKAWA representative.

4.3.4 Model selection screen (bases 1 and 2)

When "BASE 1" is selected as "ON" in the control axis configuration screen, the following base model selection screen (base 1) is displayed. Selection of base model can be made among 7 types depending on which direction the robot coordinate the base axis operates in or depending on the number of operating axes. For each type, refer to "4.3.6 Type of external axes".

〔Base model selection screen (base 1)〕

```
  SELECT MACHINE
  BASE1          ->*
 RECT-X    RECT-XYZ  *         *
 RECT-Y    *         *         *
 RECT-Z    *         *         *
 RECT-XY   *         *         *
 RECT-XZ   *         *         *
 RECT-YZ   *         *         *


SEL BY ↑ ↓ ←→/CONFIRM BY <ENTER>
RETURN BY <CANCEL>
```

RECT−X : Cartesian X−axis type (1 axis)
RECT−Y : Cartesian Y−axis type (1 axis)
RECT−Z : Cartesian Z−axis type (1 axis)
RECT−XY : Cartesian XY−axis type (2 axes)
RECT−XZ : Cartesian XZ−axis type (2 axes)
RECT−YZ : Cartesian YZ−axis type (2 axes)
RECT−XYZ: Cartesian XYZ−axis type(3 axes)

Select the model and depress ENTER. The screen is changed to "4.3.6 Motor selection screen". Set each motor model for the number of axes used.

When "BASE 2" is selected as "ON" in the control axis configuration screen, the base model selection screen (base 2) is displayed after base 1 motor model selection is performed. Therefore, set the values in the same way as base 1.

If the total number of axes exceeds 21, an error occurs.

In the example, since there is no base setting, this screen is not displayed.

NOTE: If each base axis does not intersect at a right angle (90°) when the base is composed of more than two axes, the above base models cannot be selected. In this case, contact your YASKAWA representative.

4.3.5 Model selection screen (station)

When any value other than "0" is selected for "STATION COUNT" in the control axis configuration screen, the following station model selection screen is displayed. For the station models, any external axes other than base axes are used; select either 1—axis type, 2— axis type or 3—axis type.

Select;

- TURN-1 for 1—axis type,
- TURN-2 for 2—axis type or
- RECT-XYZ for 3—axis type.

Do not select any models described above since they are still under development for stations.

〔Station Model Selection Screen〕

```
  SELECT MACHINE
  STATION-1       ->*
 TURN-1    RECT-XZ   *         *
 TURN-2    RECT-YZ   *         *
 RECT-X    RECT-XYZ  *         *
 RECT-Y    *         *         *
 RECT-Z    *         *         *
 RECT-XY   *         *         *


SEL BY ↑ ↓ ←→/CONFIRM BY <ENTER>
RETURN BY <CANCEL>
```

Select the model and depress [ENTER]. The screen is changed to "4.3.6 Motor selection screen".

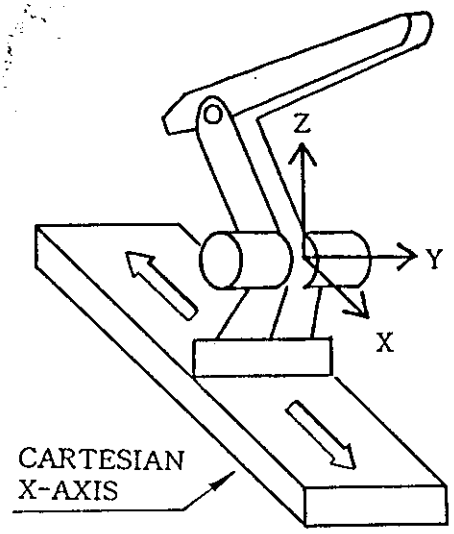
When the number of stations is set to any value more than "2" in the control axis configuration screen, the station model selection screen for station 2 and after is displayed after the motor model selection for station 1. Therefore, make the same setting as that for station 1.

If the total number of axes exceeds 21, an error occurs.

In the example, since one station axis is used, select TURN—1.

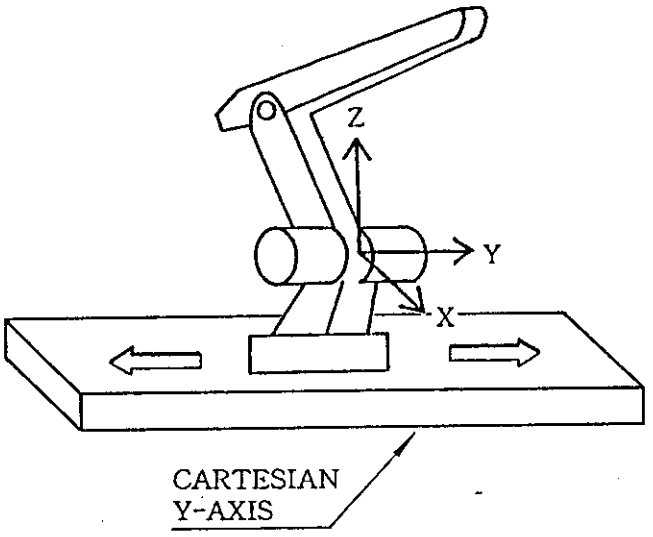
4.3.6 Types of external axes

・RECT−X



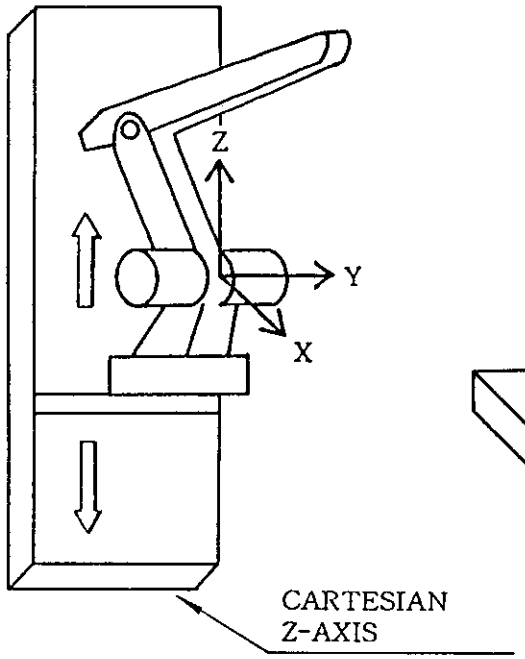
Base axis advance direction coincides with X-axis of the robot coordinate.

・RECT−Y



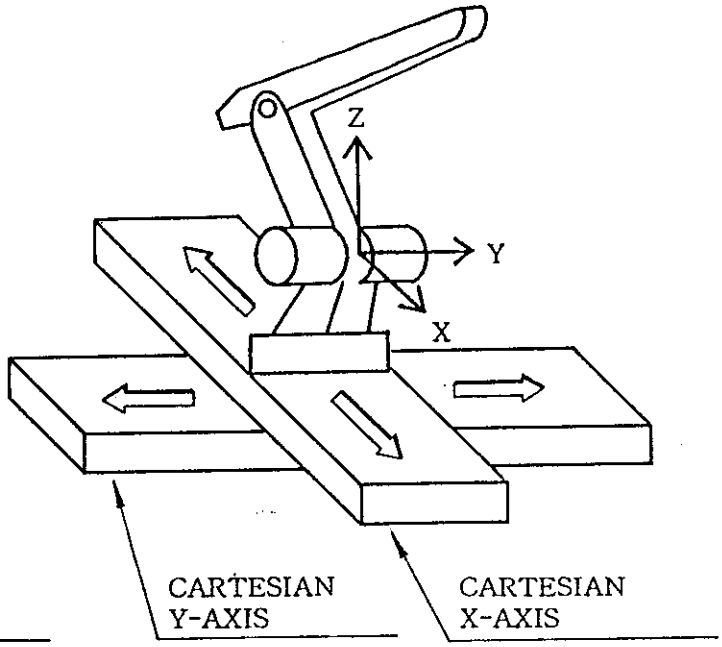
Base axis advance direction coincides with Y-axis of the robot coordinate.

・RECT−Z



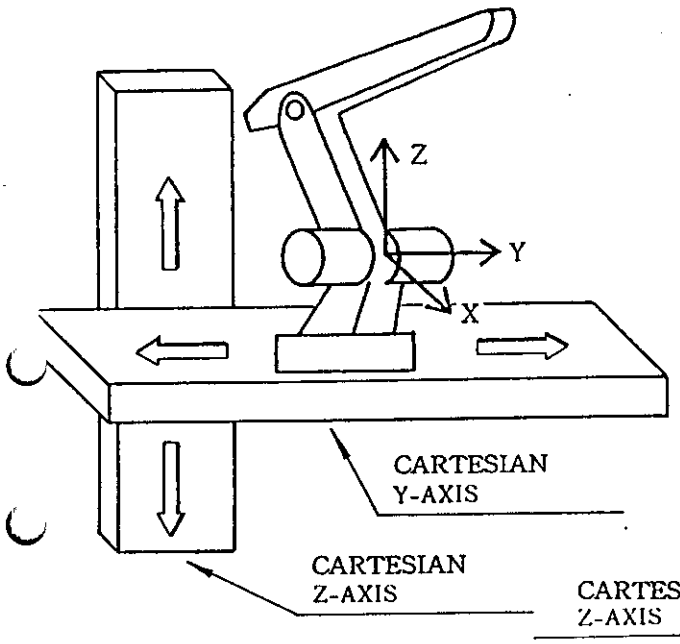
Base axis advance direction coincides with Z-axis of the robot coordinate.

・RECT−XZ



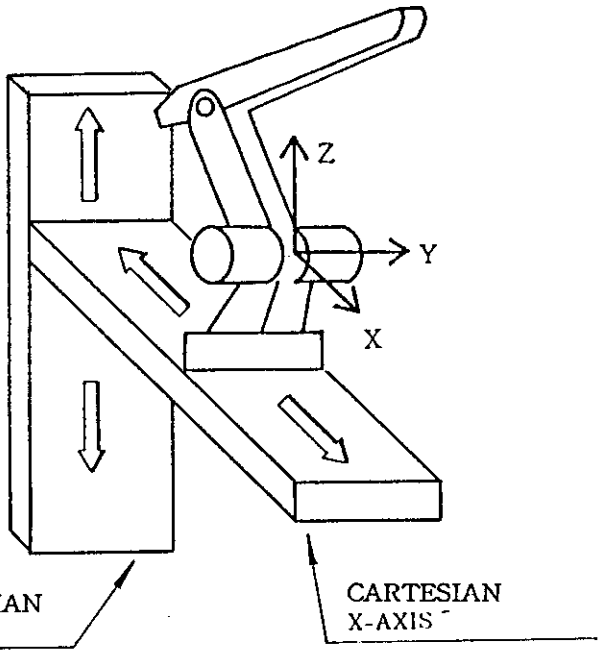
1st base axis advance direction coincides with X-axis of the robot coordinate and 2nd base axis with Y-axis.

• RECT−YZ



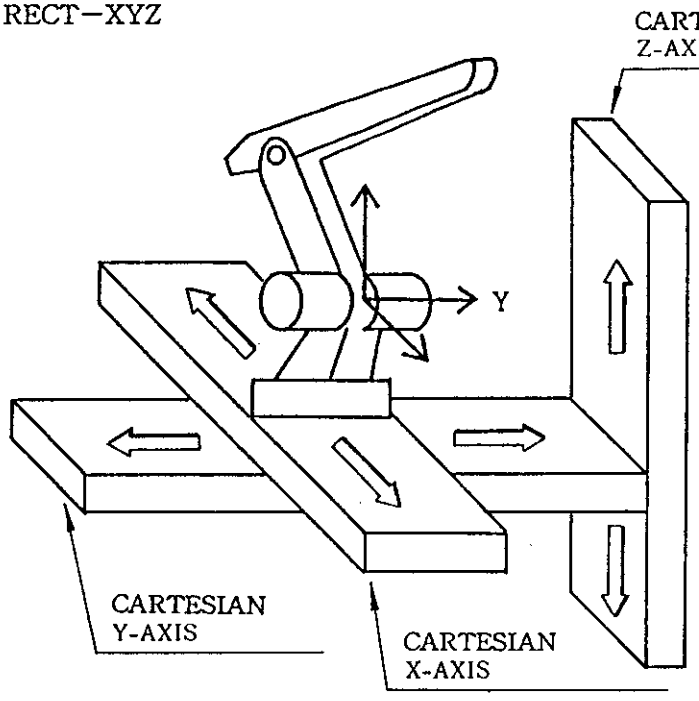
1st base axis advance direction coincides with Y-axis of the robot coordinate and 2nd base axis with Z-axis.

• RECT−XZ



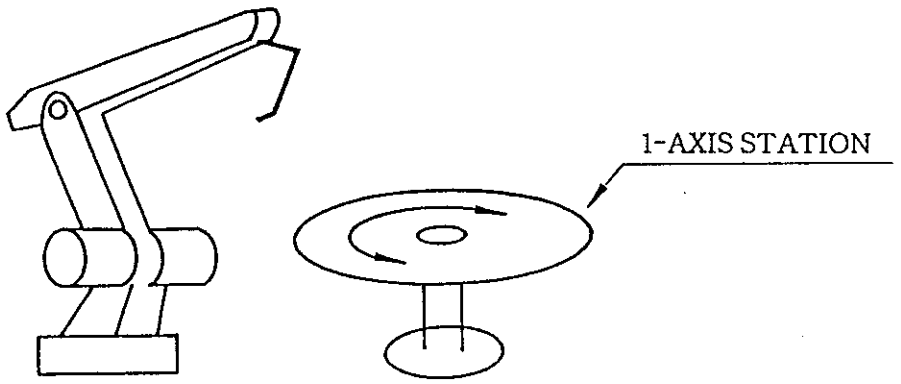
1st base axis advance direction coincides with X-axis of the robot coordinate and 2nd base axis with Z-axis.

• RECT−XYZ

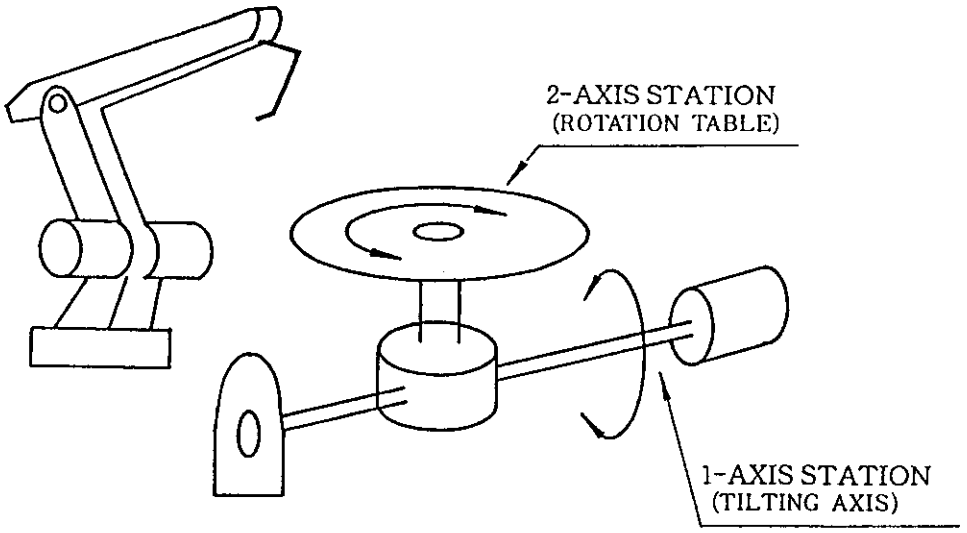


1st base axis advance direction coincides with X-axis of the robot coordinate, 2nd base axis with Y-axis and 3rd base axis with Z-axis.

• TURN-1



• TURN-2



When the model is a station, which axis becomes station 1-axis or 2-axis depends on which axis is mounted closest to the floor.

For example, the rotation table in the above diagram tilts by the tilting axis. Therefore, the tilting axis is mounted at the foot of the rotation table and becomes a 1-axis station. The rotation table is a 2-axis station.

4.3.7 Motor selection screen (base, station)

When a model is selected in the model selection screen (base, station), the following motor selection screen appears. Select motors for the number of axes selected for each model. The group name (base 1, station, etc.) which is currently set, each corresponding selection symbol (RECT−X, RECT−XY, etc.) and the axis number are displayed at the upper part of the screen. For example, the screen shown below indicates that the Station- 1 model is TURN- 1 and the first axis motor is selected. Since this model is of 2−axis type, the second axis selection screen is displayed by depressing [ENTER] after completion of the first axis selection.

〔Motor Selection Screen〕

```
  SELECT MOTOR
  STATION-1        ->TURN-1      AXIS ->1
 USADED-13-YR21        USAPEM-07-YR42
 USASEM-02-YR32        USAREM-01-YR52
 USADED-13-YR41        USADED-22-YR32
 USAREM-02CYR22        USASEM-08-YR61
 USAPEM-07-YR11        USADED-22-YR41
 USAREM-01-YR41        USASEM-08-YR71


SEL BY ↑ ↓ ←→/SEL NEXT PAGE BY <MORE>
CONFIRM BY <ENTER>/ABORT BY <CANCEL>
```

Indicates the group name, group No. and axis No.

By depressing [MORE], the next model list appears.

Select the motor and depress [ENTER]. The screen is changed to the next axis motor selection screen.

In the example, USADED-13-YR21 motor is selected.

4.3.8 Completion verification screen

When model and motor selection for all bases and stations is finished, the message "ARE YOU SURE?" is displayed at the lower part of the screen. By selecting "YES" and depressing ENTER, setting contents are registered as a parameter. By selecting "NO" and depressing ENTER, setting contents are not registered and are returned to the status before performing system configuration.

〔Motor Selection Screen(with message)〕

```
  SELECT MOTOR
  STATION-1          ->TURN-1       AXIS ->1
 USADED-13-YR21        USAPEM-07-YR42
 USASEM-02-YR32        USAREM-01-YR52
 USADED-13-YR41        USADED-22-YR32
 USAREM-02CYR22        USASEM-08-YR61
 USAPEM-07-YR11        USADED-22-YR41
 USAREM-01-YR41        USASEM-08-YR71

ARE YOU SURE?      YES      NO
SEL BY ←→/CONFIRM BY <ENTER>
```

4.4 Verification of System Configuration

The system configuration has been completed by the above procedures. In this paragraph, the setting results are verified.

4.4.1 Verification of display

To display the system configuration status, select "DISPLAY" in the system configuration screen.

〔System Configuration Screen〕

```
  SYSTEM CONFIGURATION

  INITIALIZE
  MODIFY
  DISPLAY




SEL BY ↑ ↓ /EXEC BY <ENTER>
RETURN BY <CANCEL>
```

↓

〔Display Screen〕

```
  DISPLAY

  LANGUAGE
  CONTROLLED AXES
  APPL
  IO MODULES
  SENSOR FUNCTION
  CMOS MEMORY


SEL BY ↑ ↓ /EXEC BY <ENTER>
RETURN BY <CANCEL>
```

Select "CONTROLLED AXES" and depress ENTER. The screen is changed to the "controlled axes" display screen.

4.4.2 Control axis screen

The control axis setting status can be displayed in the following screen.

〔Control Axis Screen〕

```
  CONTROLLED AXES

  ROBOT
  BASE
  STATION




SEL BY ↑ ↓ /EXEC BY <ENTER>
RETURN BY <CANCEL>
```

Select "ROBOT" and depress [ENTER]. The model display screen (robot) is displayed.
Select "BASE" and depress [ENTER]. The model display screen (base) is displayed.
Select "STATION" and depress [ENTER]. The model display screen (station) is displayed.

In the example, "STATION" is selected.

4.4.3 Robot setting status display

〔Model Display Screen (Robot)〕

```
  ROBOT

  ROBOT-1        ->K10-A00
  ROBOT-2        ->NONE




RETURN BY <CANCEL>
```

The currently set model is displayed.
In this screen, K30-A00 is selected for robot 1 and nothing for robot 2.

The control axis screen is returned by depressing [CANCEL].

4.4.4 Base setting status display

〔Group Axis Model Display Screen (Base)〕

```
  BASE

  BASE-1          ->RECT-X
  BASE-2          ->NONE




SEL BY ↑ ↓ /DISP MOTOR TYPE BY <ENTER>
RETURN BY <CANCEL>
```

The set model is displayed. (The cursor position is reversely displayed.)
In this screen, RECT-X is selected for base 1 and nothing for base 2.

Select either base 1 or 2 and depress ENTER. The screen is changed to the motor model display screen.

The control axis screen is returned by depressing CANCEL.

↓

〔Motor Model Display Screen〕

```
  MOTOR TYPE
  BASE-1            ->RECT-X
  AXIS-NO. 1        ->USADED-13-YR21
  AXIS-NO. 2        ->NONE
  AXIS-NO. 3        ->NONE
  AXIS-NO. 4        ->NONE
  AXIS-NO. 5        ->NONE
  AXIS-NO. 6        ->NONE
  AXIS-NO. 7        ->NONE
  AXIS-NO. 8        ->NONE

RETURN BY <CANCEL>
```

The currently set motor model is displayed.
In this screen, USADED-13-YR21 is selected.

The previous screen is returned by depressing CANCEL.

4.4.5 Station setting status display

〔Model Display Screen (Station)〕

```
  STATION

  STATION-1      ->TURN-1
  STATION-2      ->NONE
  STATION-3      ->NONE
  STATION-4      ->NONE
  STATION-5      ->NONE
  STATION-6      ->NONE


SEL BY ↑ ↓ /DISP MOTOR TYPE BY <ENTER>
RETURN BY <CANCEL>
```

The currently set model is displayed. (The cursor position is reversely displayed.)
In this screen, TURN-1 is selected for station-1.

Select one of STATION-1 to-6 and depress [ENTER]. The screen is changed to the motor model display screen.

The controlled axes screen is returned by depressing [CANCEL].

In the example, "TURN-1" is selected.

↓

〔Motor Model Display Screen〕

```
  MOTOR TYPE
  STATION-1          ->TURN-1
  AXIS-NO. 1         ->USADED-13-YR21
  AXIS-NO. 2         ->NONE
  AXIS-NO. 3         ->NONE
  AXIS-NO. 4         ->NONE
  AXIS-NO. 5         ->NONE
  AXIS-NO. 6         ->NONE
  AXIS-NO. 7         ->NONE
  AXIS-NO. 8         ->NONE

RETURN BY <CANCEL>
```

The currently set motor model is displayed.
In this screen, USADED-13-YR21 is selected for AXIS No1.

The previous screen is returned by depressing [CANCEL].

The system configuration has been completed.

4.5 Initialization of Job File

Setting and verification of the system configuration have been completed. By adding external axes, the job data file storing method has been changed. Job data must be initialized. Unless the job data file is initialized, error No. 2280 "JOB memory is full." is displayed when teaching a job.

By starting up the maintenance mode, the following screen is displayed.

↓

```
MAINTENANCE MODE

SETUP SYSTEM
SYSTEM VERSION
HARDWARE DIAGNOSTICS




SEL BY ↑ ↓ /EXEC BY <ENTER>
```

To initialize the file, select "SETUP SYSTEM" and depress ENTER.

↓

〔System Setting Screen〕

```
SETUP SYSTEM

SYSTEM CONFIGURATION
INITIALIZE FILES
INITIALIZE ROM FILES




SEL BY ↑ ↓ /EXEC BY <ENTER>
RETURN BY <CANCEL>
```

Select "INITIALIZE FILES" and depress ENTER.

↓

```
  INITIALIZE FILES

  ALL FILES
  PARAMETER FILES
  CONDITION FILES
  NAME FILES
  SYSTEM DATA FILES
  JOB DATA
  CIO LADDER

SEL BY ↑ ↓ /EXEC BY <ENTER>
RETURN BY <CANCEL>
```

Select "JOB DATA" and depress [ENTER]. Then a message "ARE YOU SURE?" to verify completion is displayed at the lower part of the screen as shown below. Select "YES" and depress [ENTER], and the job data are initialized. By Selecting "NO" and depressing [ENTER], initialization is not performed.

```
  INITIALIZE FILES

  ALL FILES
  PARAMETER FILES
  CONDITION FILES
  NAME FILES
  SYSTEM DATA FILES
  JOB DATA
  CIO LADDER

ARE YOU SURE?      YES      NO
SEL BY ←→/CONFIRM BY <ENTER>
```

All settings have been completed.

4.6 Startup

Turn OFF the control power supply and set the MCP01 board rotary switch to "0". Then turn ON the control power supply again.

5. SERVO CONSTANT PARAMETER SETTING

After starting up the system by performing the system configuration, set the following parameters.

5.1 Group No.

Parameters to be set to the YASNAC—MRC have group No. designations excluding parameters used in common for all axes. For example, the "X" in parameter No. "SVMxG000" indicates the group No.

Each of robots 1 and 2, stations 1 to 6 and bases 1 and 2 which are set by the system configuration is called a group. Each group No. is assigned to a group set in the order in which each group is registered. There are six types of orders according to the group configuration. Select the order from Tables ① to ⑥ according to the group configuration to be used.

≪Example≫ A system composed of robot 1, base 1 and station 1

A system composed of robot 1, base 1 and station 1 corresponds to Table ②.

According to Table ②, robot 1, base 1 and station 1 are in this order:

Robot 1 : Group No. 1 (SV1G, SVM1G, RC1G, S1CG)

Base 1 : Group No. 2 (SV2G, SVM2G, RC2G, S2CG)

Station 1: Group No. 3 (SV3G, SVM3G, RC3G, S3CG)

Tables of Each Group Order

Table ①

Group Name	Group Symbol	Order
Robot 1	R1	1
Station 1	S1	2
Station 2	S2	3
Station 3	S3	4
Station 4	S4	5
Station 5	S5	6
Station 6	S6	7

Table ②

Group Name	Group Symbol	Order
Robot 1	R1	1
Base 1	BS	2
Station 1	S1	3
Station 2	S2	4
Station 3	S3	5
Station 4	S4	6
Station 5	S5	7
Station 6	S6	8

Table ③

Group Name	Group Symbol	Order
Robot 1	R1	1
Robot 2	R2	2
Station 1	S1	3
Station 2	S2	4
Station 3	S3	5
Station 4	S4	6
Station 5	S5	7
Station 6	S6	8

Table ④

Group Name	Group Symbol	Order
Robot 1	R1	1
Robot 2	R2	2
Base 1	BS	3
Station 1	S1	4
Station 2	S2	5
Station 3	S3	6
Station 4	S4	7
Station 5	S5	8

Table ⑤

Group Name	Group Symbol	Order
Robot 1	R1	1
Robot 2	R2	2
Base 2	BS	3
Station 1	S1	4
Station 2	S2	5
Station 3	S3	6
Station 4	S4	7
Station 5	S5	8

Table ⑥

Group Name	Group Symbol	Order
Robot 1	R1	1
Robot 2	R2	2
Base 1	BS	3
Base 2	BS	4
Station 1	S1	5
Station 2	S2	6
Station 3	S3	7
Station 4	S4	8

5.2 Required Parameter Setting When Using External Axes

The following shows a list of the parameters which are required to be set when external axes are used. Items in which "setting" is entered in the Changed Value column must be set according to the external axes to be used.

For each item, refer to par 5.3 "Description of Parameters".

Since there are some parameters used as internal parameters in addition to those listed below, do not change any parameters other than those described below.

Parameter No.	Name	Initial Value	Changed Value
SVxG000 to SVxG007	Motor Rotating Direction Designation	0	0 or 1
SVxG016 to SVxG023	Feedback PPR	800	800
SVxG032 to SVxG039	Load Inertial Ratio	300	Setting
SVxG040 to SVxG047	Torque Limit Value at (+) Side	300	300
SVxG048 to SVxG055	Torque Limit Value at (−) Side	−300	−300
SVxG080 to SVxG087	Position Loop Proportional Gain	150	Setting
SVxG176 to SVxG183	Play Balancing Filter Coefficient 1	0	Setting
SVxG184 to SVxG191	Teach Balancing Filter Coefficient 1	0	180
S1CxG070 to S1CxG077	(+) Direction Soft Limit (Pulse)	0	Setting
S1CxG078 to S1CxG085	(−) Direction Soft Limit (Pulse)	0	Setting
RCxG200 to RCxG207	External Axis Accel Speed (Pulses/sec²)	510000	Setting
RCxG208 to RCxG215	External Axis Decel Speed (Pulses/sec²)	510000	Setting
RCxG224 to RCxG231	External Axis Resolution	122400	Setting
RCxG232 to RCxG239	External Axis Max.pps(Max Reference Pulse Speed)	40800	Setting
S1D150 to S1D156	SERVOPACK Specifications	0	0
RCxG240 to RCxG247	Mechanical Soft Limit (+)	0	999999999
RCxG248 to RCxG255	Mechanical Soft Limit (−)	0	−999999999
RCxG256 to RCxG263	Motor Limit (+)	0	999999999
RCxG264 to RCxG271	Motor Limit (−)	0	−999999999

5.3 Description of Parameters

(1) SVxG000 to SVxG0007: Motor Rotating Direction Designation

Specifies the motor rotating direction when the current value increases in the positive direction.

The motor forward rotating direction is CCW (counterclockwise) when viewed from the load side as shown in the figure below.

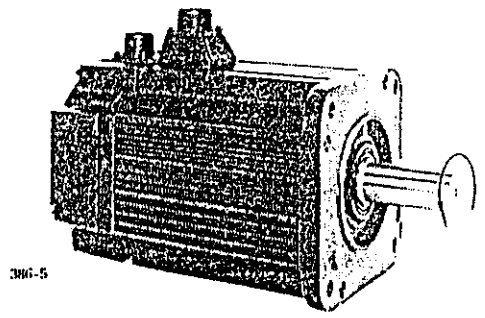
Nomally parameter setting is 「0」,so that the current value increases in the forward roating direction.

Change parameter from 「0」to 「1」when the current value increases in the reverse rotating direction.

SVxG000	1ST EXTERNAL AXIS
001	2ND
002	3RD
003	4TH
004	5TH
005	6TH
006	7TH
007	8TH

• Rotating direction

The forward rotating direction of AC servomotor is CCW viewed from the load side as shown below:



AC Servomotor

(2) SVxG016 to SVxG023: Feedback PPR

Set the number of pulses per motor revolution.

Unless otherwise specified, set it to "800".

(3) SVxG032 to SVxG039: Load Inertial Ratio (%)

Load inertial ratio indicates a ratio for motor axis inertia and increases/decreases speed loop gain according to the set value.

As the load on the motor becomes larger, actual speed loop gain decreases. Then the motor is vibrated by load variation and the motor cannot operate stably at acceleration. On the contrary, when the load is small, actual speed loop gain becomes larger and the motor may oscillate. In this way, speed loop gain depends greatly on load inertia.

Load inertial ratio set in this paragraph is a parameter to change speed loop gain by setting the load status described above.

As this value is set larger, speed loop gain Kv becomes larger; as it is set smaller, speed loop gain becomes smaller. This relation is expressed by the following equation.

$$Kv = Kv' \times (1 + (\text{load inertial ratio}/100))$$

That is, when "100" is set for load inertial ratio "0", speed loop gain is doubled.

Set the following value for load inertial ratio according to the form of the user's external axes.

External Axis Form	Load Inertial Ratio Set Value
Traveling Axis	300
Rotation Axis	0

Verify the operation after setting this value by the parameter. If any of the following faults occurs after verifying the operation, take the corrective action described for each fault.

〈Fault 1〉

The motor operates unsteadily in the forward direction.

〈Corrective Action 1〉

It is considered that speed loop gain is small. Increase the load inertial ratio parameter by 100 to verify the operation.

〈Fault 2〉

Abnormal noise occurs from the motor when it stops.

〈Corrective Action 2〉

It is considered that speed loop gain is large. Decrease the load inertial ratio parameter by 100 to verify the operation.

(4) SVxG040 to SVxG047: Torque Limit at (+) Side

Set the maximum value of torque generated in the positive direction. Torque exceeding the value set in this paragraph is not generated. Set the ratio (%) for rated torque.

For example, when "200" is set for a motor of USADED−13, torque exceeding 126kg • m (200% of rated torque 63kg • m) is not generated. Use this setting when torque limit is needed owing to the construction.

Unless otherwise specified, set this parameter to "300".

(5) SVxG048 to SVxG055: Torque Limit at (−) Side

Set the maximum value of torque generated in the negative direction. Torque exceeding the value set in this paragraph is not generated. Set the ratio (%) for rated torque.

For example, when "−200" is set for a motor of USADED−13, torque exceeding −126kg • m (200% of rated torque 63kg • m) is not generated. Use this setting when torque limit is needed owing to the construction.

Unless otherwise specified, set this parameter to "−300".

(6) SVxG080 to SVxG087: Position Loop Proportional Gain

Set position loop proportional gain of external axes. A value can be set for each axis independently. However, to maintain simultaneity of all axes at start/stop, it is recommended to set the same value for all axes.

If any axis has different gain, remember that operation timing will have a gap at starting and stopping.

When the payload of the robot used is 30kg or less, set "150" and when more than 30kg, set "100".

(7) SVxG176 to SVxG183: Play Balancing Filter Coefficient 1

Set balancing time at play mode in units of ms in the discharging segment balancing process. When used as an external axis, set the same value as the parameter value of robot axis play balancing filter coefficient-1 (SV1G176 to SV1G183).

For basic models; set 100ms for K6, K10 and K30 and 200ms for K60 and K100.

(8) SVxG184 to SVxG191: Teach Balancing Filter Coefficient 1

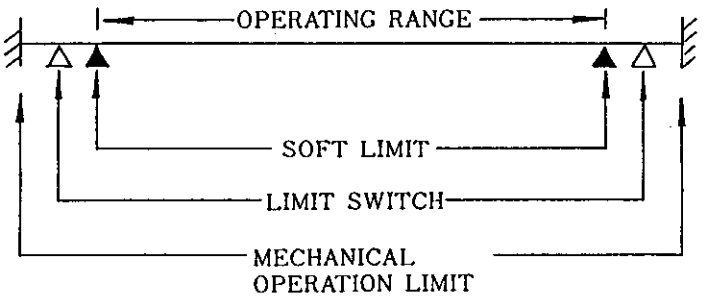
This is a parameter to set balancing time at teach mode in units of ms in the discharging segment balancing process. When used as an external axis, set the same value as the parameter value of robot axis teach balancing filter coefficient-1 (SV1G184 to SV1G191).

For basic models; set 180ms for K6, K10, K30, K60 and K100.

(9) S1CxG070 to S1CxG077: (+) Direction Soft Limit

S1CxG078 to S1CxG085: (−) Direction Soft Limit

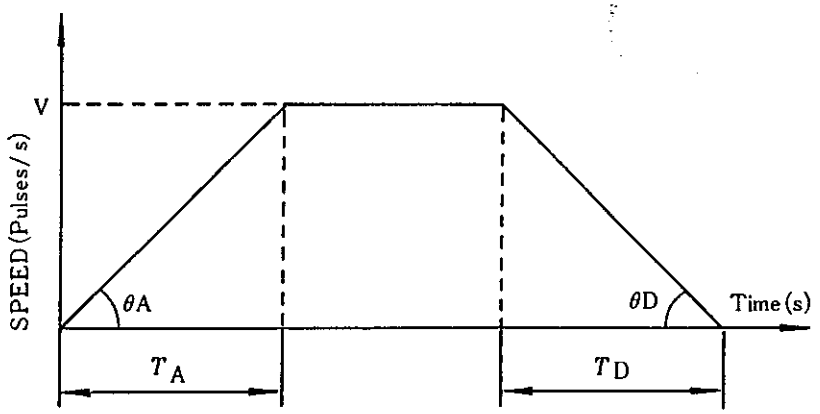
A value to specify the external axis operating range. Set a value within the mechanical operation limit or operation limit switch as shown below. Actually move the external axes to the position to limit the operation and set the current number of pulses at that position. However, this setting must be made after completing the home positioning. (Set in the number of pulses.)



(10) RCxG200to RCxG207: External Axis Accel Speed (Pulses/sec²)

RCxG208to RCxG215: External Axis Decel Speed (Pulses/sec²)

Accel speed or decel speed (pulses/sec²) is a ratio of speed variation during accel/decel.



θA : Accel speed, θD : Decel speed, V: Normal speed

TA : Accel time, TD : Decel time

$\theta A = \tan^{-1} \frac{V}{TA}$, $\theta D = \tan^{-1} \frac{V}{TD}$

Accel speed and decel speed of the external axis can be set independently. Normally, set the same value for both.

The setting is made by the following equation.

$$\text{Accel (Decel) Speed} = \frac{\text{Each Axis Max. PPS (RCxG232 to 239)}}{\text{Accel (Decel) Speed}}$$

Accel (decel) speed is the time from the stopping status to reaching the maximum speed when the manipulator operates at 100% joint speed.

≪Example≫ Max. PPS is 40800PPS and speed is required to reach this speed in 0.1 second.

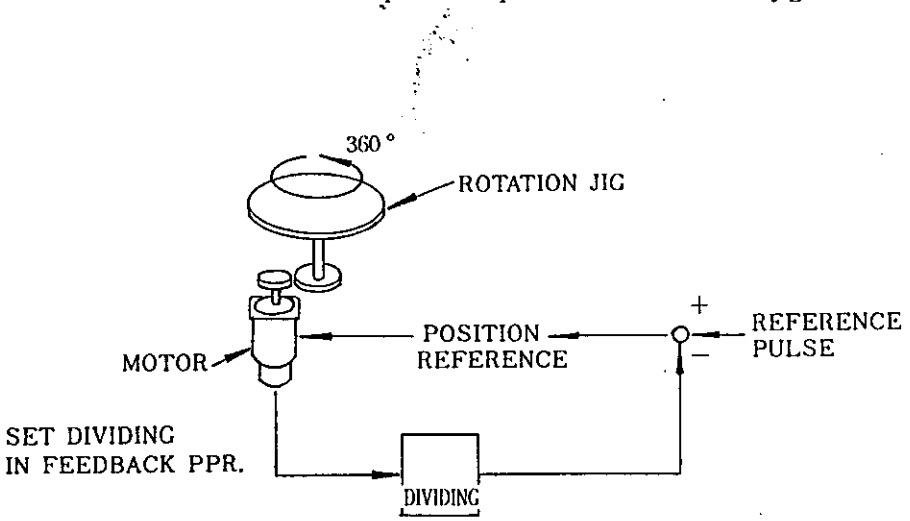
At this time, accel (decel) speed is as shown below.

$$\text{Accel (Decel) Speed} = \frac{40800\ (\text{PPS})}{0.1\ (\text{second})} = 408000\ (\text{pulses/sec}^2)$$

(11) RCxG224 to RCxG231: External Axis Resolution

• When the external axis is rotation axis

Set the number of reference pulses required for the rotation jig to rotate by 360°.



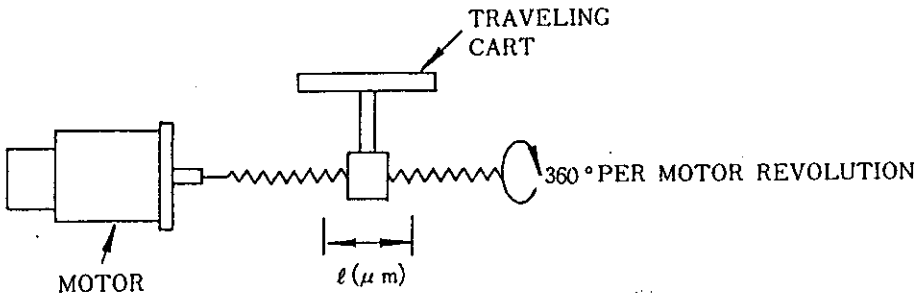
Assuming that:

Decel ratio $= \frac{1}{i} = \frac{1}{100}$, Feedback PPR (SVxG016 to 023) = 800;

Resolution $= \frac{\text{Feedback PPR}}{\text{Decel Ratio}} = \frac{800}{1/100} = 800000$

• When the external axis is traveling axis

Set the moving distance of the traveling cart when the drive motor rotates once in units of microns.



In the above figure, when the traveling cart moves by ℓ (μm) at one motor rotation, set ℓ to the parameter. For example, when it moves by 20 μm, set "20" to the parameter.

(12) RCxG232 to RCxG239: External Axis Max. pps (Maximum Reference Pulse Speed)

Set the maximum speed of each axis reference pulse.

Max. pps is determined by the following equation according to feedback PPR (SVxG016 to 023) and the maximum rotation speed of the motor used.

$$\text{Max. pps} = \frac{\text{Motor Rotation Maximum Speed (r/min)}}{60} \times \text{Feedback PPR}$$

For example, when feedback PPR = 800 and motor maximum rotation speed = 2000r/min:

$$\text{Max. pps} = \frac{2000}{60} \times 800 = 26666.6....$$

Therefore, set "26666" to the parameter.

(13) S1D150 to S1D156: SERVOPACK Specifications

Set the type of SERVOPACK corresponding to AXIS-1 to AXIS-7 for every three axes. Set either "0" or "1".

0: Each of the 3 axes of SERVOPACK connected to AXIS□ is a 1−axis collecting SERVOPACK.

1: SERVOPACK connected to AXIS□ is a 3−axis collecting SERVOPACK.

Set "0" since 1−axis collecting SERVOPACK is used basically.

(14) RCxG240 to RCxG247: Mechanical Soft Limit (+)

RCxG248 to RCxG255: Mechanical Soft Limit (−)

RCxG256 to RCxG263: Motor Limit (+)

RCxG264 to RCxG271: Motor Limit (−)

These parameters are used for robot axes. For external axes, the following settings must be made.

Set "999999999" to the (+) side.

Set "−999999999" to the (−) side.

Parameter setting has been completed.

6. VERIFICATION OF OPERATION CHARACTERISTICS

Verify that the set external axis system has been operating properly. Check the following four items:

- Maximum (starting) torque
- Constant torque (only at operation on horizontal plane)
- Stationary torque
- Normal speed status

These items must be verified when the external axes are operated at maximum speed. Therefore, verification must be performed after completion of verification of operation at low speed, break-in, safe actions such as operation limit switch verification, etc.

6.1 Creation of Verification Job

Create a verification job in which a single external axis performs operation in joint coordinate at full stroke and VJ = 100%.

6.2 Verification of Maximum (Starting) Torque

Verify that the maximum torque is not saturated by operating the created verification job.

① Display of torque reference data

Depress the following keys to display the torque status screen.

Torque reference data indicates at which percentage of the motor rated torque the axis is operating. The maximum torque data are displayed by holding the maximum value of the torque reference data.

DISP → DIAG → MORE → MORE → SERVO → TORQUE

SOFTKEY SOFTKEY SOFTKEY

TORQUE STATUS

	REFERENCE(%)	MAX TORQUE
R 1 : S	0	0
L	0	0
U	0	0
R	0	0
B	0	0
T	0	0
BASE 1	0	200

TMAX CL

Depress "TMAXCL" soft key to clear the maximum torque data.

TORQUE STATUS

	REFERENCE(%)	MAX TORQUE	
R 1 : S	0	0	
L	0	0	
U	0	0	
R	0	0	
B	0	0	
T	0	0	
BASE 1	0	0	←clear

TMAX CL

② Operation of verification job

Operate the verification job created in Par. 6.1 to check the maximum torque data. The data indicate the maximum torque during job operation. In a machine where inertia or load does not change according to the operation (an axis not affected by gravity), the value becomes equal to the starting torque. In the screen shown below, the maximum torque is 210%.

TORQUE STATUS

	REFERENCE(%)	MAX TORQUE
R 1 : S	0	0
L	0	0
U	0	0
R	0	0
B	0	0
T	0	0
BASE 1	0	210

TMAX CL

When the maximum torque value is within the allowable range, the operation is normal. If it exceeds the allowable range, the generated torque is saturated. In that case, review accel/ decel speed.

The allowable range is determined as follows.

$$\text{Motor Allowable Range} = \frac{\text{Momentary Maximum Torque}}{\text{Rated Current} \times \text{Torque Constant}} \times 100\ (\%)$$

$$= \frac{\text{SVMxG040 to 047} \times 100000}{\text{SVMxG024 to 031} \times \text{SVMxG032 to 039}}\ (\%)$$

Compare the motor allowable range with torque limit value (SVxG040 to 047); The smaller value becomes the allowable range.

For example, when the motor is USADED-13-YR21;

$$\text{Motor Allowable Range} = \frac{189000 \times 100000}{7100 \times 9900} = 268\ (\%)$$

When the torque limit value is 300%, the allowable range is 268%.

6.3 Verification of Constant Torque

This verification is not performed for any machine where inertia or load varies according to operation.

Perform the same procedure described in Par. 6.2 ①to display the torque status screen. Operate the verification job and verify that torque display in the constant speed status (excluding the accel/decel section) does not exceed 100%. If it exceeds 100%, it can be considered that dynamic friction of the external axis mechanism and running loss are large. In this case, check the machine.

6.4 Verification of Stationary Torque

Perform the same procedure described in Par. 6.2 ①to display the torque status screen.

Stop the robot in the servo-lock status at the position where the load becomes largest, and verify that torque reference value does not exceed 100%. If it exceeds 100%, an alarm such as overload, etc. may occur. Recheck the load or the like.

6.5 Verification of Normal Speed

Depress the following keys to display the feedback screen.

DISP	→	DIAG	→	MORE	→	MORE	→	SERVO	→	F B
		SOFTKEY						SOFTKEY		SOFTKEY

POSITION FEEDBACK

	FEEDBACK(PULSE)	DEVIATION(PULSE)
R 1 : S	0	0
L	0	0
U	0	0
R	0	0
B	0	0
T	0	0
BASE 1	0	200

MONSIG	FB	SPEED	SP ERR	TORQUE

Operate the verification job and verify that the position deviation display is within the specified value ±3 pulses. If it is out the range, check the parameter or adjust the load inertial ratio (SVxG032 to SVxG039).

The specified value is determined by the following equation.

$$\text{Specified Value} = \frac{\text{External Axis MAX. PPS.}}{\text{Position Loop Proportional Gain}}$$

$$= \frac{\text{RCxG232 to RCxG239}}{\text{SVxG080 to SVxG087}} \times 10$$

For example, when each set value is as follows;

external axis MAX. PPS. = 40800,

position loop proportional gain = 150,

the specified value is;

$$\text{Specified Value} = \frac{40800}{150} \times 10 = 2720 \text{ (pulses)}$$

Therefore, when position deviation pulse variation is within the range of 2717 to 2723 (pulses), the operation is normal.

APPENDIX 1 RESETTING ABSOLUTE ENCODER

When the absolute encoder has been without battery for three days or more, the capacitor discharged voltage in the absolute encoder may be insufficient and the internal elements may not operate normally. Therefore, before performing the home positioning after mounting the external axis motor, reset the absolute encoder by the following procedures.

To replace the motor, the same procedures are needed.

The following describes how to reset the absolute encoder. The resetting method differs depending on the type of absolute encoder. There are two methods. Verify the type of your absolute encoder before resetting operation.

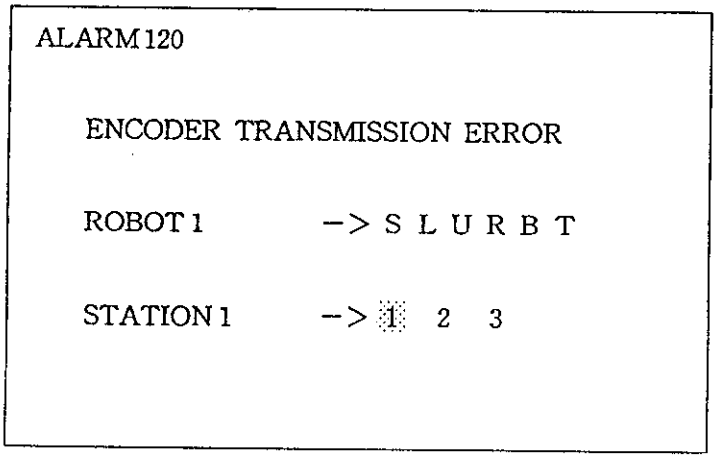
- 12-bit absolute encoder
- 15-bit absolute encoder

(1) How to reset 15-bit absolute encoder

① Shortcircuit the absolute encoder connector between terminals R and S (Fig. A), white (gray)and white (orange) terminals (Fig. B) or purple and white (purple) terminals (Fig. C) for 2 minutes or more. (The capacitor in the absolute encoder is discharged.)

② Provide proper wiring of the cables to enter the status where the battery is connected to the absolute encoder.

③ If "ALARM 120: ENCODER TRANSMISSION ERROR" is displayed on the programming pendant when the YASNAC power supply is turned ON, start from ① again. When it starts up normally, keep the control power supply ON for more than 3 minutes.



The first axis encoder of station-1 is defective. Start from ① for the encoder of this axis.

④ Perform home positioning.

ENCODER SIDE

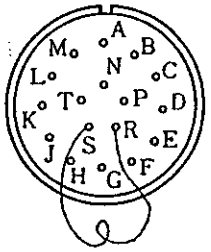
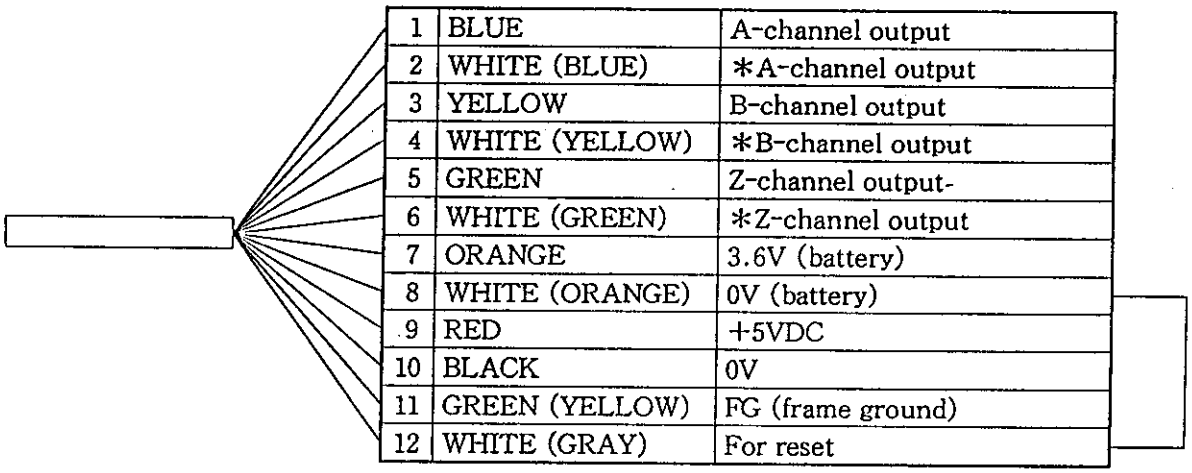


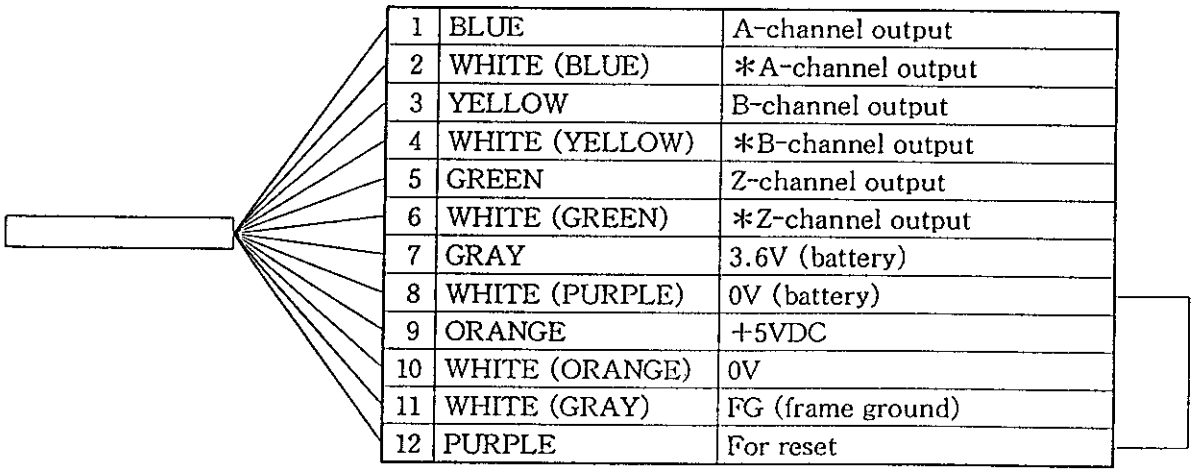
Fig. A CANNON Connector (Shortcircuiting between R and S)



1	BLUE	A-channel output
2	WHITE (BLUE)	*A-channel output
3	YELLOW	B-channel output
4	WHITE (YELLOW)	*B-channel output
5	GREEN	Z-channel output-
6	WHITE (GREEN)	*Z-channel output
7	ORANGE	3.6V (battery)
8	WHITE (ORANGE)	0V (battery)
9	RED	+5VDC
10	BLACK	0V
11	GREEN (YELLOW)	FG (frame ground)
12	WHITE (GRAY)	For reset

Fig. B MATE-N-LOK connector

[Shortcircuiting between White (Gray) and White (Orange)]



1	BLUE	A-channel output
2	WHITE (BLUE)	*A-channel output
3	YELLOW	B-channel output
4	WHITE (YELLOW)	*B-channel output
5	GREEN	Z-channel output
6	WHITE (GREEN)	*Z-channel output
7	GRAY	3.6V (battery)
8	WHITE (PURPLE)	0V (battery)
9	ORANGE	+5VDC
10	WHITE (ORANGE)	0V
11	WHITE (GRAY)	FG (frame ground)
12	PURPLE	For reset

Fig. C MATE-N-LOK connector

[Shortcircuiting between Purple and White (Purple)]

(2) How to reset 12-bit absolute encoder

① Shortcircuit the absolute encoder connector between terminals P and S (Fig. D), gray and white (orange) terminals (Fig. E) for 2 minutes or more. (The capacitor in the absolute encoder is discharged.)

② Provide proper wiring of the cables to enter the status where the battery is connected to the absolute encoder.

③ If "ALARM 132: ENCODER BACKUP ERROR" is displayed on the programming pendant when the YASNAC power supply is turned ON, it indicates that the capacitor has been discharged normally. Depress CANCEL. After that, countdown restarts and the encoder starts up normally. When it starts up normally, keep the control power supply ON for more than 3 minutes.

If "ALARM 132: ENCODER BACKUP ERROR" is not displayed, the capacitor has not been discharged normally. Start from ① again.

```
ALARM 132

   ENCODER BACK-UP ERROR

   ROBOT-1        -> S L U R B T

   STATION-1      -> 1  2  3

  RESET "CANCEL" KEY
```

The first axis encoder of station-1 is discharged normally.
Depress CANCEL.

④ Perform home positioning.

DETECTOR SIDE

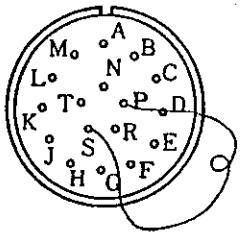
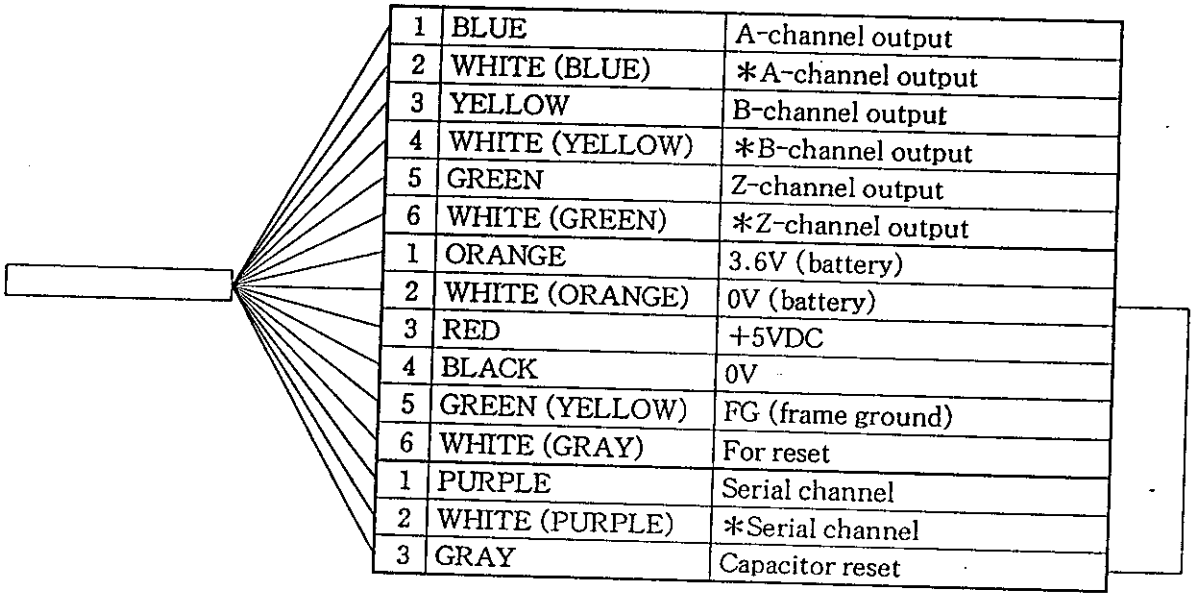


Fig. D CANNON Connector (Shortcircuiting between S and P)



1	BLUE	A-channel output
2	WHITE (BLUE)	*A-channel output
3	YELLOW	B-channel output
4	WHITE (YELLOW)	*B-channel output
5	GREEN	Z-channel output
6	WHITE (GREEN)	*Z-channel output
1	ORANGE	3.6V (battery)
2	WHITE (ORANGE)	0V (battery)
3	RED	+5VDC
4	BLACK	0V
5	GREEN (YELLOW)	FG (frame ground)
6	WHITE (GRAY)	For reset
1	PURPLE	Serial channel
2	WHITE (PURPLE)	*Serial channel
3	GRAY	Capacitor reset

Fig. E MATE-N-LOK Connector
[Shortcircuiting between Gray and White (Orange)]

EXTERNAL AXIS SETTING

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