

FS100 OPTIONS INSTRUCTIONS

FOR TWIN DRIVE FUNCTION

Upon receipt of the product and prior to initial operation, read these instructions thoroughly, and retain for future reference.

MOTOMAN INSTRUCTIONS

- MOTOMAN-□□□ INSTRUCTIONS
- FS100 INSTRUCTIONS
- FS100 OPERATOR'S MANUAL
- FS100 MAINTENANCE MANUAL

Part Number: 160726-1CD
Revision: 0



MANDATORY

- This manual explains the twin drive function of the FS100 system. Read this manual carefully and be sure to understand its contents before handling the FS100.
- General items related to safety are listed in Chapter 1: Safety of the FS100 Instructions. To ensure correct and safe operation, carefully read the FS100 Instructions before reading this manual.



CAUTION

- Some drawings in this manual are shown with the protective covers or shields removed for clarity. Be sure all covers and shields are replaced before operating this product.
- The drawings and photos in this manual are representative examples and differences may exist between them and the delivered product.
- YASKAWA may modify this model without notice when necessary due to product improvements, modifications, or changes in specifications. If such modification is made, the manual number will also be revised.
- If your copy of the manual is damaged or lost, contact a YASKAWA representative to order a new copy. The representatives are listed on the back cover. Be sure to tell the representative the manual number listed on the front cover.
- YASKAWA is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids your product's warranty.

Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the FS100.

In this manual, the Notes for Safe Operation are classified as "WARNING", "CAUTION", "MANDATORY", or "PROHIBITED".



WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury to personnel.



CAUTION

Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury to personnel and damage to equipment. It may also be used to alert against unsafe practices.



MANDATORY

Always be sure to follow explicitly the items listed under this heading.



PROHIBITED

Must never be performed.

Even items described as "CAUTION" may result in a serious accident in some situations.

At any rate, be sure to follow these important items



To ensure safe and efficient operation at all times, be sure to follow all instructions, even if not designated as "CAUTION" and "WARNING".



WARNING

- Before operating the manipulator, check that servo power is turned off when the emergency stop button on the programming pendant is pressed.
When the servo power is turned off, the SERVO ON LED on the programming pendant is turned off.

Injury or damage to machinery may result if the emergency stop circuit cannot stop the manipulator during an emergency. The manipulator should not be used if the emergency stop buttons do not function.

Fig. : Emergency Stop Button



- In the case of not using the programming pendant, be sure to supply the emergency stop button on the equipment. Then before operating the manipulator, check to be sure that the servo power is turned OFF by pressing the emergency stop button.
Connect the external emergency stop button to the 5-6 pin and 16-17 pin of the robot system signal connector (CN2).
- Upon shipment of the FS100, this signal is connected by a jumper cable in the dummy connector. To use the signal, make sure to prepare a new connector, and then input it.

If the signal is input with the jumper cable connected, it does not function, which may result in personal injury or equipment damage.

- Once the emergency stop button is released, clear the cell of all items which could interfere with the operation of the manipulator.
Then turn the servo power ON.

Injury may result from unintentional or unexpected manipulator motion.

Fig. : Release of EM



- Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:
 - View the manipulator from the front whenever possible.
 - Always follow the predetermined operating procedure.
 - Ensure that you have a safe place to retreat in case of emergency.

Improper or unintended manipulator operation may result in injury.

The emergency stop button is located on the programming pendant.



WARNING

- Confirm that no person is present in the P-point maximum envelope of the manipulator and that you are in a safe location before:
 - Turning on the power for the FS100.
 - Moving the manipulator with the programming pendant.
 - Running the system in the check mode.
 - Performing automatic operations.

Injury may result if anyone enters the working envelope of the manipulator during operation. Always press an emergency stop button immediately if there are problems.



CAUTION

- Perform the following inspection procedures prior to conducting manipulator teaching. If problems are found, repair them immediately, and be sure that all other necessary processing has been performed.
 - Check for problems in manipulator movement.
 - Check for damage to insulation and sheathing of external wires.
- Always return the programming pendant to the hook on the cabinet of the FS100 after use.

The programming pendant can be damaged if it is left in the manipulator's work area, on the floor, or near fixtures.

- Read and understand the Explanation of Warning Labels in the FS100 Instructions before operating the manipulator:

Definition of Terms Used Often in This Manual

The MOTOMAN is the YASKAWA industrial robot product.




The MOTOMAN usually consists of the manipulator, the FS100 controller, manipulator cables, the FS100 programming pendant (optional), and the FS100 programming pendant dummy connector (optional).

In this manual, the equipment is designated as follows:

Equipment	Manual Designation
FS100 controller	FS100
FS100 programming pendant	Programming pendant
Cable between the manipulator and the controller	Manipulator Cable
FS100 programming pendant dummy connector	Programming pendant dummy connector

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Descriptions of the programming pendant keys, buttons, displays and keyboard of the PC are shown as follows:

Equipment		Manual Designation
Programming Pendant	Character Keys	The keys which have characters printed on them are denoted with []. ex. [ENTER]
	Symbol Keys	The keys which have a symbol printed on them are not denoted with [] but depicted with a small picture. ex. PAGE key  The Cursor is an exception, and a picture is not shown.
	Axis Keys Numeric Keys	"Axis Keys" and "Numeric Keys" are generic names for the keys for axis operation and number input.
	Keys pressed simultaneously	When two keys are to be pressed simultaneously, the keys are shown with a "+" sign between them, ex. SHIFTkey  + COORD key 
	Mode Key	Three kinds of modes that can be selected by the mode key are denoted as follows: REMOTE, PLAY, or TEACH
	Button	Three buttons on the upper side of the programming pendant are denoted as follows: HOLD button START button EMERGENCY STOP button
	Displays	The menu displayed in the programming pendant is denoted with { }. ex. {JOB}
PC Keyboard		The name of the key is denoted ex. Ctrl key on the keyboard

Description of the Operation Procedure

In the explanation of the operation procedure, the expression "Select . . ." means that the Cursor is moved to the object item and the SELECT key is pressed, or that the item is directly selected by touching the screen.

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1 Outline

When configuring the external axes (base or station axes) in the FS100 and using a single motor to control an axis with a heavy load applied during an operation, a large-capacity motor with sufficient capacity and torque is required.

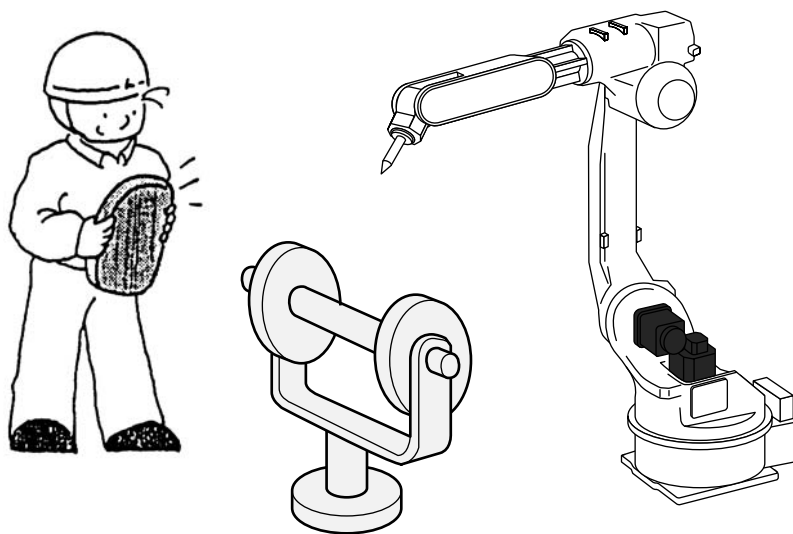
In this case, the external axis becomes very large and requires a wide space for equipment installation.

A system, where an external axis with a heavy load is operated by two motors may be built to provide the necessary motor capacity and torque.

In such a system, the two motors must be operated at the same time, or the system and external axes may be damaged.

Use the twin drive function to operate the motor on the slave axis side at the same time as the external master axis during teaching.

This function economizes on system space and obtains sufficient motor power.



2 Applicable Types

The twin drive function is valid only for the station axes that have been configured for the twin drive.

The following table lists the configurations and the three types of stations where the twin drive can be used.

Station type	Configuration			Remarks
	Number of station axes	Master axis	Slave axis	
TWIN -3A (TDT3A)	3 axes	Second axis	Third axis	See Fig. 2-1(a)
TWIN -3B (TDT3B)	3 axes	First axis	Third axis	See Fig. 2-2(a)
TWIN -2 (TDT2)	2 axes	First axis	Second axis	See Fig. 2-3(a)

The above three station types can be selected when setting the station axis for the system configuration.

Fig. 2-1(a): TWIN-3A

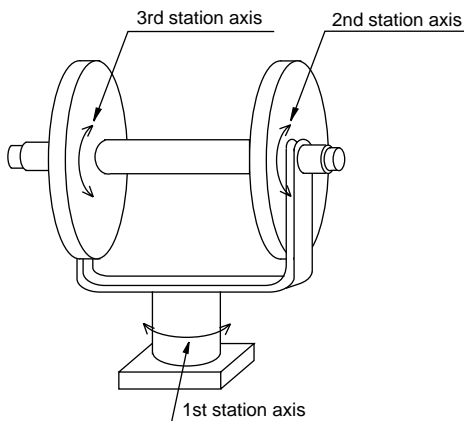


Fig. 2-2(a): TWIN-3B

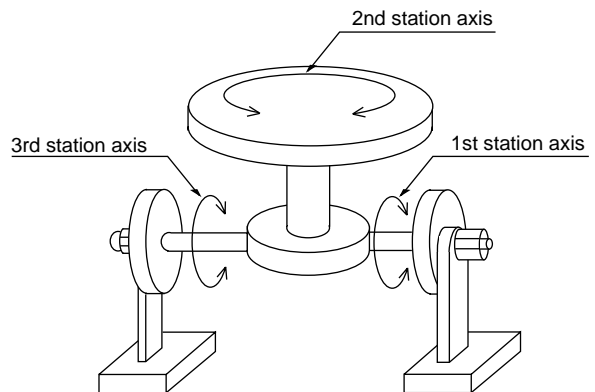
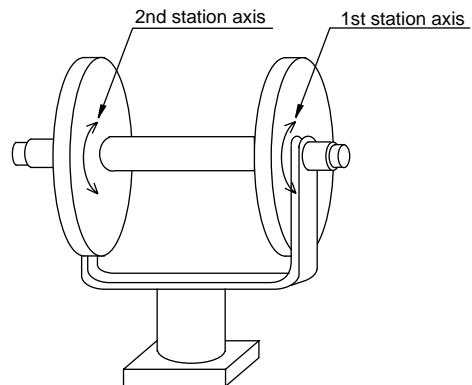


Fig. 2-3(a): TWIN-2



3 Operation

When the external axis with the twin drive is selected for the axis operation, the twin-driven axes (master axis and slave axis) can be operated at the same time by a single instruction.

External axis operation and teaching can be easily performed when teaching.

During playback, the axes move according to the taught job data.

3.1 Axis Operation

When the external axis with the twin drive is selected for the axis operation, the following motion is performed.

For the external axis with the twin drive, press the master axis key, and the slave axis and the master axis move at the same time.

However, the external input signal specified by the parameters restricts the axis as outlined in the following table.

External input signal	ON	Single motion mode
	OFF	Twin motion mode

The following describes each mode.

3.1.1 Twin Motion Mode

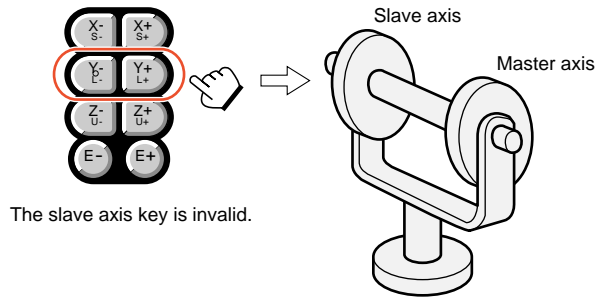
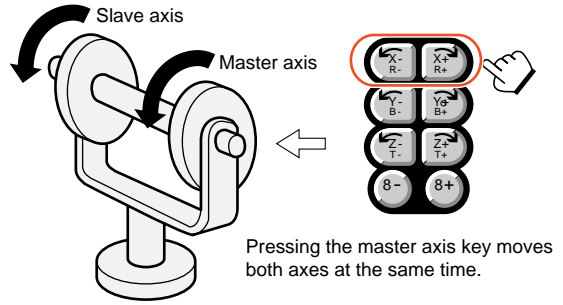
When using the twin drive, the axes can move in twin motion mode.

When the specified external input status is OFF, the axes move in the twin (concurrent) motion mode.

[Example] For TWIN-2

Press the 1st axis key to move the 2nd axis and the 1st axis at the same time.

In this case, no axis moves when the 2nd axis key is pressed.



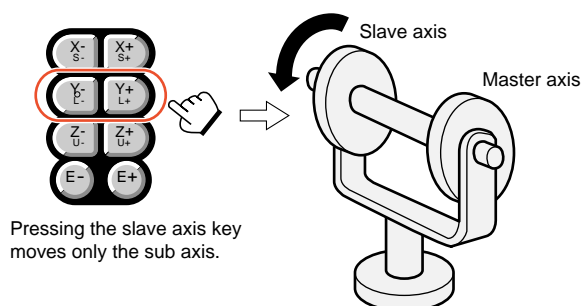
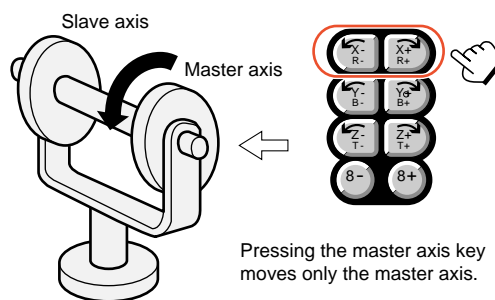
3.1.2 Single Motion Mode

In this mode, the master axis and the slave axis move individually.

When the specified external input status is ON, each axis moves in a single motion.

[Example] For TWIN-2

Press the 1st axis key or the 2nd axis key to move the corresponding axis only.



3.1.3 Precautions

Select either the twin motion mode or the single motion mode by external input before starting the axis operation.

The motion mode does not change when the external input status is changed while an axis key is pressed.

The motion mode is determined according to the external input status that exists when the axis key is pressed, not after.

4 Setting Parameters

In the twin drive, the status of external general-purpose input signal determines the mode as the twin motion or single motion.

The following parameters specify the general-purpose input numbers.

Parameter	Contents	
S4C262	General-purpose input number specification in the twin drive	Station 1
S4C263		Station 2
S4C264		Station 3

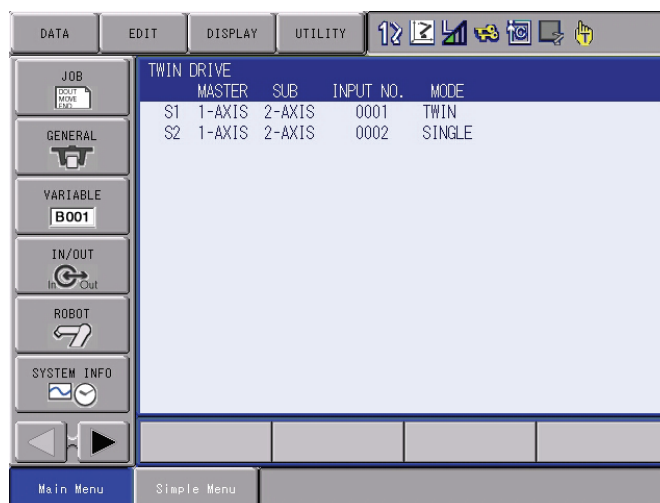
When general-purpose input numbers are not set to the above parameters (when "0" is set) for the station axes with twin drive function, the twin motion is the default mode.

5 Status Display

The application status of the twin drive function can be confirmed.

1. Select {ROBOT} from the menu.
2. Select {TWIN DRIVE}.

– The twin drive display appears.



MASTER : The number of the master axis appears when the twin drive function is used.

SUB : The number of the slave axis appears when the twin drive function is used.

INPUT NO. : The general-purpose input number set for the parameter appears.

When there is not set general-purpose input number, "[- -]" appears.

MODE : The external input signal status appears.

"TWIN" : The specified general-purpose input is OFF.
The twin (concurrent) motion is possible.

"SINGLE" : The specified general-purpose input is ON.
The single motion is possible.

6	Precautions
6.1	Precautions when selecting Motor

6 Precautions

Observe the following precautions when using the twin drive.

6.1 Precautions when selecting Motor

When using the twin drive, both twin-driven axes have to move in the same way and the same level for both axis operation and playback.

Use the same motors for the twin-driven axes.

6.2 Precautions when Setting External Axes

To use the twin drive function, the external axes must be in maintenance mode.

Note the following precautions when setting the external axes.

For operation methods in the maintenance mode, refer to "Instruction Manual" (MANUAL NO.: RE-CTO-A218).

6.2.1 Setting Mechanical Specifications

When setting the station axis, enter the following data for the mechanical specifications.

- MOTION RANGE (+)
- MOTION RANGE (-)
- REDUCTION RATIO (NUMER)
- REDUCTION RATIO (DENOM)

When using the twin drive, both twin-driven axes have to move in the same way and the same level for both axis operation and playback. Set the same condition data for both axes.

6.2.2 Setting Motor Specifications

When setting a station axis, enter the following data for the motor specifications.

- ROTATION DIRECTION (NORMAL/REVERSE)
- MAX. RPM
- ACCELERATION TIME
- INERTIA RATIO

When using the twin drive function, both twin-driven axes have to move in the same way and the same level for both axis operation and playback. Set the same condition data for "MAX. RPM", "ACCELERATION TIME", and "INERTIA RATIO" of both axes.

6.2.3 Setting the Rotating Direction

When using the twin drive, specify the same motor rotating direction for both twin-driven axes. Specifying a different direction for each axis may damage a jig and break down the system.

Before using the twin drive, confirm the rotating direction of the twin-driven axes to set the correct rotating direction.

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6 Precautions
6.3 Setting the Home Position

6.3 Setting the Home Position

Operate the two station axes configured for the twin drive at the same time and teach the home position so that the two axes have the same “0” position.

Because the two axes have the same “0” pulse position, axis operation and playback can be performed with the same pulse value.

6.4 Precautions upon Application with Coordinated Motion

The station coordinated function can be used as an option. The following restrictions apply for the station axes with the twin drive.

6.4.1 Coordinated Motion with TWIN-2

When the robot moves in a coordinated motion using TWIN-2, the coordinated motion is applied to the 1st station axis. The 2nd station axis and the 1st station axis move in twin drive.

Calibrate the 1st station axis only.

The coordinated motion is not valid for the 2nd station axis.

FS100 OPTIONS INSTRUCTIONS

FOR TWIN DRIVE FUNCTION

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