

# FS100 OPTIONS INSTRUCTIONS

## FOR ARM INTERFERE CHECK FUNCTION

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

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### MOTOMAN INSTRUCTIONS

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

Part Number: 159639-1CD  
Revision: 0



## MANDATORY

- This manual explains the arm interfere check 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 Setup Manual. To ensure correct and safe operation, carefully read the Setup manual 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.

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## 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 alert against unsafe practice.



### 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

FS100

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 Arm Interfere Check Function

### 1.1 Outline of Arm Interfere Check Function

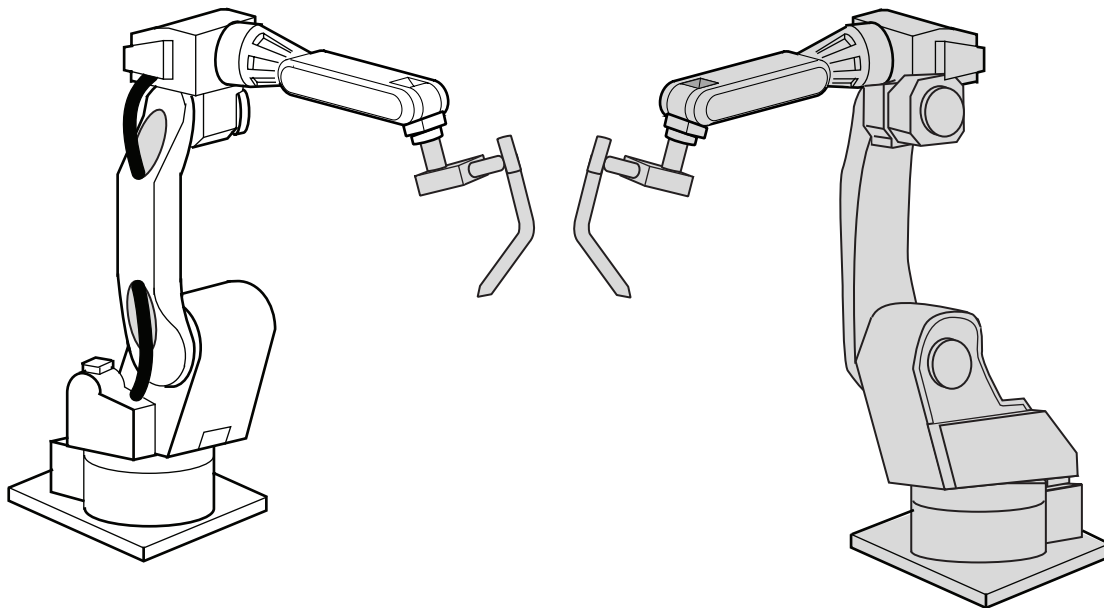
This function checks the interference among manipulator arms and tools in the system consisting of one controller and multiple manipulators.

Interference between each of the following is checked:

- (1) An arm and an arm
- (2) An arm and a tool
- (3) A tool and a tool

The checking method is to approximate each axis arm and tool in cylinder and then the interference is checked between the approximated cylinders. Spheres are set at both ends of the cylinder, and the interferences are checked between spheres and between sphere and cylinder.

If this cylinder or sphere is intersected, the manipulators stop.





	1	Arm Interfere Check Function
FS100	1.2	Setting of Arm Interfere Check Function

## 1.2 Setting of Arm Interfere Check Function

### 1.2.1 Tool Interfere File

The arm interfere check function requires setting of cylinder and sphere for the robot arm. These setting values need not be set by the customer because they are factory-set.

The tool part must be set by the customer because the tool shape depends on the work that the robot performs. These settings are set in the tool interfere file.

The tool interfere file is shown by using the procedure to select {MAIN MENU} → {ROBOT} → {TOOL INTERFERE}.

	POINT1 (mm)	POINT2 (mm)	RADIUS (mm)
TOOL INTERFERE TOOL NO.: 0			
1. X	0	140	70
Y	0	0	
Z	0	100	
2. X	140	140	30
Y	0	0	
Z	-50	240	
3. X	0	0	0
Y	0	0	
Z	0	0	
4. X	0	0	0
Y	0	0	
Z	0	0	
5. X	0	0	0

Main Menu    Simple Menu

- A maximum of 16 tool interfere files can be set.  
In accordance with the tool number specified in operation, one file is selected out of 16 files.
- A maximum of 5 cylinders and spheres can be set.  
1 to 5 points can be set by moving the cursor below.
- Point 1 and Point 2 set both end positions that set the cylinder.  
Like the setting of the tool dimensions, the setting values are set with the center of T-axis flange regarded as the starting point (X=0, Y=0, Z=0).
- Radius sets the radius of the cylinder and sphere between Point 1 and Point 2. The sphere is set for Point 1 and Point 2.

FS100	1	Arm Interfere Check Function
	1.2	Setting of Arm Interfere Check Function

### 1.2.2 Release of Arm Interfere Check

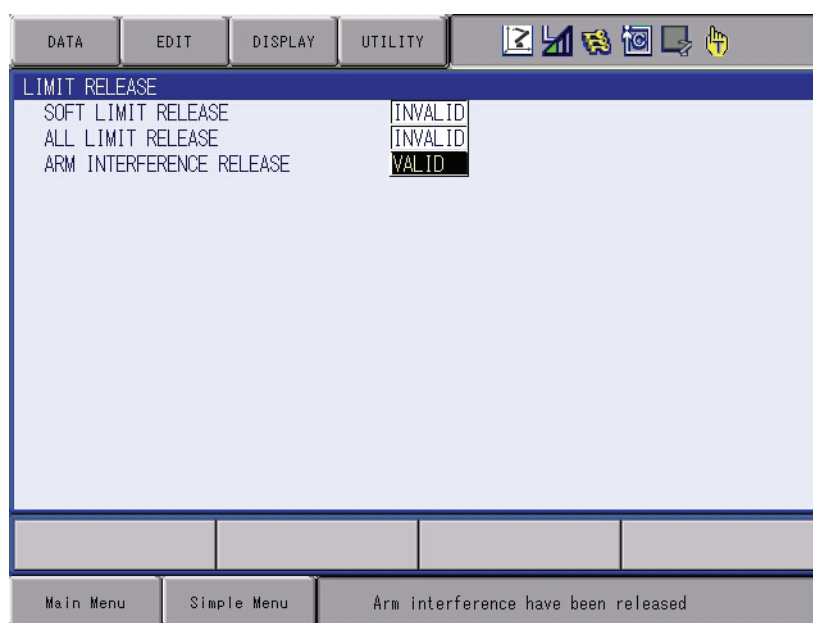
The release of the arm interfere check can be set in the limit release screen.

The limit release screen is shown by using the procedure to select {MAIN MENU} → {ROBOT} → {LIMIT RELEASE}.

When the cursor is moved to {INVALID} of the arm interfere check release and the {SELECT} key is pressed, {INVALID} is changed to {VALID} or {VALID} is changed to {INVALID}.

Setting {INVALID} invalidates the arm interfere check release and checks the arm interfere.

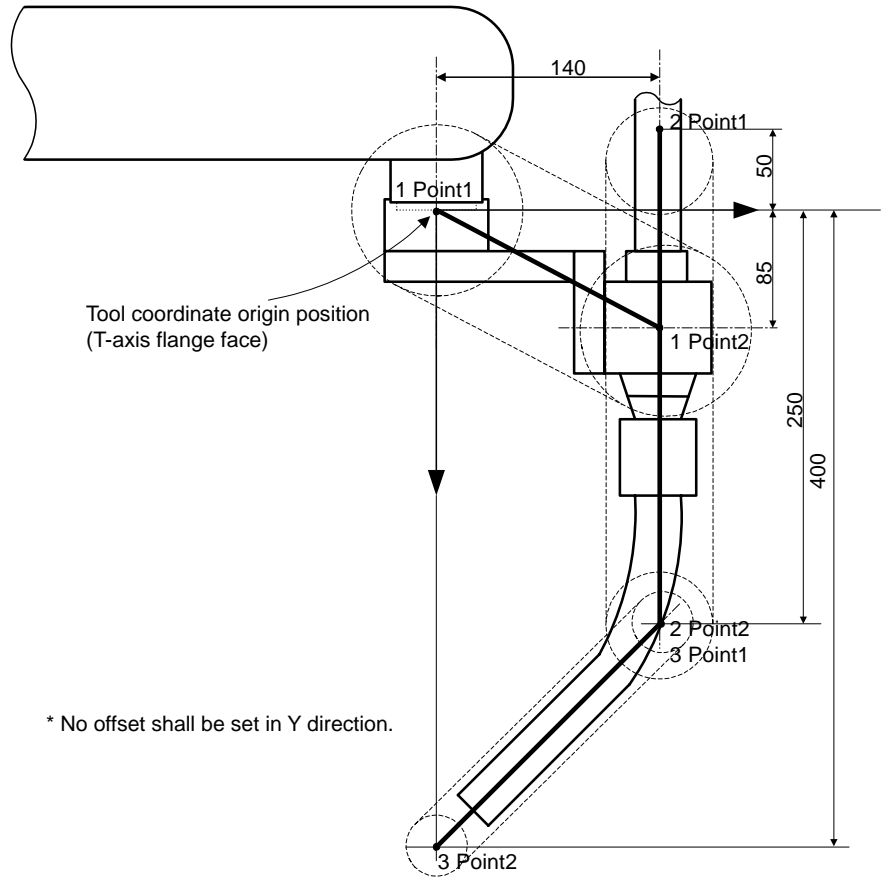
Setting {VALID} validates the arm interfere check release and does not check the arm interfere.



### 1.2.3 Calibration between Manipulators (Robots)

To use this function, perform the calibration between manipulators. For the procedure of the calibration between manipulators, refer to “FS100 Independent/Coordinated Control Function Instructions (RE-CKI-A461), Chapter 3 Jigless System, 3.3 System Setup”.

### 1.3 Example of Setting Tool Interfere File



TOOL INTERFERE			
TOOL NO.: 0			
	POINT1 (mm)	POINT2 (mm)	RADIUS (mm)
1. X	0	140	70
Y	0	0	
Z	0	85	
2. X	140	140	30
Y	0	0	
Z	-50	250	
3. X	140	0	20
Y	0	0	
Z	240	400	
4. X	0	0	0
Y	0	0	
Z	0	0	
5. X	0	0	0
Y	0	0	
Z	0	0	

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FS100	1	Arm Interfere Check Function
	1.4	Alarm/Error

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## 1.4 Alarm/Error

### 1.4.1 Axis Operation

If the arm (tool) interference occurs during the axis operation, "ARM (TOOL) INTERFERE" is shown in the message line and the manipulators stop.

In this case, perform the axis operation in the direction with no arm interfere. If the axis operation is not allowed in the direction with no arm interfere in this case, temporally invalidate the arm interfere check as described in *chapter 1.2.2 "Release of Arm Interfere Check" at page 1-3*.

### 1.4.2 PLAYBACK/FWD/BWD/TEST Operation

If the arm (tool) interfere occurs in PLAYBACK/FWD/BWD/TEST operation, "Alarm 4620 ARM (TOOL) INTERFERE" is issued and the manipulators stop.

In this case, perform the axis operation to move to the position with no arm interfere.

If the arm interfere occurs during playback, review the job to prevent the arm interfere.

## 1.5 Notes

- (1) About accuracy of arm (tool) interfere check  
The robot accuracy has an error due to the calibration accuracy between robots or a delay in the servo system.  
Therefore, set the radius of the tool interfere file with an allowance.
- (2) Determine the setting value of the TOOL INTERFERE file in accordance with the drawing.

# FS100 OPTIONS INSTRUCTIONS

## FOR ARM INTERFERE CHECK FUNCTION

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Specifications are subject to change without notice  
for ongoing product modifications and improvements.