

Motoman NX100 Controller

ServoFloat Function Manual

Part Number: 149648-10CD
Revision: 1

MOTOMAN
a YASKAWA company

Motoman, Incorporated
805 Liberty Lane
West Carrollton, OH 45449
TEL: (937) 847-6200
FAX: (937) 847-6277
24-Hour Service Hotline: (937) 847-3200

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Chapter 1

Introduction

This manual provides system information for the ServoFloat Control Function and contains the following sections:

SECTION 1 - INTRODUCTION

Provides general information about the structure of this manual, a list of reference documents, and customer service information.

SECTION 2 - SAFETY

This section provides information regarding the safe use and operation of Motoman products.

SECTION 3 - SERVOFLOAT INSTRUCTIONS

Provides detailed information about the ServoFloat Control Function.

1.1 Reference to Other Documentation

For additional information refer to the following:

- NX100 Controller Manual (P/N 149201-1)
- Concurrent I/O Manual (P/N 149230-1)
- Operator's Manual for your application
- Vendor manuals for system components not manufactured by Motoman

1.2 Customer Service Information

If you are in need of technical assistance, contact the Motoman service staff at (937) 847-3200. Please have the following information ready before you call:

- Robot Type (ServoFloat)
- Application Type (arcwelding, spot welding, handling)
- Robot Serial Number (located on back side of robot arm)
- Robot Sales Order Number (located on back of controller)

Notes

Chapter 2

Safety

2.1 Introduction

It is the purchaser's responsibility to ensure that all local, county, state, and national codes, regulations, rules, or laws relating to safety and safe operating conditions for each installation are met and followed.

We suggest that you obtain and review a copy of the ANSI/RIA National Safety Standard for Industrial Robots and Robot Systems. This information can be obtained from the Robotic Industries Association by requesting ANSI/RIA R15.06-1999. The address is as follows:

Robotic Industries Association
900 Victors Way
P.O. Box 3724
Ann Arbor, Michigan 48106
TEL: (734) 994-6088
FAX: (734) 994-3338
INTERNET: www.roboticsonline.com

Ultimately, the best safeguard is trained personnel. The user is responsible for providing personnel who are adequately trained to operate, program, and maintain the robot cell. **The robot must not be operated by personnel who have not been trained!**

We recommend that all personnel who intend to operate, program, repair, or use the robot system be trained in an approved Motoman training course and become familiar with the proper operation of the system.

This safety section addresses the following:

- Standard Conventions (Section 2.2)
- General Safeguarding Tips (Section 2.3)
- Mechanical Safety Devices (Section 2.4)
- Installation Safety (Section 2.5)
- Programming, Operation, and Maintenance Safety (Section 2.6)

2.2 Standard Conventions

This manual includes the following alerts – in descending order of severity – that are essential to the safety of personnel and equipment. As you read this manual, pay close attention to these alerts to insure safety when installing, operating, programming, and maintaining this equipment.



DANGER!

Information appearing in a **DANGER** concerns the protection of personnel from the immediate and imminent hazards that, if not avoided, will result in immediate, serious personal injury or loss of life in addition to equipment damage.



WARNING!

Information appearing in a **WARNING** concerns the protection of personnel and equipment from potential hazards that can result in personal injury or loss of life in addition to equipment damage.



CAUTION!

Information appearing in a **CAUTION** concerns the protection of personnel and equipment, software, and data from hazards that can result in minor personal injury or equipment damage.



Note: Information appearing in a Note provides additional information which is helpful in understanding the item being explained.

2.3 General Safeguarding Tips

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. General safeguarding tips are as follows:

- Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation of this robot, the operator's manuals, the system equipment, and options and accessories should be permitted to operate this robot system.
- Do not enter the robot cell while it is in automatic operation. Programmers must have the teach pendant when they enter the robot cell.
- Improper connections can damage the robot. All connections must be made within the standard voltage and current ratings of the robot I/O (Inputs and Outputs).
- The robot must be placed in Emergency Stop (E-STOP) mode whenever it is not in use.
- In accordance with ANSI/RIA R15.06-1999, section 4.2.5, Sources of Energy, use lockout/tagout procedures during equipment maintenance. Refer also to Section 1910.147 (29CFR, Part 1910), Occupational Safety and Health Standards for General Industry (OSHA).

2.4 Mechanical Safety Devices

The safe operation of the robot, positioner, auxiliary equipment, and system is ultimately the user's responsibility. The conditions under which the equipment will be operated safely should be reviewed by the user. The user must be aware of the various national codes, ANSI/RIA R15.06-1999 safety standards, and other local codes that may pertain to the installation and use of industrial equipment. Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. The following safety equipment is provided as standard:

- Safety fences and barriers
- Light curtains and/or safety mats
- Door interlocks
- Emergency stop palm buttons located on operator station, robot controller, and programming pendant

Check all safety equipment frequently for proper operation. Repair or replace any non-functioning safety equipment immediately.

2.5 Installation Safety

Safe installation is essential for protection of people and equipment. The following suggestions are intended to supplement, but not replace, existing federal, local, and state laws and regulations. Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. Installation tips are as follows:

- Be sure that only qualified personnel familiar with national codes, local codes, and ANSI/RIA R15.06-1999 safety standards are permitted to install the equipment.
- Identify the work envelope of each robot with floor markings, signs, and barriers.
- Position all controllers outside the robot work envelope.
- Whenever possible, install safety fences to protect against unauthorized entry into the work envelope.
- Eliminate areas where personnel might get trapped between a moving robot and other equipment (pinch points).
- Provide sufficient room inside the workcell to permit safe teaching and maintenance procedures.

2.6 Programming, Operation, and Maintenance Safety

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation, manuals, electrical design, and equipment interconnections of this robot should be permitted to program, operate, and maintain the system. All personnel involved with the operation of the equipment must understand potential dangers of operation.

- Inspect the robot and work envelope to be sure no potentially hazardous conditions exist. Be sure the area is clean and free of water, oil, debris, etc.
- Be sure that all safeguards are in place. Check all safety equipment for proper operation. Repair or replace any non-functioning safety equipment immediately.
- Do not enter the robot cell while it is in automatic operation. Be sure that only the person holding the programming pendant enters the workcell.
- Check the E-STOP button on the programming pendant for proper operation before programming. The robot must be placed in Emergency Stop (E-STOP) mode whenever it is not in use.
- Back up all programs and jobs onto suitable media before program changes are made. To avoid loss of information, programs, or jobs, a backup must always be made before any service procedures are done and before any changes are made to options, accessories, or equipment.

- Any modifications to PART 1, System Section, of the robot controller concurrent I/O program can cause severe personal injury or death, as well as damage to the robot! Do not make any modifications to PART 1, System Section. Making any changes without the written permission of Motoman will VOID YOUR WARRANTY!
- Some operations require standard passwords and some require special passwords. Special passwords are for Motoman use only. YOUR WARRANTY WILL BE VOID if you use these special passwords.
- The robot controller allows modifications of PART 2, User Section, of the concurrent I/O program and modifications to controller parameters for maximum robot performance. Great care must be taken when making these modifications. All modifications made to the controller will change the way the robot operates and can cause severe personal injury or death, as well as damage the robot and other parts of the system. Double-check all modifications under every mode of robot operation to ensure that you have not created hazards or dangerous situations.
- Check and test any new or modified program at low speed for at least one full cycle.
- This equipment has multiple sources of electrical supply. Electrical interconnections are made between the controller and other equipment. Disconnect and lockout/tagout all electrical circuits before making any modifications or connections.
- Do not perform any maintenance procedures before reading and understanding the proper procedures in the appropriate manual.
- Use proper replacement parts.
- Improper connections can damage the robot. All connections must be made within the standard voltage and current ratings of the robot I/O (Inputs and Outputs).

NOTES

NX100 OPTIONS INSTRUCTIONS

FOR SERVOFLOAT FUNCTION

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

MOTOMAN INSTRUCTIONS

MOTOMAN-□□□ INSTRUCTIONS
NX100 INSTRUCTIONS
NX100 OPERATOR'S MANUAL
NX100 MAINTENANCE MANUAL

The NX100 operator's manuals above correspond to specific usage.
Be sure to use the appropriate manual.





MANDATORY

- **This manual explains the servofloat function of the NX100 system and general operations. Read this manual carefully and be sure to understand its contents before handling the NX100.**
- **General items related to safety are listed in Section 1: Safety of the NX100 Instructions. To ensure correct and safe operation, carefully read the NX100 Instruction 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 NX100.

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 buttons on the front door of the NX100 and programming pendant are 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.

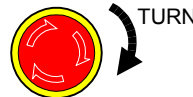
Emergency Stop Button



- **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.

Release of Emergency Stop



- **Observe the following precautions when performing teaching operations within the working 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.

- **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 NX100 power.**
 - **Moving the manipulator with the programming pendant.**
 - **Running the system in the check mode.**
 - **Performing automatic operations.**

Injury may result if anyone enters the P-point maximum envelope of the manipulator during operation. Always press an emergency stop button immediately if there is a problem. The emergency stop buttons are located on the right of the front door of the NX100 and the programming pendant.



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 NX100 cabinet 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 NX100 Instructions before operating the manipulator.**

Definition of Terms Used Often in This Manual


The MOTOMAN manipulator is the YASKAWA industrial robot product.

The manipulator usually consists of the controller, the programming pendant, and supply cables.

In this manual, the equipment is designated as follows.

Equipment	Manual Designation
NX100 Controller	NX100
NX100 Programming Pendant	Programming Pendant
Cable between the manipulator and the controller	Manipulator Cable

Descriptions of the programming pendant keys, buttons, and displays 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 key 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. [SHIFT]+[COORD]
	Displays	The menu displayed in the programming pendant is denoted with { }. ex. {JOB}

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.

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1 Servofloat Function

The servofloat function of the NX100 consists of the link servofloat function and the linear servofloat function. The link servofloat function controls the torque independently for each axis; and the linear servofloat function controls the torque on the Cartesian coordinates. Select these two functions by setting the servofloat instructions accordingly.

1.1 Link Servofloat Function

The link servofloat function works in combination with the position control and the torque control, whereas an ordinary control is a position control that generates torque to keep the taught position regardless of the applied external force. "Torque control" keeps the taught position only by using the torque against the gravitational and frictional forces. Therefore, a manipulator moved by an external force will not return to its original position.

With the servofloat function, external force moves the manipulator since the torque control has priority over the position control.

For example, when removing a workpiece from the die-casting machine, a large external force is applied to the manipulator by the extruding cylinder when a workpiece is grasped and pulled out. The servofloat function is used to protect the manipulator from excessive external force, and the manipulator moves according to the force applied from the die-casting machine.

Note that the manipulator does not move exactly to the taught position or along the taught path, because complete position control is not performed during execution of the servofloat function.

1.2 Linear Servofloat Function

When a manipulator pushes a workpiece or visa-versa, a movement to one predetermined direction may be desirable. With the link servofloat function, a servofloat motion in one direction is not possible since torque control is performed independently for each axis.

This function can specify the control of force in one direction within a space.*1

When unloading a die-casting machine, this function is useful for considerably long ejection distances or when polishing or grinding.

- *1 When external force is applied, the R, B, and T-axes move the same as in the link servo-float function.
Only the end of the U-axis moves in a linear motion.

1.3 Using the Link Servofloat Function and the Linear Servofloat Function

Use the link servofloat function when high-frequency noise, motor vibration, or unsteady manipulator motion occur depending on the manipulator posture, speed, and movement direction.



• Tool load information setting

The servofloat function compensates for gravity in real-time in order to prevent the arms from dropping due to gravity even when the generated torque is limited. For this purpose, the tool load information used for gravity compensation must be set correctly. Otherwise, the servofloat function cannot be performed properly and the arms may drop down or rise up.

For the tool load information, refer to Section "9.11.3 Tool Load Information Setting" in the NX100 INSTRUCTIONS (manual number: RE-CTO-A211) to correctly set the tool load information.

2 The Servofloat Function

Enable the servofloat function with the servofloat function start instruction FLOATON. It remains enabled until one of the following conditions is established.

- Performing the a servofloat function end instruction FLOATOF
- Performing the FWD/BWD key operation, jogging, or a job startup after the cursor is moved
- Performing the FWD/BWD key operation, jogging, or a job startup after a job call, job selection, or job editing
- Turning the servo ON again after an emergency stop

When the function is enabled, the manipulator generates only the torque that is less than the value set to the servofloat condition file. The manipulator uses the torque to operate and keep the position. If a large external force is applied, the manipulator moves according to this force.

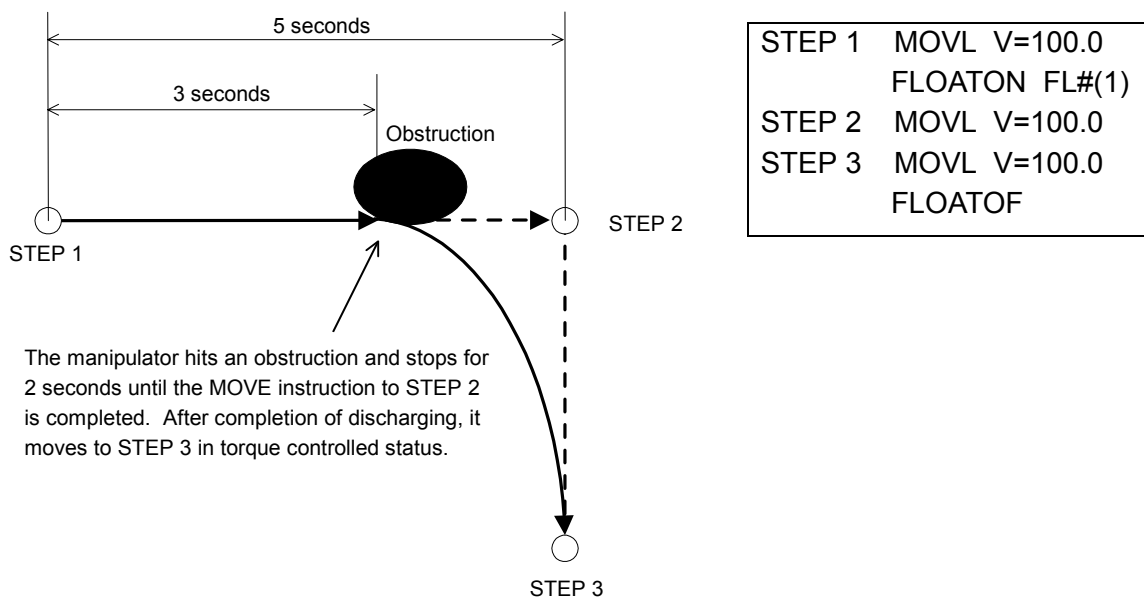
2.1 Moving with the Move Instruction

2.1 Moving with the Move Instruction

If an external force prevents manipulator operation, the manipulator does not reach the taught position when the servofloat function is enabled. Even though the manipulator does not actually reach the taught position, the instruction that would be activated at that position are nonetheless enabled, so the move instruction terminated.

Therefore, when the manipulator cannot reach the taught position because of an external force, the manipulator performs the next instruction.

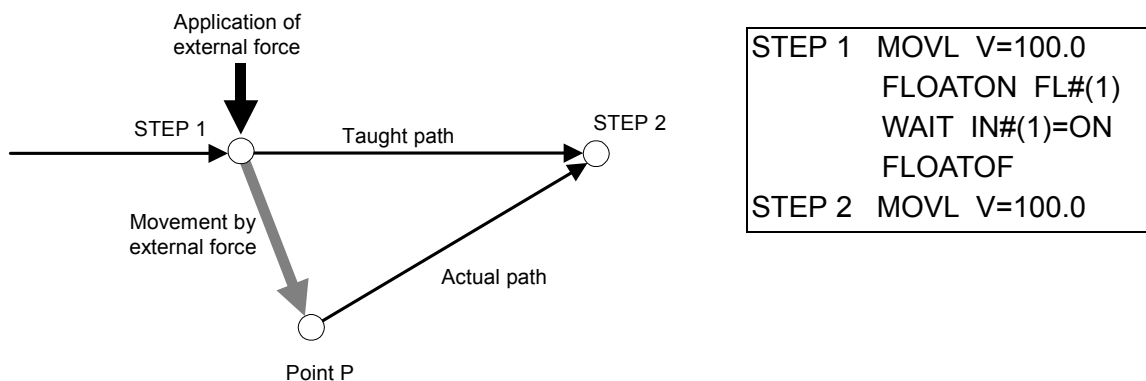
The following figure shows an example where the operation time is 5 seconds from STEP 1 to STEP 2. If the manipulator hits an obstruction 3 seconds after STEP 1 and stops there, it remains stopped at the position for the remaining 2 seconds, and then moves to STEP 3 without moving to STEP 2 when moving with the torque control.



2.2 Moving with the TIMER and WAIT Instructions

When the servofloat function is enabled, torque control can be performed even during the TIMER and WAIT instructions. These instructions end when time is up or when a condition described in page 2-1 is established.

For example, in the following figure, the manipulator reaches STEP 1, and the FLOATON instruction enables the servofloat function. Then the manipulator waits for the input of IN#1 by the WAIT instruction. In this state, if an external force is applied to the manipulator, the manipulator moves to the point P and stops. If the FLOATOF instruction is performed at this point, the servofloat function is disabled and the manipulator moves from point P to STEP 2.



2.3 Operation Check

When the servofloat function is enabled, the soft limit, cube interference, and the S-axis interference are checked at the actual position of the manipulator even though external force moved the manipulator.

2.4 When an Alarm Occurs

If an alarm occurs when the servofloat function is enabled, the servofloat function may remain effective depending on the type of alarm. To disable the servofloat during an alarm, enter “external emergency stop” or “servo OFF signal” during the “alarm occurrence” signal output. This turns OFF the servo power supply and applies the brakes.

2.5 Display during Servofloat Operation

2.5 Display during Servofloat Operation

When the servofloat function is enabled, the message “Servo float activated” appears at the bottom of the programming pendant display, and the specific output 50274 “SERVOFLOAT ON R1” is output.

2.6 Turning Servo ON Again During Servofloat Operation

When the servo power has been turned OFF due to an emergency stop during servofloat operation and turns ON again, press the [SERVO ON READY] on the playback panel until this servo recognizes that the power supply is turned ON. If the button is not pressed for a long enough time, the message “depress servo power ON” appears and the servo power cannot be turned ON.

3 Servofloat Condition Files



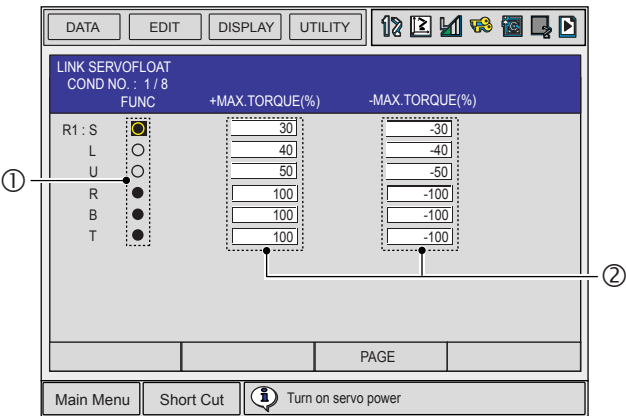
CAUTION

- **If the values for the maximum force and maximum torque are set too low, gravity may cause an arm to drop.**

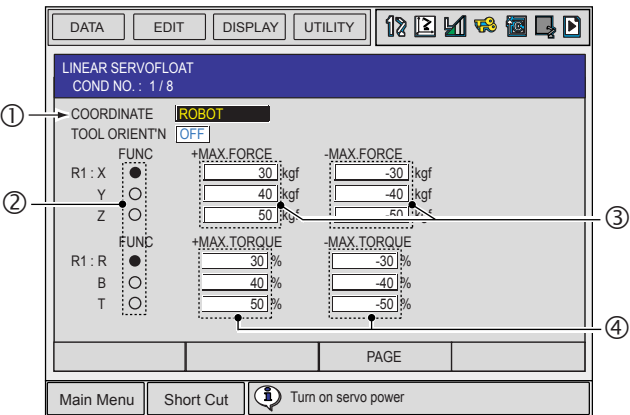
The arm drop may cause an accident or damage to the devices.

There are two kinds of servofloat condition files: the link servofloat condition file specified for the link servofloat function, and the linear servofloat condition file specified for the linear servofloat function.

3.1 Link Servofloat Condition File

	Operation	Explanation
1	Select {ROBOT} from the main menu	
2	Select {LINK SERVOFLOAT}	<p>The link servofloat window appears.</p>  <p>① FUNC Enables/Disables the link servofloat function for each axis. “●” indicates that the function is enabled; “○” indicates that the function is disabled. Pressing [SELECT] switches between “●” and “○”.</p> <p>② (+) MAX. TORQUE / (-) MAX. TORQUE Limits the amount of torque generated for keeping control of the position of each axis. Set the value for each axis using the ratios (%) of the positive and negative sides of the motor to the motor rated torque. The smaller the value is set, the more easily the manipulator can be moved by an external force.</p>
3	Select an item to be set, and set the value	The display enters the number input status. Enter a value for “MAX. TORQUE” by pressing the numeric keys. Then, press [ENTER].

3.2 Linear Servofloat Condition File

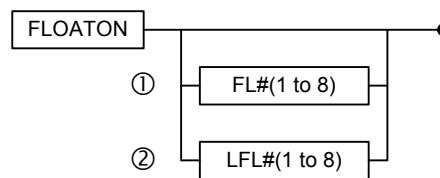
	Operation	Explanation
1	Select {ROBOT} from the main menu	
2	Select {LNR. SERVOFLOAT}	<p>The linear servofloat window appears.</p>  <p>① COORDINATE Sets a coordinate system for the linear servofloat function. Select the ROBOT coordinates, BASE coordinates, USER coordinates or TOOL coordinates. The selection dialog box appears by pressing [SELECT]. Select a coordinate system to be set.</p> <p>② FUNC Enables/Disables the linear servofloat function for each axis. “●” indicates that the function is enabled; “○” indicates that the function is disabled. Pressing [SELECT] switches between “●” and “○”.</p> <p>③ (+) MAX. FORCE / (-) MAX. FORCE Limits the amount of force generated for keeping control of the position of each axis. When the linear servofloat is enabled, a force bigger than this set value is not generated. The smaller the value is set, the more easily a set coordinate axis can be moved by an external force. However, if the set value is less than the manipulator friction, the manipulator may not move.</p> <p>④ (+) MAX. TORQUE / (-) MAX. TORQUE Limits the amount of torque generated for keeping control of the position of R-, B-, and T-axes. Set the value for each axis using the ratios (%) of the positive and negative sides of the motor to the motor rated torque. The smaller the value is set, the more easily an axis can be moved by an external force.</p>
3	Select an item to be set, and set the value	The display enters the number input status. Enter a value for “MAX. TORQUE” by pressing the numeric keys. Then, press [ENTER].

4 Instructions for the Servofloat Function

4.1 FLOATON Instruction

FLOATON is an instruction to enable and start the link servofloat function or the linear servofloat function.

Additional items for the FLOATON instruction are as follows:



① **FL# () (Setting range: 1 to 8)**

Sets the link servofloat condition file number.

② **LFL# () (Setting range: 1 to 8)**

Sets the linear servofloat condition file number.

4.2 FLOATOF Instruction

FLOATOF is an instruction to disable and end the link servofloat function or the linear servofloat function. The servofloat function can be also disabled by performing servo OFF.

4.3 SPDL Tag

The SPDL tag is a stop confirmation tag with which a motion is completed when the number of speed feedback pulses of all the axes becomes less than a constant value.

Use an SPDL tag to confirm the end of a motion caused by an external force. Add it to the move instruction immediately before the FLOATOF instruction.

If the move instruction is completed with a SPDL tag added, the next instruction will not be performed as long as the manipulator is being moved by an external force.

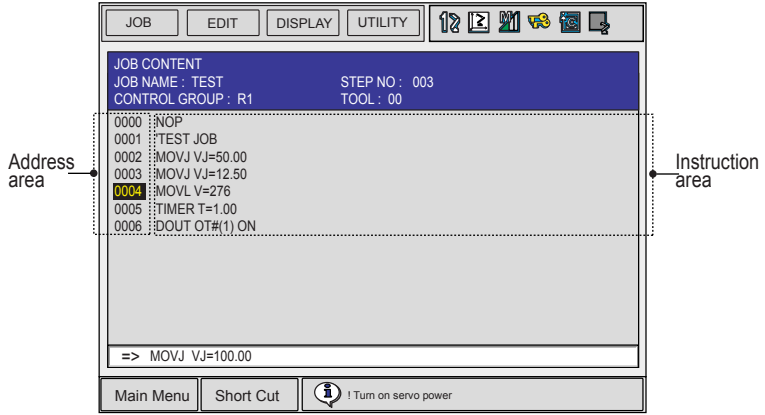
Only "0" can be set for the SPDL tag.

An example of an SPDL tag added to a move instruction is shown as follows:

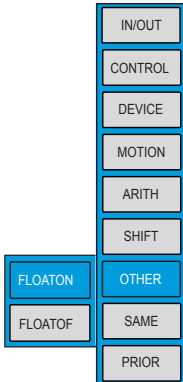
```
MOVJ VJ=50.00 SPDL=0
```

5 Registration of Instruction

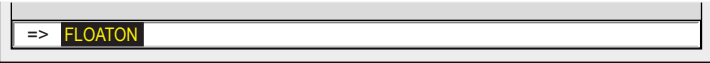
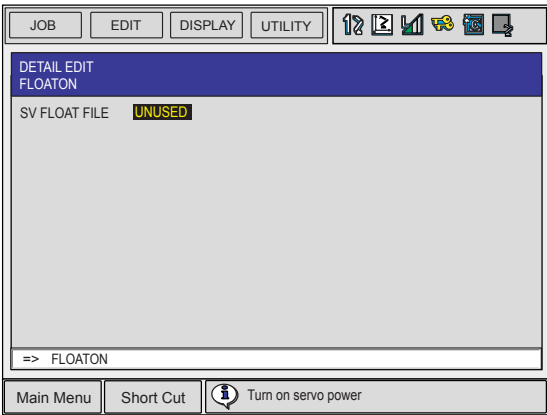
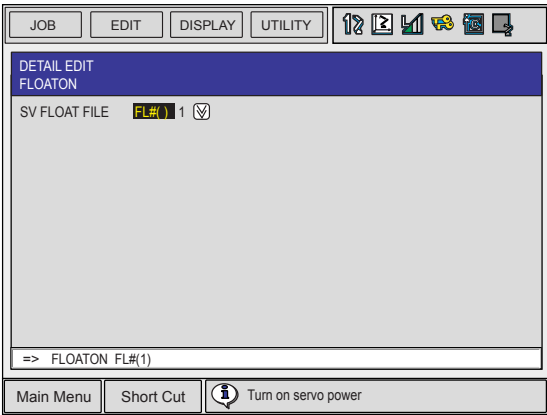
When in the job content display in teach mode, register an instruction with the cursor in the address area.

	Operation	Explanation
1	Select {JOB} from the main menu	
2	Select {JOB CONTENT}	The job content window appears. 
3	Move the cursor to the address area	

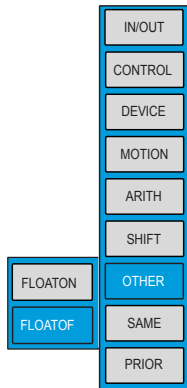
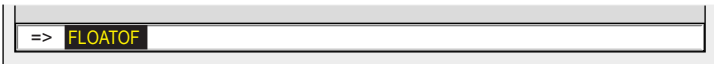
5.1 FLOATON Instruction

	Operation	Explanation
1	Move the cursor to the line where "FLOATON" is to be registered	
2	Press [INFORM LIST]	The instruction dialog box appears. 

5.1 FLOATON Instruction

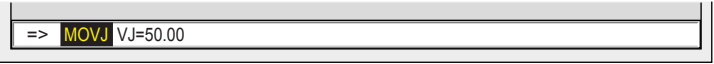
	Operation	Explanation
3	Select "FLOATON"	<p>The "FLOATON" instruction appears in the input buffer line.</p> 
4	Change any additional items and numerical values	<p>< To register without change> To register the instruction displayed in the input buffer line without any changes, go to step 5.</p> <p>< To edit the additional items> To add an additional item, with the cursor on the instruction in the input buffer line, press [SELECT] to call the detail edit display.</p>  <p>With the cursor on "UNUSED" for the "SV FLOAT FILE", press [SELECT]. The selection dialog box appears with the choices "FL# ()" or "LFL# ()". Select one.</p>  <p>After adding an additional item, press [ENTER]. The detail edit display closes, and the job content display reappears.</p>
5	Press [INSERT] and [ENTER]	The instruction displayed in the input buffer line is registered.

5.2 FLOATOF Instruction

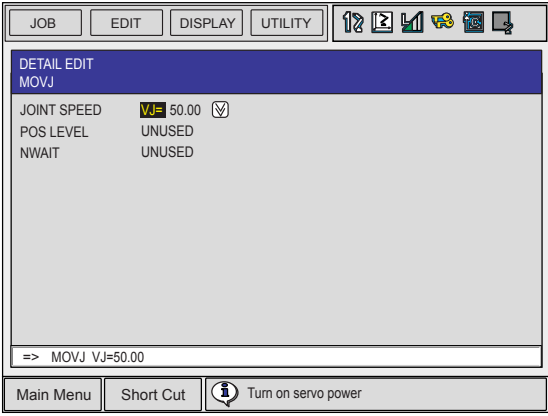
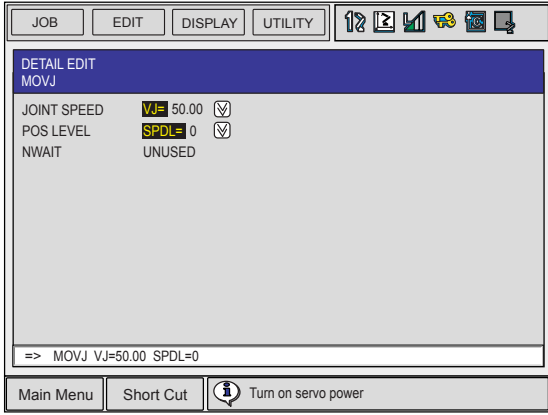
	Operation	Explanation
1	Move the cursor to the line where "FLOATOF" is to be registered	
2	Press [INFORM LIST]	The instruction dialog box appears. 
3	Select "FLOATOF"	The "FLOATOF" instruction appears in the input buffer line. 
5	Press [INSERT] and [ENTER]	The instruction displayed in the input buffer line is registered.

5.3 Addition of SPDL Tag to a Move Instruction

When in the job content display in teach mode, add an SPDL tag to a move instruction, with the cursor in the instruction area.

	Operation	Explanation
1	Select the line of the move instruction where the SPDL tag is to be added	The move instruction appears in the input buffer line. 

5.3 Addition of SPDL Tag to a Move Instruction

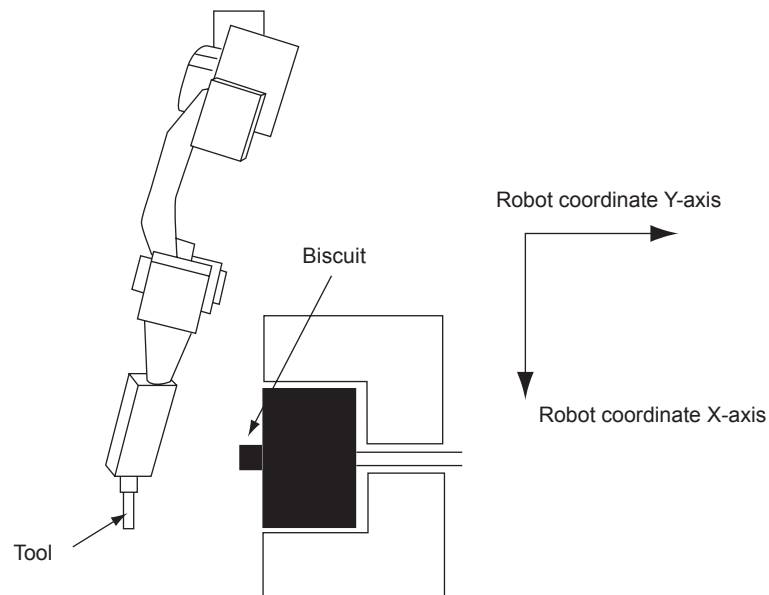
	Operation	Explanation
2	Press [SELECT]	<p>The detail edit window appears.</p>  <p>With the cursor on “UNUSED” for the “POS LEVEL”, press [SELECT]. The selection dialog box appears with the choice, “SPDL=”.</p>  <p>After adding “SPDL=” to the move instruction, press [ENTER]. The detail edit window closes, and the job content window reappears.</p>
3	Press [INSERT] and [ENTER]	The instruction displayed in the input buffer line is registered.

6 Application Example of the Servofloat Function

When removing a workpiece from a die-casting machine, a large external force is applied to the manipulator during extraction after grasping it. In such a case, the following example is applicable using the servofloat function.

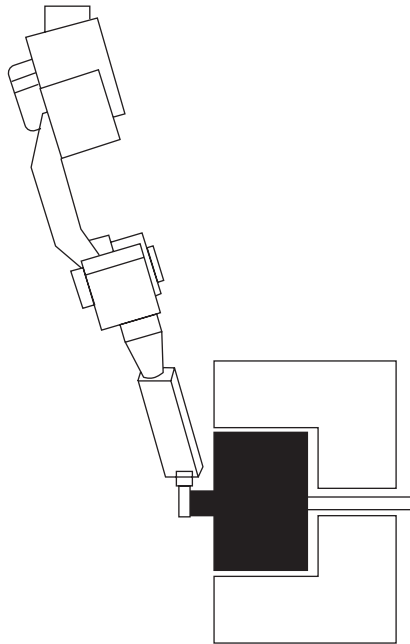
6.1 Movement Example

1. Moves to the waiting point.

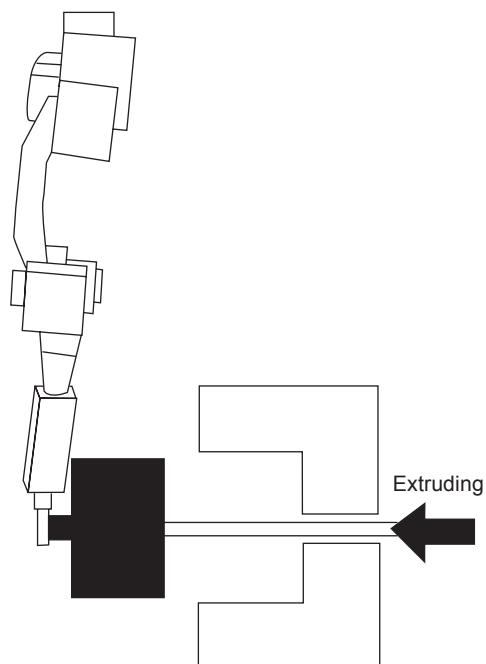


6.1 Movement Example

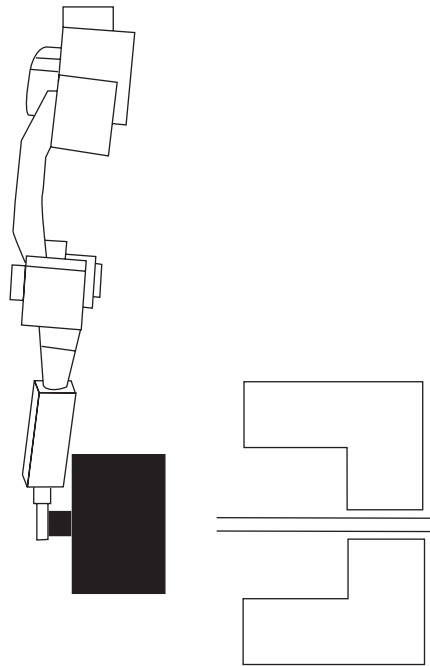
2. Moves to the grasping starting point and performs the TIMER instruction, and then starts the servofloat function.
3. When function enabled, the manipulator grasps a “biscuit”.



4. After having grasped a workpiece, the “start extraction instruction” signal is output, and the manipulator performs an extracting motion.
5. The “start extraction instruction” signal starts the extraction operation of the die-casting machine. Thereby, the manipulator performs an extracting motion.
6. The die-casting machine outputs the “end extraction instruction” signal when the manipulator reaches the completion position. The manipulator ends the servofloat function.



7. The manipulator returns to its normal motion and performs an extraction motion with the workpiece. Then, it returns to the home position.



6.2 Job Example

6.2 Job Example

No. ^{*1}	Explanation	Instruction
1	Moves to the waiting point.	MOVJ VJ=50.0
2	Moves to the workpiece grasping point.	MOVL V=300.0
	Stops and waits for 0.5 seconds.	TIMER T=0.50
	Starts the linear servofloat function.	FLOATON LFL#(1)
3	Turns ON the “grasping instruction” signal. (general output No. 10)	DOUT OT#(10)=1
	Waits for the “grasping answer” signal. (general input No. 10)	WAIT IN#(10)=1
4	Turns ON the “start extraction instruction” signal. (general output No. 11).	DOUT OT#(11)=1
5	Performs the extraction motion. Ends the motion when the “end extraction instruction” signal (gen- eral input No. 11) is input during the motion.	MOVL V=50.0 UNTIL IN#(11)
	Stops and waits for 0.5 seconds.	TIMER T=0.50
6	Completes the servofloat function.	FLOATOF
7	Starts the extracting.	MOVL V=300.0
	Returns to the waiting point.	MOVJ VJ=50.0

***1** The numbers represent the procedure numbers in “6.1 Movement Example”.

6.3 A Setting Example in the Linear Servofloat Condition File

For the example described in “6.1 Movement Example”, set the servofloat condition file as follows.

In the example, the extracting direction corresponds to that of the Y-axis of the robot coordinates. If the direction does not correspond to the robot coordinates, define the extracting direction with the user coordinates and set “COORDINATE” to “USER#01”.

DATA		EDIT		DISPLAY		UTILITY	
LINEAR SERVOFLOAT COND NO. : 1 / 8							
COORDINATE		USER#01					
TOOL ORIENT'N		OFF					
FUNC		+MAX.FORCE		-MAX.FORCE			
R1 : X	●	100	kgf	-100	kgf		
Y	●	0	kgf	-0	kgf		
Z	●	100	kgf	-100	kgf		
FUNC		+MAX.TORQUE		-MAX.TORQUE			
R1 : R	●	100	%	-100	%		
B	●	100	%	-100	%		
T	●	100	%	-100	%		
				PAGE			
Main Menu		Short Cut		Turn on servo power			

6.4 A Setting Example for the Link Servofloat Condition File

6.4 A Setting Example for the Link Servofloat Condition File


For the example described in “6.1 Movement Example”, specify the link servofloat condition file by specifying LF# as the FLOATON instruction file. In this case, a setting example is as follows.

Since the S-axis moves according to the force applied by the extruding cylinder of the die-casting machine, set the “MAX. TORQUEs” of the S-axis to “0”. Set the “MAX. TORQUEs” of the L- and U-axes to “30” to prevent the arms from dropping or rising up due to the load variation. To orientate the tool posture, set the “MAX. TORQUEs” of the R-, B-, and T-axes to “100”.

Using the above settings as a guide, adjust the ratio of each set value according to the circumstances.

LINK SERVOFLOAT			
COND NO. : 1 / 8			
	FUNC	+MAX.TORQUE(%)	-MAX.TORQUE(%)
R1 : S	<input checked="" type="radio"/>	<input type="text" value="0"/>	<input type="text" value="0"/>
L	<input type="radio"/>	<input type="text" value="30"/>	<input type="text" value="-30"/>
U	<input type="radio"/>	<input type="text" value="30"/>	<input type="text" value="-30"/>
R	<input checked="" type="radio"/>	<input type="text" value="100"/>	<input type="text" value="-100"/>
B	<input checked="" type="radio"/>	<input type="text" value="100"/>	<input type="text" value="-100"/>
T	<input checked="" type="radio"/>	<input type="text" value="100"/>	<input type="text" value="-100"/>

PAGE

Main Menu Short Cut  Turn on servo power

NX100 OPTIONS INSTRUCTIONS

FOR SERVOFLOAT FUNCTION

HEAD OFFICE

2-1 Kurosaki-Shiroishi, Yahatanishi-ku, Kitakyusyu-shi, 806-0004, Japan
Phone 81-93-645-7745 Fax 81-93-645-7746

MOTOMAN INC. HEADQUARTERS

805 Liberty Lane West Carrollton, OH 45449, U.S.A.
Phone 1-937-847-6200 Fax 1-937-847-6277

YASKAWA MOTOMAN CANADA LTD.

2280 Argentia Road, Mississauga, Ontario, L5N 6H8, Canada
Phone 1-905-813-5900 Fax 1-905-813-5911

YASKAWA ELECTRIC AMERICA, INC.

2121 Norman Drive South Waukegan, IL 60085, U.S.A.
Phone 1-847-887-7000 Fax 1-847-887-7370

YASKAWA ELECTRIC EUROPE GmbH

Am Kronberger Hang 2, 65824 Schwalbach, Germany
Phone 49-6196-569-300 Fax 49-6196-888-301

MOTOMAN ROBOTICS EUROPE AB

Box 504 S38525 Torsas, Sweden
Phone 46-486-48800 Fax 46-486-41410

MOTOMAN ROBOTEC GmbH

Kammerfeldstr.1, D-85391 Allershausen, Germany
Phone 49-8166-90100 Fax 49-8166-90103

YASKAWA ELECTRIC KOREA CORPORATION

KFPA Bldg #1201, 35-4 Yeoido-dong, Youngdungpo-Ku, Seoul 150-010, Korea
Phone 82-2-784-7844 Fax 82-2-784-8495

YASKAWA ELECTRIC (SINGAPORE) PTE. LTD.

151 Lorong Chuan, #04-01, New Tech Park Singapore 556741, Singapore
Phone 65-6282-3003 Fax 65-6289-3003

YASKAWA ELECTRIC (SINGAPORE) PTE. LTD. MALAYSIA REPRESENTATIVE OFFICE

B615, 6th Floor, East Wing, Wisma Tractors, No.7, Jalan SS 16/1, Subang Jaya, 47500 Petaling Jaya, Selangor D.E. Malaysia
Phone 60-3-5031-5311 Fax 60-3-5031-5312

YASKAWA ELECTRIC (SHANGHAI) CO., LTD.

4F No Aona Road, Waigaoqiao Free Trade Zone, Pudong New Area, Shanghai 200131, China
Phone 86-21-5866-3470 Fax 86-21-5866-3869

YASKAWA ELECTRIC TAIWAN CORPORATION

9F, 16, Nanking E. RD., Sec. 3, Taipei, Taiwan
Phone 886-2-2502-5003 Fax 886-2-2505-1280

YASKAWA ELECTRIC (HK) COMPANY LIMITED

Rm. 2909-10, Hong Kong Plaza, 186-191 Connaught Road West, Hong Kong
Phone 852-2803-2385 Fax 852-2547-5773

BEIJING OFFICE

Room No. 301 Office Building International Club, 21 Jianguomenwai Avenue, Beijing 100020, China
Phone 86-10-6532-1850 Fax 86-10-6532-1851

BEIJING YASKAWA BEIKE AUTOMATION ENGINEERING CO.,LTD.

30 Xue Yuan Road, Haidian, Beijing P.R. China Post Code: 100083, China
Phone 86-10-6234-5003 Fax 86-10-6234-5002

SHOUGANG MOTOMAN ROBOT CO., LTD.

7, Yongchang-North Road, Beijing Economic & Technological Development Area, Beijing 100076, China
Phone 86-10-6788-0541 Fax 86-10-6788-2878



YASKAWA ELECTRIC CORPORATION

YASKAWA