

Motoman NX100 Controller

Interrupt Job Function Manual

Part Number: 149648-6CD
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

COMPLETE OUR ONLINE SURVEY

Motoman is committed to total customer satisfaction! Please give us your feedback on the technical manuals you received with your Motoman robotic solution.

To participate, go to the following website:

<http://www.motoman.com/forms/techpubs.asp>

The information contained within this document is the proprietary property of Motoman, Inc., and may not be copied, reproduced or transmitted to other parties without the expressed written authorization of Motoman, Inc.

©2007 by MOTOMAN
All Rights Reserved

Because we are constantly improving our products, we reserve the right to change specifications without notice. MOTOMAN is a registered trademark of YASKAWA Electric Manufacturing.

Chapter 1

Introduction

This manual provides system information for the Interrupt Job 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 - INTERRUPT JOB INSTRUCTIONS

Provides detailed information about the Interrupt Job 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 (EA1400, HP20, etc.)
- 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 THE INTERRUPT JOB 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 interrupt job 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 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 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.

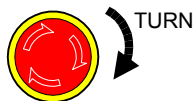
Emergency Stop Button



- **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 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.

- **Confirm that no persons are 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 are problems. 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 P-point maximum envelope of the manipulator, 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

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, or that the item is directly selected by touching the screen.

1	What is the Interrupt Job Function?	
2	Setting of the Interrupt Job Function	
2.1	Interruption Table Display	2-1
2.2	Setting of Interruption Table	2-2
2.2.1	Setting of Signals	2-2
2.2.2	Setting of Job Names	2-3
2.3	Setting of Interruption Levels	2-3
3	Registration of Instructions	
3.1	EI (Enable Interruption) Instruction	3-1
3.2	DI (Disable Interruption) Instruction	3-3
4	Execution of an Interrupt Job	
4.1	Interruption Signal Detection	4-1
4.2	Timing for Interrupt Job Execution	4-1
4.3	Deceleration Before Interrupt Job Execution	4-1
4.4	Interruption Signal Entered During Another Interrupt Job	4-2
4.5	Output Signal of “Interrupt Job in Execution”	4-2
4.6	Automatic Interruption Disabled Status	4-2
4.7	Job Call Stack	4-2
5	Application Examples	
5.1	Interruption During Timer Instruction	5-1
5.2	Interruption During Move Instruction	5-1
5.3	Interruption During Move Instruction with NWAIT	5-2
5.4	Interruption During Circular Interpolation Move Instruction (MOVC)	5-3

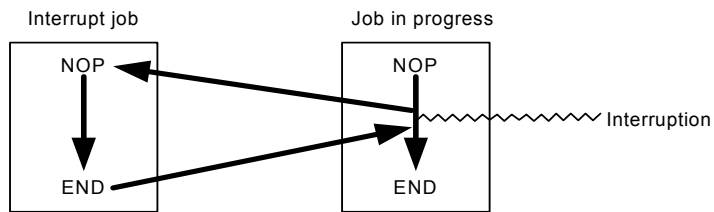
6 System with Independent Control

7 Instruction List

1 What is the Interrupt Job Function?

The interrupt job function is a kind of call job. When a signal to interrupt the job is sent from a peripheral device or another system, this function momentarily suspends a job in progress, and executes the job corresponding to the signal.

This function is useful when an error occurs in a peripheral device or in another system, or when the manipulator should be withdrawn in an emergency.

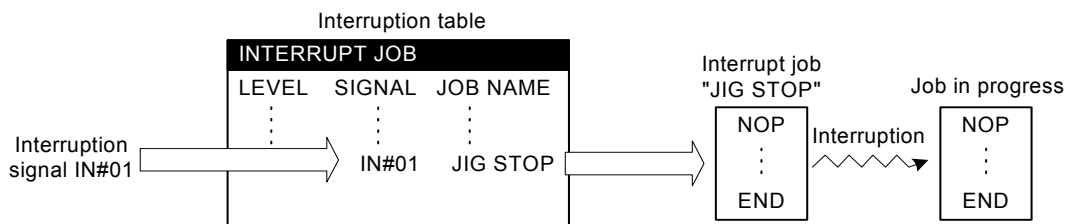


An interruption table defines the relation among the interruption levels (priority of an interruption signal), the interruption signals, and the interrupting jobs.

Sending a user input signal specified in the table calls, a job corresponding to that signal.

When interrupt job is completed, the suspended job is restarted from the instruction line where the cursor was at the time of interruption.

NOTE If an interruption signal is received while the manipulator is in the “step” cycle, the manipulator stops at once, and then the next starting operation starts the interrupt job.



The smaller the interruption level number becomes, the higher the priority of the processing becomes.

Since the NX100 determines which interrupt job is to be executed according to this interruption table, make sure the settings for this table are correct. The system engineer sets up this interruption table.



An interrupt job can be executed when the start lamp is ON and between the execution of the EI (enable interruption) instruction and the DI (disable interruption) instruction. A different interruption level can be specified for both EI and DI.

0010 MOVJ VJ=50.00	
0011 EI ●	Allows all levels if no interruption level is specified.
0012 MOVJ VJ=50.00	
0013 TIMER T=1.00	
0014 DI LEVEL=5 ●	Disables the interruption levels 0 and 2.
0015 MOVJ VJ=50.00	

2 Setting of the Interrupt Job Function

2.1 Interruption Table Display

	Operation	Explanation
1	Select {JOB} under the main menu.	The sub menu appears.
2	Select {INTERRUPT JOB} in the sub menu.	<div data-bbox="710 645 1316 1075" style="border: 1px solid black; padding: 5px;"> </div> <p>① TABLE NO. (Initial value: 1)</p> <p>② OUTPUT SIGNAL (Initial value: no setting) A user output signal that is turned ON during the execution of an interrupt job.</p> <p>③ LEVEL The interruption level indicates the priority of the interruption signal. The smaller the interruption level number becomes, the higher the priority of the processing becomes. Eight levels from 0 to 7 can be set.</p> <p>④ SIGNAL (Initial value: no setting) A user input signal serves as an interruption signal.</p> <p>⑤ JOB NAME (Initial value: no setting) A job name corresponding to an interruption signal</p> <p>⑥ PERMIT Interruption enabled or disabled status (for diagnosis) <input checked="" type="checkbox"/> (Enabled): Interruption enabled by the execution of the EI instruction <input type="checkbox"/> (Disabled): Interruption disabled</p> <p>⑦ EXEC <input checked="" type="radio"/> (ON): Interrupting job in progress <input type="radio"/> (OFF): Interrupting job not in progress "Exec" turns ON when an interruption signal is received and the interrupt job is called, and turns OFF when the job is completed. "Exec" turns OFF in the following cases: <ul style="list-style-type: none"> • An interrupt job is completed and the suspended job is restarted. • Another job is called. • CLEAR STACK instruction is executed. </p>



NOTE {INTERRUPT JOB} appears when the security mode is the edit mode or management mode.

2.2 Setting of Interruption Table

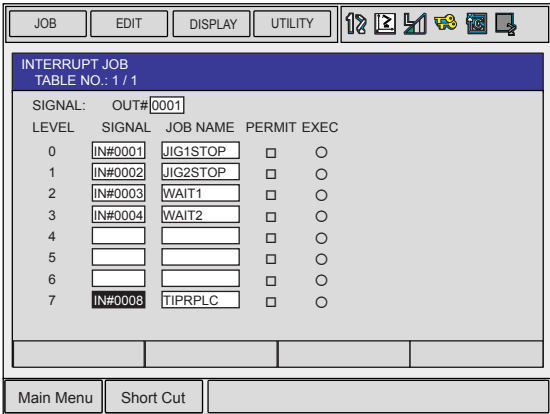
2.2 Setting of Interruption Table

In a system where an independent control is used simultaneously with the interrupt job function, an interrupt job can be set and executed for each task.

When using four tasks (eight tasks maximum) for the independent control:

- Pressing the page key  changes the table No. in this order : “1” → “2” → “3” → “4” → “1.”
- Pressing [SHIFT] + the page key  changes the table No. in the reverse order : “4” → “3” → “2” → “1” → “4.”

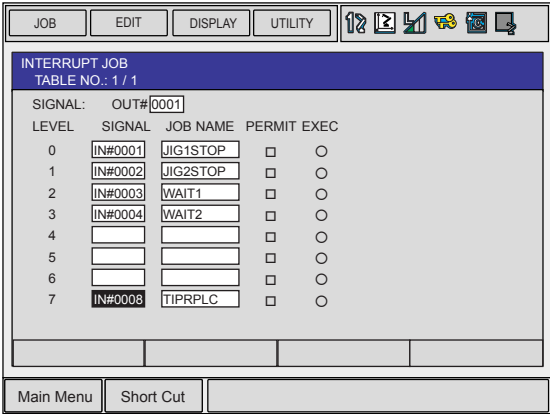
2.2.1 Setting of Signals

	Operation	Explanation																																													
1	Move the cursor to the item to be selected, and press [SELECT].	 <table border="1"> <thead> <tr> <th>LEVEL</th> <th>SIGNAL</th> <th>JOB NAME</th> <th>PERMIT</th> <th>EXEC</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>IN#0001</td> <td>JIG1STOP</td> <td><input type="checkbox"/></td> <td><input type="radio"/></td> </tr> <tr> <td>1</td> <td>IN#0002</td> <td>JIG2STOP</td> <td><input type="checkbox"/></td> <td><input type="radio"/></td> </tr> <tr> <td>2</td> <td>IN#0003</td> <td>WAIT1</td> <td><input type="checkbox"/></td> <td><input type="radio"/></td> </tr> <tr> <td>3</td> <td>IN#0004</td> <td>WAIT2</td> <td><input type="checkbox"/></td> <td><input type="radio"/></td> </tr> <tr> <td>4</td> <td></td> <td></td> <td><input type="checkbox"/></td> <td><input type="radio"/></td> </tr> <tr> <td>5</td> <td></td> <td></td> <td><input type="checkbox"/></td> <td><input type="radio"/></td> </tr> <tr> <td>6</td> <td></td> <td></td> <td><input type="checkbox"/></td> <td><input type="radio"/></td> </tr> <tr> <td>7</td> <td>IN#0008</td> <td>TIPRPLC</td> <td><input type="checkbox"/></td> <td><input type="radio"/></td> </tr> </tbody> </table>	LEVEL	SIGNAL	JOB NAME	PERMIT	EXEC	0	IN#0001	JIG1STOP	<input type="checkbox"/>	<input type="radio"/>	1	IN#0002	JIG2STOP	<input type="checkbox"/>	<input type="radio"/>	2	IN#0003	WAIT1	<input type="checkbox"/>	<input type="radio"/>	3	IN#0004	WAIT2	<input type="checkbox"/>	<input type="radio"/>	4			<input type="checkbox"/>	<input type="radio"/>	5			<input type="checkbox"/>	<input type="radio"/>	6			<input type="checkbox"/>	<input type="radio"/>	7	IN#0008	TIPRPLC	<input type="checkbox"/>	<input type="radio"/>
LEVEL	SIGNAL	JOB NAME	PERMIT	EXEC																																											
0	IN#0001	JIG1STOP	<input type="checkbox"/>	<input type="radio"/>																																											
1	IN#0002	JIG2STOP	<input type="checkbox"/>	<input type="radio"/>																																											
2	IN#0003	WAIT1	<input type="checkbox"/>	<input type="radio"/>																																											
3	IN#0004	WAIT2	<input type="checkbox"/>	<input type="radio"/>																																											
4			<input type="checkbox"/>	<input type="radio"/>																																											
5			<input type="checkbox"/>	<input type="radio"/>																																											
6			<input type="checkbox"/>	<input type="radio"/>																																											
7	IN#0008	TIPRPLC	<input type="checkbox"/>	<input type="radio"/>																																											
2	Enter a numerical value using the Numeric keys.																																														



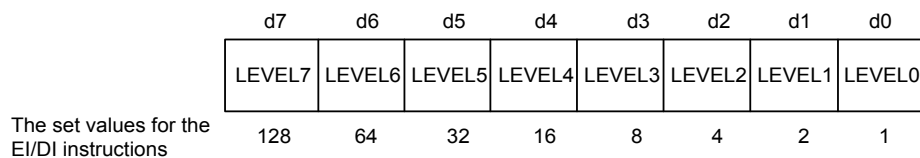
Entering “0” in SIGNAL clears the set signal No. and job name.

2.2.2 Setting of Job Names

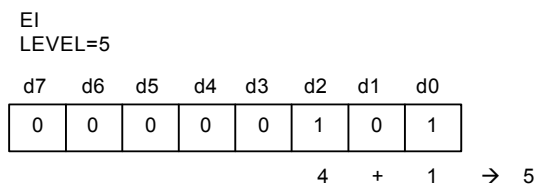
	Operation	Explanation
1	Move the cursor to the item to be selected, and press [SELECT].	
2	Select a job in the JOB LIST window.	
3	Press [ENTER].	

2.3 Setting of Interruption Levels

To specify the levels where interruptions can be enabled or disabled by the EI and DI instructions respectively, set the bits corresponding to the levels to “1.”



For example, the set value of level 0 is “1” and the set value of level 2 is “4,” with a total set value of “5.” Therefore, to permit levels 0 and 2, set the EI instruction to “5.”



The status of other interruption levels remains unchanged.

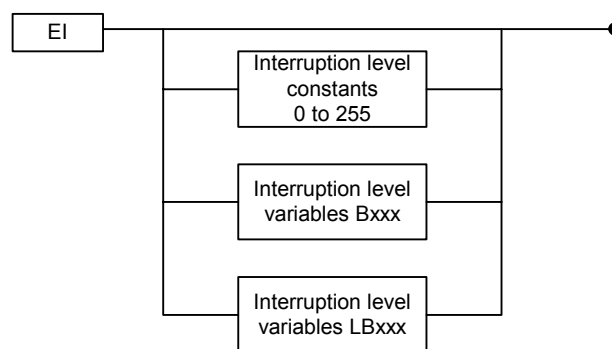


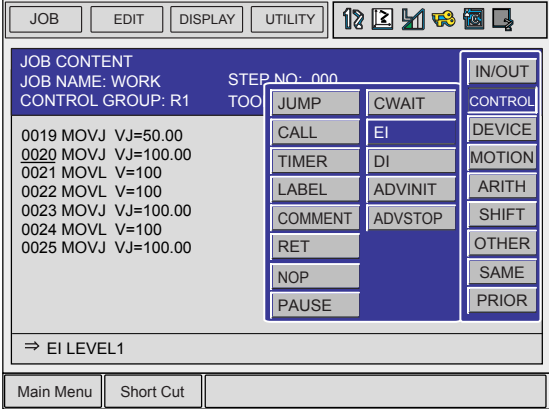
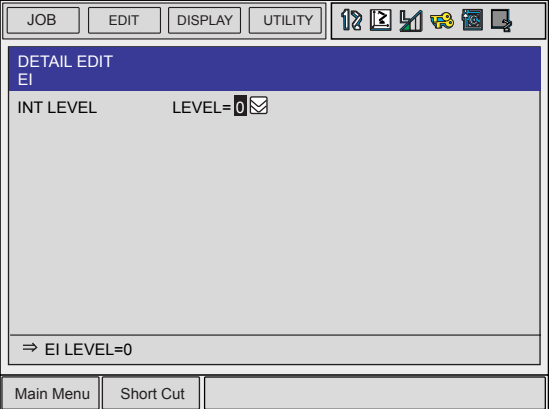
- If no interruption level is specified, all levels from 0 to 7 enable or disable interruption.
- If the interruption level is set to “0,” it is treated like an NOP instruction where no operation is executed and proceeds to the next instruction.

3 Registration of Instructions

3.1 EI (Enable Interruption) Instruction

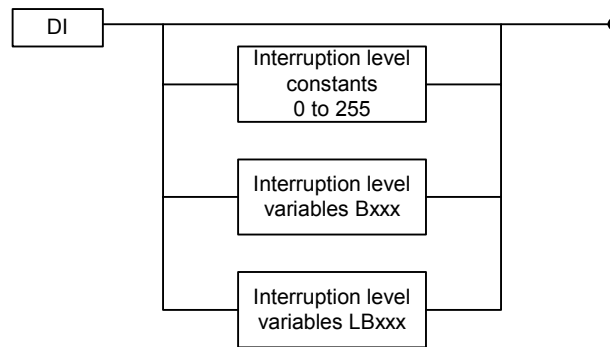
Executing an EI instruction activates the specified interruption levels set in the additional item. To specify the levels where interruptions can be enabled, set the bits corresponding to the levels to "1." The status of the other interruption levels remains unchanged.

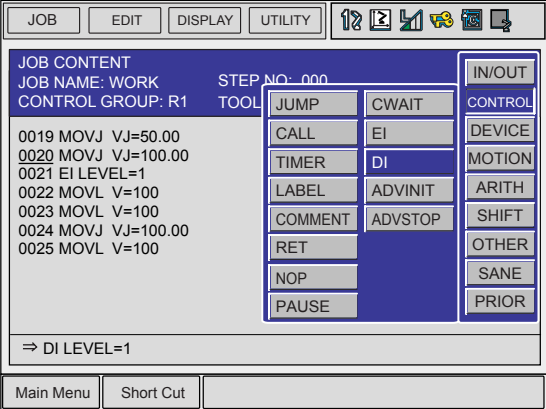
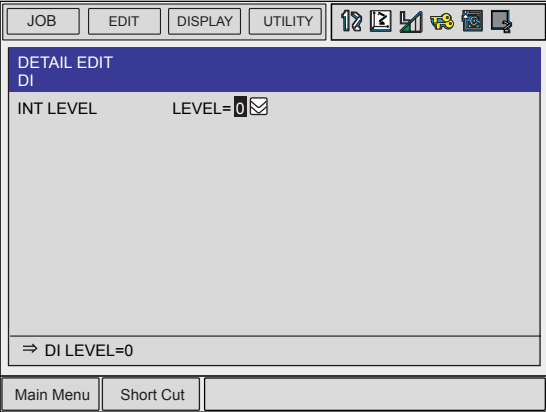


	Operation	Explanation
1	Move the cursor to the address area.	
2	Press [INFORM LIST].	
3	Select {CONTROL}.	
4	Move the cursor to "EI."	<p>The EI instruction appears in the input buffer line with the previously registered additional items.</p>  <p>The screenshot shows a software interface with a menu bar (JOB, EDIT, DISPLAY, UTILITY) and a toolbar. The main window is titled 'JOB CONTENT' and displays job details: JOB NAME: WORK, STEP NO: 000, CONTROL GROUP: R1. A list of instructions is shown: 0019 MOVJ VJ=50.00, 0020 MOVJ VJ=100.00, 0021 MOVL V=100, 0022 MOVL V=100, 0023 MOVJ VJ=100.00, 0024 MOVL V=100, 0025 MOVJ VJ=100.00. A right-hand menu contains options like IN/OUT, CONTROL, DEVICE, MOTION, ARITH, SHIFT, OTHER, SAME, and PRIOR. The 'EI' option is highlighted in the input buffer area. At the bottom, it shows '⇒ EI LEVEL1' and buttons for 'Main Menu' and 'Short Cut'.</p>
5	Press [SELECT] twice to set an interruption level in the DETAIL EDIT window.	<p>Enter the interruption level using the Numeric keys.</p>  <p>The screenshot shows a software interface with a menu bar (JOB, EDIT, DISPLAY, UTILITY) and a toolbar. The main window is titled 'DETAIL EDIT' and shows 'EI' as the selected instruction. The 'INT LEVEL' is set to 'LEVEL=0' with a checkmark next to it. At the bottom, it shows '⇒ EI LEVEL=0' and buttons for 'Main Menu' and 'Short Cut'.</p>
6	Press [ENTER] twice.	<p>Pressing [ENTER] once shows the set contents in the input buffer line. Pressing [ENTER] again registers the set contents in the job.</p>

3.2 DI (Disable Interruption) Instruction

Executing a DI instruction activates the specified interruption levels set in the additional item. To specify the levels where interruptions can be disabled, set the bits corresponding to the levels to "1." The status of the other interruption levels remains unchanged.



	Operation	Explanation
1	Move the cursor to the address area.	
2	Press [INFORM LIST].	
3	Select {CONTROL}.	
4	Move the cursor to "DI."	<p>The DI instruction appears in the input buffer line with the previously registered additional items.</p> 
5	Press [SELECT] twice to set an interruption level in the DETAIL EDIT window.	<p>Enter the interruption level using the Numeric keys.</p> 
6	Press [ENTER] twice.	<p>Pressing [ENTER] once shows the set contents in the input buffer line. Pressing [ENTER] again registers the set contents in the job.</p>

4 Execution of an Interrupt Job

4.1 Interruption Signal Detection

An interruption signal is detected at the rising edge of the signal.

If more than one interruption signal is detected at the same time, the job for the level with higher priority is executed.

4.2 Timing for Interrupt Job Execution

The timing of executing an interrupt job depends on what instruction is being executed when the interruption signal is received, and can be divided into the following two types.

- Suspends the instruction being executed to do an interrupt job

The following instructions are suspended while executing an interrupt job.

Move Instructions	MOVJ/MOVL/MOVC/IMOV
I/O Instruction	WAIT
Control Instruction	TIMER

- Executes an interrupt job after the completion of the instruction being executed.
Any instructions other than those listed above are completed before starting an interrupt job.

4.3 Deceleration Before Interrupt Job Execution

If the manipulator is moving at a high speed and the interrupt job is executed immediately after the interruption signal is received, an excessive shock to the manipulator may result. To avoid this risk, the manipulator automatically decelerates upon receipt of the interruption signal, and then the interrupt job is executed.

4.4 Interruption Signal Entered During Another Interrupt Job

All interruptions are automatically disabled during the execution of an interrupt job. Therefore, if another interruption signal with a higher priority is received, its corresponding job is not executed.

The new signal is ignored. When an interrupt job is completed, even if any interruption signal is ON, the corresponding interrupt job is not executed until the rising edge of the interruption signal is detected.

4.5 Output Signal of “Interrupt Job in Execution”

During execution of an interrupt job, the output signal turns ON to indicate that the interrupt job is being executed. This output signal turns ON when an interruption signal is received and the interrupt job is called, and turns OFF when the interrupt job completes.

The output signal “Interrupt Job in Execution” turns OFF in the following cases:

- The execution of an interrupt job completes and the suspended job is restarted.
- Another job is called.
- The CLEAR STACK instruction is executed.

4.6 Automatic Interruption Disabled Status

Only execution of the EI instruction enables interruptions. Even after the main power supply turns OFF, the interruption enabled/disabled status is kept.

However, when a job is called, all interruption levels are automatically disabled for security.

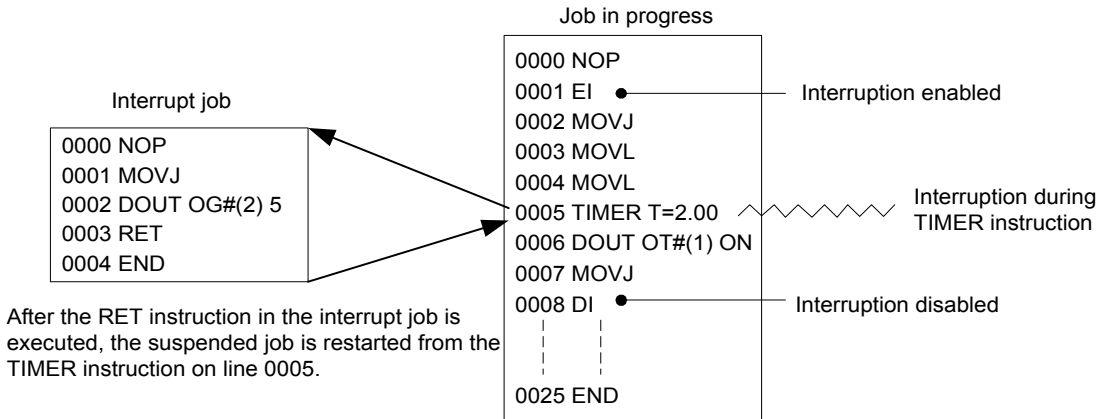
4.7 Job Call Stack

Job calls made by interruptions are processed like other job calls. The same job call stack is used for both kinds of job calls.

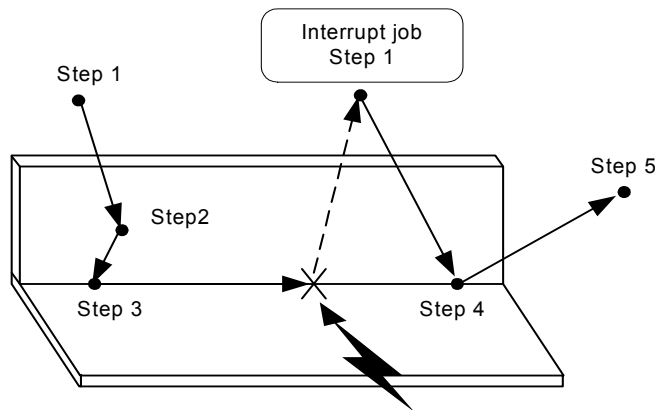
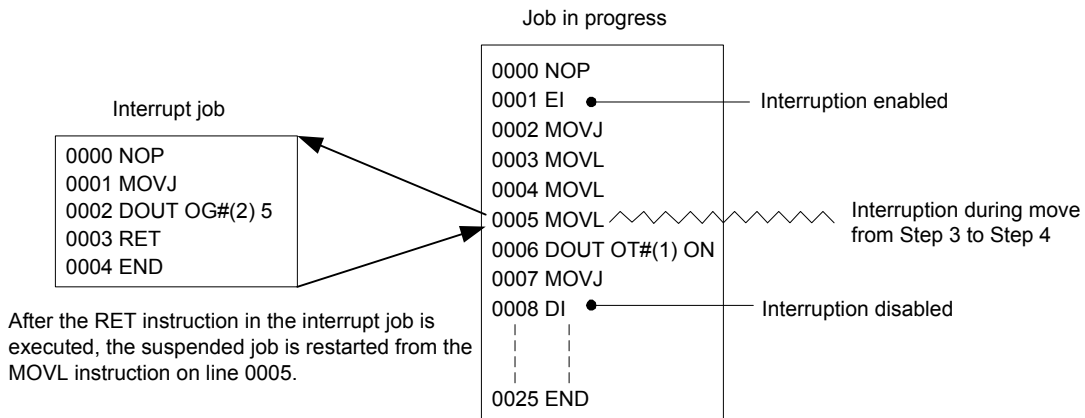
Therefore, adding an interrupt job to a job call stack filled to level 8 causes the stack to overflow.

5 Application Examples

5.1 Interruption During Timer Instruction

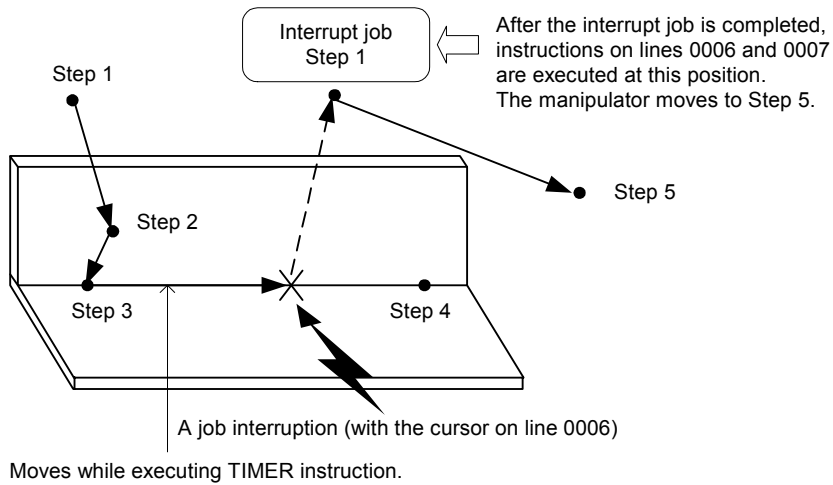
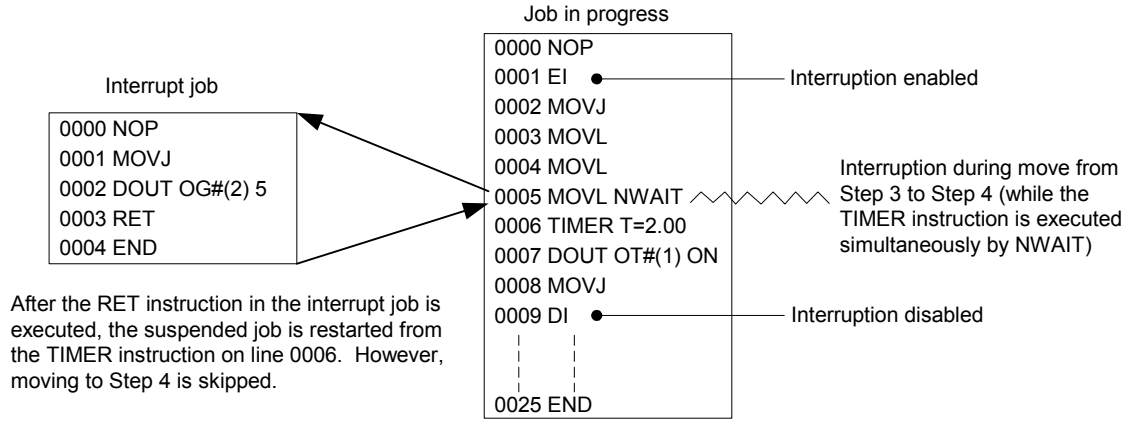


5.2 Interruption During Move Instruction

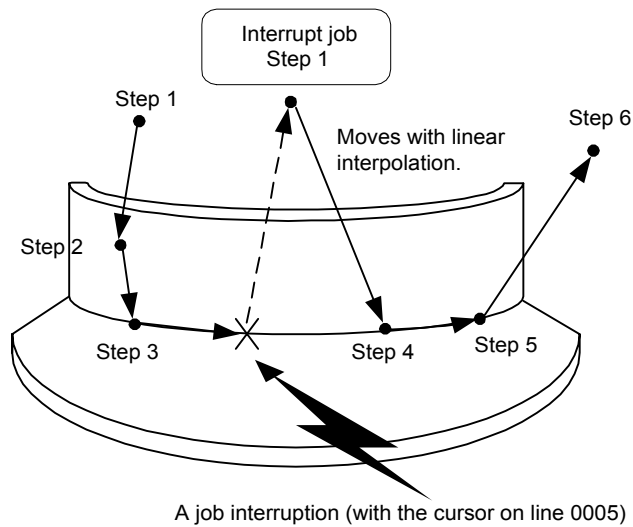
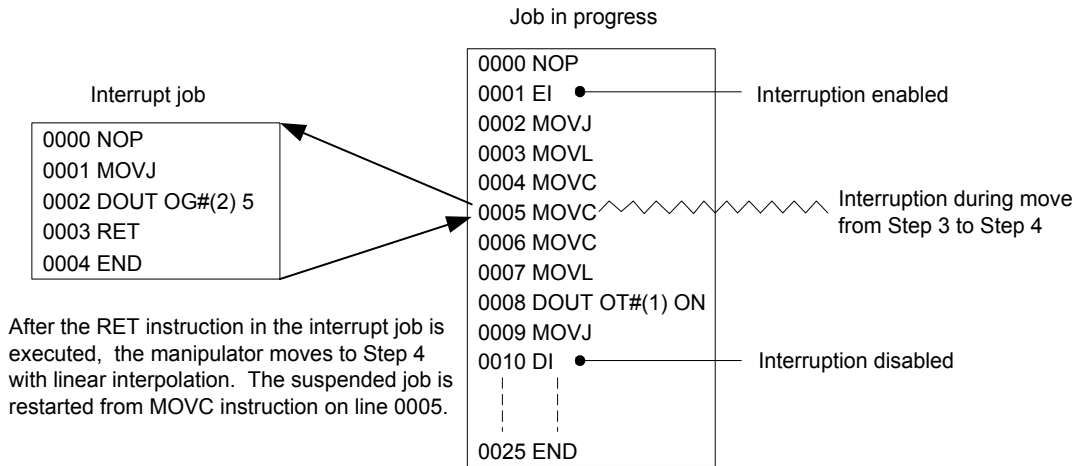


A job interruption (with the cursor on line 0005)

5.3 Interruption During Move Instruction with NWAIT



5.4 Interruption During Circular Interpolation Move Instruction (MOVC)

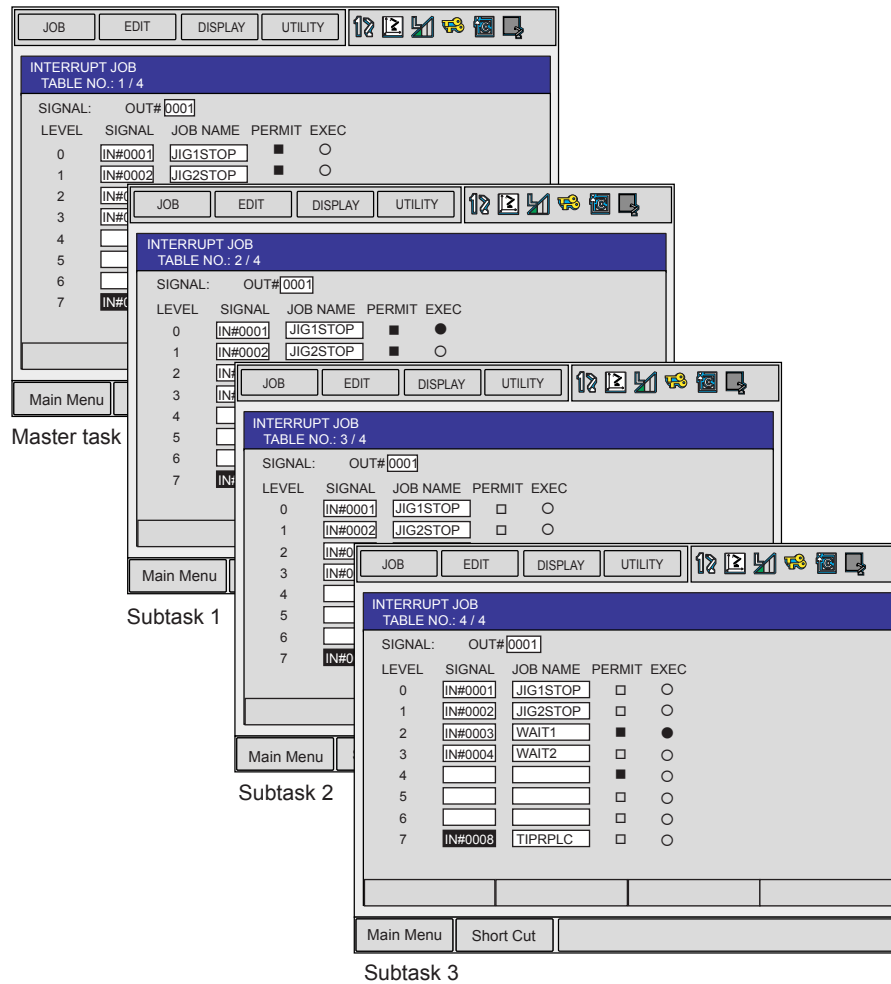


6 System with Independent Control

In a system where an independent control is used simultaneously with the interrupt job function, an interrupt job can be set and executed for each task.

When using four tasks (eight tasks maximum) for the independent control, the table No. indicates the type of task being displayed as follows:

- Master task ··· Table No. 1
- Subtask 1 ··· Table No. 2
- Subtask 2 ··· Table No. 3
- Subtask 3 ··· Table No. 4





- EI and DI instructions are valid only in each individual task. For example, an EI instruction in subtask 1 does not affect any interruption tables in the master task or in subtask 2.
- The following instructions are used for independent control.

PSEND
PRCIV
PSTART
PWAIT
TSYNC

During execution of an independent control instruction above, the interrupt job function can not be used. Program a DI and an EI instruction before and after the independent control instruction to disable interruptions.

<Job Example>

When a PSEND instruction is used

```
NOP
....
DI
PSEND SUB1 1
EI
....
END
```

7 Instruction List

< > indicates numerical or alphabetical data. If multiple items are shown in one section, select one of the items.

EI	Function	Enables a specified interruption level.	
	Additional Items	<Interruption level> B <Variable No.> LB <Variable No.>	0 to 255 for constants. When omitted, all levels are enabled.
	Example	EI LEVEL=1 EI LEVEL=B001 EI	
DI	Function	Disables a specified interruption level.	
	Additional Items	<Interruption level> B <Variable No.> LB <Variable No.>	0 to 255 for constants When omitted, all levels are disabled.
	Example	DI LEVEL=5 DI LEVEL=B001 DI	

NX100 OPTIONS INSTRUCTIONS

FOR THE INTERRUPT JOB 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