

Motoman® NX100 Controller

Compact Flash Job Exchanger Instruction Manual

Part Number: 154037-1CD
Revision: 0

MOTOMAN
a YASKAWA company

Motoman, Incorporated
805 Liberty Lane
West Carrollton, Ohio 45449 USA
937.847.6200 (Voice)
937.847.6277 (Fax)
937.847.3200 (24-Hour Support)
www.motoman.com
info@motoman.com

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.

Table of Contents

Chapter 1

Introduction	1
1.1 About This Document	1
1.2 Overview	2
1.2.1 Main Work Area	2
1.2.2 Set Configuration	3
1.2.3 Configuration	3
1.3 Reference Documentation	4
1.4 Customer Support Information	4

Chapter 2

Safety	5
2.1 Introduction	5
2.2 Standard Conventions	6
2.3 General Safeguarding Tips	6
2.4 Mechanical Safety Devices	7
2.5 Installation Safety	7
2.6 Programming, Operation, and Maintenance Safety	8

Chapter 3

Operation	9
3.1 Accessing the Compact Flash Job Exchanger	9
3.2 Job Sets	10
3.3 Validation	11
3.4 Trigger	11
3.5 Job Structure	12

Notes

Chapter 1

Introduction

1.1 About This Document

This Instruction Manual provides an overview of the Motoman Compact Flash Job Exchanger application. For additional information regarding your robot controller or other system components, please refer to the documentation package included with your robotic system (refer to Section 1.3).

This Instruction Manual contains the following chapters –

CHAPTER 1 – INTRODUCTION

This chapter introduces the Compact Flash Job Exchanger and provides a general overview of the application, lists reference documents that are included with the documentation package, and provides Motoman Customer Support contact information.

CHAPTER 2 – SAFETY

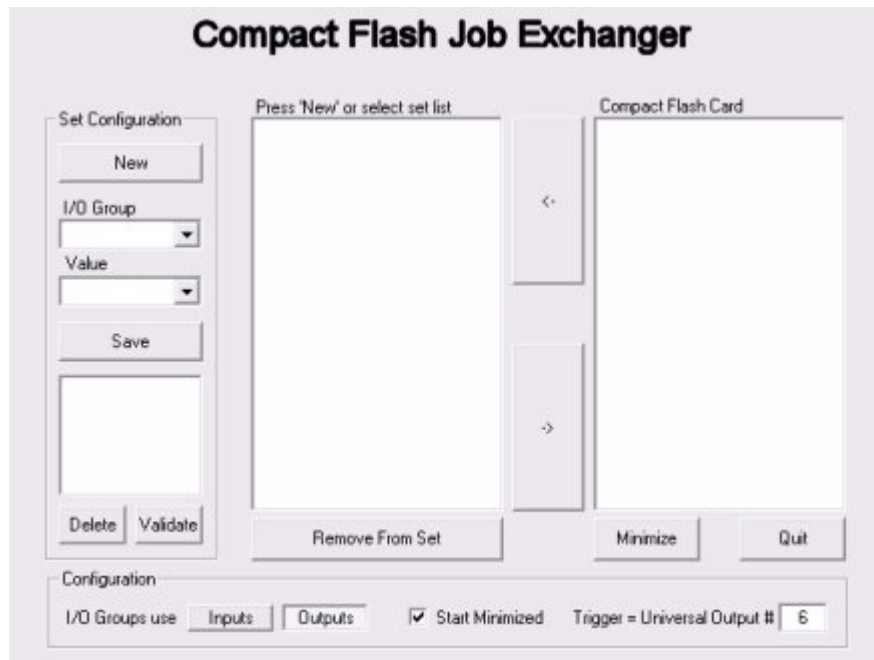
This chapter provides general information regarding the safe installation, maintenance, and operation of the Compact Flash Job Exchanger system.

CHAPTER 3 – OPERATION

This chapter provides an overview of the Compact Flash Job Exchanger operation.

1.2 Overview

The Compact Flash Job Exchanger is a utility that allows you to swap jobs between the robot controller and a compact flash card. This is particularly useful when working with complex applications where the number of jobs and sub-routines is larger than can be stored directly on the controller. Compact Flash Job Exchanger allows you to create lists of jobs or “job sets” that can be swapped back and forth between the compact flash card and the controller as needed. Further, these job swaps can be triggered directly from the Master job.



1.2.1 Main Work Area

The main work area contains two main windows. The left window displays the list of jobs or job set that will be loaded to the controller once a swap is initiated. The right window list the job files that currently present on the compact flash card.

Remove From Set

The Remove From Set button removes the selected job file from the current job set. Only jobs that are backed up on the compact flash card can be removed from the job set.



Note: Removing files from a job set does not delete the file from the controller. This simply modifies the job set. No job files are added or deleted from the controller until a job set is activated and a swap is initiated.

Minimize

The Minimize button closes the Compact Flash Job Exchanger interface but allows the application to continue running in the background.

Quit

The Quit button stops the Compact Flash Job Exchanger application from running.

1.2.2 Set Configuration

The Set Configuration area defines each job set.

New

The New button is used to create a new job set.

I/O Group

The I/O Group dropdown window is used to define the job set.

Value

The Value dropdown window is used to define the value that activates the job set.

Save

The Save button saves the defined job set.

Set List window

The Set List window shows all job sets currently available.

Delete

The Delete button deletes the selected job set from the compact flash card.

Validate

The Validate button verifies that the jobs listed in the selected job set reside on the compact flash card and that the current Master Job is included in the job set. If the current Master Job is not included, it is automatically added to the job set. If a job listed in the job set is missing from both the controller and the compact flash card, the job set is renamed “bad” and cannot be used. To correct this error, simply re-load the missing job to the controller or compact flash card and re-name the job set file.

1.2.3 Configuration

I/O Groups use [Inputs] [Outputs]

The I/O Groups use Inputs / Outputs buttons allow you to select between using Input I/O Groups or Output I/O Groups to store job set values.

Start Minimized

Checking the Start Minimized radio button causes the Compact Flash Job Exchanger application to automatically start and begin running minimized in the background when the robot controller is turned ON.

Trigger = Universal Output # []

The Trigger = Universal Output # window determines what Universal Output is used to trigger the controller to begin scanning the defined I/O Groups to determine which job sets are active.

1.3 Reference Documentation

For additional information on other system components, refer to the following documentation –

- Motoman *Manipulator Manual* for your robot model
- Motoman *NX100 Controller Manual* (P/N 149201-1)
- Motoman *NX100 Maintenance Manual* (P/N 150133-1)
- Motoman *NX100 Concurrent I/O Parameter Manual* (P/N 149230-1)
- Motoman *NX100 Independent/Coordinated Control Function Manual* (P/N 149648-1)
- Motoman *INFORM User's Manual* (P/N 150078-1)
- Vendor manuals for system components not manufactured by Motoman

1.4 Customer Support Information

If you need technical assistance with your Compact Flash Job Exchanger system, please contact Motoman Customer Support at the following 24-hour telephone number –

937. 847. 3200

Please have the following information ready before you call –

- PRODUCT — Compact Flash Job Exchanger
- ROBOTS — SSA2000, EA1400N, HP50, etc.
- CONTROLLER — NX100
- PRIMARY APPLICATION — Handling
- SOFTWARE VERSION — Access this information on the Programming Pendant display screen by selecting MAIN MENU → SYSTEM INFO → VERSION
- ROBOT SERIAL No — Located on data plate of robot
- ROBOT SALES ORDER No — Located on data plate of NX100 controller
- WARRANTY ID CODE — Located on back of the Programming Pendant

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.

Here is RIA contact information –

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

Chapter 3

Operation



CAUTION!

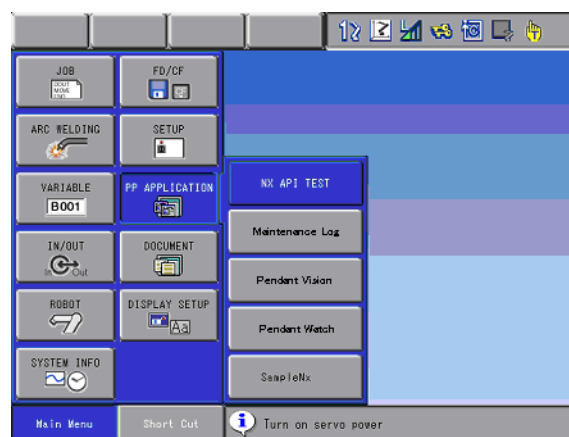
The customer is responsible for providing trained operators to run the equipment. The customer is also responsible for making sure that the equipment is operated in accordance with the ANSI/RIA R15.06-1999 Robot Safety standard, as well as any other local or state standards.

This chapter provides operating procedures and instructions for the Compact Flash Job Exchanger pendant application. For detailed instructions regarding other components including the NX100 controller, refer to specific component manuals included with your documentation package (refer to Section 1.3).

3.1 Accessing the Compact Flash Job Exchanger

To access the Compact Flash Job Exchanger application:

1. Select the [PP Application] menu button. A sub menu of installed applications is displayed.



2. Select the Compact Flash Job Exchanger application from the list.

3.2 Job Sets

The lists of jobs or 'Job Sets' are the heart of the application. A job set is simply a list of robot job files that is loaded on the controller when the swap completes. When a swap is initiated, jobs may be added to, or deleted from the robot controller so that only those jobs in the job set reside on the controller when the swap is complete. To prevent important jobs from being permanently lost, only job files backed up on the compact flash card can be deleted from the controller. In addition, the Master job can never be deleted from the controller, even if a backup copy exists on the compact flash card.

Job sets are defined by an I/O Group number and activation Value. The I/O Group number is the storage location for a job set and the Value number activates the job set. So you could have 10 job sets defined to I/O Group #3, and activate each one individually using the Value number (i.e. if I/O Group 3 has a Value of 1, activate job set 1, If I/O Group 3 has a Value of 2, activate job set 2, etc.). The defined I/O Group must be at the specified value for a particular job set to be active. If more than one set is active at a time, only the first set evaluated will be swapped. Either input or output groups can be used to define the job set. This choice is made in the configuration area at the bottom of the screen.

To create a job set:

1. Press the [New] button.
2. Add files to the list by selecting from the right window list and press the [-] button located between the main windows.
3. Remove files from the list by highlighting the file and pressing the [Remove] button. Only jobs that are backed up on the compact flash card can be removed from the job set.



Note: Removing files from a job set does not delete the file from the controller. This simply modifies the job set. No job files are added or deleted from the controller until a job set is activated and a swap is initiated.

4. Select the I/O Group number from the dropdown menu.
5. Select the Value that will activate this job set from the dropdown menu.
6. Once you have made all the appropriate selections, press the Save button. The new job set is added to the list named according to the I/O Group and Value numbers (i.e. 3_1 = I/O Group 3 and Value 1).



Note: If you have chosen an existing I/O Group and Value combination, your current selections will overwrite the previous job set.

To delete a job set:

Press the [Delete] button.

To copy a file from the robot controller to the compact flash card:

Select the file from the left window and press the [->] button located between the main windows.

To review a job set:

Select the job set from the set list window. The I/O Group and Value boxes are populated and the list of job files appears in the left window.

To edit a job set:

1. Select the job set from the set list window. The I/O Group and Value boxes are populated and the list of job files appears in the left window.
2. Make changes as required and press [Save].

3.3 Validation

An automatic validation is performed when Compact Flash Job Exchanger is first started. This verifies that the jobs listed in the active job set actually reside on the compact flash card and that the current Master Job is included in the job set. If the current Master Job is not included, it is automatically added to the job set. If a job listed in the job set is missing from both the controller and the compact flash card, the job set is renamed with a “.bad” extension and cannot be used. To correct this error, simply re-load the missing job to the controller or compact flash card and re-name the job set file with the proper “.set” extension.

While an automatic validation is performed upon controller start-up, it is a good idea to perform a manual validation after making any changes to job set.

To validate a job set:

1. Select the job set you wish to validate.
2. Press the [Validate] button.

3.4 Trigger

A Universal Output, defined in the configuration area at the bottom of the screen, is used as a trigger to begin evaluating the defined I/O Groups to determine which job sets are active. The robot controller begins scanning the 'Value' of a group by its binary value starting at the lowest output number representing 1 to the highest representing 128. The total value range is 1 to 255. Additional I/O Groups can be used if more than 255 job sets are needed. You can also combine different I/O Groups and Values as needed. You do not need to use every combination within a I/O Group.

Once the active job set is determined, the actual job swap starts and job files are added to or deleted from robot controller until all the job files listed in the job set reside on the controller. The trigger output is then turned OFF at the end of the swap process.

3.5 Job Structure

Motoman recommends using the following job structure when calling the Compact Flash Job Exchanger application. Because the robot job is not processed synchronously with the job exchanger application, failure to follow these recommendations may cause unpredictable results.

The following code example assumes that the application is using B000 to hold the swap value and that output group 3 is the destination. Modify your code appropriately. Place this code at the bottom of the Master job. When a job swap is performed, no lines of code below the 'CALL JOB:SWAP' line are executed. Compact Flash Job Exchanger re-starts the robot at the top of Master job.

```
0037 DOUT OG#(3) B000
0038 WAIT OG#(3)=B000 T=1.00
0039 JUMP *SKIP IF B000=0
0040 CALL JOB:SWAP
0041 *SKIP
0042 END
```

The WAIT OG#(3)=B000 T=1.00 ensures that the output group value has settled before starting the swap process.

The SWAP job should be constructed as follows substituting the appropriate trigger output for the example output OT #(6).

```
0000 NOP
0001 DOUT OT#(6) ON
0002 WAIT OT#(6)=ON T=1.00
0003 WAIT OT#(6)=OFF
0004 END
```


A

About 1
Accessing the Program 9

C

Configuration 3
Customer Service 4

D

Delete 3
Documentation 4

G

General Safeguarding Tips 6

I

I/O Group 3
I/O Groups use 3
Installation Safety 7
Introduction 1

J

Job Sets 10
Job Structure 12

M

Main Work Area 2
Mechanical Safety Devices 7
Minimize 2

N

New 3

O

Operation 9
Overview 2

P

Programming, Operation, and Maintenance Safety
8

Q

Quit 2

R

Remove From Set 2

S

Safety 5
Save 3
Set Configuration 3
Set List window 3
Standard Conventions 6
Start Minimized 3

T

Trigger 11

V

Validate 3
Validation 11
Value 3