

# NX100 OPTIONS INSTRUCTIONS

FOR PRESS SYNCHRONIZED FUNCTION

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

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## MOTOMAN INSTRUCTIONS

NX100 INSTRUCTIONS  
NX100 OPERATOR'S MANUAL  
NX100 MAINTENANCE MANUAL

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

Part Number: 163955-1CD  
Revision: 0

 **MANDATORY**

- This manual explains the Press Synchronized 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 Motoman 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 Motoman is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids your product's warranty.

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## Notes for Safe Operation

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

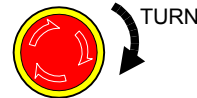
Emergency Stop Button



- 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 is a 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
Cable between the manipulator and NX100	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, or that the item is directly selected by touching the screen.

## Registered Trademark

In this manual, names of companies, corporations, or products are trademarks, registered trademarks, or brand names for each company or corporation. The indications of (R) and TM are omitted.

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1	Outline of Press synchronized Function	
2	Hardware specifications	
2.1	Communication board	2-1
2.2	Switch setting	2-2
2.3	I/O module setting	2-3
2.4	Upper controller setting	2-5
3	Press Condition File	
3.1	Setting data	3-1
4	Teaching	
	■ SYSTART	4-1
	■ SYEND	4-1
	■ MOVJ (ENC tag)	4-1
5	Position Correction Function	
5.1	Outline	5-1
5.2	Operation procedure	5-1
6	Current Manipulator Position Output Function	
6.1	Outline	6-1
6.2	Parameters	6-1
6.3	Output range	6-1
7	Current Press Position Output Function	
7.1	Outline	7-1
7.2	Parameters	7-1

## 8 Interlocking Operation Fixing Function

8.1 Outline .....	8-1
8.2 Parameter.....	8-1
8.3 Switching single operation.....	8-1



# 1 Outline of Press synchronized Function

With the press synchronized function, the manipulator can move synchronized with the press motion according to the operation program in which the manipulator positions according to the press angles are registered.

The manipulator detects the press angle by the encoder mounted on the press.

The system configuration of press synchronized function is as follows;

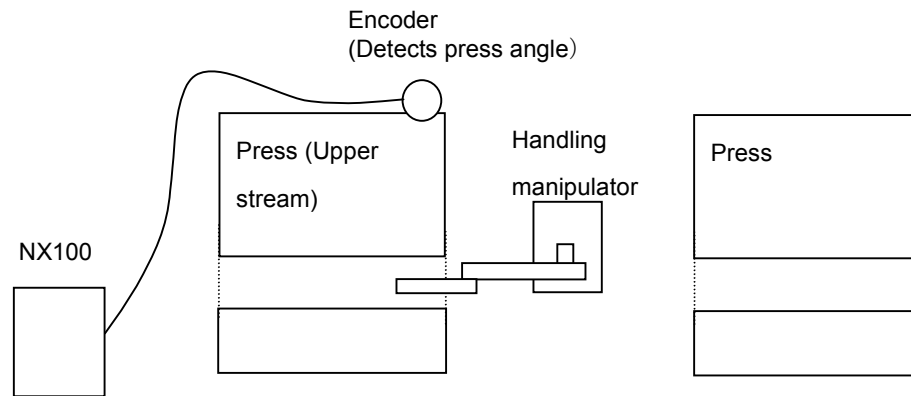


Fig.1 Press synchronized Function System Configuration



## 2 Hardware specifications

The devices and the board necessary for the press synchronized function are described as below.

### 2.1 Communication board

In addition to standard boards, a press synchronized function board; JAPMC-MC2110-ET3 must be installed to use the press synchronized function.

With JAPMC-MC2110-ET3, general IO and press encoder data can be transmitted between other mechatrolink device and NX100.

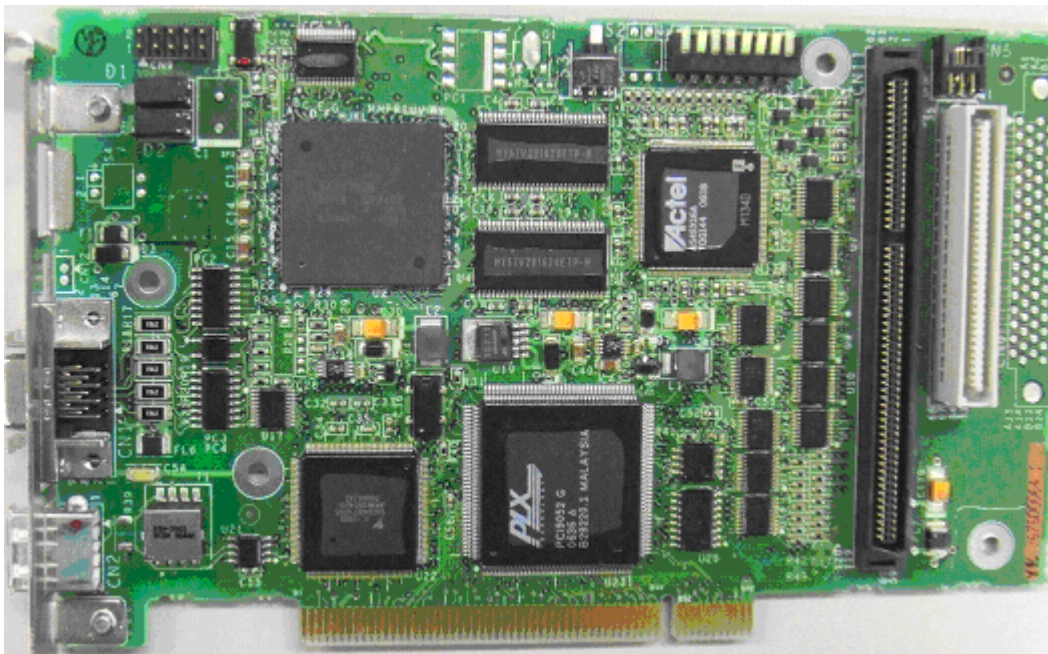


Fig. 2 MP2110 board

## 2.2 Switch setting

## 2.2 Switch setting

Confirm that the dip switch (S1) of JAPMC-MC2110-ET3 is set as the Fig3 shows.

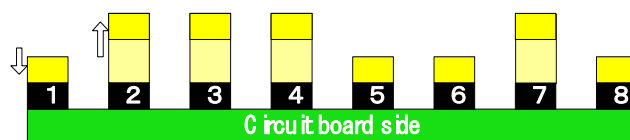


Fig. 3 Dip switch (S1) setting

(Meaning of each bit)

- S1-1 to 4 : Node address ( S1-1 is the least significant bit, not 0)
- S1-5 : Communication frequency 0: 2 msec, 1: 1 msec
- S1-6 : Communication mode 0: 32 bytes, 1: 17 bytes
- S1-7 : Fixed to 0
- S1-8 : Fixed to 1



- Fig.3 shows the initial setting when shipment.
- Don't change the initial setting for S1-5 to S1-8.
- To set "1", press down the switch.

## 2.3 I/O module setting

Before installing a JAPMC-MC2110--ET3, check that the NX100 (Controller) power is OFF, and then install the board to “Option CPU board slot 1”.

Set the I/O module according to the following procedure.

### 【Operation procedure】

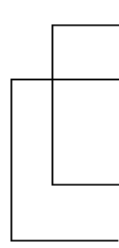
Operation procedure	
1-1	Turn the power ON while pressing [Main menu] simultaneously to start up the maintenance mode.
1-2	Press {SYSTEM} under the main menu and then {SETUP} ->{I/O MODULE}.
1-3	Check the board is correctly mounted before confirming the setting.
2-1	Press {SYSTEM} under the main menu and then {SYSTEM} ->{INITIALIZE} -> {OPTION BOARD}.
2-2	Confirm the Press synchronized function is selected for CPU02#1 and then press [ENTER].
2-3	“ROBOT SENSOR OPTION“ screen appears. Confirm that both R1 and R2 indicate “○” (Use) and then press [ENTER]. If the setting indicates “-“ (Not used), change the indication to “○“ by moving the cursor to the “-“ and then pressing [SELECT] key.

<IO allocation example>

- Option CPU board slot 1: JAPMC-MC2110-ET3 board
- Option CPU board slot 2: SST-CCS-PCU board

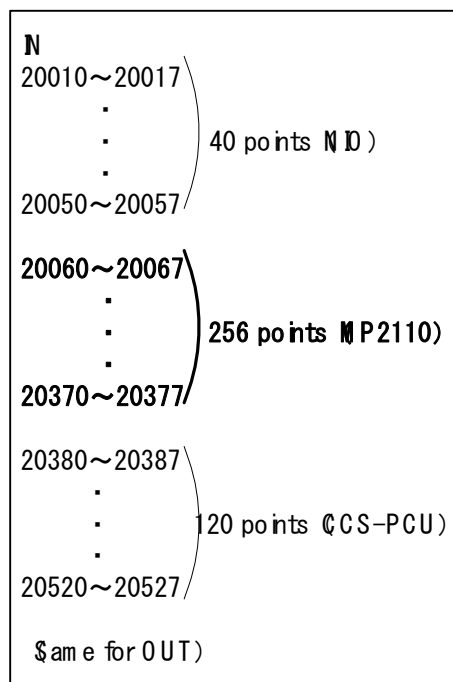
In this case, the “I/O MODULE” in the maintenance mode indicates as follows.

ST#	DI	DO	AI	AO	BOARD	
00	0040	0040	-	-	NI001-01	←Standard I/O
01	-	-	-	-	-	
.	.	.	.	.	.	
15	-	-	-	-	-	
16	0256	0256	-	-	MP2110	
17	0120	0120	-	-	CCS-PCU	(←4 stations occupied)

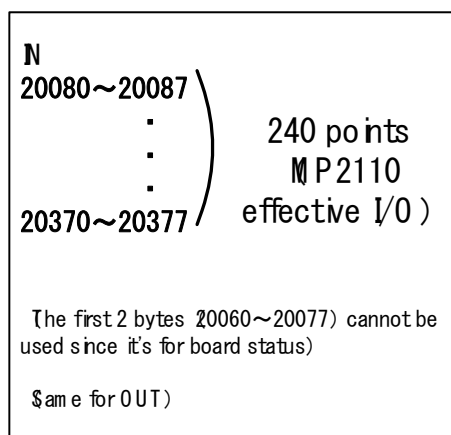

  
 PCI slot (1)  
 PCI slot (2)

## 2.3 I/O module setting

The external I/O allocation for NX100 is as follows.



**NOTE:** The beginning 2 bytes of MP2110 are for control data. (It's not communication data.)  
Therefore, the communication data with MP controller is to be allocated as follows.



**NOTE:** Set the following parameter again if IO module setting is changed.

S1E	Meaning	Set value
19	Press synchronized function specification	3

## 2.4 Upper controller setting

Refer to the instruction manual supplied with MP2200 for details.

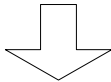
When MP2200(MPE720) IO map is allocated, the signals correspond as follows.

IO map allocation for MP2200

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	ST#	TYPE
0000	HO	HO	HO	HO	HO	HO	HO	HO	HI	HI	HI	HI	HI	HI	HI	HI	01	*****I/O
0010																		

### 【MP controller output】

OW0000=AB\_CDh



### 【NX external input】

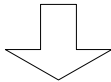
#2008\*=1100\_1101 (CDh)

#2009\*=1010\_1011 (ABh)

### 【NX external output】

#3008\*=1100\_1101 (CDh)

#3009\*=1010\_1011 (ABh)



### 【MP controller input】

IW0008 = AB\_CDh

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## 2.4 Upper controller setting

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## 3 Press Condition File

To correctly operate press synchronized function, it is necessary to set the press data in NX100. Data setting can be performed in Press Condition File.

### 3.1 Setting data

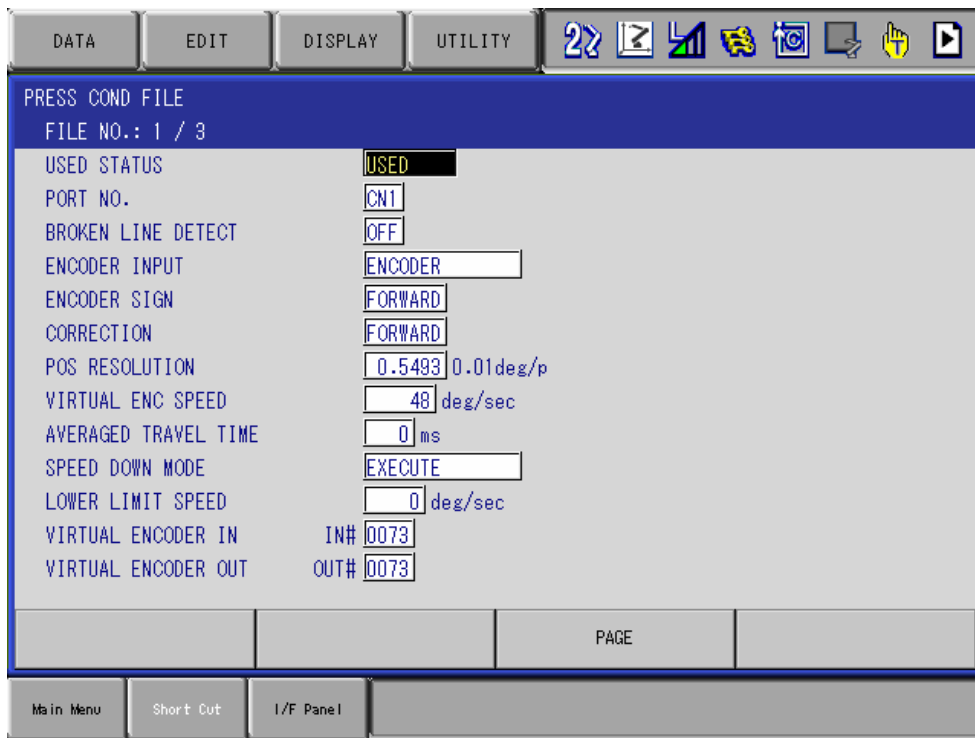


Fig. 4 Press Condition File

1) FILE NO.

Specify the Press Condition File No.

2) USED STATUS (NOT USED / USED)

Specify whether the press condition file of the file No. is used.

3) PORT NO.

Not used.

4) BROKEN LINE DETECT (ON / OFF)

Specify whether the broken line detection is executed.

5) ENCODER INPUT (ENCODER / VIRTUAL ENCDR)

Specify whether the tracking motion is performed according to encoder input or virtual pulse encoder.

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### 3.1 Setting data

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If VIRTUAL ENCODER is specified, the manipulator can perform tracking motion even if the encoder is not connected or the press is not moving, which can be used for test run.

#### 6) ENCODER SIGN (FORWARD / REVERSE)

Specify whether the sign of the encoder position pulse input from the encode is reversed.

When "REVERSE" is selected, the signs of the press position data and press speed data in the Press Monitor screen are reversed.

#### 7) CORRECTION (FORWARD / REVERSE)

Specify whether the direction in which the tracking motion is performed is reversed.

When "REVERSE" is selected, the sign of the correction position in the press speed data in Press Monitor screen is reversed.

#### 8) POSITION RESOLUTION ( 0 to 9.9999 [0.01 deg/pulse] )

Convert the pulse data from the encoder to press moving volume (deg) .

In this function, the setting value is fixed as follows;

Resolution[0.01deg/pulse] =  $36000/65536 = 0.5493$

#### 9) VIRTUAL ENCODER SPEED ( -32767 to 32767 deg / sec )

Specify the virtual encoder speed.

#### 10) AVERAGED TRAVEL TIME (0 to 3000 ms)

Even if the press moving volume is suddenly changed, it automatically performs the processing in which the manipulator can move smoothly. At that time, however, the reponse of the tracking is decreased.

This item is set when the press pulsation is large.

#### 11) SPEED DOWN MODE

Not used.

#### 12) LOWER LIMIT SPEED (0 to 65535 deg / sec)

Not used.

#### 13) VIRTUAL ENCODER INPUT SIGNAL (0 to 1024)

If the specified general input signal is input, the encoder input becomes virtual encoder mode.

0: Not used

1 to 1024: The specified general input signal becomes valid.

#### 14) VIRTUAL ENCODER OUTPUT SIGNAL (0 to 1024)

Specify the destination of the output signal that indicates virtual encoder mode.

0: Not used

1 to 1024: Output the signal for the specified general output.

## 4 Teaching

### ■ SYSTART

An instruction to indicate the starting of the press synchronized operation section. Synchronized operation is performed from the move instruction after this instruction is registered.

### ■ SYEND

An instruction indicates the end of the press synchronized operation section. Synchronization is completed in the step where this instruction is registered.

### ■ MOVJ (ENC tag)

An instruction to perform press synchronized operation. When the manipulator position is taught, the press position is also registered at the same time.

While press synchronized operation is performed, the manipulator moves in the direction of next step according to the same amount as the press position increase.

The unit of the ENC tag is [0.01deg] (same unit as press current position).

JOB example is as follows;

```

NOP
SYEND CV#(1)
JUMP *END IF IN#(1)=OFF
SYSTART CV#(1) STP=0.000
*CONT
MOVJ VJ=I000 ENC1=500
MOVJ VJ=I000 ENC1=1000
MOVJ VJ=I000 ENC1=1500
MOVJ VJ=I000 ENC1=2000
      .
      .
MOVJ VJ=I000 ENC1=350000
MOVJ VJ=I000 ENC1=355000
JUMP *CONT IF IN#(2)=ON
*END
SYEND CV#(1)
MOVJ VJ=10.00
END

```



## 5 Position Correction Function

### 5.1 Outline

In press synchronized function, the position relationship between the press and manipulator is fixed. This function automatically corrects the error between press position and manipulator position by moving the manipulator to the current press position.

### 5.2 Operation procedure

Operation procedure	
1	Confirm that both press and manipulator are not moving.
2	Turn ON Specific input signal: Position Correction Request (#40114).
3	When a press synchronized JOB is started under this status, the position correction operation starts and the system becomes synchronized status.
4	Automatically search the step just before press position to move to the corresponding step. While moving, the specific output signal: Executing Position Correction #50344 is turned ON. For example; if the current press position is 35 degree, search the step just before press position (Fig.5 A) and move the manipulator to the corresponding position.
5	The manipulator moves from the current position to A and then press position C, and then it becomes the status of synchronization with the stopped press. At that time, the specific output #50344 becomes OFF to complete position correction.
6	After the position correction is completed (#50344 is OFF), the manipulator starts synchronized operation according to the start of the press operation.

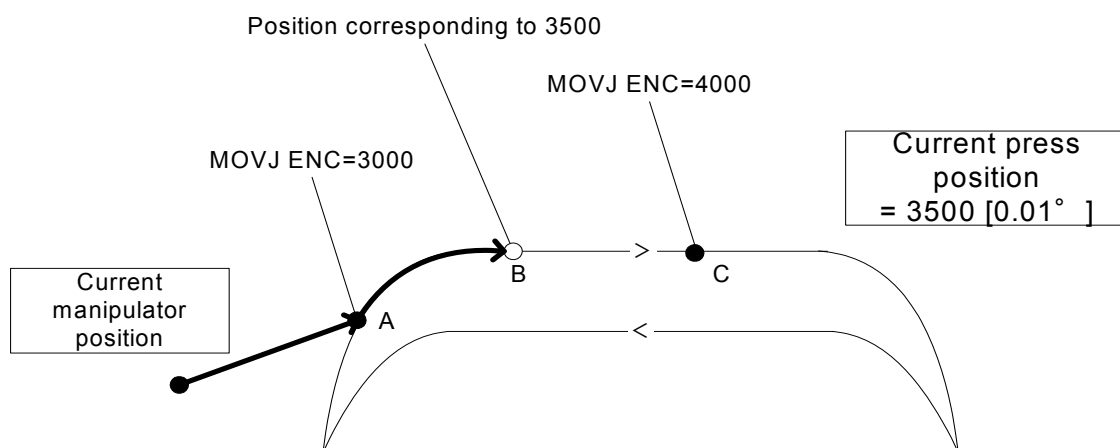


Fig. 5 Position correction

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## 5.2 Operation procedure

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# 6 Current Manipulator Position Output Function

## 6.1 Outline

Output the current position of Robot #1 to #2 (Robot coordinate system) to the specified register.

## 6.2 Parameters

The following parameters specify the output initial register number.

Output the coordinate value (X, Y, Z) in order to three consecutive registers starting from the specified register.

S1E	Meaning
101	R1: Current position (Command position) output destination
102	R2: Current position (Command position) output destination
105	R1: Current position (FB position) output destination
106	R2: Current position (FB position) output destination

Ex.) If “10” is set to S1E106, output to each register as follows;

Register M0010 = FB position of Robot 2 (X)

Register M0011 = FB position of Robot 2 (Y)

Register M0012 = FB position of Robot 2 (Z)

### NOTE

If “0” is set to the parameter, current position output is not performed. (Cannot output to Register 0)  
If destination registers are overlapped, the data will be overwritten by the later data.

## 6.3 Output range

Output range is -32768 to + 32767[mm] (Unit: 1mm).

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### 6.3 Output range

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# 7 Current Press Position Output Function

## 7.1 Outline

Output the current press position and the value of the ENC tag added to the MOV instruction under execution to the specified register.

## 7.2 Parameters

The output register number can be specified by the following parameters

S1E	Meaning
60	Current press position output destination
63	Executing ENC tag value output destination

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## 7.2 Parameters

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## 8 Interlocking Operation Fixing Function

### 8.1 Outline

This is a specific function for hexa-feeder system in which two manipulators are interlocked by a cross-bar. To avoid only one manipulator from operating, this function restricts the operations as follows.

### 8.2 Parameter

The function can be set by the following parameter.

Parameter	Meaning	Initial value
S2C224	0: Single operation enabled 1: Single operation disabled	<b>1</b>

In case of “1: Single operation disabled”, the following operations are disabled, indicating operation disable message. (Registration and editing of positions are permitted.)

- Forward operation for the second home position
- Forward operation for work home position
- Forward operation for position variable

### 8.3 Switching single operation

When “1” is specified for the S2C224 parameter (Single operation disabled), [ROBOT] key is disabled. Therefore, only the manipulator (control group) specified in the following table can be operated. Especially, if the JOB with no control group is selected, any manipulator cannot be operated.

		Operable robot		
		R1	R2	R1+R2
Selected JOB	No control group	×	×	×
	R1	○	×	×
	R2	×	○	×
	R1+R2	×	×	○

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### 8.3 Switching single operation

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# NX100 OPTIONS INSTRUCTIONS

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## HEAD OFFICE

2-1 Kurosakishiroishi, Yahatanishi-ku, Kitakyushu 806-0004 Japan  
Phone +81-93-645-7745 Fax +81-93-645-7746

YASKAWA America Inc. MOTOMAN Robotics Division  
100 Automation Way, Miamisburg, OH 45342, U.S.A.  
Phone +1-937-847-6200 Fax +1-937-847-6277

YASKAWA Nordic AB  
Verkstadsгатan 2, PO Box 504, SE-385 25 Torsås, Sweden  
Phone +46-480-417-800 Fax +46-486-414-10

YASKAWA Europe GmbH Robotics Div.  
Kammerfeldstr. 1, 80591 Allershausen, Germany  
Phone +49-8166-90-0 Fax +49-8166-90-103

YASKAWA Electric Korea Co., Ltd  
9F, KYOBO Securities Bldg., 26-4, Yeoido-Dong Yeoungseongpo-ku, Seoul, KOREA  
Phone +82-2-784-7844 Fax +82-2-784-8495

YASKAWA Electric (Singapore) PTE Ltd.  
151 Lorong Chuan, #04-02A, New Tech Park, Singapore 556741  
Phone +65-6282-3003 Fax +65-6289-3003

YASKAWA Electric (Thailand) Co., Ltd.  
252/246, 4th Floor, Muang Thai-Phatra Office Tower II Rachadaphisek Road, Huaykwang Bangkok, 10320 Thailand  
Phone +66-2-693-2200 Fax +66-2-693-4200

YASKAWA Shougang Robot Co. Ltd.  
No.7, Yongchang-North Road, Beijing E&T Development Area, China 100176  
Phone +86-10-6788-0548 Fax +86-10-6788-0548-813

YASKAWA ELECTRIC (SHANGHAI) Co., Ltd.  
No.18Xizang Zhong Road, 17F, Harbour Ring Plaza, Shanghai 200001, CHINA  
Phone +86-21-5385-0655 Fax +86-21-5385-2770

YASKAWA Robotics India Ltd.  
#426, Udyog Vihar, Phase- IV, Gurgaon, Haryana, India  
Phone +91-124-475-8500 Fax +91-124-414-8016

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