

DX200 OPTIONS INSTRUCTIONS

FOR SEARCH FUNCTION IN CONTINUOUS MOTION

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

MOTOMAN INSTRUCTIONS

MOTOMAN-□□□ INSTRUCTIONS
DX200 INSTRUCTIONS
DX200 OPERATOR'S MANUAL
DX200 MAINTENANCE MANUAL

The DX200 operator's manual above corresponds to specific usage.
Be sure to use the appropriate manual.

Part Number: 165555-1CD
Revision: 0



MANDATORY

- This manual explains the search function in continuous motion of the DX200 system and general operations. Read this manual carefully and be sure to understand its contents before handling the DX200.
- General items related to safety are listed in Chapter 1: Safety of the DX200 Instructions. To ensure correct and safe operation, carefully read the DX200 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 DX200.

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 pressing the emergency stop buttons on the front door of the DX200 and the programming pendant. 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.

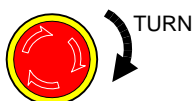
Figure 1: Emergency Stop Button



- 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.

Figure 2: 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.
 - Keep in mind the emergency response measures against the manipulator's unexpected motion toward you.
 - 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 power for the DX200.
 - 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 front door of the DX200 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 cabinet of the DX200 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 DX200 Instructions before operating the manipulator:

Definition of Terms Used Often in This Manual

The MOTOMAN is the YASKAWA industrial robot product.

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

In this manual, the equipment is designated as follows:

Equipment	Manual Designation
DX200 controller	DX200
DX200 programming pendant	Programming pendant
Cable between the manipulator and the controller	Manipulator cable

Descriptions of the programming pendant, buttons, and displays are shown as follows:

Equipment	Manual Designation	
Programming Pendant	Character Keys /Symbol Keys	The keys which have characters or its symbol printed on them are denoted with []. ex. [ENTER]
	Axis Keys /Numeric Keys	[Axis Key] and [Numeric Key] 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}

Search Function in Continuous Motion

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

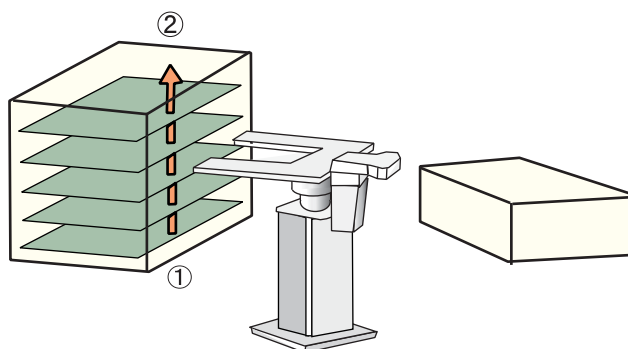
In this manual, names of companies, corporations, or products are trademarks, registered trademarks, or brand names for each company or corporation. The indications of (R) and TM are omitted.

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1 Search Function in Continuous Motion

The search function in continuous motion holds the data of positions where the DX200 detects signals from sensors during job execution. This function allows a clean robot, etc. to detect LCD glass substrates in a cassette to obtain the position data beforehand.

<Example in Usage> Transportation of LCD glass substrates:

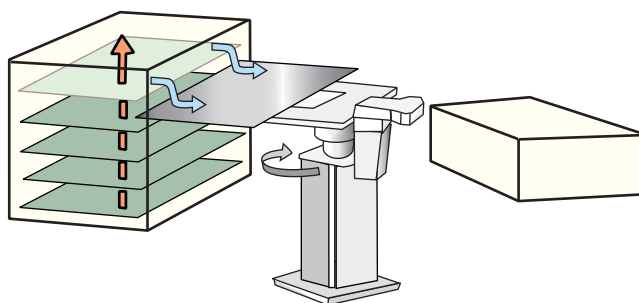


Operation No.1

The robot detects the positions where each LCD glass substrate is located in a cassette.

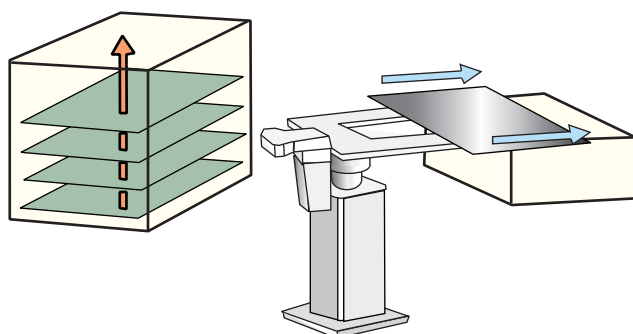
Moving from the step ① to step ②, the robot saves the positions at the points where each LCD glass substrate is detected.

* The search function in continuous motion is used in the operation No.1.



Operation No.2

The robot takes out the LCD glass substrates from the position detected in the operation No.1.



Operation No.3

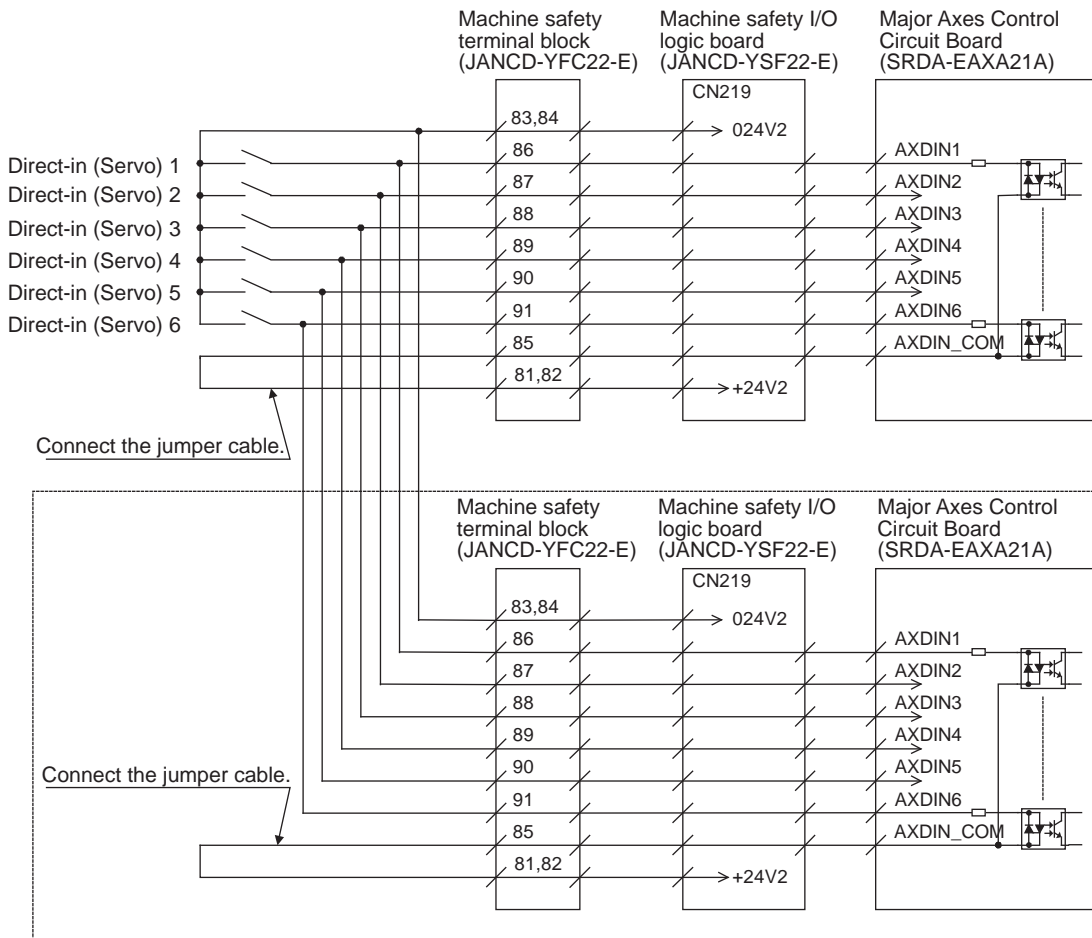
The LCD glass substrate which is removed in the operation No.2 will be located on the carrier device.

2 Wiring

Output signals of the sensor used in the system are connected to the DX200 input port for direct-input signals. The signals that are input from this port are called direct-in signals.

The output signals of the sensor used in the system can be connected via a sequencer to the direct-in signal input port, however, processing variations may result due to scanning timing of the sequencer.

It is therefore recommended to connect the output signal of the sensor directly to the DX200 input port



The [] part of wiring is that if there is a slave for the coordinated control side major axes control circuit board (SRDA-EAXA21A).

2.1 Confirmation of Direct IN Signal Status

Check the status of direct-input signal on the RIN INPUT window.

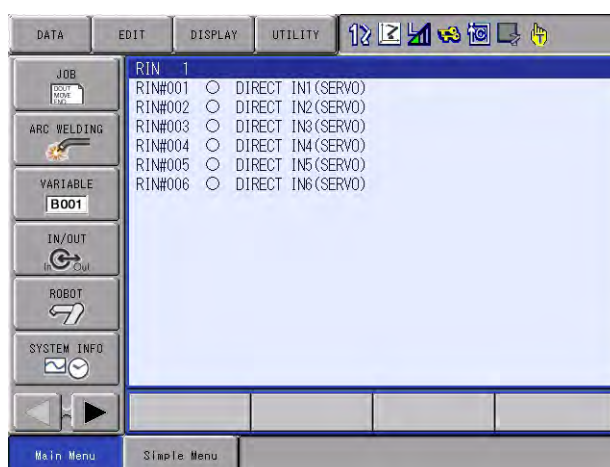
2.1.1 RIN INPUT Window

1. Select {IN/OUT} under the main menu



2. Select {RIN}

- The RIN INPUT window appears.
- “●” indicates the ON status of direct IN signal.
- “○” indicates the OFF status of direct IN signal



NOTE

In case the system consists of multiple manipulators, every pressing of the page key changes the title of general-purpose display area as "RIN INPUT 1", "RIN INPUT 2" and so forth, and switches the window.

For example, the RIN INPUT 1 window shows the direct-in signals for manipulator 1, and the RIN INPUT 2 window shows the direct-in signals for manipulator 2.

3 Functions

3.1 Starting the Search Function

- The search function will start with the execution of NSRCHON instruction.
- The search function is activated even while the robot is not moving, such as being under the statement of WAIT instruction.

3.2 Exiting from the Search Function

- The search function will be end up with the execution of NSRCHOF instruction.

3.3 Intermitting and Restarting the Search Function During the Operation

The search function will be discontinued upon the intermission of the executing of a JOB due to the following operations and factors. Restart the JOB to restart the search action.

- Hold, External Hold
- Emergency Stop, External Emergency Stop
- Mode switching operation
- When switching the operating cycle to step
- Occurrence of minor failure alarm

In case of the intermission due to the following operations and factors, the search function will not start again upon the restart of the JOB.

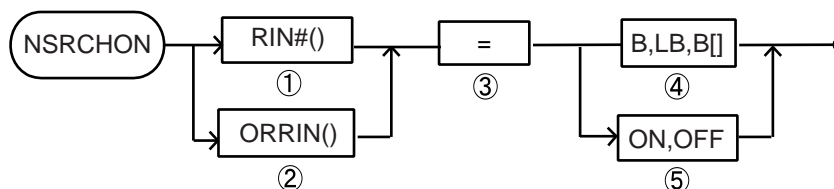
- Moving the cursor
- Selecting JOB
- Editing the condition file

4 Instructions on the Search Function in Continuous Motion

4.1 NSRCHON (Search ON Instruction)

The NSRCHON is an instruction to start the search function.

The followings are the additional items for the NSRCHON instruction:



NSRCHON RIN # (Direct-in No.) = <Status>

or ORRIN (Specified Direct-in No.) = <Status>

<Direct-in No.>: 1 - 6

<Specified Direct-in No. (applicable unit: bit)>: 1 - 63 (D0: RIN#(1), D1: RIN#(2), D2: RIN#(3), D3: RIN#(4), D4: RIN#(5), D5: RIN#(6))

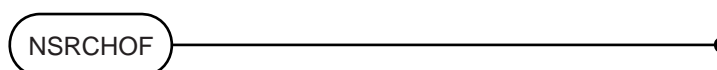
<Status>: Status of Direct-in No. (Common in all signals.)

ON/OFF, or B type variable.

4.2 NSRCHOF (Search OFF Instruction)

The NSRCHOF is an instruction to end the search function.

The followings are the additional items for the NSRCHOF instruction.



4.3 GETS (System Variable Fetch Instruction)

The GETS is an instruction to fetch the system variable (\$ variable) as a user variable.

The DX200 can not use system variables directly for operating instructions. Use the GETS instruction to fetch the values as a user variable.

Format: GETS <user variable> <system variable>

- The user and the system variables must be of the same type.
<Example> GETS B000 \$B000
- The position type variable can be specified by only PX variables.

- The PX variables are the position type variables that are defined in a job. In a job for a single manipulator, PX000 equals to P000.

4.3.1 System Variables

The system variables can be referred only by the GETS instruction which are written by the controller system.

System Variable	Type	Explanation
\$B type	\$B type	\$B002: Specifies detected/not detected of the NSRCHON instruction. 0: Not detected 1: Detected \$B016: Numbers detected by NSRCHON. (Corresponding to RIN#(1)) \$B017: Numbers detected by NSRCHON. (Corresponding to RIN#(2)) \$B018: Numbers detected by NSRCHON. (Corresponding to RIN#(3)) \$B019: Numbers detected by NSRCHON. (Corresponding to RIN#(4)) \$B020: Numbers detected by NSRCHON. (Corresponding to RIN#(5)) \$B021: Numbers detected by NSRCHON. (Corresponding to RIN#(6))

System Variable	Type	Explanation																																																																																																																																																			
\$PX type	\$PX type	PX type Positions detected by NSRCHON (Maximum detectable number: 50)																																																																																																																																																			
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* The position detected in the 51st will not be set in the system variable.																																																																																																																																																					

4.4 CNVRT (Position Type Variable Conversion Instruction)

The CNVRT is an instruction to convert a pulse data position type variable into a Cartesian data position type variable using a specified coordinate system.

Format: CNVRT <PX variable> <PX variable> <Coordinate system>
 B A

<PX variable (A)>: Pulse data only.

<PX variable (B)>: Cartesian data (the converted Cartesian data are stored).

<Coordinate system>: Base coordinate system: BF

 Robot coordinate system: RF

 Tool coordinate system: TL

 User coordinate system: UF

 Master tool coordinate system: MTF

Specifying the master tool coordinate system is to convert into a relative position with the master manipulator only when the coordinated system is set.

4.4.1 PX Variables

The PX variables are a group of position type variables that are defined by the control group specified in the job header.

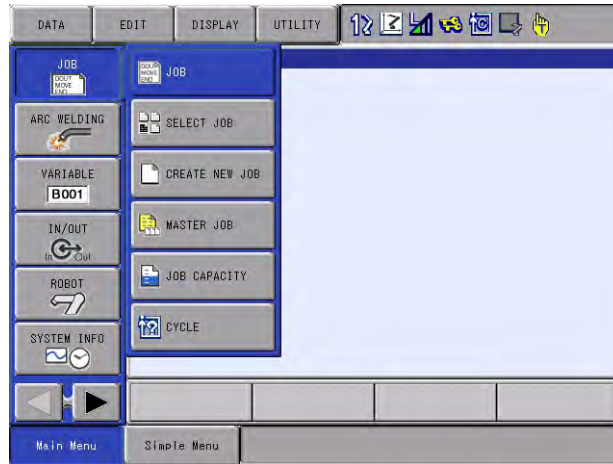
- When the control group is R1, PX000 indicates P000.
- When the control group is R1 + B1, PX000 indicates P000 and BP000.
- When the control group is R1 + B1 + ST1, PX000 indicates P000, BP000 and EX000.
- When the control group is R1 + R2 + B1 + B2 + ST1, and the master in the coordinated job is R1 + B1, PX000 indicates the following variables.

P000 :	R2 (Slave)
P001 :	R1 (Master)
BP000 :	B2 (Slave)
BP001 :	B1 (Master)
EX000 :	ST1

5 Registration of Instructions

The instructions are to be registered when the cursor is in the address area in the JOB CONTENT window during the teach mode.

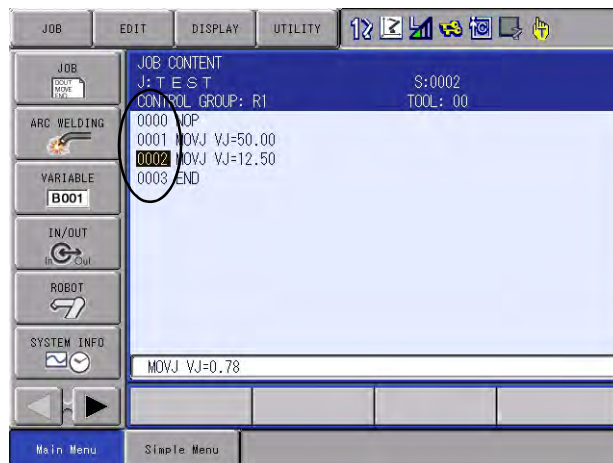
1. Select {JOB} under the main menu.



2. Select {JOB} under the submenu.
 - The JOB CONTENT window appears.

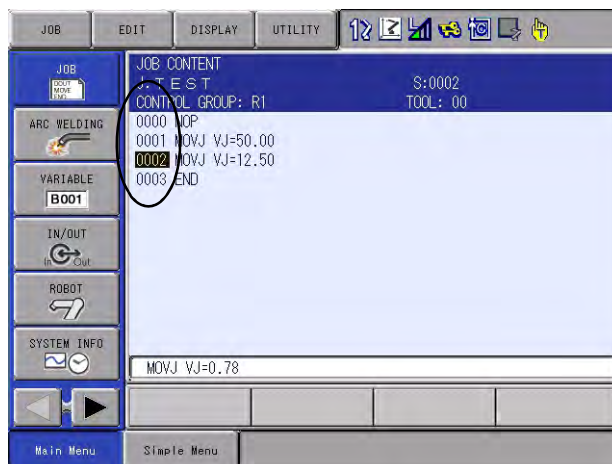


3. Move the cursor to the address area.

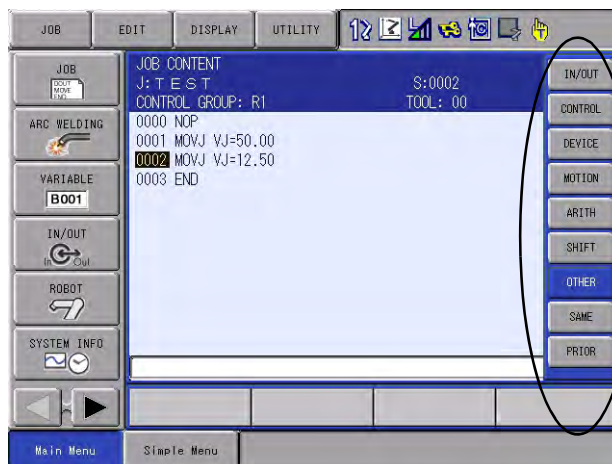


5.1 NSRCHON Instruction (To Start Search Function)

1. Move the cursor to the address area.



2. Press [INFORM LIST] of the programming pendant.
 - The INFORM LIST dialog box appears
 - Cursor moves to the INFORM LIST dialog box, and the cursor of address area is highlighted.



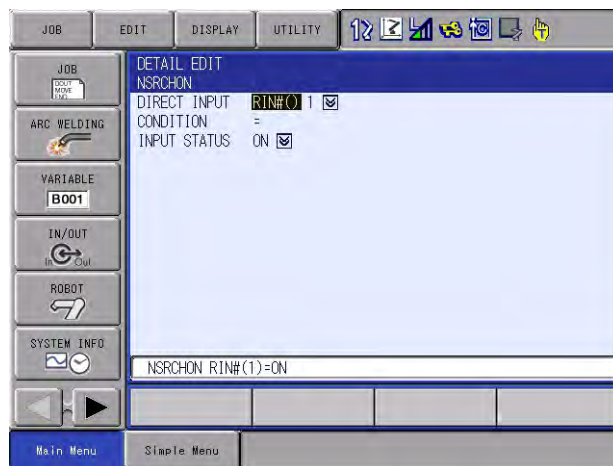
3. Select {OTHER}.

4. Select {NSRCHON}.

- The NSRCHON instruction appears on the input buffer line.



5. Press [SELECT] to set the data for each item on the DETAIL EDIT window.



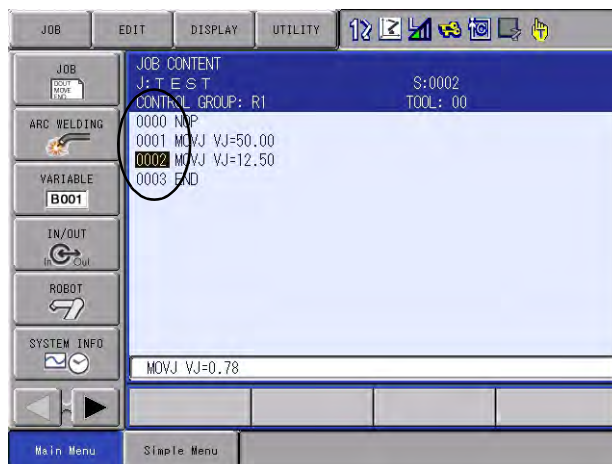
- Move the cursor to each setting item and press [SELECT].
Enter desired value/data into each setting item and press [ENTER].

6. Press [ENTER]

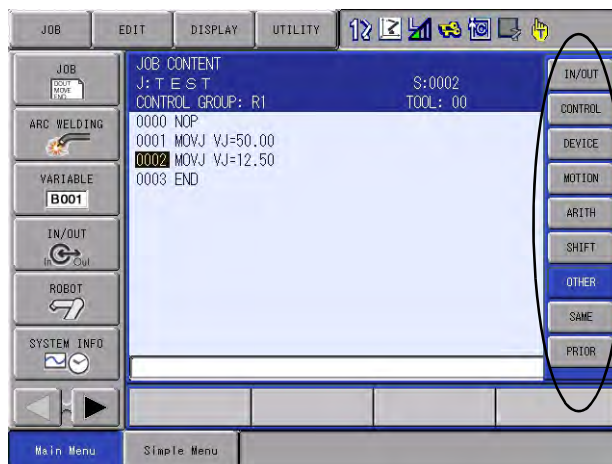
- The entered value/data are registered in the job.

5.2 NSRCHOF Instruction (To Exit from Search Function)

1. Move the cursor to the address area.



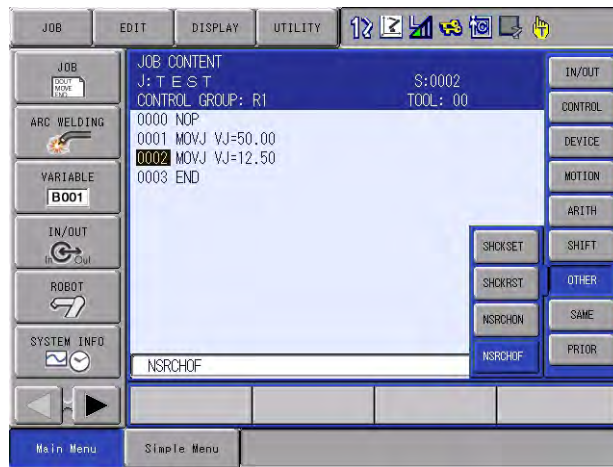
2. Press [INFORM LIST] of the programming pendant.
 - The INFORM LIST dialog box appears.
 - Cursor moves to the INFORM LIST dialog box, and the cursor of address area is highlighted.



3. Select {OTHER}.

4. Select {NSRCHOF}.

- The NSRCHOF instruction appears on the input buffer line.



5. Press [ENTER].

- The entered value/data are registered in the job.

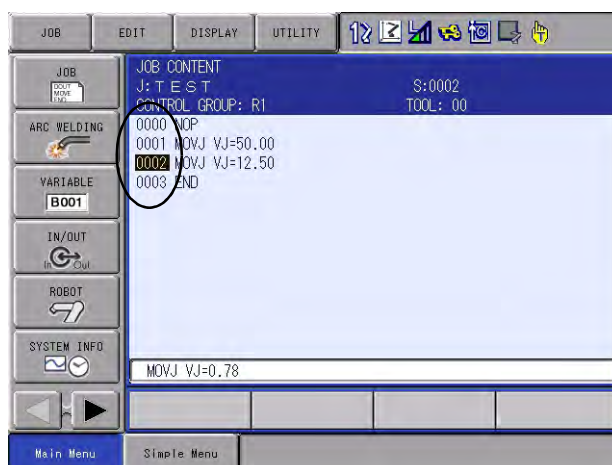


The data of positions may not be held when signals from sensors are detected just before executing NSRCHOF.

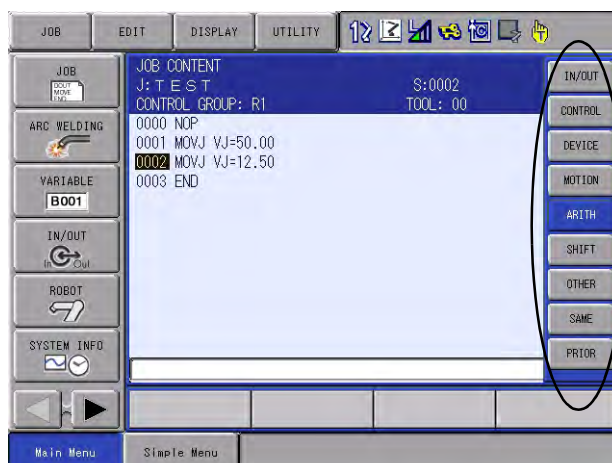
Insert the TIMER instruction just before NSRCHOF, then the data of positions can be held.

5.3 GETS Instruction

1. Move the cursor to the address area.



2. Press [INFORM LIST] of the programming pendant.
 - The INFORM LIST dialog box appears.
 - Cursor moves to the INFORM LIST dialog box, and the cursor of address area is highlighted.



3. Select {ARITH}.

4. Select the {GETS} instruction.

- The GETS instruction appears on the input buffer line.



5. Press [SELECT] to set the data for each item on the DETAIL EDIT window.



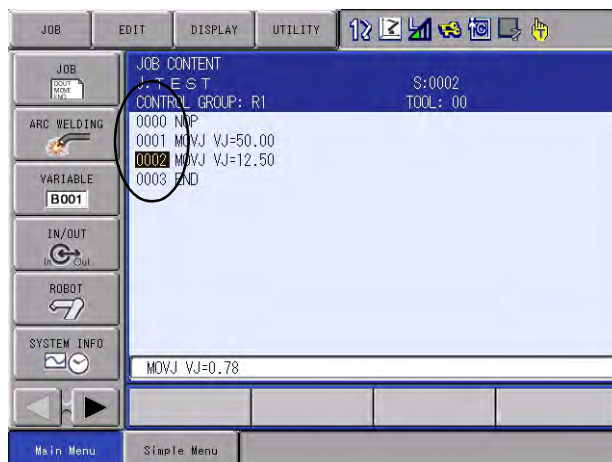
- Move the cursor to each setting item and press [SELECT].
Enter desired value/data into each setting item and press [ENTER].

6. Press [ENTER] .

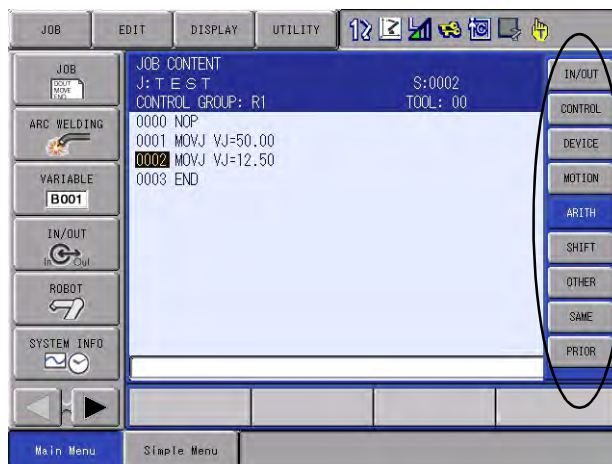
- The entered value/data are registered in the job.

5.4 CNVRT Instruction

1. Move the cursor to the address area.



2. Press [INFORM LIST] of the programming pendant.
 - The INFORM LIST dialog box appears.
 - Cursor moves to the INFORM LIST dialog box, and the cursor of address area is highlighted.



3. Select {ARITH}.

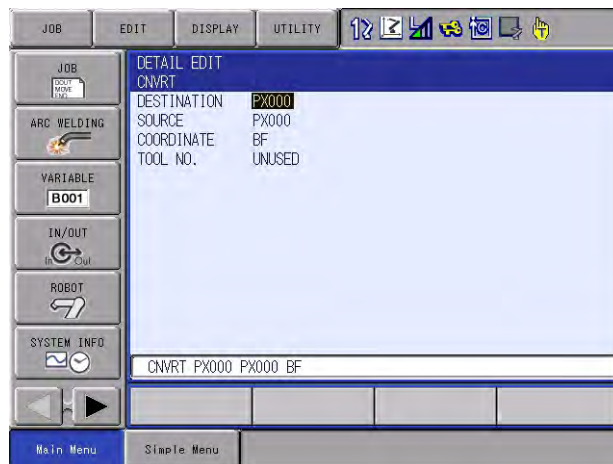
4. Select the {CNVRT} instruction.

- The CNVRT instruction appears on the input buffer line.



5. Press [SELECT] to set the data for each item on the DETAIL EDIT window.

- The DETAIL EDIT window appears.



- Move the cursor to each setting item and press [SELECT].
Enter desired value/data into each setting item and press [ENTER].

6. Press [ENTER].

- the entered value/data are registered in the job.

6 Job Sample

The following table shows a simple job example. The applied job types are further developed based upon the job sample below.

Registered Instruction	Status
NOP	
MOVJ	Moves to the standby position.
MOVL	Moves to the starting position for search detection.
NSRCHON RIN#(1)=ON	Search activating instruction. Detects the start of DIN1. Instruction to start search detection.
MOVL	Search detecting section.
NSRCHOF	Search exit instruction. Instruction to exit from search detection.
GETS B002 \$B002	Specifies detected/not detected of the search detection. Transfers the contents of the system variables \$B002 - B002. B002=1: Detected. B002=0: Not detected.
JUMP *NG IF B002=0	Jumps to the label [*NG] in case of B002=0, which comes out to be NOT DETECTED.
GETS B003 \$B016	Transfers the contents of the system variables \$B016, which are corresponding to RIN#(1), to B003.
GETS P001 \$PX150	Transfers the contents of the system variables \$P150 (which indicate the detecting position pulse) to P001 (the pulse data position type variables). *If B003 shows 2 or more detections, transfers the contents above \$P150 to the Cartesian data position type variable.
CNVRT P002 P001 BF	Converts P001 (the pulse data position type variables) to P002 (the Cartesian data position type variables).
MOVL P002	Moves to the position type variables (P002).
*NG	Jumps to this destination in case of no detection is found.
MOVJ END	Moves to the standby position; finishes the current instruction.

7 Instruction List

Numbers or character data are indicated within the "< >". When there are more than one item in the additional item, choose one of them.

NSRCHON	Function	Executes a search function.	
	Additional Item	RIN# (<Direct IN No.>) = <Status>	Direct IN No.: 1 - 6 Status: ON, OFF, B<variable No.>.
		ORRIN# (<Specified direct IN No.>) = <Status>	Specified direct IN No.: (applicable unit: bit): 1 - 63(Do: RIN#(1), D1: R IN#(2), D2: RIN#(3), D3: RIN#(4), D4: RIN#(5), D5: RIN#(6)) Status: ON, OFF, B<variable No.>.
Example	NSRCHON RIN#(1)=ON MOVL V=50 MOVL V=50		
NSRCHOF	Function	Exit from the search function.	
	Example	NSRCHOF	
GETS	Function	Saves the system variable (\$ variable) as a user variable.	
	Additional Item	B <Variable No.>, I <Variable No.>, D <Variable No.>, R <Variable No.>, PX <Variable No.>,	User Variable
		\$B <Variable No.>, \$I <Variable No.>, \$D <Variable No.>, \$R <Variable No.>, \$PX <Variable No.>,	System Variable
Example	GETS B000 \$B000 GETS I001 \$I[1] GETS PX003 \$PX001		
CNVRT	Function	Converts the data 2 (position type variable) into a specified Cartesian data position type variable, and store in the data 1. Format: CNVRT <Data 1> <Data 2> <Coordinate system>	
	Additional Item	Data 1	PX <Variable No.>
		Data 2	PX <Variable No.>
		BF, RF, TF, UF# (<User coordinate system No.>), MTF	BF: Base coordinate system RF: Robot coordinate system TF: Tool coordinate system UF: User coordinate system MTF: Master tool coordinate system
Example	CNVRT PX000 PX001 BF CNVRT LPX000 LPX001 TF		

DX200 OPTIONS INSTRUCTIONS

FOR SEARCH FUNCTION IN CONTINUOUS MOTION

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