

DX200 OPTIONS INSTRUCTIONS

FOR CONVEYOR SYNCHRONIZED FUNCTION WITH SHIFT FUNCTIONS

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 (for each purpose)

DX200 MAINTENANCE MANUAL

DX200 OPTIONS INSTRUCTIONS FOR CONVEYOR SYNCHRONIZED FUNCTION

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

Part Number: 165553-1CD

Revision: 1

Copyright © 2015, Yaskawa America, Inc. All Rights Reserved.

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.



MANDATORY

- This manual explains the synchronized-to-conveyor control with shift functions of the DX200 system for teaching, playback, editing of jobs and files, and management of each operation. 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 Setup Manual 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.

We suggest that you obtain and review a copy of the ANSI/RIA National Safety Standard for Industrial Robots and Robot Systems (ANSI/RIA R15.06-2012). You can obtain this document from the Robotic Industries Association (RIA) at the following address:

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, well-trained personnel are the best safeguard against accidents and damage that can result from improper operation of the equipment. The customer is responsible for providing adequately trained personnel to operate, program, and maintain the equipment. **NEVER ALLOW UNTRAINED PERSONNEL TO OPERATE, PROGRAM, OR REPAIR THE EQUIPMENT!**

We recommend approved Yaskawa training courses for all personnel involved with the operation, programming, or repair of the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

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 “DANGER”, “WARNING”, “CAUTION”, “MANDATORY”, or “PROHIBITED”.



DANGER

Indicates an imminent hazardous situation which, if not avoided, could result in death or serious injury to personnel.



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 “DANGER”, “WARNING” and “CAUTION”.



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:
 - Be sure to use a lockout device to the safeguarding when going inside. Also, display the sign that the operation is being performed inside the safeguarding and make sure no one closes the safeguarding.
 - 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 keys, 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}

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.

Table of Contents

1	Conveyor Synchronized Function with Shift Functions.....	1-1
1.1	Conveyor Synchronized Function with Shift Functions.....	1-1
1.2	Start Shift Function	1-2
1.3	WORK ID Shift Function.....	1-3
1.4	WORK IN/NOT Shift Function	1-4
1.5	Precautions on Using Conveyor Synchronized Function with Shift Functions	1-5
2	Conveyor Condition File.....	2-1
2.1	Conveyor Condition File	2-1
2.2	Editing Conveyor Condition File	2-6
2.2.1	Display the Conveyor Condition File	2-6
2.2.2	Edit the Conveyor Condition File.....	2-6
2.3	Setting Conveyor Resolution	2-8
2.4	Detection Function for BROKEN LINE DETECT Status (Conveyor Pulse).....	2-9
2.5	Conveyor Supplemental Condition File	2-10
2.6	Start Shift Condition File.....	2-11
2.7	Editing the Start Shift Condition File	2-14
2.7.1	Display of the Start Shift Condition File.....	2-14
2.7.2	Editing the Start Shift Condition File.....	2-14
2.8	WORK ID SHIFT Condition File.....	2-15
2.9	Editing the WORK ID SHIFT Condition File.....	2-17
2.9.1	Display the WORK ID SHIFT Condition File.....	2-17
2.9.2	Edit the WORK ID SHIFT Condition File	2-17
2.10	WORK IN/NOT SHIFT Condition File	2-18
2.11	Editing the WORK IN/NOT SHIFT Condition File.....	2-20
2.11.1	Display the WORK IN/NOT SHIFT Condition File	2-20
2.11.2	Edit the WORK IN/NOT SHIFT Condition File.....	2-20
3	Teaching	3-1
3.1	Registering Instructions	3-1
3.1.1	SYSTART Instruction	3-1
3.1.2	SYEND Instruction.....	3-4
3.1.3	SYMOV □ Instruction.....	3-5

3.1.4	CVQUE Instruction	3-6
3.1.5	Interpolation Mode for Conveyor Synchronized Motion	3-7
3.2	Manipulator Motion Speed	3-8
3.3	Wrist Posture in Conveyor Synchronized Section	3-8
3.4	Changing Circular Steps	3-8
3.5	Teaching	3-9
3.6	Teaching After Interruption of Synchronized Motion in Playback Operation.....	3-11
3.7	Notes on Operation.....	3-12
3.7.1	Confirming Reach to Step.....	3-12
3.7.2	Changing Tool	3-12
3.7.3	Deleting Taught Positions.....	3-12
3.7.4	Manipulator Stand-by Position for the SYSTART Instruction	3-12
3.8	Job Examples	3-13
3.8.1	Job Example for the Conveyor Synchronized Function without Shift Functions	3-13
3.8.2	Job Example when Using the Start Shift Function.....	3-14
3.8.3	Job Example Using the Start Shift, WORK ID Shift, and WORK IN/NOT Shift Functions.....	3-16
3.9	Manual Setting Function for Conveyor Position.....	3-19
3.9.1	Manual Setting Procedure for the Conveyor Position.....	3-20
3.9.2	Precautions.....	3-21
3.10	Test Run without Moving the Conveyor.....	3-22
3.11	Manual Setting Function for Pseudo ON of the Conveyor Home-position Limit Switch	3-23
4	Playback.....	4-1
4.1	Conveyor Speed Down	4-1
4.2	Accuracy	4-2
4.3	Conveyor Resolution Error.....	4-2
4.4	Restarting Synchronization After Manipulator Stops	4-3
4.5	Continuance of Conveyor Synchronized Status	4-3
4.6	Continuance of Parallel Shift Status	4-3
4.7	Conveyor Synchronized Motion During Execution of TIMER and WAIT	4-3
4.8	Detection of the Position beyond the Specified Maximum-workpiece-position.....	4-4

5	Conveyor Monitoring Displays for the Shift Functions	5-1
5.1	CV (SYNCHRONIZATION) MONITOR Display.....	5-2
5.1.1	Switching the Reference Workpiece for Synchronization.....	5-3
5.1.2	Deleting a Data of Conveyor Synchronized Section.....	5-5
5.1.3	Deleting the Shift Data and the Data of Conveyor Synchronized Section.....	5-6
5.2	CV START SHIFT STATUS Display.....	5-7
5.2.1	Deleting a Conveyor Start Shift Data.....	5-8
5.2.2	Deleting the Shift Data and the Data of Conveyor Synchronized Section.....	5-9
5.3	CV WORK ID SHIFT STATUS Display.....	5-10
5.3.1	Deleting a Conveyor WORK ID Shift Data	5-11
5.3.2	Deleting the Shift Data and the Data of Conveyor Synchronized Section.....	5-12
5.4	CV WORK IN/NOT SHIFT STATUS Display	5-13
5.4.1	Deleting a Conveyor WORK IN/NOT Shift Data.....	5-14
5.5	CV SHIFT MONITOR display	5-15
5.5.1	Switching the Reference Workpiece for Synchronization.....	5-16
5.5.2	Deleting a Data of Conveyor Synchronized Section.....	5-17
5.5.3	Deleting a Data of Conveyor Shift Section	5-18
5.5.4	Deleting the Shift Data and the Data of Conveyor Synchronized Section.....	5-19
6	Instruction List.....	6-1
7	Alarm List.....	7-1
8	Specific I/O Signals.....	8-1
8.1	Specific Input Signals "4xxx".....	8-1
8.2	Specific Output Signals "5xxx".....	8-1
9	Conveyor Parameters.....	9-1
10	Sensor Parameters (SxE).....	10-1

1 Conveyor Synchronized Function with Shift Functions

1.1 Conveyor Synchronized Function with Shift Functions

In the conveyor synchronized function of the position tracking type, the taught motion path of the manipulator is corrected according to the conveyor travel amount so that the manipulator performs follow-up motion in the conveyor moving direction at a constant relative speed to the workpiece.

There are two conveyor synchronized function types:

Manipulator follow-up control: The manipulator's basic axis moves in synchronization with the conveyor movement.

Travel-axis follow-up control: A travel axis (external axis) moves in synchronization with the conveyor movement.

When the conveyor synchronized function is used with "shift functions," it is useful for a situation where the conveyor home-position limit switch, the workpiece identification detecting limit switch (WORK ID detecting limit switch), and the workpiece detecting limit switch (WORK IN/ NOT detecting limit switch) cannot be installed near the manipulator. Using the conveyor synchronized function with shift functions, the information of all the workpieces that pass all the limit switches to reach the synchronization start position of the manipulator can be managed.

And then, when a workpiece reaches the manipulator start position, the corresponding job is started so that the manipulator can start the job in synchronization with the conveyor.

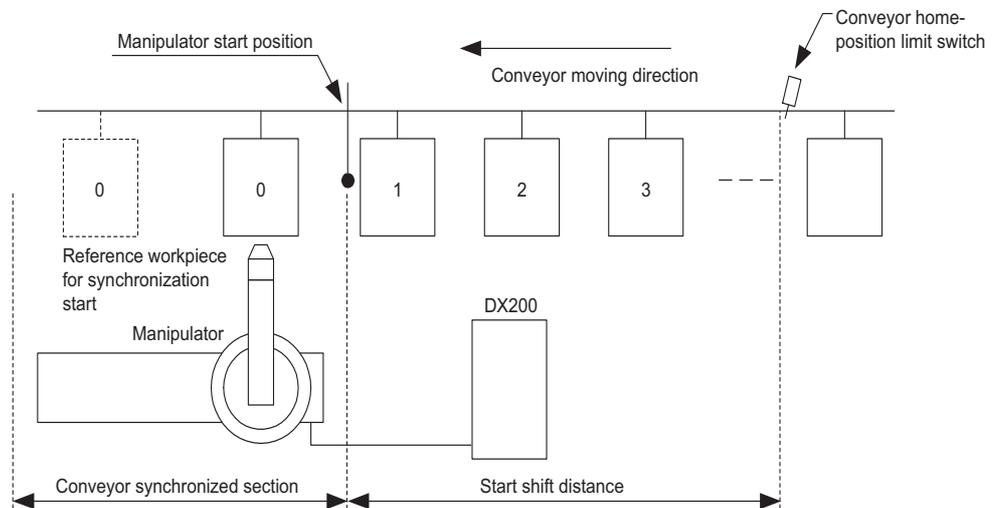
In such operation flow, the section from each limit switch to the manipulator start position is defined as "shift section," and the section from the manipulator start position to the synchronization start position of the manipulator is defined as "synchronized section."

1.2 Start Shift Function

When the conveyor home-position limit switch is not installed near the manipulator, the second workpiece may pass the conveyor home-position limit switch before the first workpiece, which passed the conveyor home-position limit switch, enters the conveyor synchronized section.

The DX200 manages the position information of all the workpieces that passed the conveyor home-position limit switch, and starts the job programmed for each workpiece when the corresponding workpiece reaches the manipulator start position so that the manipulator executes the job in the follow-up motion to the conveyor.

For the above control, the start shift function manages up to 99 workpiece position data from the conveyor home-position limit switch to the reference workpiece for synchronization start.



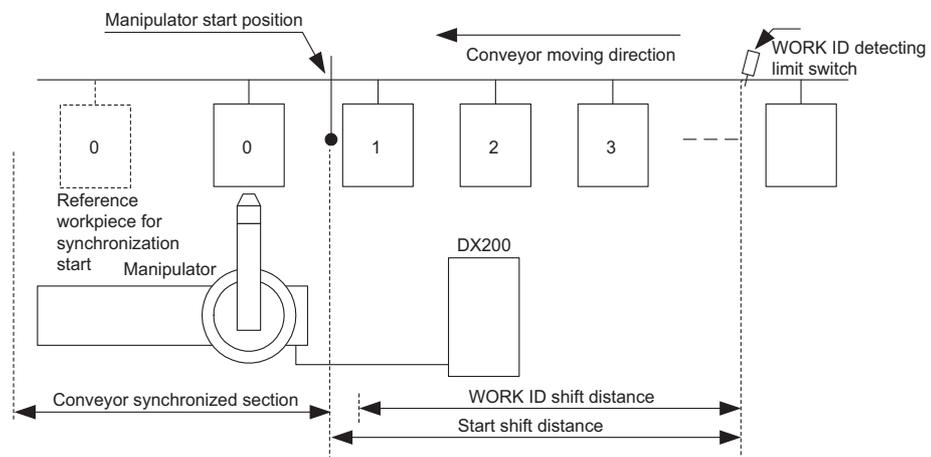
1.3 WORK ID Shift Function

When the workpieces are conveyed sequentially and the WORK ID detecting limit switch is turned on, the DX200 reads the WORK ID of each workpiece by the predefined general-purpose input signal.

When the WORK ID detecting limit switch is not installed near the manipulator, the second workpiece may pass the WORK ID detecting limit switch before the first workpiece, which passed the WORK ID detecting limit switch, enters the conveyor synchronized section.

The DX200 manages the WORK ID information of all the workpieces that passed the WORK ID detecting limit switch, and starts the job programmed for each workpiece when the corresponding workpiece reaches the manipulator start position so that the manipulator executes the job in the follow-up motion to the conveyor.

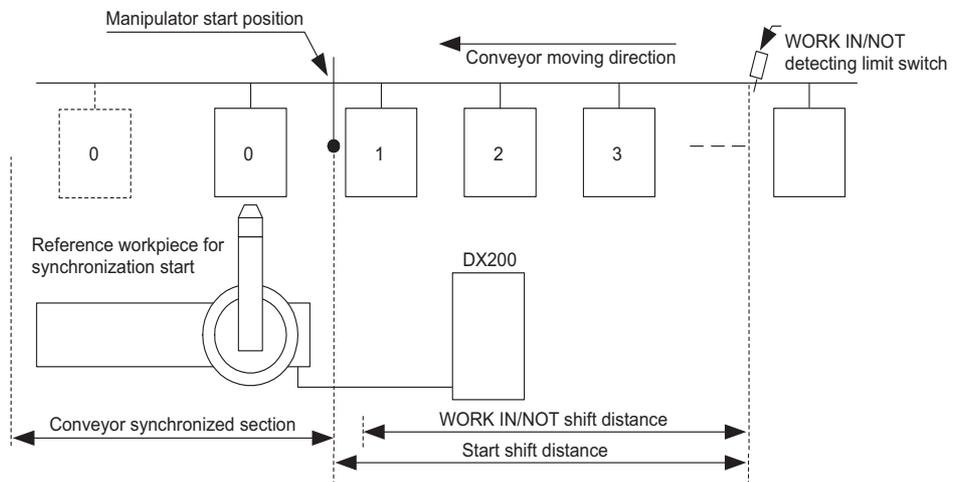
For the above control, the WORK ID shift function manages the WORK ID information up to 99 workpieces in the section from the WORK ID detecting limit switch to the reference workpiece for synchronization start.



1.4 WORK IN/NOT Shift Function

In the system that workpieces are conveyed in skits, the WORK IN/NOT detecting limit switch is activated when a skit passes, and the DX200 reads whether a workpiece is in or not from the predefined general-purpose input signal.

When the WORK IN/NOT detecting limit switch is not installed near the manipulator, the second workpiece may pass the WORK IN/NOT detecting limit switch before the first workpiece, which passed the WORK ID detecting limit switch, enters the conveyor synchronized section. The DX200 manages the WORK IN/NOT information obtained through the WORK IN/NOT detecting limit switch. When the DX200 receives the information that a workpiece is in the skit, the DX200 starts the job for the workpiece to move the manipulator in synchronization with the conveyor. For the above control, the WORK IN/NOT shift function manages up to 99 skit data in the section from the WORK IN/NOT detecting limit switch to the reference workpiece for synchronization start.



1.5 Precautions on Using Conveyor Synchronized Function with Shift Functions

With the conveyor synchronized function with shift functions, the shift data such as Start Shift, WORK ID, and WORK IN/NOT in the synchronized section and shift section are all erased when the power is OFF. Take this into account when activating the function after the power is ON.

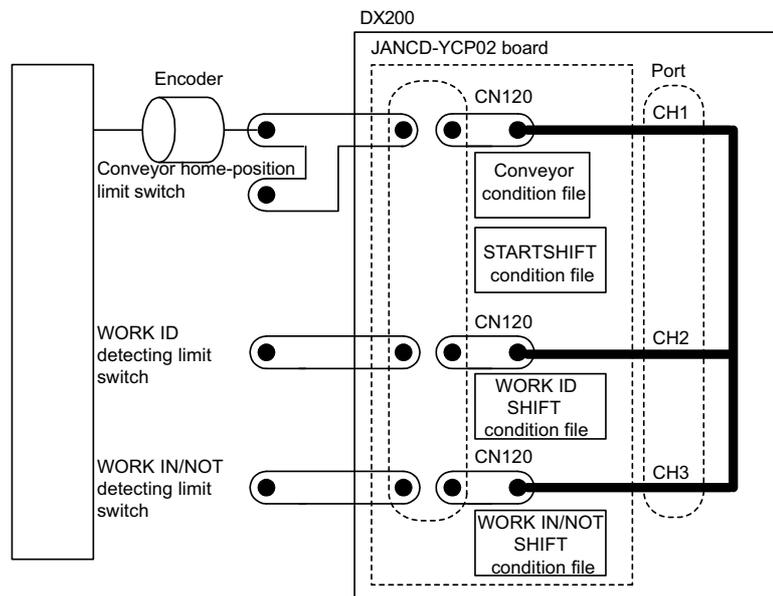
When all the shift functions such as Start Shift function, WORK ID Shift function, and WORK IN/NOT Shift function are disabled (set to "NOT USED"), the DX200 operates in the same way as the operation with the basic conveyor synchronized function without shift functions. Refer to "DX200 OPTIONS INSTRUCTIONS FOR CONVEYOR SYNCHRONIZED FUNCTION" for the basic conveyor synchronized function.

2 Conveyor Condition File

2.1 Conveyor Condition File

To execute the conveyor synchronized function with shift functions properly, the conveyor data must be set to the DX200. The data are set in the conveyor condition file, start shift condition file, WORK ID condition file, and WORK IN/NOT condition file.

The conveyor condition file sets the characteristics of the conveyor and the input method of the encoder, etc. Also, the conveyor supplemental condition file such as the Start Shift condition file, the WORK ID Shift condition file, and the WORK IN/NOT Shift condition file sets shift functions.



Although, in the above connection example, the conveyor encoder and conveyor home-position limit switch are connected to CH1, the WORK ID detecting limit switch to CH2, and the WORK IN/NOT detecting limit switch to CH3, each limit switch can be connected to any connector from CH1 to CH3 on the conveyor synchronization board JANCD-YCP02. Also, more than two different limit switches can be connected to one connector. Which limit switch is to be connected to which connector can be specified in the conveyor supplemental condition file explained later.

Refer to section 2.6 "Start Shift Condition File," section 2.8 "WORK ID SHIFT Condition File," and section 2.10 "WORK IN/NOT SHIFT Condition File" for details.

Refer to chapter 2. "Hardware Specifications" of the "DX200 OPTIONS INSTRUCTIONS FOR CONVEYOR SYNCHRONIZED FUNCTION" for the connecting method of encoder and each limit switch.

CONVEYOR COND FILE	
(1) FILE NO.:	1 / 3
(2) USED STATUS	USED
(3) PORT NO.	CN1
(4) BROKEN LINE DETECT	OFF
(5) ENCODER INPUT	ENCODER
(6) ENCODER SIGN	FORWARD
(7) CORRECTION	FORWARD
(8) TRACKING	BASE AXIS
(9) USER COORD NO.	01
(10) BASE AXIS	Y
(11) POS RESOLUTION	999.99 μ m/p
(12) VIRTUAL CV SPEED	1000.0 mm/sec
(13) AVERAGED TRAVEL TIME	3000 ms
(14) RESET SIG. MONITOR	10000 ms
(15) CV SPEED DOWN MODE	EXECUTE
(16) CV LOWER LIMIT SPEED	0 mm/sec
(17) VIRTUAL ENCODER IN	IN# 0001
(18) VIRTUAL ENCODER OUT	OUT# 0001
(19) TRACKING CORRECTION	1000 ms

(1) FILE NO.

The conveyor condition file number is shown below.

(2) USED STATUS (USED/NOT USED)

Specify whether to use or not to use the conveyor condition file.

(3) PORT NO. (CN1/CN2/CN3)

Select the port number where the encoder in use is connected.

Use this port number for the start shift home-position limit switch of the conveyor synchronized function with shift functions.

(4) BROKEN LINE DETECT (ON/OFF)

Specify whether the disconnection detection is to be enabled or not.

(5) ENCODER INPUT (ENCODER/VIRTUAL ENCODER)

Specify whether the actual encoder input or a virtual pulse encoder is used for the conveyor synchronized control.

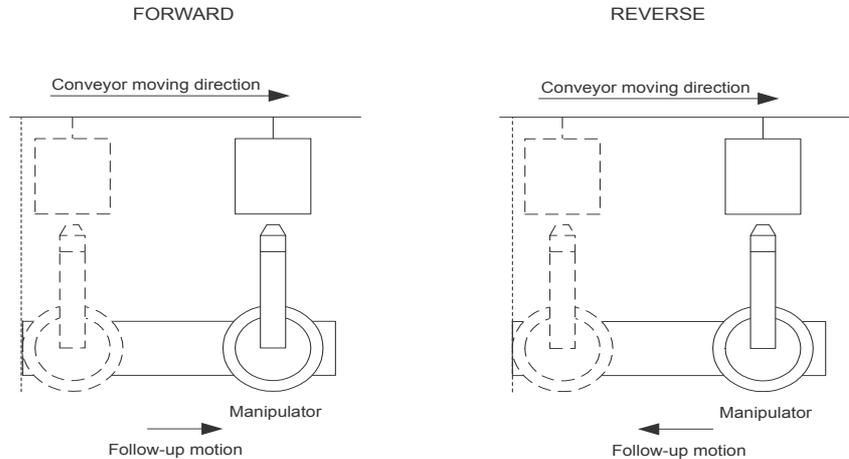
If the virtual pulse encoder is selected, the manipulator can execute the synchronized motion to the conveyor even if the encoder is not connected or the conveyor is not running, which can be used for confirming the manipulator motion at the test run.

(6) ENCODER SIGN (FORWARD/REVERSE)

Specify whether the sign of the position pulse input from the encoder should be inverted or not. When "REVERSE" is selected, the sign of the conveyor position and the data on the conveyor speed display is inverted so that the manipulator executes the follow-up motion in the reverse direction.

(7) CORRECTION (FORWARD/REVERSE)

Specify if the direction of the follow-up motion should be reversed or not. If "REVERSE" is selected, the sign of the correction position on the conveyor speed display is reversed and the manipulator executes the follow-up motion in the reversed direction.

**(8) TRACKING (ROBOT AXIS/BASE AXIS)**

Specify whether the manipulator is synchronized with the robot axis or the base axis (travel axis). If "BASE AXIS" is selected for the system without base axis, no synchronized motion can be performed.

(9) USER COORD NO. (1 to 63)

When "ROBOT AXIS" is selected in (8), specify the user coordinate number in whose X-axis direction the manipulator moves in synchronization with the conveyor movement.

(10) BASE AXIS (X/Y/Z)

When "BASE AXIS" is selected in (8), specify X-, Y-, or Z-axis to move in synchronization with the conveyor movement.

(11) POS RESOLUTION (0 to 999.99 $\mu\text{m}/\text{pulse}$)

This data convert one pulse from the encoder to the conveyor travel amount (μm).

For the details of setting method, refer to section 4.3 "Setting of Conveyor Positional Resolution" of "DX200 OPTIONS INSTRUCTIONS FOR CONVEYOR SYNCHRONIZED FUNCTION."

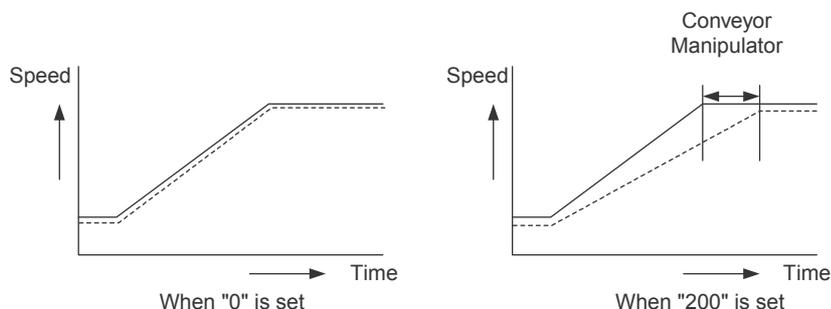
(12) VIRTUAL CV SPEED (-3276.8 to +3276.7 mm/s)

When "VIRTUAL ENCODER" is selected in (5), set the virtual encoder speed.

(13) AVERAGED TRAVEL TIME (0 to 3000 ms)

Set a time to average the travel amount so that the manipulator moves smoothly at the sudden change of the conveyor speed.

When using the conveyor with large pulsation, set the value between 300 and 500. If this setting is not used, set to "0."

**(14) RESET SIG. MONITOR (0 to 65535 ms)**

If no encoder reset signal for a specified conveyor has been input when the SYSTART instruction is carried out, set the amount of time to wait for the conveyor home-position input signal.

If the actual waiting time is greater than the setting, the SYSTART instruction is aborted and the next instruction is carried out. Prepare the job so that the manipulator takes retreat motion by internal status. When "0" is set, the system waits for the conveyor home-position input signal without being interrupted by the time limit for encoder reset signal monitoring.

(15) CV SPEED DOWN MODE**(EXECUTE/ALARM/PAUSE JOB/JOB INTERRUPTION AFTER OPERATION)**

Specify the action of the manipulator when the conveyor speed is lowered below the conveyor speed lower limit set in (16).

• EXECUTE

Regardless of the conveyor speed, the manipulator executes the job.

When the conveyor stops, the manipulator continues the synchronized motion with the conveyor moving at the speed "0."

• ALARM

When the conveyor average speed becomes below the set value in (16) for 0.1 second or more, an alarm occurs and the manipulator stops.

• PAUSE JOB

When the conveyor average speed becomes below the set value in (16) for 0.1 second or more, the job execution is interrupted (only the move instructions are suppressed) and the manipulator performs only the follow-up motion. When the conveyor speed recovers to the set value in (16) or higher, the job execution is re-started.

(16) CV LOWER LIMIT SPEED (0 to 65535 mm/s)

When a mode other than "EXECUTE" is selected in (15), set the conveyor speed lower limit by which the manipulator takes the respective action.

(17) VIRTUAL ENCODER IN (0 to 4096)

Set the general-purpose input signal number to be set for the virtual encoder . When this signal is input, the encoder input enters the virtual encoder mode.

000 : Virtual encoder not used

001 to 4096: The general-purpose input signal of the set number activates the virtual encoder mode.

(18) VIRTUAL ENCODER OUT (0 to 4096)

When "VIRTUAL ENCODER" is selected in (5), set the general-purpose output signal number to be set for the virtual encoder output.

000 : Virtual encoder not used

001 to 4096: The general-purpose output signal of the set number is output from the virtual encoder

(19) TRACKING CORRECTION (-500 to 1000 msec)

Set the tracking correction time.

*Displayed on version DN1.60-000 and later.

2.2 Editing Conveyor Condition File

2.2.1 Display the Conveyor Condition File

Select {ROBOT} under the main menu → Select {CV CONDITION} → Display a desired conveyor condition file¹⁾

- 1 Press the [PAGE] to display the next file number.
Press [SHIFT] + the [PAGE] to display the previous file number.

2.2.2 Edit the Conveyor Condition File

■ Selecting “USED STATUS”

Select “USED STATUS” → “USED” or “NOT USED” is selected alternately

■ Selecting “PORT NO.”

Select “PORT NO.” → The selection dialog appears → Select a desired port number



■ Selecting “BROKEN LINE DETECT”

Select “BROKEN LINE DETECT” → “OFF” or “ON” is selected alternately

■ Selecting “ENCODER INPUT”

Select “ENCODER INPUT” → “ENCODER” or “VIRTUAL ENCDR” is selected alternately

■ Selecting “ENCODER SIGN”

Select “ENCODER SIGN” → “FORWARD” or “REVERSE” is selected alternately

■ Selecting “CORRECTION”

Select “CORRECTION” → “FORWARD” or “REVERSE” is selected alternately

■ Selecting “TRACKING”

Select “TRACKING” → “ROBOT AXIS” or “BASE AXIS” is selected alternately

■ Specifying “USER COORD NO.”

Select “USER COORD NO.” → Enter a value by pressing [Numeric keys]

■ Selecting “BASE AXIS”

Select “BASE AXIS” → The selection dialog box appears → Select a desired axis

■ Specifying “RESOLUTION”

Select “RESOLUTION” → Enter a value by pressing [Numeric keys]

■ Specifying “VIRTUAL CONVEYOR SPEED”

Select “VIRTUAL CONVEYOR SPEED” → Enter a value by pressing [Numeric keys]

■ Specifying “AVERAGED TRAVEL TIME”

Select “AVERAGED TRAVEL TIME” → Enter a value by pressing [Numeric keys]

■ Specifying “RESET SIGNAL MONITORING TIME”

Select “RESET SIGNAL MONITORING TIME” → Enter a value by pressing [Numeric keys]

■ Selecting “CONVEYOR SPEED DOWN MODE”

Select “CONVEYOR SPEED DOWN MODE” → Selection dialog box appears → Select a desired mode

■ Specifying “CONVEYOR LOWER LIMIT SPD”

Select “CONVEYOR LOWER LIMIT SPD” → Enter a value by pressing [Numeric keys]

■ Specifying “VIRTUAL ENCODER INPUT”

Select “VIRTUAL ENCODER INPUT” → Enter a value by pressing [Numeric keys]

■ Specifying “VIRTUAL ENCODER OUTPUT”

Select “VIRTUAL ENCODER OUTPUT” → Enter a value by pressing [Numeric keys]

■ Specifying “TRACKING CORRECTION”

Select “TRACKING CORRECTION” → Enter a value by pressing [Numeric keys]



Editing the conveyor condition file clears both the shift data and the synchronization data. Observe the above precaution when the conveyor condition file is modified.

2.3 Setting Conveyor Resolution

The encoder mounted on the conveyor sends the pulse amount to the DX200 as the conveyor current position data. In order that the manipulator recognizes this pulse amount as the conveyor travel amount for its follow-up motion, this pulse amount must be converted into a distance.

The conveyor travel amount (μm) per 1 pulse to be used for this conversion is called "RESOLUTION." The resolution is set in units of micrometer. For example, when the conveyor resolution is 30 $\mu\text{m}/\text{pulse}$, set "RESOLUTION" to "30.00."

The setting range is from 0 to 999.99 $\mu\text{m}/\text{pulse}$. Since the DX200 internally quadruples every encoder pulse number, the conveyor's maximum positional resolution is 3999.96 $\mu\text{m}/\text{pulse}$.

As the resolution error is stored as much as the conveyor travel pulse amount, the setting must be correct. For example, when the resolution is set 0.01 $\mu\text{m}/\text{pulse}$ bigger, the follow-up error of 0.1 mm at the point that the conveyor moves for 1000 pulses.

The conveyor resolution is mentioned in the specification of each conveyor. However, this value cannot be used because of the following reason.



As the feedback pulse becomes four times the amount of the pulse from the conveyor encoder, the conveyor resolution of the conveyor condition file is 1/4 of the conveyor resolution mentioned in your conveyor specifications.

For more detailed information on the setting method, refer to section 4.3 "Setting Conveyor Positional Resolution" of the "DX200 OPTIONS INSTRUCTIONS FOR CONVEYOR SYNCHRONIZED FUNCTION."

2.4 Detection Function for BROKEN LINE DETECT Status (Conveyor Pulse)

When “BROKEN LINE DETECT” in the CONVEYOR COND FILE display is set ON (enabled), an alarm occurs if the broken line detection status signal for conveyor pulse is detected. The following specific outputs are used to output the disconnection detection.

For the production line, whether the alarm occurrence stops the entire line or not can be specified by the concurrent I/O ladder program or by the setting on the host controller, referring to the information of these outputs.

51437	51436	51435	51434	51433	51432	51431	51430
		BROKEN LINE DETECT (CONVEYOR COND FILE 6)	BROKEN LINE DETECT (CONVEYOR COND FILE 5)	BROKEN LINE DETECT (CONVEYOR COND FILE 4)	BROKEN LINE DETECT (CONVEYOR COND FILE 3)	BROKEN LINE DETECT (CONVEYOR COND FILE 2)	BROKEN LINE DETECT (CONVEYOR COND FILE 1)

The time to output the broken line detection status signal can be set. Set the time to output the signal sent from the board for synchronization to the main CPU in the sensor parameter SE017 (setting for output time of broken line detection signal). This prevents the main CPU from failing to get the information of the disconnection status when the output time is too short. Set 50 ms or more considering the time lag between the signal writing of the board for synchronization and the signal reading of the main CPU.

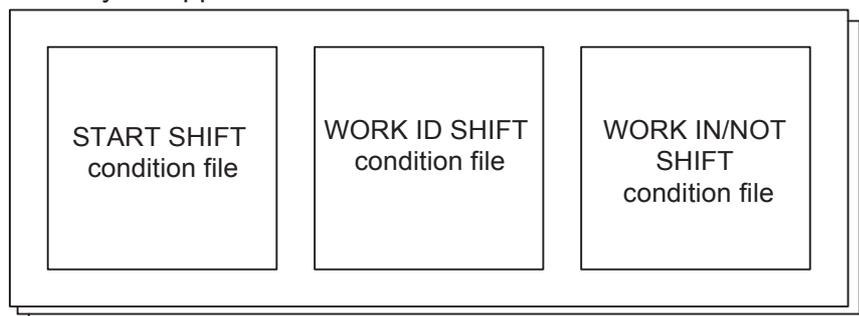
2.5 Conveyor Supplemental Condition File

To use the conveyor synchronized function with shift functions, the conveyor supplemental condition file "CV TRACKING COND SUPP." must be set in addition to the conveyor condition file.

The CV TRACKING COND SUPP. file consists of three files: START SHIFT SET, WORK ID.

SHIFT SET, and WORK IN/NOT SHIFT SET. Set the files of the functions required for your system configuration.

Conveyor supplemental condition file



The maximum number of the conveyor supplemental condition files depends on the number of mounted conveyor synchronization boards (JANCD-YCP02).

Board for synchronization (JANCD-YCP02)	File Number
With one board	1 to 3
With two board	1 to 6

2.6 Start Shift Condition File



(1) FILE NO.

Displays the start shift condition file number.

(2) USED STATUS (USED/NOT USED)

Specify whether the start shift condition file is used or not.

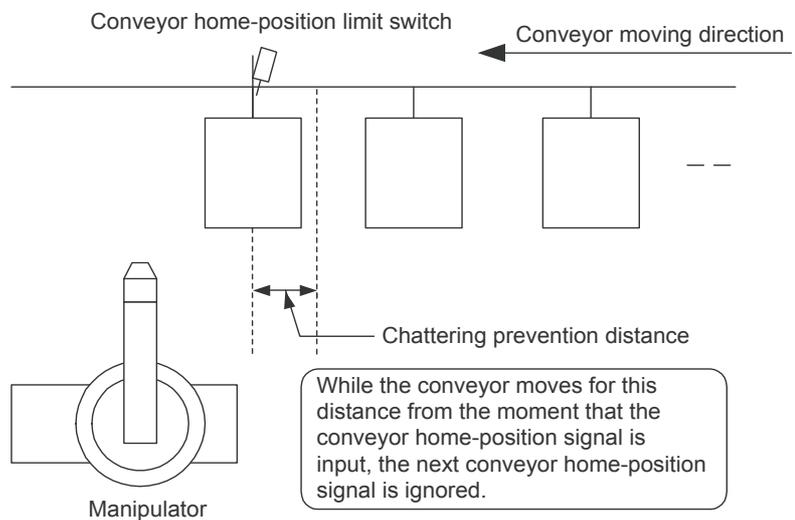
(3) PORT NO.

Displays the port number where the encoder specified in the conveyor condition file is connected.

(4) CHATTERING PRVNT DIS (0 to 9999.9 mm)

While the conveyor moves for the chattering prevention distance from the moment that the conveyor home-position signal is input, the next conveyor home-position signal input is ignored.

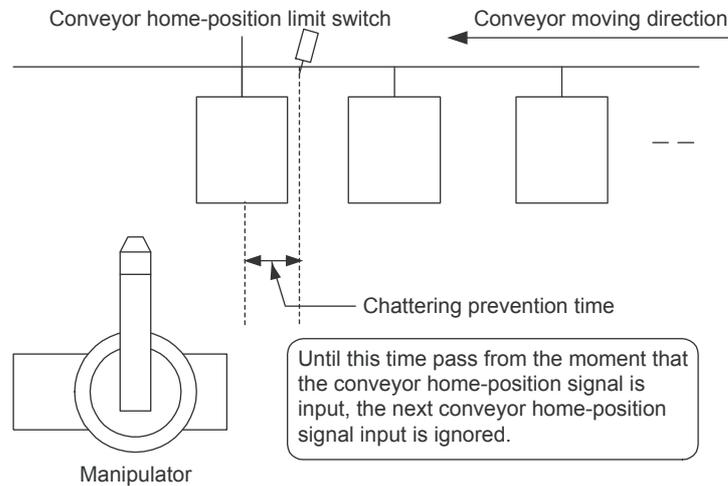
Set "0" to disable monitoring for the chattering prevention distance and to count the number of workpieces with every input.



(5) CHATTERING PRVNT TIME (0 to 999.9 seconds)

Until the chattering prevention time pass from the moment that the conveyor home-position input signal is input, the next conveyor home-position signal input is ignored.

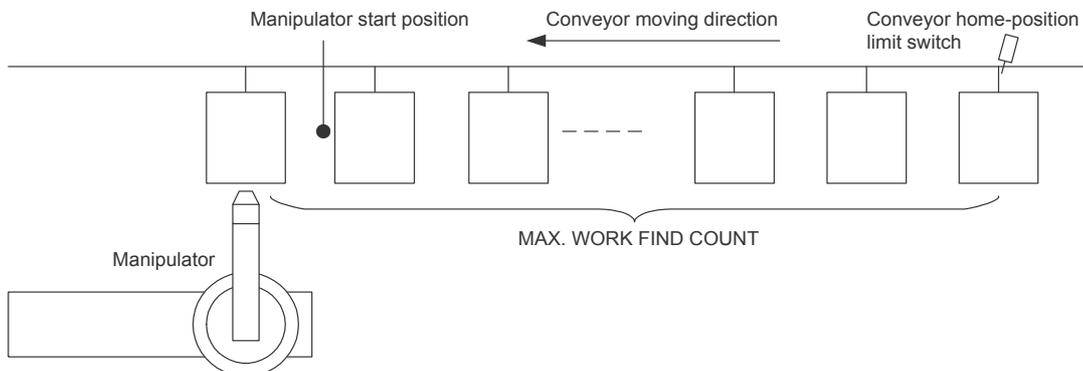
Set "0" to disable monitoring for the chattering prevention time and to count the number of workpieces with every input.



If both the distance and the time for the chattering prevention are set, the larger one is applied.

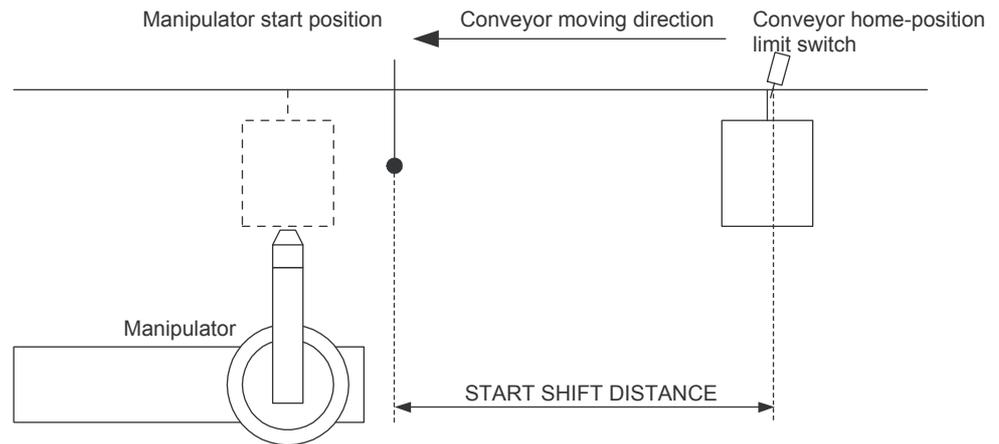
(6) MAX. WORK CNT (0 to 99 workpieces)

Set the maximum number of workpieces that move between the conveyor home-position limit switch to the reference workpiece for synchronization start.



(7) START SHIFT DISTANCE (0 to 99999mm)

When the conveyor home-position limit switch cannot be installed within the manipulator working envelope, the home-position limit switch ON signal is shifted in synchronization with the conveyor movement to the manipulator working envelope. Set the distance from the conveyor home-position limit switch to the shift end position. When 0 is set, the SYSTART instruction is executed when the conveyor home-position limit switch ON signal is input.



2.7 Editing the Start Shift Condition File

2.7.1 Display of the Start Shift Condition File

Select {ROBOT} under the main menu → Select {CONVEYOR COND SUPP.} →
Select {DISPLAY} → Select "START SHIFT"¹⁾

- 1 Press the [PAGE] to display the next file number.
Press [SHIFT] + [PAGE] to display the previous file number.

2.7.2 Editing the Start Shift Condition File

- **Selecting "USED STATUS"**

Select "USED STATUS" → "USED" or "NOT USED" is selected alternately

- **Specifying "CHATTERING PREVENTION DISTANCE"**

Select "CHATTERING PREVENTION DISTANCE" → Enter a value by pressing [Numeric keys]

- **Specifying "CHATTERING PREVENTION TIME"**

Select "CHATTERING PREVENTION TIME" → Enter a value by pressing [Numeric keys]

- **Specifying "MAX. WORK FIND COUNT"**

Select "MAX. WORK FIND COUNT" → Enter a value by pressing [Numeric keys]

- **Specifying "START SHIFT DISTANCE"**

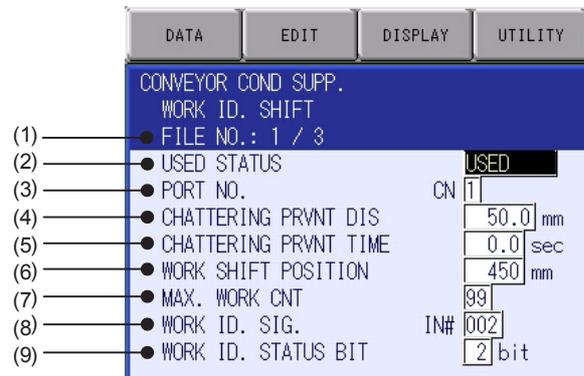
Select "START SHIFT DISTANCE" → Enter a value by pressing [Numeric keys]



Editing the start shift condition file clears both the shift data and the synchronization data.

Observe the above precaution when the start shift condition file is modified.

2.8 WORK ID SHIFT Condition File



(1) FILE NO.

Displays the WORK ID SHIFT condition file.

(2) USED STATUS (USED/NOT USED)

Specify whether the WORK ID SHIFT condition file is used or not.

(3) PORT NO. (CN1/CN2/CN3)

Displays the port number where the WORK ID detecting limit switch is connected.

(4) CHATTERING PRVNT DIS (0 to 9999.9 mm)

Set a distance to prevent the repeated inputs of the WORK ID detecting limit switch signal due to the limit switch chattering. While the conveyor moves for the set distance from the moment the WORK ID detecting limit switch signal is input, another WORK ID detecting limit switch signal is ignored.

Set "0" to disable monitoring for the chattering prevention distance and to count the number of workpieces with every input.

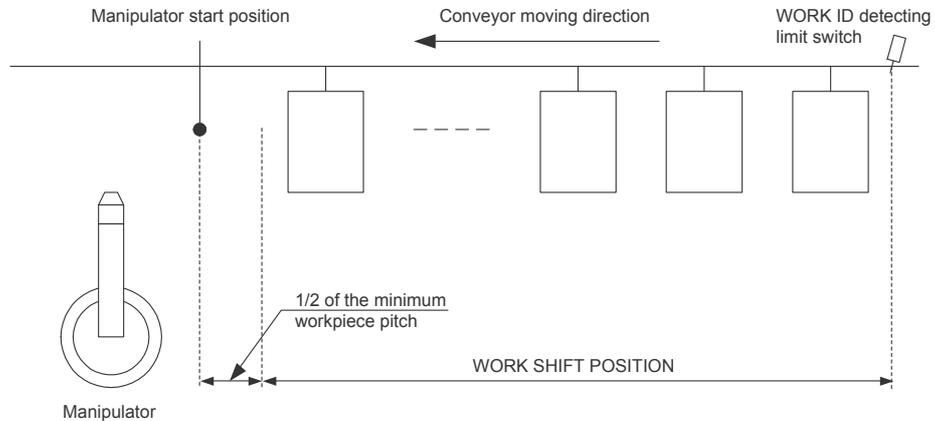
(5) CHATTERING PRVNT TIME (0 to 999.9 sec)

Set a time to prevent the repeated inputs of the WORK ID detecting limit switch signal due to the limit switch chattering. Until the set time passes from the moment the WORK ID detecting limit switch signal is input, another WORKD ID detecting limit switch signal is ignored.

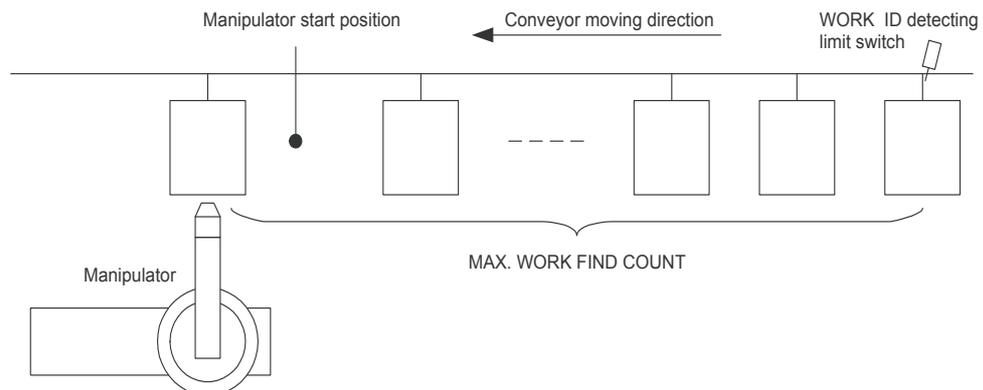
Set "0" to disable monitoring for the chattering prevention time and to count the number of workpieces with every input. If both the distance and the time for the chattering prevention are set, the larger one is applied.

(6) WORK SHIFT POS (0 to 99999 mm)

Set the distance from the WORK ID detecting limit switch to the shift end position. Normally, set the value of the distance from the WORK ID detecting limit switch to the manipulator start position subtracted by 1/2 of the minimum workpiece pitch.

**(7) MAX. WORK CNT (1 to 99 workpieces)**

Set the maximum number of workpieces that are set between the WORK ID detecting limit switch to the reference workpiece for synchronization start.

**(8) WORK ID SIG (0 to 4096)**

Set the head general-purpose input number that specifies the WORK ID number.

(9) WORK ID STATUS BIT (1 to 10)

Set the number of valid bits of the WORK ID number.

Maximum 10 bits can be set to specify up to the WORK ID number 1024.

2.9 Editing the WORK ID SHIFT Condition File

2.9.1 Display the WORK ID SHIFT Condition File

Select {ROBOT} under the main menu → Select {CONVEYOR COND SUPP.} → Select {DISPLAY} → Select "WORK ID SHIFT"¹⁾

- 1 Press the [PAGE] to display the next file number.
Press [SHIFT] + [PAGE] to display the previous file number.

2.9.2 Edit the WORK ID SHIFT Condition File

■ Selecting "USED STATUS"

Select "USED STATUS" → "USED" or "NOT USED" is selected alternately

■ Selecting "PORT NO."

Select "PORT NO." → The selection dialog appears → Select a desired port number

■ Specifying "CHATTERING PREVENTION DISTANCE"

Select "CHATTERING PREVENTION DISTANCE" → Enter a value by pressing [Numeric keys]

■ Specifying "CHATTERING PREVENTION TIME"

Select "CHATTERING PREVENTION TIME" → Enter a value by pressing [Numeric keys]

■ Specifying "WORK SHIFT POSITION"

Select "MAX. WORK SHIFT POSITION" → Enter a value by pressing [Numeric keys]

■ Specifying "MAX. WORK FIND COUNT"

Select "MAX. WORK FIND COUNT" → Enter a value by pressing [Numeric keys]

■ Specifying "WORK ID SIGNAL"

Select "WORK ID SIGNAL" → Enter a value by pressing [Numeric keys]

■ Specifying "WORK ID STATUS BIT"

Select "WORK ID STATUS BIT" → Enter a value by pressing [Numeric keys]



Editing the WORK ID SHIFT condition file clears both the shift data and the synchronization data.
Observe the above precaution when modifying the WORK ID SHIFT condition file.

2.10 WORK IN/NOT SHIFT Condition File**(1) FILE NO.**

Displays the WORK IN/NOT SHIFT condition file number.

(2) USED STATUS (NOT USED/USED)

Specify whether the WORK IN/NOT SHIFT condition file is used or not.

(3) PORT NO. (CN1/CN2/CN3)

Displays the port number where the WORK IN/NOT detecting limit switch is connected.

(4) CHATTERING PRVNT DIS (0 to 9999.9 mm)

Set a distance to prevent the repeated inputs of the WORK IN/NOT detecting limit switch signal due to the limit switch chattering. Until the conveyor moves for the set distance from the moment the WORK IN/NOT detecting limit switch signal is input, another WORK IN/NOT detecting limit switch signal is ignored.

Set "0" to disable monitoring for the chattering prevention distance and to count the number of workpieces with every input.

(5) CHATTERING PRVNT TIME (0 to 999.9 seconds)

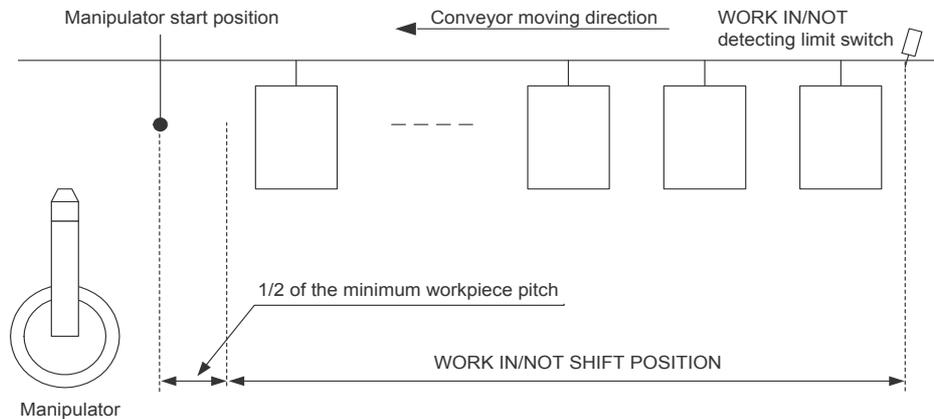
Set a time to prevent the repeated inputs of the WORK IN/NOT detecting limit switch signal due to the limit switch chattering. Until the set time passes from the moment the WORK IN/NOT detecting limit switch signal is input, another WORK ID detecting limit switch signal is ignored.

Set "0" to disable monitoring for the chattering prevention time and to count the number of workpieces with every input. If both the distance and the time for the chattering prevention are set, the larger one is applied.

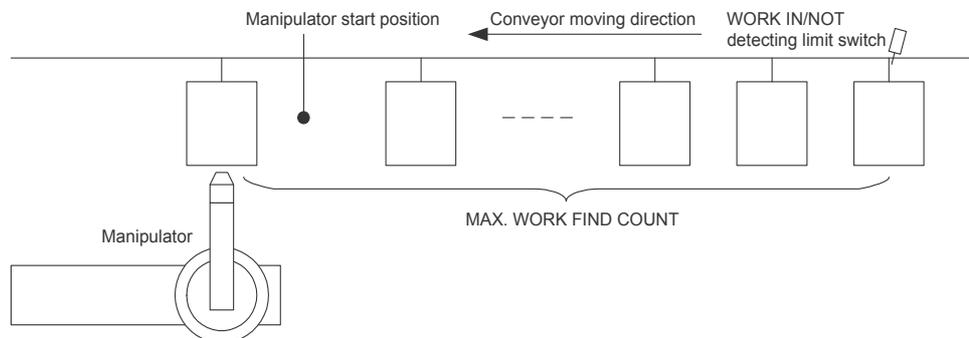
(6) WORK SHIFT POSITION

Set the distance from the WORK IN/NOT detecting limit switch to the shift end position.

Normally, set the distance from the WORK IN/NOT detecting limit switch to the manipulator start position subtracted by 1/2 of the minimum workpiece pitch.

**(7) MAX. WORK CNT (1 to 99)**

Set the maximum number of workpieces that are set between the WORK IN/NOT detecting limit switch to the reference workpiece for synchronization start.

**(8) WORK IN/NOT SIG (0 to 4096)**

Set the general-purpose output signal number that specifies the presence/absence of workpiece.

2.11 Editing the WORK IN/NOT SHIFT Condition File

2.11.1 Display the WORK IN/NOT SHIFT Condition File

Select {ROBOT} under the main menu → Select {CONVEYOR COND SUPP.} →
Select {DISPLAY} → Select "WORK IN/NOT SHIFT"¹⁾

- 1 Press the [PAGE] to display the next file number.
Press [SHIFT] + [PAGE] to display the previous file number.

2.11.2 Edit the WORK IN/NOT SHIFT Condition File

- **Selecting "USED STATUS"**

Select "USED STATUS" → "USED" or "NOT USED" is selected alternately

- **Selecting "PORT NO."**

Select "PORT NO." → The selection dialog appears Select a desired port number

- **Specifying "CHATTERING PREVENTION DISTANCE"**

Select "CHATTERING PREVENTION DISTANCE" → Enter a value by pressing [Numeric keys]

- **Specifying "CHATTERING PREVENTION TIME"**

Select "CHATTERING PREVENTION TIME" → Enter a value by pressing [Numeric keys]

- **Specifying "MAX. WORK IN/NOT SHIFT POSITION"**

Select "MAX. WORK IN/NOT POSITION" → Enter a value by pressing [Numeric keys]

- **Specifying "MAX. WORK FIND COUNT"**

Select "MAX. WORK FIND COUNT" → Enter a value by pressing [Numeric keys]

- **Specifying "WORK IN/NOT SIGNAL"**

Select "WORK IN/NOT SIGNAL" → Enter a number by pressing [Numeric keys]



Editing the WORK IN/NOT SHIFT condition file clears both the shift data and the synchronization data. Observe the above precaution when modifying the WORK IN/NOT SHIFT condition file.

3 Teaching

3.1 Registering Instructions

The instructions can be registered when the cursor is in the address area on the job content display in teach mode.

Select {JOB} under the main menu → Select {JOB CONTENT} → Move the cursor to the address area



3.1.1 SYSTART Instruction

■ Function

The SYSTART instruction starts the conveyor synchronized control. The manipulator starts follow-up motion by a move instruction after the SYSTART instruction, or TIMER or WAIT instruction.

When this instruction is executed, the manipulator stops and waits until the conveyor current position value exceeds the synchronization start position value. When the conveyor current position value exceeds the synchronization start position value, the manipulator starts the follow-up motion.

When the conveyor current position value exceeds the synchronization start position value within the tolerance (OL) at the moment the SYSTART instruction is executed, the manipulator starts the follow-up motion from the point the SYSTART instruction is executed.

When the conveyor current position value exceeds the synchronization start position value beyond the tolerance (OL) at the moment the SYSTART instruction is executed, the system variable \$B008 is reset to "0," and the manipulator executes the proceeding instruction without the synchronized motion. At the normal completion, "1" is set to the system variable \$B008.



The system variable \$B008 cannot be read directly. Copy the system variable to Bxxx by using a GETS instruction and read the value.

<Example> GETS B000 \$B008
JUMP *NG IF B000<1

When the SYSTART instruction has been executed and then another SYSTART instruction is executed in the middle of the job, the manipulator completes the execution of the previous move instruction, and tracks the conveyor in the stand-by posture until the conveyor reaches the synchronization start position for the next SYSTART instruction. Then, when the conveyor reaches the synchronization start position, the manipulator executes the next instruction.

When the SYEND instruction with a tag CONT (continuity attribute) is executed in the middle of the job of a SYSTART instruction and then another SYSTART instruction is executed, the manipulator completes the execution of the previous move instruction and stops without changing its posture until the conveyor reaches the synchronization start position for the next SYSTART instruction. When the conveyor reaches the synchronization start position, the manipulator starts the follow-up motion to the conveyor.

■ Format

SYSTART CV#(1) STP=50.000 OL=10.
 ① ② ③

① **Conveyor condition file No. (CONVEYOR FILE)**

Set the conveyor condition data file No. to be used.

② **Synchronization start position (SYNC START POS)**

Set the conveyor position where the synchronized operation starts.

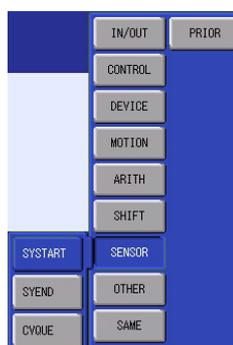
③ **Tolerance (OVER LIMIT)**

The maximum excess to execute the synchronized operation when the conveyor current position value exceeds the synchronization start position value at the execution of SYSTART instruction. When omitted or 0 is set, tolerance check is not executed.

■ Registering the SYSTART Instruction

Move the cursor to the line just above the place where a SYSTART instruction is to be registered Press [INFORM LIST]¹⁾ → Select "SYSTART"²⁾ → Change the additional items³⁾ → Press [INSERT] and [ENTER]⁴⁾

1 The instruction list dialog appears.



2 The SYSTART instruction is displayed in the input buffer line.

SYSTART CV#(1) STP=0.000

3 Teaching

3.1 Registering Instructions

3 <Register without editing the additional items>

Perform the operation 4.

<Edit the additional items>

•To change the conveyor condition file number or/and the synchronization start position

Move the cursor to CONVEYOR FILE or SYNC START POS, and press [SELECT].

Enter a desired number or value by using [Numeric keys], then press [ENTER].

•To add, change, or delete an additional item

Move the cursor to the instruction in the input buffer line, and press [SELECT].
The detail edit display appears.



To add a tolerance, select "UNUSED" in OVER LIMIT. And then the selection dialog appears. Select "OL=."



After having added or changed the additional items, press [ENTER]. The detail edit display is closed and the job content display appears.

4 The instruction displayed in the input buffer line is registered.

3.1.2 SYEND Instruction**■ Function**

The SYEND instruction ends the conveyor synchronized control. The synchronized operation ends at the step where this instruction is registered.

Executing a SYEND clears the conveyor home-position data. When the conveyor home-position limit switch is on after the conveyor home-position data is cleared, the conveyor home position data will be updated.

Execution of this instruction after CVQUE instruction invalids the position table of the workpiece in case there is no following position data of the workpiece.

Without this instruction, the SYSTART instruction is terminated before the workpiece passes the manipulator and the cursor may move to the next instruction.

Register the SYEND instruction to the following places:

- End step of the synchronization
- Head of the synchronizing operation line
- After the CVQUE instruction

For the details, refer to *section 3.8 “Job Examples” on page 3-13.*

■ Format

SYEND CV#(1) CONT
 ① ②

① Conveyor condition file No. (CONVEYOR FILE)

Set the conveyor condition file number to be used.

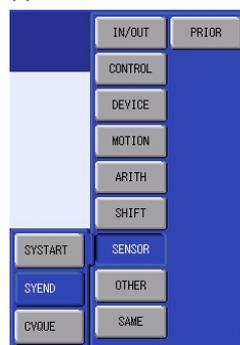
② Continuity attribute

Without ON signal from the conveyor home-position limit switch, the DX200 executes the SYSTART instruction and the manipulator starts the follow-up motion when the conveyor current position reaches and passes the synchronization start position. (Refer to “3.1.1 SYSTART Instruction.”) The manipulator stops while it waits for the start of the follow-up motion.

■ Registering the SYEND Instruction

Move the cursor to the line just above the place where a SYEND instruction is to be registered Press [INFORM LIST]¹⁾ → Select “SYEND”²⁾ → Change the additional items → Press [INSERT] and [ENTER]³⁾

1 The instruction list dialog appears.



2 The SYEND instruction is displayed in the input buffer line.

SYEND CV#(1)

3 The instruction displayed in the input buffer line is registered.



The conveyor synchronized motion can be suspended in the middle of a job. To suspend the conveyor synchronized motion, insert the SYEND instruction added with a tag CONT (continuity attribute). The manipulator completes the execution of the previous move instruction of the SYEND instruction with a tag CONT, and stops to wait until the conveyor current position value reaches the value set for STP of the next SYSTART instruction. To wait until the conveyor current position value reaches the value set in STP for the SYSTART instruction moving the manipulator with the follow-up control to the conveyor, keep the SYSTART instruction executed without using the SYEND instruction.

3.1.3 SYMOV □ Instruction

■ Function

These move instructions executes the conveyor synchronized motion. Except that the conveyor positions at the time of teaching are registered as CTP (conveyor position at teaching), these instructions are same as ordinary move instructions. Joint motion, linear interpolation, and circular interpolation can be performed in the same way as the ordinary move instructions.

SYMOVJ	Conveyor synchronized joint motion
SYMOVL	Conveyor synchronized linear interpolation
SYMOVC	Conveyor synchronized circular interpolation

When these instructions are used, the teaching method is different from that with the ordinary move instructions. Refer to *section 3.1.5 "Interpolation Mode for Conveyor Synchronized Motion"*.

■ Format

```
SYMOVJ VJ=50.00 CV#(1) CTP=100.000
SYMOVL V=200.00 CV#(1) CTP=100.000
SYMOVC V=200.00 CV#(1) CTP=100.000
          ①       ②       ③
```

① Play speed

Set the manipulator motion speed in playback mode.

② Conveyor condition file number

Set the conveyor condition file number to be used.

③ Conveyor position at teaching

Set the conveyor position at teaching.

■ Precautions on Executing the SYMOVJ Instruction

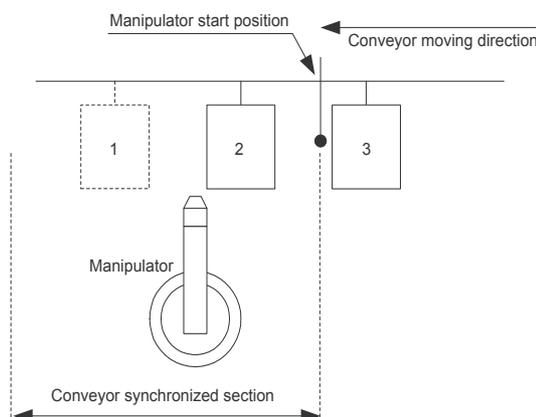
The SYMOVJ instruction calculates the orbit based on the conveyor speed when beginning to operate. The robot operation changes according to the conveyor speed changes to maintain a relative position of robot and conveyor (work) positions. The robot operation stops, too, when the conveyor stops. When the conveyor speed goes up again, the robot operation is restarted.

During the synchronized operation with the conveyor, three axes of the manipulator wrist may move faster than the set play-speed regardless of the conveyor moving direction. Therefore, set approximately 70% maximum of the actual play-speed for the SYMOVJ instruction. However, even if the play speed for the SYMOVJ instruction is set lower than 70%, the wrist may not be able to move depending on the conveyor speed or the manipulator's wrist posture. In such a case, reset the play speed lower.

3.1.4 CVQUE Instruction

■ Function

The CVQUE instruction switches the conveyor position data, which is used for the conveyor synchronized motion, to the position data of the next workpiece. If the next workpiece information is not set in the shift table, the CVQUE instruction is ignored.



If the CVQUE instruction is executed after the end of conveyor synchronized motion for the workpiece 1, the conveyor position data switches to the position data for the workpiece 2.

Register the SYEND instruction after this instruction,

Execution of the SYEND instruction after this instruction invalids the position table of the workpiece in case there is no following position data of the workpiece.

Without this instruction, the SYSTART instruction is terminated before the workpiece passes the manipulator and the cursor may move to the next instruction.

■ Format

CVQUE CV#(1)

①

① Conveyor condition file number

Set the conveyor condition file number to be used.



When the CVQUE instruction is executed, the first information of the WORK ID shift data and WORK IN/NOT shift data are set to the system variables and deleted from each shift data. Pay attention to the execution timing of CVQUE instruction when preparing a job.

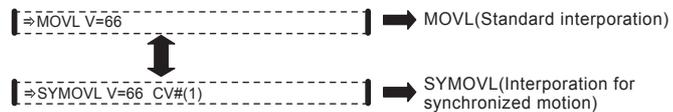
3.1.5 Interpolation Mode for Conveyor Synchronized Motion

The interpolation mode for conveyor synchronized move instruction at teaching differs from that for the standard move instruction. Switch the interpolation mode in the manner described below.

Once the conveyor positions at teaching are registered, they must be properly set up in relation to the conveyor home-position (the position where the conveyor home-position limit switch turns on.)

■ Switching the Interpolation Mode

Press [SHIFT] + [MOTION TYPE]. The interpolation mode displayed in the input buffer line switches between the standard interpolation and the interpolation for synchronized motion.



Then, each time [MOTION TYPE] is pressed, the interpolation mode changes as SYMOVJ →SYMOVL→SYMOVC.

3.2 Manipulator Motion Speed

Generally, teaching in the direction opposite to the conveyor moving direction gives such a result as a manipulator can move more easily and slowly in playback operation.

In conveyor synchronized operation, the manipulator motion speed is the teaching speed added to the conveyor speed.

Refer to section 5.2 Motion Speed” of “DX200 OPTIONS INSTRUCTION FOR CONVEYOR SYNCHRONIZED FUNCTION” for more information on the relation between the manipulator motion speed and the conveyor moving direction.

3.3 Wrist Posture in Conveyor Synchronized Section

In the conveyor synchronized section, the manipulator wrist maintains its taught posture while the manipulator moves in synchronization with the conveyor movement. Teach a posture so that the wrist can be moved in the conveyor moving direction.

For further information on the wrist posture, refer to section 5.3 “Wrist Posture in Synchronization” of “DX200 OPTIONS INSTRUCTION FOR CONVEYOR SYNCHRONIZED FUNCTION.”

3.4 Changing Circular Steps

Continuous circular steps should be taught on the same conveyor position.

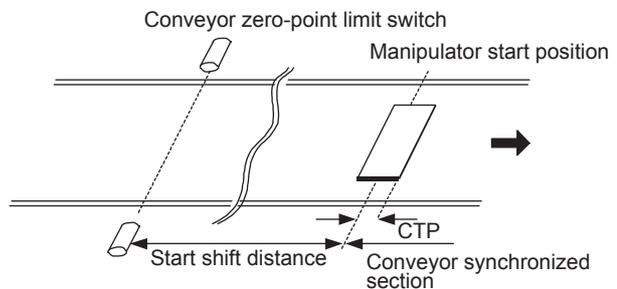
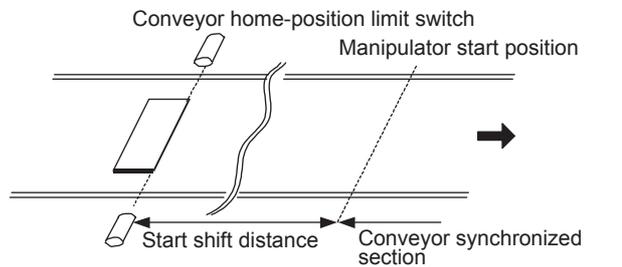
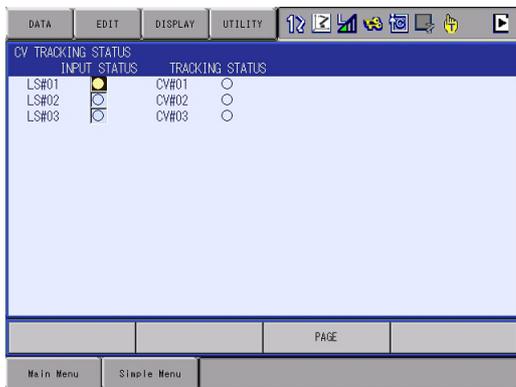
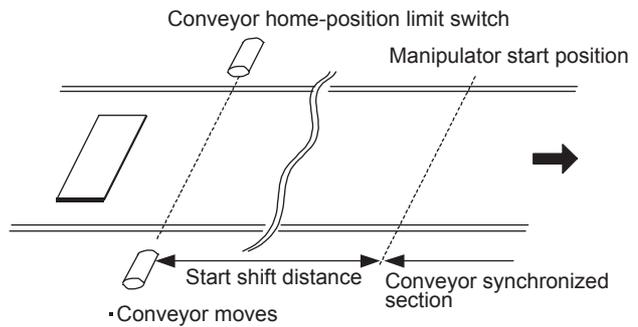
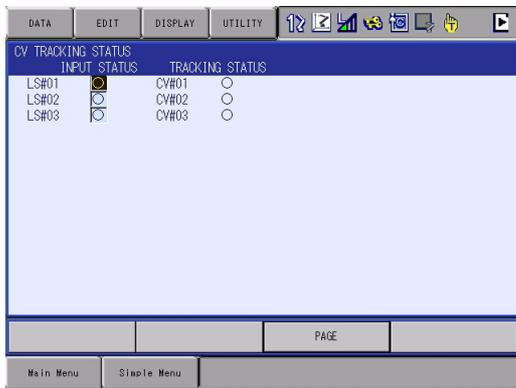
When continuous circular steps are taught on different conveyor positions, a motion path is different from the taught path in the synchronized motion.

3.5 Teaching

The conveyor positions at teaching are registered in a job. The conveyor position is defined as follows:

- When the start shift function is not used, the distance from the conveyor home-position (the position where the conveyor home-position limit switch turns on) to the synchronization start position.
- When the start shift function is used, the distance from the manipulator start position to the synchronization start position.

When performing a teaching to a workpiece, move the conveyor to turn on the conveyor home-position limit switch by the workpiece, then move to a teaching position. The position where the conveyor home-position limit switch is turned on is automatically registered as the conveyor home-position.



Add or Modify

SYMOVL V=1000.0 CV#(1) CTP=100.000



Perform teaching after having confirmed that the conveyor is completely stopped. Teaching while the conveyor moves may cause an error or segment over alarm.

Select {ROBOT} under the main menu Select {CV MONITOR}¹⁾ → Move the conveyor²⁾ → Press [SHIFT] + [MOTION TYPE]³⁾ → Select a interpolation type⁴⁾ → Press [Axis key]⁵⁾ → Press [ENTER]⁶⁾

- 1 The conveyor position display appears.

CONVEYOR POSITION			
	CURR POS(PULSE)	CURR POS	
CV#01	884	8.840 mm	
CV#02	0	0.000 mm	
CV#03	0	0.000 mm	

In the start shift section, the workpiece position cannot be confirmed in the conveyor monitor, but can be confirmed in the conveyor monitor (shift).

To display the conveyor monitor (shift), select {ROBOT} under the main menu, and select {CONVEYOR MONITOR (SHIFT)}.

START SHIFT SET			
CV#01SPEED	0.0 mm/sec		FIND CNT 4
No.	WORK POS(PULSE)	WORK POS(mm)	
1	1840	18.4	
2	4920	49.2	
3	6672	66.7	
4	8120	81.2	
5	*	*,*	
6	*	*,*	

While the conveyor is moving, if there is a workpiece in the start shift section, the workpiece position measured from the manipulator start position is displayed in the column No. 1.

- 2 Move the conveyor. Then, stop the workpiece at the teaching position after the conveyor home-position limit switch is turned on. At the moment the conveyor home-position limit switch is turned on, make sure that "0" is displayed in "CURR POS (PULSE)" on the conveyor position display and the counter is reset.

CONVEYOR POSITION			
	CURR POS(PULSE)	CURR POS	
CV#01	0	0.000 mm	
CV#02	0	0.000 mm	
CV#03	0	0.000 mm	

When using the start shift function: Start the conveyor. Make sure that the workpiece passes the manipulator start position when the conveyor moves for the preset start shift distance or more after the conveyor home-position limit switch is turned on.

- 3 The conveyor interpolation mode enters.
- 4 Select the interpolation method to be used by pressing [MOTION TYPE].
- 5 Move the manipulator to the desired position by using [Axis keys].
- 6 The step is registered.

When teaching the position 1000 mm from the conveyor home-position (or the manipulator start position) in linear interpolation using No.1 conveyor characteristic file, the following step is registered.

```
0005 = SYMOVL V=100.0 CV#(1) CTP=1000.000
```

Proceed the rest of the teaching in the same manner as the normal teaching. To use a move instruction for synchronizing to the conveyor after having changed to the standard interpolation mode, the operation to select the interpolation mode for conveyor synchronized move instruction is necessary.



As long as the conveyor synchronized operation is not being performed, a conveyor home position input signal is accepted and the conveyor home-position is updated. Therefore, even though teaching is made on the same conveyor position, if the conveyor home-position limit switch turns on inadvertently, the conveyor position data will be changed. If there is a risk that the conveyor home-position limit switch is turned on inadvertently, perform a FWD key operation for that step after programming a move instruction for conveyor synchronized motion such as SYMOVL and SYMOVC. This starts the conveyor synchronized operation so that the conveyor home-position will not be changed even if the conveyor home-position limit switch turns on. In this case, execute a SYEND instruction at the end of teaching to cancel the synchronization.

3.6 Teaching After Interruption of Synchronized Motion in Playback Operation

After the synchronized motion is interrupted by a hold operation or switching to teach mode during playback operation, another conveyor home-position cannot be registered since no conveyor home-position input signal is accepted. At this moment, the tracking status in the conveyor tracking display is "ON" (marked with "●").

In this case, another conveyor home-position can be registered by either of the following operations.

- (1) Add a step or change the step after interruption of synchronized motion
- (2) Perform another teaching (for other workpiece)

For the details of the above operations, refer to section 5.6 "Teaching After Interruption of Playback in Synchronized Operation" of "DX200 OPTIONS INSTRUCTION FOR CONVEYOR SYNCHRONIZED FUNCTION."

3.7 Notes on Operation

The conveyor synchronized move instructions are special instructions to register the conveyor positions together with the manipulator positions. Therefore, the conveyor synchronized move instructions are different from standard move instructions such as MOVJ, and these instructions have the following restrictions on operations.

3.7.1 Confirming Reach to Step

When the manipulator reaches the target step in FWD/BWD operation or test run (step motion mode), the operation is stopped and the cursor stops blinking. In this way, it can be easily confirmed that the manipulator reaches the target step.



When the manipulator reaches the target step, the cursor stops blinking. However, when the following operations are performed, the cursor restarts blinking. In this case, move the cursor to the target step and perform FWD operation again.

- Emergency stop
- The cursor movement in editing job
- File and job editing operation
- Jog operation

3.7.2 Changing Tool

The first FWD operation of the SYMOV□ after changing a tool should be performed on the conveyor position at changing a tool. Performing the FWD operation after changing a tool and moving the conveyor causes a segment over alarm.

3.7.3 Deleting Taught Positions

Before deleting a move instruction, the manipulator must be placed at the step position to be deleted. However, this condition cannot be satisfied with conveyor synchronized motion move instructions. This is because a taught position for a conveyor synchronized motion move instruction is interpreted to different step positions on the conveyor position, as explained before. Therefore, ordinary deleting operation is not possible. To delete a conveyor synchronized move instruction, press [MODIFY] to change the step position. Then, after the cursor blinks, press [DELETE].

3.7.4 Manipulator Stand-by Position for the SYSTART Instruction

The manipulator's stand-by position for the SYSTART instruction should be same as the manipulator's position for a move instruction for the conveyor synchronized motion (SYMOV□) after the SYSTART instruction. If these two positions are different, the manipulator may not be on the taught position to start moving because the DX200 executes the move instruction for the conveyor synchronized motion immediately after the synchronization starts.

3.8 Job Examples

3.8.1 Job Example for the Conveyor Synchronized Function without Shift Functions

An example of the job without using the start shift is given below. Use this example as the basic programming for application to various system.

	Instruction	Description
0000	NOP	
0001	SYEND CV#(1)	Resets the registered status of the conveyor's home position. The conveyor home-position limit switch becomes valid.
0002	MOVJ V=50.00	Starts the job and moves the manipulator to the stand-by position.
0003	SYSTART CV#(1) STP=100.000	Conveyor synchronization start instruction When the conveyor reaches the specified position, the conveyor synchronized control starts.
0004	0004 GETS B000 \$B008	The system variable to indicate whether the synchronization has started normally or not The contents of \$B008 is copied to B000: Synchronization started normally if B000=1, and an error occurred if B000=0
0005	JUMP *END IF B000=0	If B000=0 (the synchronization did not start normally), jumps to the label [*END].
0006	SYMOVL CV#(1) CTP=50.000	Move instruction for the conveyor synchronized motion
0007	:	The manipulator moves in synchronization with the conveyor.
0008	SYMOVL CV#(1) CTP=50.000	
0009	*END	Jumps here if the conveyor synchronization did not start normally.
0010	SYEND CV#(1)	Ends the synchronization.
0011	CVQUE CV#(1)	Switches the reference workpiece for synchronization.
0012	SYEND	The position table of the workpiece becomes invalid in case there is no following position data of the workpiece.
0013	MOVJ V=50.00	Returns the manipulator to the stand-by position and ends the job.
0014	END	

Set "NOT USED" for START SHIFT, WORK ID. SHIFT, and WORK IN/NOT SHIFT of the CONVEYOR COND SUPP. file.



- Do not insert the instructions "MOVJ," "MOVL," "MOVC," "MOVS," or "IMOV" during the conveyor synchronization (from the SYSTART instruction to the SYEND instruction). The manipulator may not be able to move depending on the manipulator's posture in synchronization with the conveyor immediately before the execution of these instructions (move instruction status for the conveyor synchronization).
- After the SYEND instruction, insert the CVQUE instruction before the next SYSTART instruction whether the Start Shift function is used or not.

Conveyor Synchronized with Shift Function	3 Teaching 3.8 Job Examples
--	--------------------------------

3.8.2 Job Example when Using the Start Shift Function

An example of the job using the start shift function is given below.

■ Master Job

	Instruction	Description
0000	NOP	
0001	SYEND CV#(1)	Resets the registered status of the conveyor's home position. The conveyor home-position limit switch becomes valid.
0002	*TOP	
0003	MOVJ V=50.00	Moves the manipulator to the stand-by position.
0004	SYSTART CV#(1) STP=100.000	Conveyor synchronization start instruction When the conveyor reaches the specified position, the conveyor synchronized control starts.
0005	GETS B000 \$B008	The system variable to indicate whether the synchronization has started normally or not The contents of \$B008 is copied to B000: Synchronization started normally if B000=1, and an error occurred if B000=0
0006	JUMP *END IF B000=0	If B000=0 (the synchronization did not start normally), jumps to the label [*END].
0007	CALL JET#(1) ENTRY=18	Starts the work job registered in the job registration table 1.
0008	*END	Jumps here if the conveyor synchronization did not start normally.
0009	SYEND CV#(1)	Ends the synchronization.
0010	CVQUE CV#(1)	Switches the reference workpiece for synchronization.
0011	SYEND	The position table of the workpiece becomes invalid in case there is no following position data of the workpiece.
0012	JUMP *TOP	
0013	END	

Set "USED" for START SHIFT, and set "NOT USED" for WORK ID. SHIFT and WORK IN/NOT SHIFT of the CONVEYOR COND file.



- After the SYEND instruction, insert the CVQUE instruction before the next SYSTART instruction whether the Start Shift function is used or not.
- Be sure to program the SYEND instruction at the beginning of the master job to reset the registered status of the conveyor's home position.

■ **Work Job**

Instruction	Description
0000	NOP
0001	SYSTART CV#(1) STP=200.00 Waits for the synchronization start of the module 1. The manipulator moves following up the conveyor until the conveyor reaches the specified position.
0002	SYMOVL CV#(1) CTP=200.00 Move instruction for the conveyor synchronized motion
0003	SYMOVL CV#(1) CTP=200.00 Move instruction for the conveyor synchronized motion
0004	SYEND CV#(1) CONT Ends synchronization of module 1. Holds the conveyor synchronization.
0005	SYSTART CV#(1) STP=1000.00 Waits for the synchronization start of module 2. The manipulator stops and waits until the conveyor reaches the specified position.
0006	SYMOVL CV#(1) CTP=1000.00 Move instruction for the conveyor synchronized motion
0007	SYMOVL CV#(1) CTP=100.000 Move instruction for the conveyor synchronized motion
0008	SYSTART CV#(1) STP=2000.00 Waits for the synchronization start of module 2. The manipulator stops and waits until the conveyor reaches the specified position.
0009	SYMOVL CV#(1) CTP=2000.00 Move instruction for the conveyor synchronized motion
0010	SYMOVL CV#(1) CTP=2000.00 Move instruction for the conveyor synchronized motion
0011	END

NOTE

- Do not insert the instructions “MOVJ,” “MOVL,” “MOVC,” “MOVS,” or “IMOV” during the conveyor synchronization (from the SYSTART instruction to the SYEND instruction). The manipulator may not be able to move depending on the manipulator’s posture in synchronization with the conveyor immediately before the execution of these instructions (move instruction status for the conveyor synchronization).
- Teach the target position of the manipulator for the move instruction, which is executed after the conveyor synchronized motion starts, as close as possible to the manipulator’s stand-by position before the conveyor synchronization starts.
If these two positions are too far, the manipulator may not be able to move.

Conveyor Synchronized with Shift Function	3 Teaching 3.8 Job Examples
--	--------------------------------

3.8.3 Job Example Using the Start Shift, WORK ID Shift, and WORK IN/NOT Shift Functions

An example of the job using all the shift functions (Start Shift, WORK ID Shift, and WORK IN/ NOT Shift) is given as follows.

■ Master Job

	Instruction	Description
0000	NOP	
0001	SYEND CV#(1)	Resets the registered status of the conveyor's home position. The conveyor home-position limit switch become valid.
0002	*TOP	
0003	MOVJ V=50.00	Moves the manipulator to the stand-by position.
0004	GETS I000 \$I000	Gets the WORK IN/NOT shift completion status, and stores to I000.
0005	GETS I006 \$I006	Gets the WORK ID shift completion status, and stores to I006.
0006	JUMP *TOP IF I000=0	If the WORK IN/NOT shift is not completed, jumps to [*TOP].
0007	JUMP *TOP IF I006=0	If the WORK ID shift is not completed, jumps to [*TOP].
0008	CVQUE CV#(1)	Switches the reference workpiece for synchronization.
0009	SYEND	The position table of the workpiece becomes invalid in case there is no following position data of the workpiece.
0010	GETS I012 \$I012	Gets the WORK IN/NOT information, and stores to I012.
0011	GETS I018 \$I018	Gets the WORK ID information, and stores to I018.
0012	JUMP *TOP IF I012=0	If no workpiece exists, the manipulator does not execute the job.
0013	SYSTART CV#(1) STP=100.00 OL=100.0	Start instruction for the conveyor synchronization. Starts the conveyor synchronized control when the conveyor reaches the specified position.
0014	GETS B000 \$B008	The system variable to indicate whether the synchronization has started normally or not The contents of \$B008 is copied to B000: Synchronization started normally if B000=1, and an error occurred if B000=0
0015	JUMP *END IF B000=0	If B000=0 (the synchronization did not start normally), jumps to the label [*END].
0016	CALL JET#(1) ENTRY=I018	Reads the WORK ID information stored in I018, and starts the I018 registered job in the job registration table.
0017	*END	
0018	SYEND CV#(1)	Ends the synchronization.
0019	JUMP *TOP	
0020	END	

Set "USED" for the START SHIFT, WORK ID. SHIFT, and WORK IN/NOT SHIFT of the CONVEYOR COND SUPP. file.

The system variables are defined as follows:

\$I000 to \$I005: Stores the WORK IN/NOT shift completion status.

\$I000: Corresponds to the WORK IN/NOT characteristic file 1.

to

\$I005: Corresponds to the WORK IN/NOT characteristic file 6.

\$I006 to \$I011: Stores the WORK ID shift completion status.

\$I006: Corresponds to the WORK ID characteristic file 1.

to

\$I011: Corresponds to the WORK ID characteristic file 6.

\$I012 to \$I017: Stores the first WORK IN/NOT information

\$I012: Corresponds to the WORK IN/NOT characteristic file 1.

to

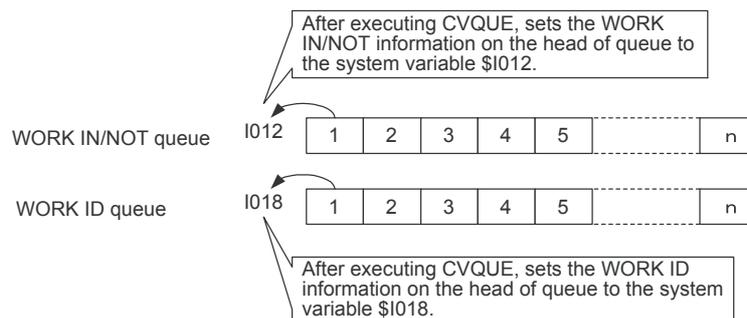
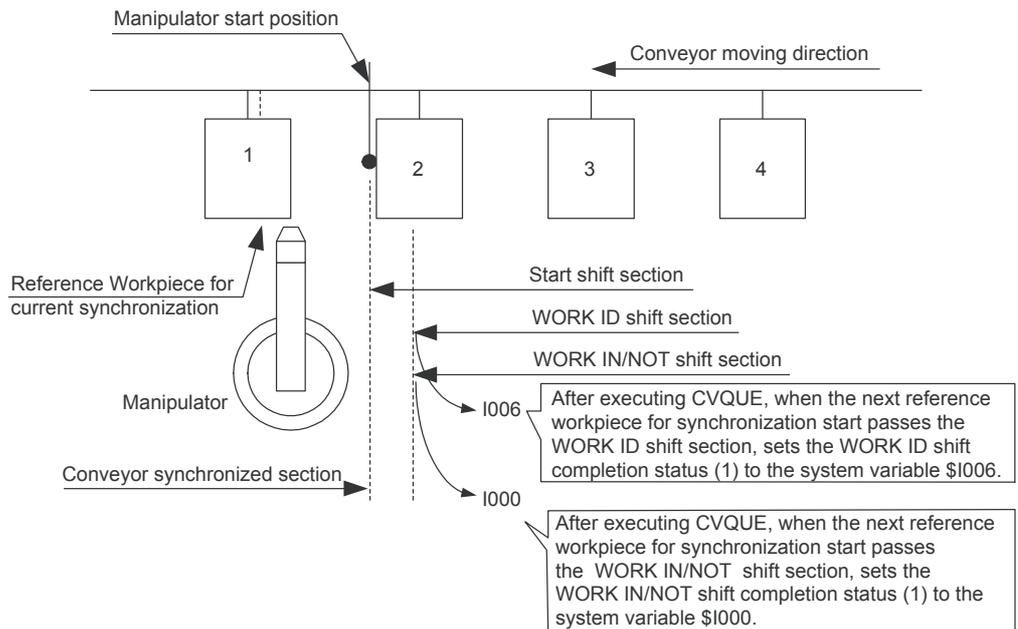
\$I017: Corresponds to the WORK IN/NOT characteristic file 6.

\$I018 to \$I023: Stores the first WORK ID information

\$I018: Corresponds to the conveyor WORK ID characteristic file 1.

to

\$I023: Corresponds to the conveyor WORK ID characteristic file 6.



When the first workpiece for the WORK IN/NOT shift completes the shift section, (1) is set to the system variable \$I000. When the first workpiece for the WORK ID shift completes the shift section, (1) is set to the system variable \$I006.

In the job, these system variables are read out, and the CVQUE instruction is executed when both the WORK IN/NOT shift and the WORK ID shift completes the respective shift sections.

Executing the CVQUE instruction sets the head information of WORK IN/NOT shift data and WORK ID shift data to the system variables \$I012 and \$I018 respectively and switches the reference workpiece for synchronization start to the next reference workpiece.



- When the conveyor synchronized function with shift function is valid, insert the CVQUE instruction and the SYEND instruction between the SYEND instruction and the next SYSTART instruction, whether the Start Shift function is used or not.
- Be sure to program the SYEND instruction at the beginning of the master job to reset the registered status of the conveyor's home position.

3.9 Manual Setting Function for Conveyor Position

With the manual setting function for conveyor position, the conveyor position can be set from the programming pendant without moving the conveyor to modify the taught job.

Using this function, instead of moving the conveyor to move the workpiece to the teaching position, by removing a fastening device such as a dog and moving the workpiece to the desired position on the conveyor, the conveyor position can be input to modify the taught job.

When the taught job is modified by using the manual setting function for conveyor position, the newly-set value of the conveyor position is registered to the value of CTP when the registration of the move instruction for the synchronized motion (SYMOV□) is modified.

Select {ROBOT} under the main menu → Select {MANUAL CONVEYOR}¹⁾

1 The MANUAL CONVEYOR display appears.

DATA	EDIT	DISPLAY	UTILITY	MANUAL CONVEYOR			
				CURRENT (mm)	SET (mm)	SET	
				CV#01	1000.000	1000.000	VALID
				CV#02	0.000	*,***	INVALID
				CV#03	0.000	*,***	INVALID
				①	②	③	④
				Main Menu Simple Menu			

- ① **CV#**
Displays CV#1 to 3 when one conveyor board is mounted, and CV#1 to 6 when two conveyor boards are mounted.
- ② **CURRENT (mm)**
Displays the conveyor's current position (in actual amount of pulses).
When the manual setting function for the conveyor position is used, the position data set is displayed.
- ③ **SET POSITION (mm)**
Sets the conveyor position. A value out of the setting range cannot be entered.
- ④ **SET**
Enables or Disables the manual setting mode for the conveyor position.

3.9.1 Manual Setting Procedure for the Conveyor Position

■ Setting the Conveyor Position

Move the cursor to the desired value in the column of the {SET (mm)} → Enter a value using [Numeric keys]

■ Validating or Invalidating the Manual Setting

Move the cursor to the desired value in the column of the {SET} → Press [SELECT] *1

*1 "VALID" or "INVALID" alternately appears.

3.9.2 Precautions

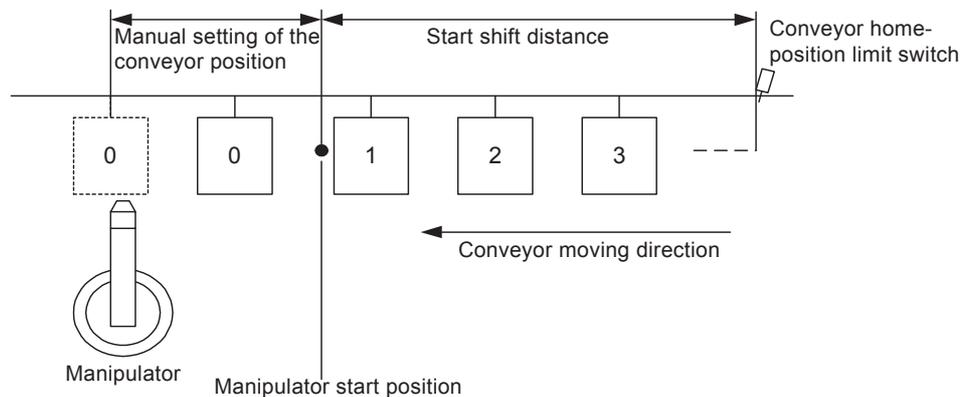
■ **When the Power is Turned ON**

When the power is turned ON, all the manual setting functions for conveyor position are disabled regardless of the play or teach mode, and the actual conveyor positions are displayed in {CURRENT (mm)}. When the MANUAL CONVEYOR display is called up after the power is turned ON, "****" appears in the column of {SET (mm)}. The set conveyor positions are retained until the power is turned OFF.

■ **Definition of Conveyor Position**

When the shift functions are used, the set conveyor position is defined as the distance from the manipulator start position as shown in the figure below. When the shift functions are not used, it is defined as the distance from the conveyor home-position limit switch.

When the conveyor moves in the manual setting mode for conveyor position, the pulse value of the actual conveyor is read out, and the actual conveyor status on the conveyor shift table and the synchronization table are updated.



NOTE

- When the teach mode is switched to the play mode while the manual setting function for conveyor position is enabled, the manual setting function for conveyor position is automatically disabled.
- The MANUAL CONVEYOR display can be viewed only in the teach mode.
- The manual setting function for conveyor position is valid only when the turntable synchronization function is disabled.

3.10 Test Run without Moving the Conveyor**CAUTION**

- During the test run using a virtual encoder, the manipulator moves in the pseudo conveyor synchronization. Therefore, the manipulator motion may be different from the taught motion. Make sure that no one is in the manipulator working envelope before starting the test run.

Injury may result from unintentional or in unexpected manipulator motion.

A test run can be done to confirm the manipulator's motions without moving the conveyor in the teach mode. This is useful to confirm a continuous path and execution of each instruction.

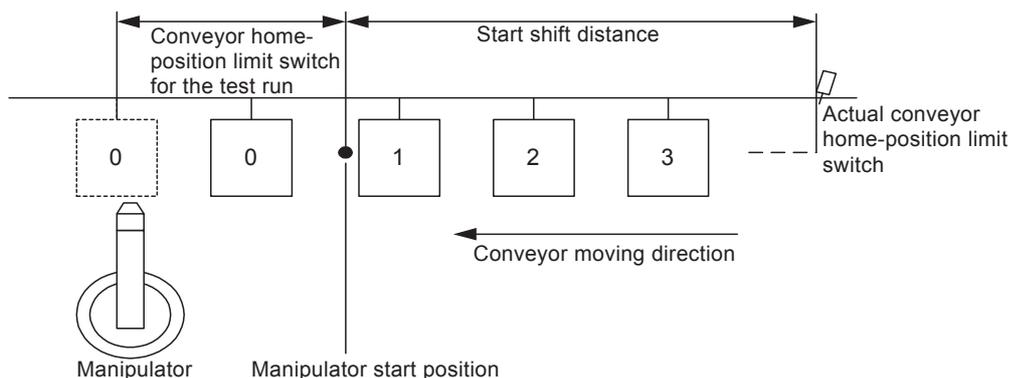
For a job without the conveyor synchronization instruction, the test run can be carried out without any special settings. For a job with the conveyor synchronization instruction, however, the following operations are required to carry out this test run.

1. Set "ENCODER INPUT" of the conveyor condition file to "VIRTUAL ENCODER."
Or, specify the virtual encoder by the general-purpose input signal.
(Refer to *section 2.2 "Editing Conveyor Condition File" on page 2-6* for the setting method.)
2. Turn ON the conveyor home-position limit switch of the actual conveyor.
3. Select a job for which the test run is to be carried out and open its JOB CONTENT display.
Press [INTERLOCK] and [TEST START] at the same time. The virtual encoder starts counting the pseudo pulses and the manipulator starts moving.

The test run starts by pressing [INTERLOCK] and [TEST START] at the same time. To assure the safe operation, the manipulator moves only while these keys are pressed.

For a job where a start shift distance (WORK SHIFT POS) is set, the distance can be temporarily changed to "0." In this way, only the manipulator's motion can be confirmed by the test run without waiting the manipulator to move for the start shift distance.

Set "1" for the sensor parameter SE016 "Ignorance of shift distance in virtual conveyor mode" so that the start shift distance is changed to "0" in the virtual encoder mode.



3.11 Manual Setting Function for Pseudo ON of the Conveyor Home-position Limit Switch

When the conveyor home-position limit switch cannot be turned ON, it can be pseudonymously turned ON in the following manner.

1. Open the CV TRACKING STATUS display.



① LS#

Indicates the conveyor home-position input signal number.

② STATUS

Displays the conveyor home-position input signal status, or inputs the conveyor home-position input signal.

2. Move the cursor to the limit switch number connected to the conveyor home-position input signal that is set in PORT NO. in the conveyor condition file.
3. By pressing [INTERLOCK] and [SELECT] at the same time, select "ON" status to pseudonymously turn the conveyor home-position input signal ON.

The manual setting function for pseudo ON of the conveyor home-position limit switch is valid only in the teach mode. This function is disabled in the play mode.

4 Playback

4.1 Conveyor Speed Down

When the conveyor slows down while the manipulator moves in synchronization with the conveyor, the manipulator will react according to the mode setting in the conveyor condition file:

Fig. 4-1: Conveyor Condition File Display



- EXECUTE
Regardless of the conveyor speed, the manipulator continues moving. When the conveyor stops, the manipulator motion is synchronized with the conveyor speed "0."
- ALARM
When the conveyor average speed remains below the set value in "CONVEYOR LOWER LIMIT SPD" for 0.1 second, an alarm occurs and the manipulator stops.
- PAUSE JOB
When the conveyor speed remains below the set value in "CONVEYOR LOWER LIMIT SPD" for 0.1 second, the job execution is interrupted (only the execution of move instructions in the job are suppressed) and the manipulator continues only follow-up motion in the conveyor moving direction. When the conveyor speed recovers to the set value in "CONVEYOR LOWER LIMIT SPD" or higher, the job execution restarts.
- PAUSE JOB AFTER APRAY OFF
When the conveyor average speed remains below the set value in "CONVEYOR LOWER LIMIT SPD" for 0.1 second, the manipulator executes the job up to the spray off instruction, and then executes only the follow-up motion in the conveyor moving direction. When the conveyor speed recovers to the "CONVEYOR LOWER LIMIT SPD" or higher, the job execution restarts.

For the details of the above four modes, refer to *section 2.1 "Conveyor Condition File" on page 2-1*.



The specific output 51420 turns ON when the conveyor slows down.

4.2 Accuracy

In the operation by the conveyor synchronized control, the manipulator motion path taught on the conveyor in stop status is reproduced on the conveyor in run status.

Therefore, the accuracy of the operation is determined by the amount of difference between the taught motion path and the synchronized motion path. Since the object is moving, it is impossible to appreciate the accuracy in the same way as the repetitive positioning accuracy for still-object.

The amount of difference between the taught motion path and the synchronized motion path is resulted from the following factors. Even if the following factors are adjusted not to cause the difference, the amount of difference can be about ten times of the amount of difference resulted from the repetitive positioning for still-object.

- Linearity of the conveyor in the synchronization section
- Conveyor movements that are not indicated in the pulse data from the conveyor encoder
(such as swings with hanger conveyor)
- Difference between the manipulator actual dimensions and the dimensions registered in the DX200
- Conversion resolution error that occurs when converting the pulse data from the conveyor encoder to the conveyor travel amount in mm
- Manipulator mechanical accuracy such as arm bending
- Follow-up delay due to the conveyor speed fluctuation
- Manipulator system lag time
- Difference between the conveyor moving direction and the travel-axis moving direction when the synchronization is performed by the travel-axis

4.3 Conveyor Resolution Error

The synchronization error resulted from the conveyor resolution setting error increases as the conveyor position value increases. The farther the conveyor moves, the bigger the synchronization error becomes. The minimum value for conveyor positional resolution setting is 0.01 μm . Therefore, a maximum error of 0.005 μm per pulse may occur. Entering a correct resolution is especially required when using the conveyor synchronized function with shift functions because of its large follow-up distance.

For example, when the conveyor resolution is 10 μm per pulse and the synchronization distance is 2 m, 200,000 pulses are output when the conveyor moves for 2 m. Since the maximum error per pulse is 0.005 μm , the following synchronization error may occur: 200,000 pulses \times 0.005 μm = 1 mm

4.4 Restarting Synchronization After Manipulator Stops

When a manipulator stops during the synchronized operation in the following cases, the manipulator restarts the synchronized motion when the operation is restarted.

- At occurrence of minor failure alarm (excluding occurrence of alarm related to the conveyor synchronized control)
- At emergency stop or external emergency stop
- By hold or external hold
- By switching the mode (mode switching between play and teach mode)
- By switching the operation cycle (switching among Auto/1 cycle/ Step)

4.5 Continuance of Conveyor Synchronized Status

The conveyor synchronized status started by SYSTART instruction remains until SYEND instruction is executed or the control power supply is turned off. Even if a manipulator stops in the cases explained in the previous section, the conveyor synchronized status remains.

Note that a manipulator performs the synchronized motion by SYMOV□ instruction even if the cursor is moved in teach mode, the master job is called, or a job selection is made.

4.6 Continuance of Parallel Shift Status

The parallel shift status in the conveyor synchronized status continues even after a manipulator stops in the cases explained in the previous section. However, the parallel shift status is cleared in the following cases. Be careful when using the parallel shift function in combination with the conveyor synchronized control.

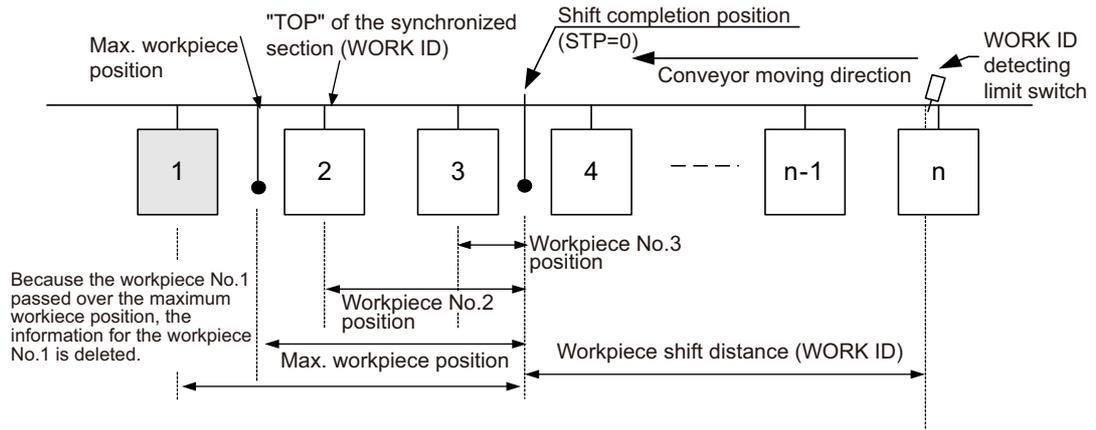
- Execution of SFTOF instruction
- The cursor is moved in teach mode.
- The master job is called.
- Job selection
- The main power supply is shut down.

4.7 Conveyor Synchronized Motion During Execution of TIMER and WAIT

While a manipulator is in waiting status by execution of TIMER, WAIT, etc. the manipulator continues the conveyor synchronized motion.

4.8 Detection of the Position beyond the Specified Maximum-workpiece-position

When a workpiece passes over the specified point (MAX. WORK POSITION) on the conveyor of the synchronized section without execution of the CVQUE instruction or the switching of workpieces, the position information, WORK ID information, and WORK IN/NOT information of the workpiece are automatically deleted from the job queue data.



Set the maximum workpiece position in the sensor parameter SxE13.

5 Conveyor Monitoring Displays for the Shift Functions

To monitor the conveyor synchronized status when using the shift functions, use the following display.

- CV (SYNCHRONIZATION) display

To monitor each shift status, use the following four displays.

- CV START SHIFT STATUS display
- CV WORK ID SHIFT STATUS display
- CV WORK IN/NOT SHIFT STATUS display
- CV SHIFT MONITOR display

■ Open the CV (SYNCHRONIZATION) Display

Open the CV (SYNCHRONIZATION) display in the following manner.

Select {ROBOT} under the main menu → Select {CV (SYNCHRONIZATION)} → The conveyor synchronization section monitor display appears → Open the desired display¹⁾

- 1 Pressing the [PAGE] switches the display.
Pressing [SHIFT] + [PAGE] returns to the previous display.

*Not displayed in new units shipped with version DN1.60-000 and later.

■ Open the CV (SHIFT) Display

Open the CV (SHIFT) Display in the following manner.

Select {ROBOT} under the main menu → Select {CV (SHIFT)} → The CV START SHIFT STATUS display appears → Open a desired display¹⁾

- 1 Press the area key, move the cursor to {DISPLAY} and press [SELECT]. Then, select the CV START SHIFT STATUS display, the CV WORK ID SHIFT STATUS display, or the CV WORK IN/NOT SHIFT STATUS display.

■ Open the CV SHIFT MONITOR Display

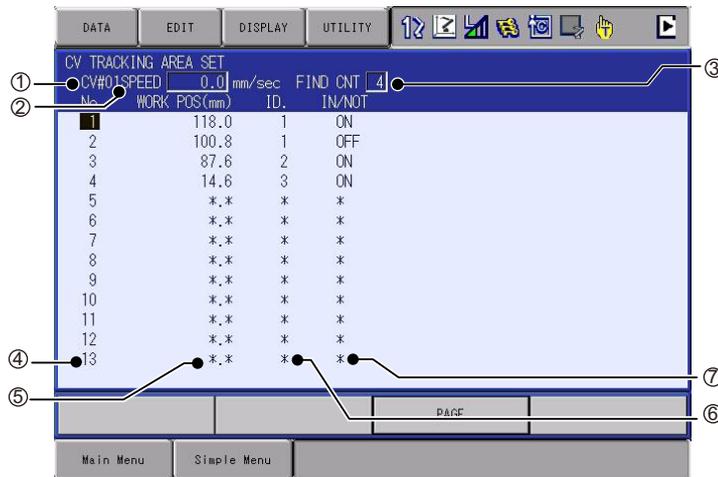
Open the CV SHIFT MONITOR Display in the following manner.

Select {ROBOT} under the main menu → Select {CV SHIFT MONITOR} → The CV SHIFT MONITOR display appears

*Displayed in new units shipped with version DN1.60-000 and later.

5.1 CV (SYNCHRONIZATION) MONITOR Display

*Not displayed in new units shipped with version DN1.60-000 and later.



① CV#

Displays the conveyor characteristic file number.

② CONVEYOR AVERAGE SPEED (mm/s)

Displays the conveyor average speed per 0.1 second.

③ FIND CNT

Displays the number of workpieces that have passed the manipulator start position and are in the synchronizing section.

④ WORKPIECE No.

Displays the workpiece number that is detected.

⑤ WORK POS (mm)

Displays the distance between the position of the detected workpiece in synchronization and the manipulator start position in mm.

When the painting operation for the first workpiece in synchronization is completed and the CVQUE instruction is executed, the workpiece for synchronization is switched to the next workpiece.

⑥ WORK ID INFORMATION

Displays the WORK ID information of the detected workpiece in synchronization.

When the CVQUE instruction is executed after the job for the first workpiece in the synchronized section has been completed, the reference workpiece for synchronization is changed to the next workpiece.

⑦ WORK IN/NOT INFORMATION

Displays the WORK IN/NOT information of the detected workpiece in synchronization.

When the CVQUE instruction is executed after the job for the first workpiece in the synchronization section has been completed, the reference workpiece for synchronization is changed to the next workpiece.

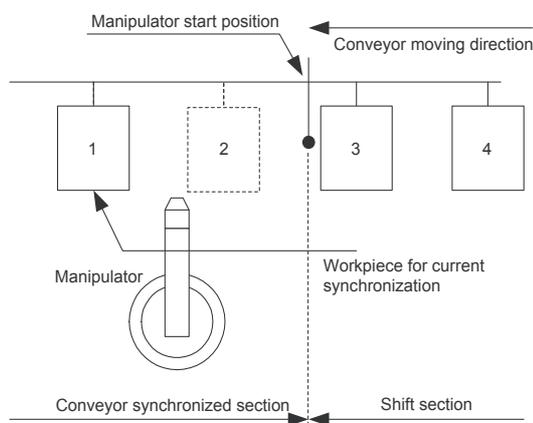
5.1.1 Switching the Reference Workpiece for Synchronization

To switch the reference workpiece for synchronization from the currently objective workpiece to the next workpiece at teaching, follow the operation procedure below.

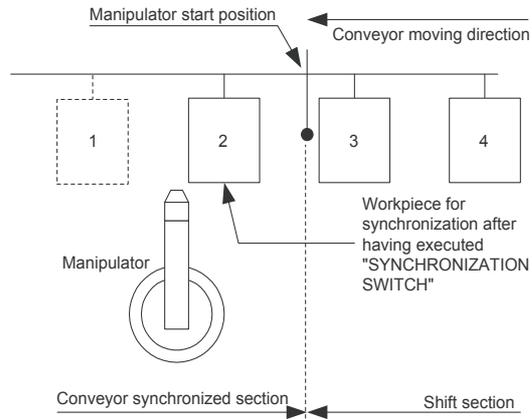
Press the area key → Select {DATA} → Select "SYNCHRONIZATION SWITCH"¹⁾

- 1 Press the area key, move the cursor to [DISPLAY] and press [SELECT] to open the desired display.

The synchronization before switching the reference workpiece for synchronization is shown in the figure below. The workpiece for the current synchronization is the first workpiece on the conveyor synchronized section display.



Execute "SYNCHRONIZATION SWITCH" switches the objective workpiece to the next workpiece as shown in the figure below.



- The information of the workpiece for current synchronization is deleted by the execution of "SYNCHRONIZATION SWITCH" and UNDO operation is not possible. Observe the above precaution when "SYNCHRONIZATION SWITCH" is executed.
- "SYNCHRONIZATION SWITCH" is valid only when two or more workpieces are in the conveyor synchronized section. Do not execute "SYNCHRONIZATION SWITCH" operation when only one workpiece is in the conveyor synchronized section. Doing so causes an alarm because no workpiece exists to be switched.

5.1.2 Deleting a Data of Conveyor Synchronized Section

Delete a data of conveyor synchronized section in the following manner.

Press the area key → Select {DATA} → Select “CLEAR DATA”¹⁾ → Move the cursor to “YES” and press [ENTER]

1 The following display appears.



- While power is supplied to the DX200, the DX200 manages and updates automatically all the conveyor data regardless of the operation mode. Accordingly, deleting data while the conveyor is moving does not cause a problem. However, it may cause a malfunction due to inconsistency between the actual conveyor status and the DX200 conveyor data in the following cases:
 - The conveyor moves while power is not supplied to the DX200 or during the DX200 start sequence.
 - A momentary power failure occurs during operation in play mode.
 - The virtual conveyor mode is set with the setting “Ignorance of shift distance in virtual mode.”
- “CLEAR DATA” operation deletes the data on the currently active display. Delete a start shift data on the start shift data display, a WORK ID shift data on the WORK ID shift display, and a WORK IN/NOT shift data on the WORK IN/NOT shift display respectively. Delete unnecessary shift data according to the system configuration.

5.1.3 Deleting the Shift Data and the Data of Conveyor Synchronized Section

Delete the shift data and the data of conveyor synchronized section at a time in the following manner.

Press the area key → Select {DATA} → Select “ALL CLEAR”¹⁾ → Move the cursor to “YES” and press [ENTER]

1 The following display appears.



While power is supplied to the DX200, the DX200 manages and updates automatically all the conveyor data regardless of the operation mode. Accordingly, deleting data while the conveyor is moving does not cause a problem. However, it may cause a malfunction due to inconsistency between the actual conveyor status and the DX200 conveyor data in the following cases:

- The conveyor moves while power is not supplied to the DX200 or during the DX200 start sequence.
- A momentary power failure occurs during operation in play mode.
- The virtual conveyor mode is set with the setting “Ignorance of shift distance in virtual mode.”

5.2 CV START SHIFT STATUS Display

CV#	CONVEYOR AVERAGE SPEED (mm/s)	FIND CNT	WORKPIECE No.	WORK POS (PULSE)	WORK POS (mm)
1	0.0	5	1	1995	77.7
2			2	4638	180.8
3			3	7240	282.2
4			4	9885	385.4
5			5	12524	488.3
6			6	*	*,*
7			7	*	*,*
8			8	*	*,*

- ① **CV#**
Displays the conveyor start shift characteristic file number.
- ② **CONVEYOR AVERAGE SPEED (mm/s)**
Displays the conveyor average speed per 0.1 second.
- ③ **FIND CNT**
Displays the number of workpieces that are detected by the start shift function and in the start shift section.
- ④ **WORKPIECE No.**
Displays the detected start shift workpiece number.
- ⑤ **WORK POS (PULSE)**
Displays the distance between the detected workpiece position and the manipulator start position in pulses.
- ⑥ **WORK POS (mm)**
Displays the distance between the detected workpiece position and the manipulator start position in mm.
When the first workpiece in the shift section reaches the manipulator start position, the information of this workpiece is deleted and the information of the next workpiece is displayed on the top.

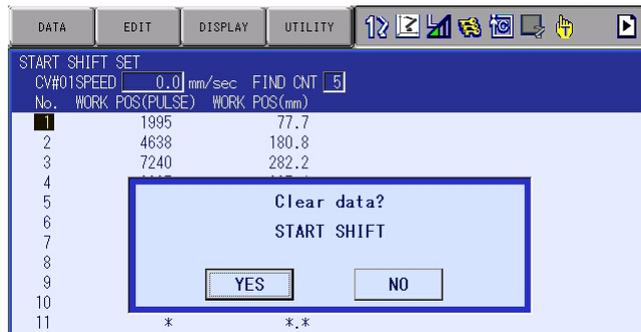
5.2.1 Deleting a Conveyor Start Shift Data

*Cannot be used on new models shipped with version DN1.60-00 or later.

Delete a conveyor start shift data in the following manner.

Press the area key → Select {DATA} → Select "CLEAR DATA"¹⁾ → Move the cursor to "YES" and press [ENTER]

1 The following display appears.



- While power is supplied to the DX200, the DX200 manages and updates automatically all the conveyor data regardless of the operation mode. Accordingly, deleting data while the conveyor is moving does not cause a problem. However, it may cause a malfunction due to inconsistency between the actual conveyor status and the DX200 conveyor data in the following cases:

- The conveyor moves while power is not supplied to the DX200 or during the DX200 start sequence.



- A momentary power failure occurs during operation in play mode.

- The virtual conveyor mode is set with the setting "Ignorance of shift distance in virtual mode."

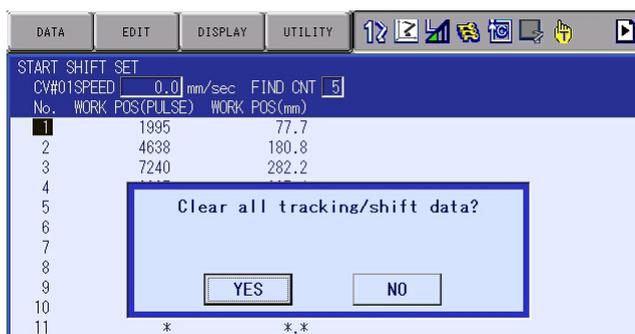
- "CLEAR DATA" operation deletes the shift data on the currently active display. Delete a start shift data on the start shift data display, a WORK ID shift data on the WORK ID shift display, and a WORK IN/NOT shift data on the WORK IN/NOT shift display respectively. Delete unnecessary shift data according to the system configuration.

5.2.2 Deleting the Shift Data and the Data of Conveyor Synchronized Section

Delete the shift data and the data of conveyor synchronized section at a time in the following

Press the area key → Select {DATA} → Select "ALL CLEAR" ¹⁾ → Move the cursor to "YES" and press [ENTER]

1 The following display appears.



- While power is supplied to the DX200, the DX200 manages and updates automatically all the conveyor data regardless of the operation mode. Accordingly, deleting data while the conveyor is moving does not cause a problem. However, it may cause a malfunction due to inconsistency between the actual conveyor status and the DX200 conveyor data in the following cases:
 - The conveyor moves while power is not supplied to the DX200 or during the DX200 start sequence.
 - A momentary power failure occurs during operation in play mode.
 - The virtual conveyor mode is set with the setting "Ignorance of shift distance in virtual mode."

5.3 CV WORK ID SHIFT STATUS Display

No.	WORK POS(PULSE)	WORK POS(mm)	ID.
1	713	27.7	1
2	3356	130.8	1
3	5958	232.3	1
4	8603	335.4	1
5	11242	438.3	1
6	*	*,*	*
7	*	*,*	*
8	*	*,*	*
9	*	*,*	*
10	*	*,*	*

① **CV#**

Displays the conveyor WORK ID shift characteristic file number.

② **CONVEYOR AVERAGE SPEED (mm/s)**

Displays the conveyor average speed per 0.1 second.

③ **FIND CNT**

Displays the number of workpieces that are detected by the WORK ID shift function and in the WORK ID shift section.

④ **WORKPIECE No.**

Displays the detected WORK ID shift workpiece number.

⑤ **WORK POS (PULSE)**

Displays the distance between the detected workpiece position and the manipulator start position in pulses.

⑥ **WORK POS (mm)**

Displays the distance between the detected workpiece position and the manipulator start position in mm.

When the first workpiece in the shift section reaches the manipulator start position, the WORK ID information of this workpiece is deleted and the WORK ID information of the next workpiece is displayed on the top.

⑦ **WORK ID**

Displays the WORK ID number that is read by the WORK ID detecting limit switch.

5.3.1 Deleting a Conveyor WORK ID Shift Data

*Cannot be used on new models shipped with version DN1.60-00 or later.

Delete a conveyor WORK ID shift data in the following manner.

Press the area key → Select {DATA} → Select "CLEAR DATA"¹⁾ → Move the cursor to "YES" and press [ENTER]

1 The following display appears.

**NOTE**

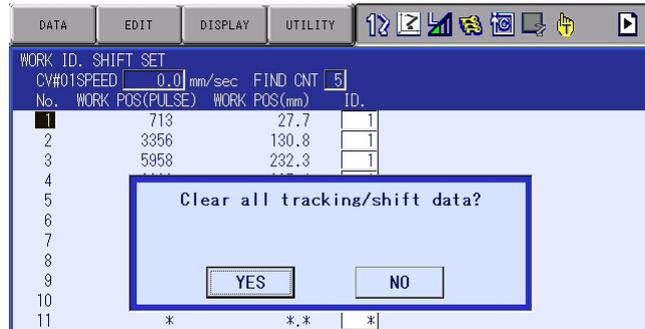
- While power is supplied to the DX200, the DX200 manages and updates automatically all the conveyor data regardless of the operation mode. Accordingly, deleting data while the conveyor is moving does not cause a problem. However, it may cause a malfunction due to inconsistency between the actual conveyor status and the DX200 conveyor data in the following cases:
 - The conveyor moves while power is not supplied to the DX200 or during the DX200 start sequence.
 - A momentary power failure occurs during operation in play mode.
 - The virtual conveyor mode is set with the setting "Ignorance of shift distance in virtual mode."
- "CLEAR DATA" operation deletes the shift data on the currently active display. Delete a start shift data on the start shift data display, a WORK ID shift data on the WORK ID shift display, and a WORK IN/NOT shift data on the WORK IN/NOT shift display respectively. Delete unnecessary shift data according to the system configuration.

5.3.2 Deleting the Shift Data and the Data of Conveyor Synchronized Section

Delete the shift data and the data of conveyor synchronized section at a time in the following manner.

Press the area key → Select {DATA} → Select "ALL CLEAR"¹⁾ → Move the cursor to "YES" and press [ENTER]

1 The following display appears.



- While power is supplied to the DX200, the DX200 manages and updates automatically all the conveyor data regardless of the operation mode. Accordingly, deleting data while the conveyor is moving does not cause a problem. However, it may cause a malfunction due to inconsistency between the actual conveyor status and the DX200 conveyor data in the following cases:
 - The conveyor moves while power is not supplied to the DX200 or during the DX200 start sequence.
 - A momentary power failure occurs during operation in play mode.
 - The virtual conveyor mode is set with the setting "Ignorance of shift distance in virtual mode."

5.4 CV WORK IN/NOT SHIFT STATUS Display

No.	WORK POS(PULSE)	WORK POS(mm)	IN/NOT
1	713	27.7	ON
2	3356	130.8	ON
3	5958	232.3	ON
4	8603	335.4	ON
5	11242	438.3	ON
6	*	*,*	*
7	*	*,*	*
8	*	*,*	*
9	*	*,*	*
10	*	*,*	*

① CV#

Displays the conveyor WORK IN/NOT shift characteristic file number.

② CONVEYOR AVERAGE SPEED (mm/s)

Displays the conveyor average speed per 0.1 second.

③ FIND CNT

Displays the number of workpieces that are detected by the WORK IN/NOT shift function and in the WORK IN/NOT shift section.

④ WORKPIECE No.

Displays the detected WORK IN/NOT shift workpiece number.

⑤ WORK POS (PULSE)

Displays the distance between the detected workpiece position and the manipulator start position in pulses.

⑥ WORK POS (mm)

Displays the distance between the detected workpiece position and the manipulator start position in mm.

When the first workpiece in the shift section reaches the manipulator start position, the WORK IN/NOT information of this workpiece is deleted and the WORK IN/NOT information of the next workpiece is displayed on the top.

⑦ WORK IN/NOT INFORMATION

Displays the WORK IN/NOT information that is read by the WORK IN/NOT detecting limit switch.

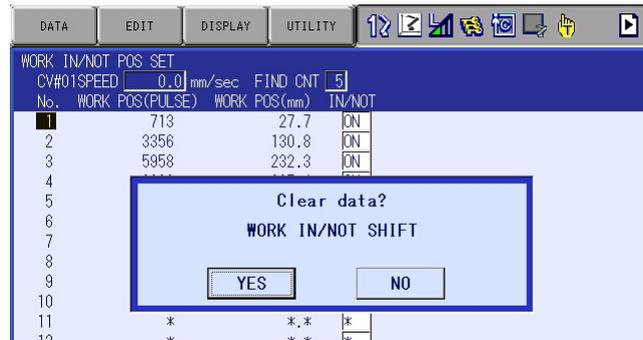
5.4.1 Deleting a Conveyor WORK IN/NOT Shift Data

*Cannot be used on new models shipped with version DN1.60-00 or later.

Delete a conveyor WORK IN/NOT shift data in the following manner.

Press the area key → Select {DATA} → Select "CLEAR DATA"¹⁾ → Move the cursor to "YES" and press [ENTER]

1 The following display appears.



- While power is supplied to the DX200, the DX200 manages and updates automatically all the conveyor data regardless of the operation mode. Accordingly, deleting data while the conveyor is moving does not cause a problem. However, it may cause a malfunction due to inconsistency between the actual conveyor status and the DX200 conveyor data in the following cases:

- The conveyor moves while power is not supplied to the DX200 or during the DX200 start sequence.



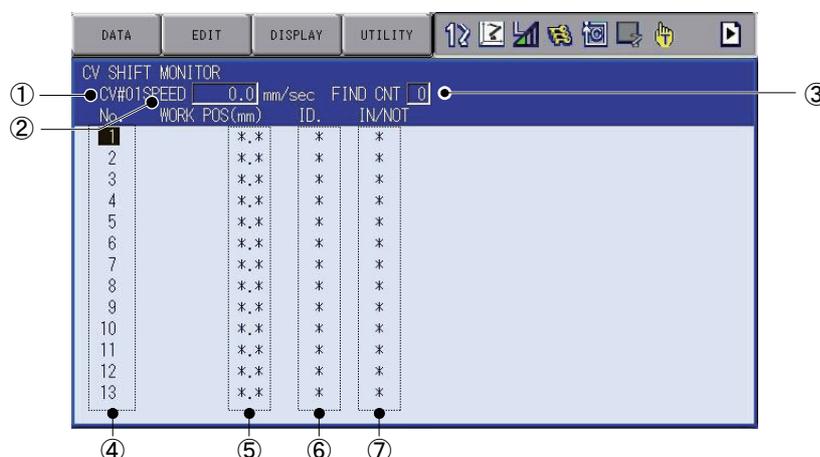
- A momentary power failure occurs during operation in play mode.

- The virtual conveyor mode is set with the setting "Ignorance of shift distance in virtual mode."

- "CLEAR DATA" operation deletes the shift data on the currently active display. Delete a start shift data on the start shift data display, a WORK ID shift data on the WORK ID shift display, and a WORK IN/NOT shift data on the WORK IN/NOT shift display respectively. Delete unnecessary shift data according to the system configuration.

5.5 CV SHIFT MONITOR display

*Displayed in new units shipped with version DN1.60-000 and later.



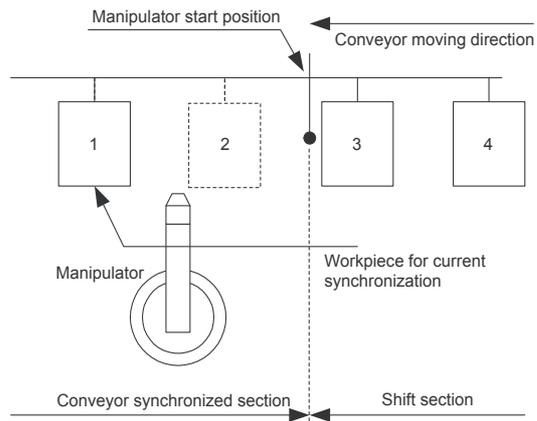
- ① **CV#**
Displays the conveyor characteristic file number.
- ② **CONVEYOR AVERAGE SPEED (mm/s)**
Displays the conveyor average speed per 0.1 second.
- ③ **FIND CNT**
Displays the number of workpieces that have been detected using the shift function and are in the shift section.
- ④ **WORKPIECE No.**
Displays the workpiece number that is detected.
- ⑤ **WORK POS (mm)**
Displays the distance between the detected workpiece position and the manipulator start position in mm.
When the workpiece in the shift section has not reached the manipulator start position, the negative value is displayed, and when the workpiece in the shift section reaches the manipulator start position, the positive value is displayed.
- ⑥ **WORK ID INFORMATION**
Displays the WORK ID information of the detected workpiece in synchronization.
- ⑦ **WORK IN/NOT INFORMATION**
Displays the WORK IN/NOT information of the detected workpiece in synchronization.

5.5.1 Switching the Reference Workpiece for Synchronization

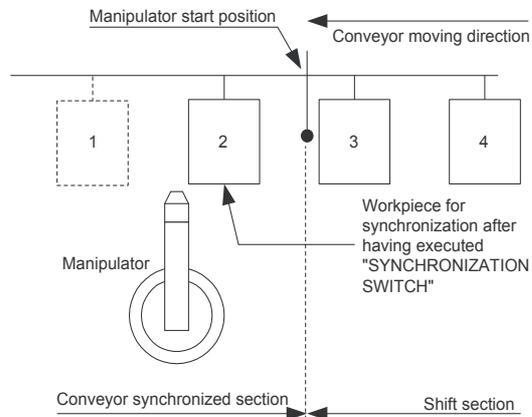
To switch the reference workpiece for synchronization from the currently objective workpiece to the next workpiece at teaching, follow the operation procedure below.

Press the area key → Select {DATA} → Select "SYNCHRONIZATION SWITCH"

The synchronization before switching the reference workpiece for synchronization is shown in the figure below. The workpiece for the current synchronization is the first workpiece on the conveyor synchronized section display.



Execute "SYNCHRONIZATION SWITCH" switches the objective workpiece to the next workpiece as shown in the figure below.



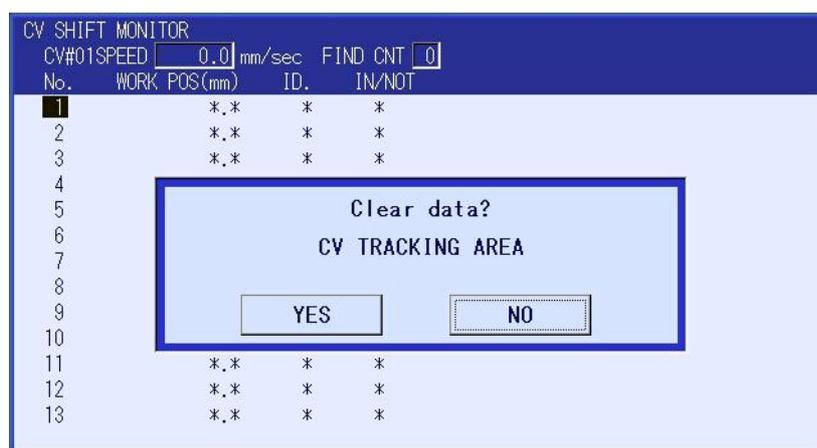
The information of the workpiece for current synchronization is deleted by the execution of "SYNCHRONIZATION SWITCH" and UNDO operation is not possible. Observe the above precaution when "SYNCHRONIZATION SWITCH" is executed.

5.5.2 Deleting a Data of Conveyor Synchronized Section

Delete a data of conveyor synchronized section in the following manner.

Press the area key → Select {DATA} → Select “CLR TRACKING DATA”¹⁾ →
Move the cursor to “YES” and press [ENTER]

1 The following display appears.



While power is supplied to the DX200, the DX200 manages and updates automatically all the conveyor data regardless of the operation mode. Accordingly, deleting data while the conveyor is moving does not cause a problem. However, it may cause a malfunction due to inconsistency between the actual conveyor status and the DX200 conveyor data in the following cases:

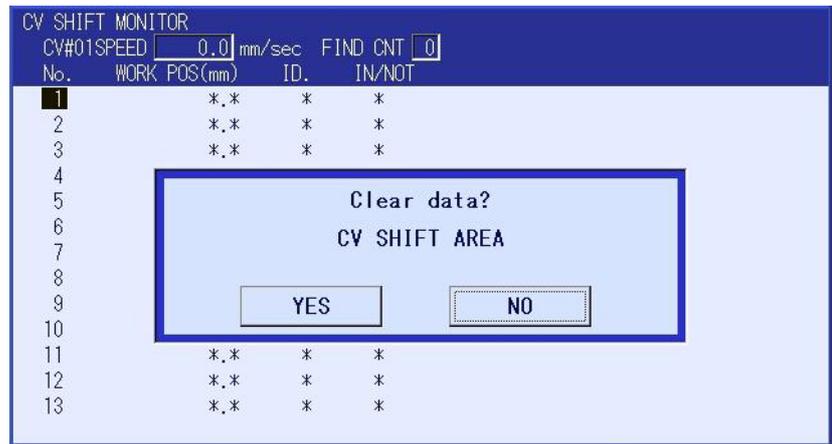
- The conveyor moves while power is not supplied to the DX200 or during the DX200 start sequence.
- A momentary power failure occurs during operation in play mode.
- The virtual conveyor mode is set with the setting “Ignorance of shift distance in virtual mode.”

5.5.3 Deleting a Data of Conveyor Shift Section

Delete a data of conveyor shift section in the following manner.

Press the area key → Select {DATA} → Select “CLR SHIFT DATA”¹⁾ → Move the cursor to “YES” and press [ENTER]

1 The following display appears.



While power is supplied to the DX200, the DX200 manages and updates automatically all the conveyor data regardless of the operation mode. Accordingly, deleting data while the conveyor is moving does not cause a problem. However, it may cause a malfunction due to inconsistency between the actual conveyor status and the DX200 conveyor data in the following cases:

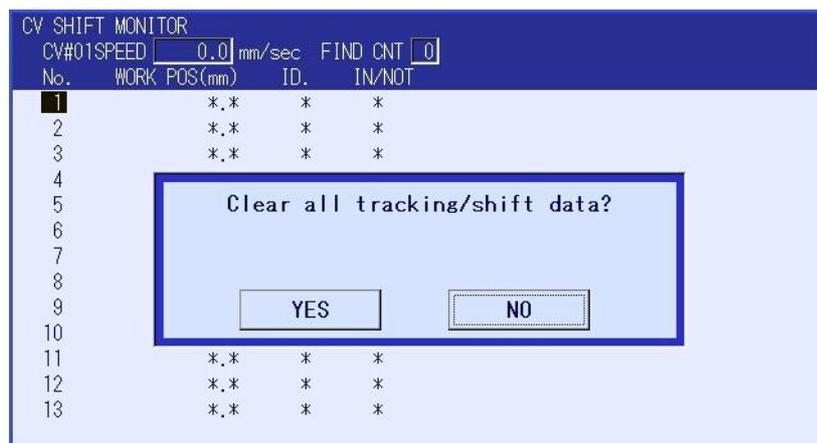
- The conveyor moves while power is not supplied to the DX200 or during the DX200 start sequence.
- A momentary power failure occurs during operation in play mode.
- The virtual conveyor mode is set with the setting “Ignorance of shift distance in virtual mode.”

5.5.4 Deleting the Shift Data and the Data of Conveyor Synchronized Section

Delete the shift data and the data of conveyor synchronized section at a time in the following manner.

Press the area key → Select {DATA} → Select “ALL CLEAR”¹⁾ → Move the cursor to “YES” and press [ENTER]

1 The following display appears.



While power is supplied to the DX200, the DX200 manages and updates automatically all the conveyor data regardless of the operation mode. Accordingly, deleting data while the conveyor is moving does not cause a problem. However, it may cause a malfunction due to inconsistency between the actual conveyor status and the DX200 conveyor data in the following cases:

- The conveyor moves while power is not supplied to the DX200 or during the DX200 start sequence.
- A momentary power failure occurs during operation in play mode.
- The virtual conveyor mode is set with the setting “Ignorance of shift distance in virtual mode.”

6 Instruction List

The instructions used for the conveyor synchronized control with shift functions are listed below. The numerical data to be set is explained in < >.

SYSTART	Function	Starts the conveyor synchronized operation.	
	Additional items	CV# (<Conveyor condition file>)	1 to 3
		STP=<Synchronization start position in mm>	
		OL=<Tolerance in mm>	When omitted or 0 is set, the tolerance check is not executed.
Example	SYSTART CV#(1) STP=100.00		
SYMOVJ ¹⁾	Function	Moves the manipulator in joint interpolation in synchronization with the conveyor.	
	Additional items	CV# (<Conveyor condition file>)	1 to 3
		CTP= <Conveyor position at teaching in mm>	
		VJ= <Play speed in percentage>	
Example	SYMOVJ VJ=50.00 CV#(1) CTP=100.00		
SYMOVL	Function	Moves the manipulator in linear interpolation in synchronization with the conveyor.	
	Additional items	CV# (<Conveyor condition file>)	1 to 3
		CTP= <Conveyor position at teaching in mm>	
		V= <Play speed>	
Example	SYMOVL V=200.0 CV#(1) CTP=100.00		
SYMOV C	Function	Moves the manipulator in circular interpolation in synchronization with the conveyor.	
	Additional items	CV# (<Conveyor condition file>)	1 to 3
		CTP= <Conveyor position at teaching in mm>	
		V= <Play speed>	
Example	SYMOV C V=200.0 CV#(1) CTP=100.00		
SYEND	Function	Ends the conveyor synchronized operation.	
	Additional items	CV# (<Conveyor condition file>)	1 to 3
		CONT	CONT (continuity attribute) may be omitted.
Example	SYEND CV#(1)		
CVQUE	Function	Switches the workpiece for synchronization to the next workpiece.	
	Additional items	CV# (<Conveyor condition file>)	1 to 3
	Example	CVQUE	
GETCVSFT ²⁾	Function	Gets the synchronizable queue information.	
	Additional items	CV# (<Conveyor condition file>)	1 to 3
		QUENO= <Queue number>	1 to 99
		WKKIND <WORK ID information storage location>	
		WKEXIST <WORK IN/NOT information storage location>	
		RESULT <Execution result storage location>	
Example	GETCVSFT CV#(1) QUENO=1 WKKIND I000 WKEXIST I001 RESULT B000		

1 SYMOVJ can be used only when the base axis is used for synchronization.

2 GETCVSFT can be used on new models shipped with version DN1.60-00 or later.

7 Alarm List

Alarm No.	Message	Causes	Corrective Actions
1003	ROM ERROR (YCP02)		Replace the YCP02 board (ROM).
1109	SYSTEM ERROR (CONVEYOR) [Decimal Data: 0 to 255]	Internal error.	Replace the YCP02 board.
1400	CONVEYOR ENCODER ERROR [Error occurred conveyor No.: 1, 2, 3]	Conveyor encoder error at the error occurred conveyor No.	Replace the encoder cable or the encoder.
1401	CANNOT CHANGE CONVEYOR MODE	The encoder selection "ENCODER/VIRTUAL ENCDR" has been switched by the general purpose input signal during the conveyor synchronized operation.	Switch the encoder by the general purpose input signal while the manipulator is not in the conveyor synchronized operation.
4021	MEMORY ERROR (CONVEYOR CONDITION FILE) [Decimal Data: 0 to 255]	The conveyor condition file data in the memory has been destroyed.	Initialize the conveyor condition file in customer maintenance mode.
4530	CONVEYOR SYNCHRONIZATION ERROR [Decimal Data; 0 to 255]	1: The base axis specification in the conveyor condition file is set to other than 0, 1, and 2. 2: The robot axis specified for tracking does not exist. 3: The base axis specified for tracking does not exist in the job. The error data other than 1, 2, and 3 is an internal error.	Turn the power OFF then back ON. If the alarm occurs again, contact your YASKAWA representative.
4531	UNDEFINED CONVEYOR CONDITION FILE [Decimal Data: 0 to 255]	The conveyor condition file specified for the job is not set to "USED."	Set the conveyor condition file to "USED."
4532	CONVEYOR SPEED DOWN [Decimal Data: 0 to 255]	When the mode for conveyor speed down mode in the conveyor condition file is set to "ALARM," the conveyor speed is lowered to less than its lower limit specified in the conveyor condition file.	Increase the conveyor speed so that it becomes higher than the conveyor speed lower limit specified in the conveyor condition file.
4533	ARITHMETIC ERROR [Decimal Data, 0 to 255]	Internal error.	Turn the power OFF then back ON. If the alarm occurs again, contact your YASKAWA representative.
4538	CAN NOT USE SMOVJ DURING TRACKING [10], Decimal Data, 0 to 255	SYMOVJ was executed when a robot axis was used for synchronization.	SYMOVJ can be used only when the base axis is used for synchronization.

Alarm No.	Message	Causes	Corrective Actions
4637	NO MORE WORKPIECE IN SYN SECTION	The CVQUE instruction is executed, but there is no more workpiece in the synchronization section.	Check the workpieces in the synchronization section and the data for the synchronization section.
4638	NO MORE WORKPIECE ID DATA IN SYN SECTION	The CVQUE instruction is executed, but there is no more workpiece in the synchronization section.	Check the workpieces in the synchronization section and the data for the synchronization section.
4727	GETCVSFT ERROR [Decimal data: 1 to 6]	An error occurred at GETCVSFT command execution.	Check the conveyor condition file and the conveyor supplemental condition file.
4728	CONVEYOR SYNCHRONIZATION (SHIFT FUNCTION) ERROR [Decimal data: 1 to 2]	An error occurred at conveyor synchronization (shift function) execution.	Check the conveyor supplemental condition file.
5020	SENSOR PARAMETER ERROR [Decimal Data: 0 to 255]	On the YCP02 board, when parameters were calculated using data in the conveyor condition file, an operation error occurred.	Check whether the data are properly set in the conveyor condition file. Confirm that "0" is not set for the user coordinate number.
5022	CONVEYOR POSITION LIMIT OVER [Alarm occurred conveyor condition file No.: 1, 2, or 3]	The corrected conveyor position value exceeds ± 21 m.	Review the synchronization section. After this alarm occurs, the conveyor position is not updated. Therefore, the synchronized operation is not performed after the alarm is reset, and the manipulator continues operation at the position where the alarm occurred.
5023	CONVEYOR COUNTER LIMIT OVER [Alarm occurred conveyor condition file No.: 1, 2, or 3]	The conveyor position counter pulse overflow	Review the conveyor resolution or the synchronization section. After this alarm occurs, the conveyor position is not updated. Therefore, the synchronized operation is not performed after the alarm is reset, and the manipulator continues operation at the position where the alarm occurred.
5024	CONVEYOR SUPPLEMENTAL CONDITION FILE ERROR	A conveyor supplemental condition file setting error occurred.	Check the conveyor supplemental condition file.
5070	WORK IN/NOT SHIFT DATA OVERFLOW	The WORK IN/NOT shift data overflow	Check the shift data and the actual workpiece status. If any inconsistency is found, delete the shift data and prepare newly the shift data.
5071	WORK ID SHIFT DATA OVERFLOW	WORK ID shift data overflow	Check the shift data and the actual workpiece status. If any inconsistency is found, delete the shift data and prepare newly the shift data.

Conveyor Synchronized with Shift Function 7 Alarm List

Alarm No.	Message	Causes	Corrective Actions
5072	START SHIFT DATA OVERFLOW	Start shift data overflow	Check the shift data and the actual workpiece status. If any inconsistency is found, delete the shift data and prepare newly the shift data.
5073	SHIFT DATA OVERFLOW IN SYNCHRONIZATION SECTION	Shift section data overflow	Check the tracking area data in the synchronized section and the actual workpiece status. If any inconsistency is found, delete the shift data in the synchronized section and prepare newly the shift data.
5075	FAIL TO SUSPEND CONVEYOR ENCODER	The encoder was not in suspend status when the control power supply was turned on.	Check the shift data and the actual workpiece status. If any inconsistency is found, delete the shift data and prepare newly the shift data.
5076	TRACKING AREA IN/NOT DATA POSITION LIMIT	The WORK IN/NOT data of the first workpiece in the synchronized section exceeds the preset value.	Delete the WORK IN/NOT data in the synchronized section.
5077	TRACKING AREA ID. DATA POSITION LIMIT	The WORK ID data of the first workpiece in the synchronized section exceeds the preset value.	Delete the WORK ID data in the synchronized section.
1402	WORK IN/NOT SHIFT DATA COUNT LIMIT OVER	The current position pulse operation error in the WORK IN/NOT shift data	Check the WORK IN/NOT shift data and the actual workpiece status.
1403	WORK IN/NOT SHIFT DATA POSITION LIMIT OVER	The current travel distance operation error in the WORK IN/NOT shift data	Check the WORK IN/NOT shift data and the actual workpiece status.
1404	WORK ID SHIFT DATA COUNT LIMIT OVER	The current position pulse operation error in the WORK ID shift data	Check the WORK ID shift data and the actual workpiece status.
1405	WORK ID SHIFT DATA POSITION LIMIT OVER	The current travel distance operation error in the WORK ID shift data	Check the WORK ID shift data and the actual workpiece status.
1406	START SHIFT DATA COUNT LIMIT OVER	The current position pulse operation error in the start shift data	Check the start shift data and the actual workpiece status.
1407	START SHIFT DATA POS LIMIT OVER	The current travel distance operation error in the start shift data	Check the start shift data and the actual workpiece status.

8 Specific I/O Signals

8.1 Specific Input Signals “4xxxx”

■ 40700 to 40702: Conveyor Home-position Limit Switch Input



When this signal turns on, the conveyor home-position limit switch turns on. Each specific input signal corresponds to the following conveyor home-position limit switches.

Conveyor home-position limit switch 1 input: 40700

Conveyor home-position limit switch 2 input: 40701

Conveyor home-position limit switch 3 input: 40702

■ 41020: Delete All Shift Data



All the shift data are deleted by turning ON this signal.

■ 41021: Delete All Synchronization Data



All the synchronization data are deleted by turning ON this signal.

■ 41022: Single Work Control (Tracking Area)



While this signal is ON, the DX200 manages only the latest information of the workpiece in the conveyor synchronized section. When another workpiece passes the manipulator start position, the XRC overwrites the currently-stored workpiece information with the newly-entered workpiece information.

8.2 Specific Output Signals “5xxxx”

■ 51100 to 51102: Conveyor Home-position Limit Switch Output



Indicates the status of the conveyor home-position limit switch. Each specific output signal corresponds to the following conveyor home-position limit switches.

Conveyor home-position limit switch 1 output: 51100

Conveyor home-position limit switch 2 output: 51101

Conveyor home-position limit switch 3 output: 51102

■ 51410: SYMOVJ in Execution

Indicates that the move instruction "SYMOVJ" for the conveyor synchronized motion is being executed.

■ 51420: Conveyor Speed Down

Indicates that the conveyor speed falls below the lower limit of the speed that is set in the Conveyor Condition File.

■ 51430 to 51432: Disconnection Detected

Indicates the detected disconnection of the conveyor pulse signals. Each specific output signal corresponds to the following Conveyor Condition Files.

Conveyor Condition File No. 1: 51430

Conveyor Condition File No. 2: 51431

Conveyor Condition File No. 3: 51432

9 Conveyor Parameters

■ S3C1210: Conveyor Model Speed for SYMOVJ

Specifies the conveyor speed at the execution of the SYMOVJ instruction when "ROBOT AXIS" is selected for "TRACKING" in the Conveyor Condition File. If "0" is set, the DX200 refers to the actual conveyor speed immediately before the execution of SYMOVJ.

Set the conveyor speed to the conveyor model speed for SYMOVJ for the system where the conveyor speed varies largely.

- Units: $\mu\text{m/s}$

NOTE

• Regardless whether "ENCODER" or "VIRTUAL ENCODER" is selected for "ENCODER INPUT" in the Conveyor Condition File, the manipulator moves according to the conveyor model speed of the SYMOVJ instruction when the SYMOVJ instruction is executed. Therefore, when executing a job including the SYMOVJ instruction using a virtual encoder, set the same value as the virtual encoder speed or "0" to the parameter S3C469.

■ S3C1211: Lower Limit of the Conveyor Speed for SYMOVJ

Sets the lower limit of the conveyor speed at the execution of the SYMOVJ instruction when "ROBOT AXIS" is selected for "TRACKING" in the Conveyor Condition File.

The specific output 51420 turns ON when the conveyor speed falls below the set speed.

- Units: $\mu\text{m/s}$

■ S2C769: Switch the conveyor speed unit of conveyor monitor

This parameter switch the conveyor speed unit of the conveyor monitor.

0: The conveyor speed is displayed by (mm/sec).

1: The conveyor speed is displayed by (m/min).

■ S2C770: The conveyor speed update timing of conveyor monitor

This parameter change the conveyor speed update timing of the conveyor monitor.

0 : Display conveyor speed is updated at real time.

Excluding 0: The conveyor speed update timing is value * 100msec.

10 Sensor Parameters (SxE)

Use the sensor parameters with their initial value settings.

No.	Contents	Initial Value
0	Application designation	16
1	Time to recognize the input of start signal ¹⁾	5
2	Reference time to recognize the occurrence of speed down	100
3	Time for averaging the speed variation amount	60
4	Time to recognize the falling edge of start signal	5
13	Maximum workpiece position (0 to 2000m) ²⁾ 0 corresponds to 21 m	0
14	Data overflow alarm specification Specifies the action to be taken when a workpiece is carried for the distance set in SxE13. 0: Alarm occurrence 1: No alarm occurrence	0
16	Ignorance of shift distance in virtual conveyor mode Specifies whether the start shift distance is to be "0" or not in the virtual conveyor mode. 0: Validates the start shift distance 1: Invalidates the start shift distance (set to 0)	0
17	Output time of detection signal for disconnection Sets the time during which the conveyor synchronization board sends the signal to the main CPU when a disconnection of the conveyor pulse signal is detected. Units: ms	0

- 1 The time to recognize the input of start signal (S1E) indicates the time from the moment that the conveyor home-position limit switch turns on until the DX200 confirms the conveyor home-position limit switch ON input signal. The setting range is from 1 to 1000.
Use the parameter S1E with its initial setting. However, if the conveyor home-position limit switch malfunction occurs frequently, change the setting to a bigger value as required.
- 2 The maximum workpiece position indicates the distance between the workpiece position and the manipulator start position. When a workpiece is carried for this distance from the manipulator start position, the DX200 automatically deletes the workpiece information from the job queue or issues the alarm. Whether to automatically delete the information or issue the alarm can be selected by the setting of the sensor parameter No.14 "Data overflow alarm specification."
While the conveyor synchronization is not executed, however, the workpiece information is automatically deleted from the job queue regardless of the setting of the sensor parameter No.14.

DX200 OPTIONS INSTRUCTIONS

FOR CONVEYOR SYNCHRONIZED FUNCTION WITH SHIFT FUNCTIONS

HEAD OFFICE

2-1 Kurosakishiroishi, Yahatanishi-ku, Kitakyushu 806-0004, Japan
Phone +81-93-645-7703 Fax +81-93-645-7802

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 Europe GmbH (Robotics Division)
Yaskawastrasse 1, 85391 Allershausen, Germany
Phone +49-8166-90-100 Fax +49-8166-90-103

YASKAWA Nordic AB
Bredbandet 1 vån. 3 varvsholmen 392 30 Kalmar, Sweden
Phone +46-480-417-800 Fax +46-480-417-999

YASKAWA Electric (China) Co., Ltd.
22/F One Corporate Avenue No.222, Hubin Road, Huangpu District, Shanghai 200021, China
Phone +86-21-5385-2200 Fax +86-21-5385-3299

YASKAWA SHOUGANG ROBOT Co. Ltd.
No7 Yongchang North Road, Beijing E&T Development Area, China 100176
Phone +86-10-6788-2858 Fax +86-10-6788-2878

YASKAWA India Private Ltd. (Robotics Division)
#426, Udyog Vihar, Phase- IV, Gurgaon, Haryana, India
Phone +91-124-475-8500 Fax +91-124-475-8542

YASKAWA Electric Korea Co., Ltd
9F, Kyobo Securities Bldg., 26-4, Yeouido-dong, Yeongdeungpo-gu, Seoul 150-737, Korea
Phone +82-2-784-7844 Fax +82-2-784-8495

YASKAWA Electric Taiwan Corporation
12F, No.207, Sec. 3, Beishin Rd., Shindian District, New Taipei City 23143, Taiwan
Phone +886-2-8913-1333 Fax +886-2-8913-1513

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.
252/125-126 27th Floor, Tower B Muang Thai-Phatra Complex Building,
Rachadaphisek Road, Huaykwang, Bangkok 10320, Thailand
Phone +66-2693-2200 Fax +66-2693-4200

PT. YASKAWA Electric Indonesia
Secure Building-Gedung B Lantai Dasar & Lantai 1 Jl. Raya Protokol Halim Perdanakusuma,
Jakarta 13610, Indonesia
Phone +62-21-2982-6470 Fax +62-21-2982-6741

Specifications are subject to change without notice
for ongoing product modifications and improvements.