YASKAWA

DX200/YRC1000/YRC1000micro
MOVCHK Function
(Pre-operation check, Singular point passage)
INSTRUCTIONS

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

MOTOMAN INSTRUCTIONS

DX200 INSTRUCTIONS
DX200 OPERATOR'S MANUAL (for each purpose)
DX200 MAINTENANCE MANUAL (Volume 1) (Volume2)
YRC1000 INSTRUCTIONS
YRC1000 OPERATOR'S MANUAL (GENERAL) (SUBJECT SPECIFIC)
YRC1000 MAINTENANCE MANUAL
YRC1000 ALARM CODES (MAJOR ALARMS) (MINOR ALARMS)
YRC1000micro INSTRUCTIONS
YRC1000micro OPERATOR'S MANUAL
YRC1000micro MAINTENANCE MANUAL
YRC1000micro ALARM CODES (MAJOR ALARMS) (MINOR ALARMS)

MANUAL No.
HW1483901 ②

⚠ DANGER

- This manual explains MOVCHK Function (Pre-operation check, Singular point passage). Read this manual carefully and be sure to understand its contents before handling the DX200/YRC1000/YRC1000micro. Any matter, including operation, usage, measures, and an item to use, not described in this manual must be regarded as "prohibited" or "improper".
- General information related to safety are described in chaper 1 "Safety" of the DX200/YRC1000/YRC1000micro INSTRUCTIONS.   To ensure correct and safe operation, carefully read chaper 1 "Safety" of the DX200/YRC1000/YRC1000micro INSTRUCTIONS.

⚠ CAUTION

- In some drawings in this manual, protective covers or shields are removed to show details. Make sure that all the covers or shields are installed in place before operating this product.
- YASKAWA is not responsible for incidents arising from unauthorized modification of its products.   Unauthorized modification voids the product warranty.

NOTICE

- 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.

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Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the DX200/YRC1000/YRC1000micro.

In this manual, the Notes for Safe Operation are classified as "DANGER", "WARNING", "CAUTION", or "NOTICE".

⚠ **DANGER**	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. Safety Signs identified by the signal word DANGER should be used sparingly and only for those situations presenting the most serious hazards.
⚠ **WARNING**	Indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury. Hazards identified by the signal word WARNING present a lesser degree of risk of injury or death than those identified by the signal word DANGER.
⚠ **CAUTION**	Indicates a hazardous situation, which if not avoided, could result in minor or moderate injury. It may also be used without the safety alert symbol as an alternative to "NOTICE".
NOTICE	NOTICE is the preferred signal word to address practices not related to personal injury. The safety alert symbol should not be used with this signal word. As an alternative to "NOTICE", the word "CAUTION" without the safety alert symbol may be used to indicate a message not related to personal injury.

Even items described as "CAUTION" may result in a serious accident in some situations.
At any rate, be sure to follow these important items.

> **NOTE** To ensure safe and efficient operation at all times, be sure to follow all instructions, even if not designated as "DANGER", "WARNING" and "CAUTION".

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⚠ **DANGER**
• Maintenance and inspection must be performed by specified personnel.
Failure to observe this caution may result in electric shock or injury.
• For disassembly or repair, contact your YASKAWA representative.
• Do not remove the motor, and do not release the brake.
Failure to observe these safety precautions may result in death or serious injury from unexpected turning of the manipulator's arm.

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<DX200/YRC1000>

⚠ **DANGER**

- Before operating the manipulator, make sure the servo power is turned OFF by performing the following operations.   When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.
  - Press the emergency stop buttons on the front door of the DX200/ YRC1000, on the programming pendant, on the external control device, etc.
  - Disconnect the safety plug of the safety fence. (when in the play mode or in the remote mode)

If operation of the manipulator cannot be stopped in an emergency, personal injury and/or equipment damage may result.

Fig.: Emergency Stop Button

- Before releasing the emergency stop, make sure to remove the obstacle or error caused the emergency stop, if any, and then turn the servo power ON.

Failure to observe this instruction may cause unintended movement of the manipulator, which may result in personal injury.

Fig.: Release of Emergency Stop

- Observe the following precautions when performing a teaching operation within the manipulator's operating range:
  - Be sure to perform lockout by putting a lockout device on the safety fence when going into the area enclosed by the safety fence.   In addition, the operator of the teaching operation must display the sign that the operation is being performed so that no other person closes the safety fence.
  - View the manipulator from the front whenever possible.
  - Always follow the predetermined operating procedure.
  - Always keep in mind emergency response measures against the manipulator's unexpected movement toward a person.
  - Ensure a safe place to retreat in case of emergency.

Failure to observe this instruction may cause improper or unintended movement of the manipulator, which may result in personal injury.

- *Confirm* that no person is present in the manipulator's operating range and that the operator is in a safe location before:
  - Turning ON the DX200/YRC1000 power
  - Moving the manipulator by using the programming pendant
  - Running *the* system in the check mode
  - *Performing* automatic operations

Personal injury may result if a person enters the manipulator's operating range during operation. Immediately press an emergency stop button whenever there is a problem. The emergency stop buttons are located on the front panel of the DX200/YRC1000 and on the right of the programming pendant.

- Read and understand the Explanation of the Warning Labels before operating the manipulator.

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\<YRC1000micro\>

> ### ⚠ DANGER
>
> - Before operating the manipulator, make sure the servo power is turned OFF by performing the following operations. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.
>   - Press the emergency stop button on the programming pendant or on the external control device, etc.
>   - Disconnect the safety plug of the safety fence.
>   (when in the play mode or in the remote mode)
>
> If operation of the manipulator cannot be stopped in an emergency, personal injury and/or equipment damage may result.
>
> *Fig.: Emergency Stop Button*
>
> - Before releasing the emergency stop, make sure to remove the obstacle or error caused the emergency stop, if any, and then turn the servo power ON.
>
> Failure to observe this instruction may cause unintended movement of the manipulator, which may result in personal injury.
>
> *Fig.: Release of Emergency Stop*
>
> TURN
>
> - Observe the following precautions when performing a teaching operation within the manipulator's operating range:
>   - Be sure to perform lockout by putting a lockout device on the safety fence when going into the area enclosed by the safety fence. In addition, the operator of the teaching operation must display the sign that the operation is being performed so that no other person closes the safety fence.
>   - View the manipulator from the front whenever possible.
>   - Always follow the predetermined operating procedure.
>   - Always keep in mind emergency response measures against the manipulator's unexpected movement toward a person.
>   - Ensure a safe place to retreat in case of emergency.
>
> Failure to observe this instruction may cause improper or unintended movement of the manipulator, which may result in personal injury.
>
> - Confirm that no person is present in the manipulator's operating range and that the operator is in a safe location before:
>   - Turning ON the YRC1000micro power
>   - Moving the manipulator by using the programming pendant
>   - Running the system in the check mode
>   - Performing automatic operations
>
> Personal injury may result if a person enters the manipulator's operating range during operation. Immediately press an emergency stop button whenever there is a problem. The emergency stop button is located on the upper right of the programming pendant.
>
> - Read and understand the Explanation of the Warning Labels before operating the manipulator.

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\<YRC1000micro only\>

⚠ DANGER
• In the case of not using the programming pendant, be sure to supply the emergency stop button on the equipment. Then before operating the manipulator, check to be sure that the servo power is turned OFF by pressing the emergency stop button. Connect the external emergency stop button to the 4-14 pin and 5-15 pin of the Safety connector (Safety). • Upon shipment of the YRC1000micro, this signal is connected by a jumper cable in the dummy connector. To use the signal, make sure to supply a new connector, and then input it. If the signal is input with the jumper cable connected, it does not function, which may result in personal injury or equipment damage.

\<DX200/YRC1000/YRC1000micro\>

⚠ WARNING

• Perform the following inspection procedures prior to conducting manipulator teaching. If there is any problem, immediately take necessary steps to solve it, such as maintenance and repair.
 	
    - Check for a problem in manipulator movement.
    - Check for damage to insulation and sheathing of external wires.
• Return the programming pendant to a safe place after use.
 	
If the programming pendant is left unattended on the manipulator, on a fixture, or on the floor, etc., the Enable Switch may be activated due to surface irregularities of where it is left, and the servo power may be turned ON. In addition, in case the operation of the manipulator starts, the manipulator or the tool may hit the programming pendant left unattended, which may result in personal injury and/or equipment damage.

Definition of Terms Used Often in This Manual < DX200/YRC1000>

The MOTOMAN is the YASKAWA industrial robot product.

The MOTOMAN usually consists of the manipulator, the DX200/YRC1000 controller, the DX200/YRC1000 programming pendant, and supply cables.

In this manual, the equipment is designated as follows:

Equipment	Manual Designation
DX200/YRC1000 controller	DX200/YRC1000
DX200/YRC1000 programming pendant	Programming pendant
Cable between the manipulator and the controller	Manipulator cable

Definition of Terms Used Often in This Manual <YRC1000micro>

The MOTOMAN is the YASKAWA industrial robot product.

The MOTOMAN usually consists of the manipulator, the YRC1000micro controller, manipulator cables, the YRC1000micro programming pendant (optional), and the YRC1000micro programming pendant safety signal short circuit connector (optional).

In this manual, the equipment is designated as follows:

Equipment	Manual Designation
YRC1000micro controller	YRC1000micro
YRC1000micro programming pendant	Programming pendant (optional)
Cable between the manipulator and the controller	Manipulator cable
YRC1000micro programming pendant safety signal short circuit connector	Programming pendant safety signal short circuit connector (optional)

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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 symbols printed on them are denoted with [ ]. e.g. [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, e.g. [SHIFT]+[COORD].
	Mode Switch	Mode Switch can select three kinds of modes that are denoted as follows: REMOTE, PLAY or TEACH. (For YRC1000/YRC1000micro, the switch names are denoted as symbols)
	Button	The three buttons on the upper side of the programming pendant are denoted as follows: START, HOLD, or EMERGENCY STOP. (For YRC1000/YRC1000micro, the button names are denoted as symbols)
	Displays	The menu displayed in the programming pendant is denoted with { }. e.g. {JOB}

<DX200>　　　　　　　　　　**<YRC1000/YRC1000micro>**

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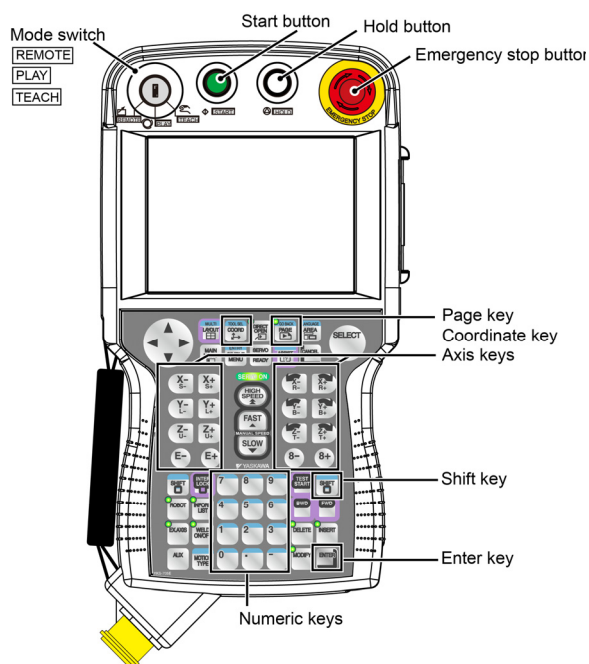
Registered Trademark

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

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1. Outline

This chapter describes the outline of the MOVCHK function.

1.1. MOVCHK function outline

This chapter outlines the singular point passage processing function and the pre-operation check function provided by the MOVCHK function.

(A) Singular point passage processing

This function allows the robot to pass through singular postures at the specified maximum speeds of the axes while avoiding alarms such as "excessive segment" and "interpolated action unable". The maximum speed of each axis refers to an internal parameter specified as the maximum speed of a joint. For example, this allows the robot to move through the wrist singular point as show in Figure 1 continuously and stably (without vibration and overspeed).

(B) Pre-operation check processing

Assuming an approach action such as shown in Figure 1, this function performs the pre-operation interference, pulse limit, and interpolated action unable checks between the entire robot and a registered obstacle model using an entered target hand position of the robot. This eliminates alarms from the interference, pulse limit, and interpolated action unable checks during the operation.

Figure 1   Singular point passage processing/Pre-operation check processing
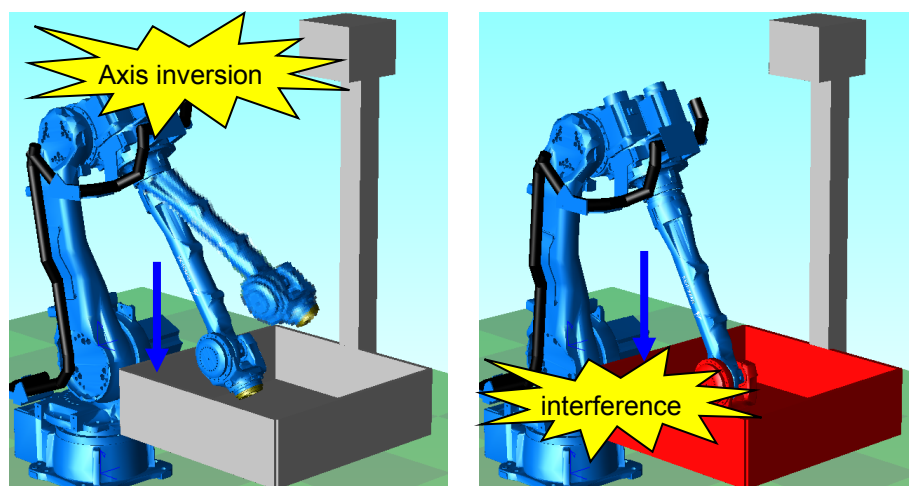
1.2. Supported robots

The MOVCHK function is available for the single-arm six-axis robots only.

If the controller has multiple system configurations, this function is available for R1 only.

This function is not available for the seven-axis robots and dual-arm robots.

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2. Command List

2.1. Macro Job List

In MOVCHK, commands are executed by using the following commands (macro job).

The commands used in MOVCHK are described below.

> NOTE   Please do not perform editing and the deletion of the MacroJob.
>
> Movement guarantee is not possible when edited or deleted.

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2.1.1.   INCMOV

Description	Singular point passage macro job This command is used to linearly travel between two points (one section) or three points (two section) specified in P-variables. Traveling sections, speeds, and other settings are specified using INCSET. For the command specification of INCSET, refer to chapter 2.1.4 "INCSET".	
Argument	Sno	[Used S-variable number] The number of the S-variable used to store the information for this operation. * When you specify 50 for this argument, register information with S050 using the INCSET instruction in advance.	[Setting value] 0〜
	UNTIL	[I/O number for UNTIL] The number of the I/O signal used to interrupt the singular point passage processing. When the specified I/O number is set ON, the robot stops operating. Set 0 to disable the UNTIL function.	[Setting value] 0 or within the universal output
Return value	Refer to chapter 2.2 "Status (return value)".	
Remarks	· An alarm occurs when a specified target point P-variable number does not have a value. · These P-variables must store values in the robot coordinate system. · An alarm occurs when executed with [INTERLOCK] + [NEXT]. · The robot slows down around a singular point. · The posture at the target point may be different from the one registered in the P-variables. · The parallel shifting function is not supported. Take a measure such as shifting a value itself registered in the P-variable number for the target point. · The "pulse limit" status is returned when the U axis angle becomes 75° or larger.	

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2.1.2. MOVCHK

Description	Pre-operation check macro job This command is used to check for interference with the specified cube model or any alarms when linearly traveling between two points (one section) or three points (two section) specified in P-variables using INCMOV.	
Argument	Sno	[Used S-variable number] The number of the S-variable used to store the information for this check. [Example] When you specify 50 for this argument, register information with S050 using the INCSET instruction in advance.	[Setting value] 0～
	cLV	[Check level] Specifies the strictness of the pre-operation check. Specifying 0 enables stricter check but takes longer processing time. Specifying 1 makes the processing time shorter but can overlook alarms which possibly occur on the path. (Just before an alarm occurs, INCMOV returns an error status and exits the operation.)	[Setting value] 0 or 1
	Margin	[Margin] Specifies the margin between the robot and the interfering object for the interference check. [Example] When you specify 10 for this argument, an interference is detected if the distance between the robot and cube models becomes 10 mm or less.	[Setting value] 0～[mm]
Return value	Refer to chapter 2.2 "Status (return value)".	

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Remarks	· An alarm occurs when a specified target point P-variable number does not have a value.
	· The interference check is not supported around the wrist singular point (B axis angle is about 0). The "interference check unable" status is returned when the specified path passes close to the wrist singular point.
	· The "pulse limit" status is returned when the U axis angle becomes 75° or larger.

2.1.3. cMOVCHK

Description	Pre-operation check macro job (concurrent macro job)
	This command is used to check for interference with the specified cube model or any alarms when linearly traveling between two points (one section) or three points (two section) specified in P-variables using INCMOV.
	For the function details, refer to chapter 2.1.2 "MOVCHK".

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2.1.4. INCSET

Description		INCMOV/MOVCHK operation pattern setting macro job This command is used to set various information in an S-variable specified by the argument.	
Argument	SNo	[Used S-variable number] Specify the number of the S-variable to store the information used for the pre-operation check or singular point passage processing.	[Setting value] 0～
	Path	[Path] The number of the sections of the command. Set 1 to travel from the start point directly to the target point. Set 2 to travel via the through-point to the target point.	[Setting value] 1 or 2
	P1_no	[Start point] The P-variable number which stores the start point of the command. Use MOVL or MOVJ to move to this point before using INCMOV.	[Setting value] 0～999
	P2_no	[Target point 1] The target point of the first section of the command. When Path=1 is set, specify the number of the P-variable which stores the end position of the operation. When Path=2 is set, specify the number of the P-variable which stores the position of the through-point.	[Setting value] 0～999
	P3_no	[Target point 2] The target point of the second section of the command. This is not used when Path=1 is set. When Path=2 is set, specify the number of the P-variable which stores the end position of the operation.	[Setting value] 0～999

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	V1	[Translational speed 1] The translational speed of the first section of the command.	[Setting value] 1～ 1000[mm/sec]
	VR1	[Rotating speed 1] The rotating speed of the first section of the command.	[Setting value] 1～360 [deg/sec]
	V2	[Translational speed 2] The translational speed of the second section of the command. This is not used when Path=1 is set.	[Setting value] 1～1000 [mm/sec]
	VR2	[Rotating speed 2] The translational speed of the second section of the command. This is not used when Path=1 is set.	[Setting value] 1～ 360[deg/sec]
	PL1	[Position level 1] The position level of the first section of the command.	[Setting value] 0～3[mm]
	PL2	[Position level 2] The position level of the second section of the command. This is not used when Path=1 is set.	[Setting value] 0～3[mm]
Return value		None	
Remarks		・ An alarm occurs when an argument has an invalid value set.	

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2.2. Status (return value)

This section describes the status of the macro jobs listed above.

2.2.1. INCMOV (Singular point passage function)

The status 0 indicates the robot is operating, and 1 it has reached the target point.
When it is 2 or larger, the robot has not reached the target point. Take a measure such
as changing the target position/posture for retry and going through another point. Note
that the problem occurred in the first path if the status is 2 - 6, or in the second path if
12 - 16.

Table 1   INCMOV status

Item	Variable	Variable number	Return value	Description
INCMOV status	B-variable	100	0	Robot is operating
			1	Reached the target point
			2	Pulse limit in the first path
			3	Local solution in the first path
			4	Pulse delivery error in the first path
			5	UNTIL signal ON in the first path
			6	Interrupt in the first path
			12	Pulse limit in the second path
			13	Local solution in the second path
			14	Pulse delivery error in the second path
			15	UNTIL signal ON in the second path
			16	Interrupt in the second path

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2.2.2. MOVCHK (Pre-operation check function)

The status 1 indicates the robot can reach the target point. When it is 2 or larger, the robot cannot reach the target point. Take a measure such as changing the target position/posture and going through another point.

Table 2   MOVCHK status

Item	Variable	Variable number	Return value	Description
MOVCHK status	B-variable	102	0	Checking
			1	Target point reachable
			2	Pulse limit
			3	Local solution
			4	Interfere with an obstacle
			5	Interpolated action unable
			6	Interference check unable (Interference check do not cover some parts in the path)

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Table 3   cMOVCHK status

Item	Variable	Variable number	Return value	Description
cMOVCHK status	B-variable	103	0	Checking
			1	Target point reachable
			2	Pulse limit
			3	Local solution
			4	Interfere with an obstacle
			5	Interpolated action unable
			6	Interference check unable (Interference check do not cover some parts in the path)

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3. How to use MOVCHK function

This chapter describes how to use the MOVCHK function.

3.1. Combination with DX200/YRC1000/YRC1000micro functions

The DX200/YRC1000/YRC1000micro move instructions and their availability with the MOVCHK function are listed in the table below. For the functions that cannot be used with the MOVCHK function, alarms cannot be checked and avoided and the settings cannot be reflected by the MOVCHK function. Each of those functions can be used individually, separated from the MOVCHK function.

Table 4   Available function with MOVCHK function

DX200/YRC1000/YRC1000micro function		Available with
Speed override		○
Special run		×
Parallel shift		×
Batch speed conversion		×
Functional safety	Operating Range Limit of each axis	×
	Robot Operating Range Limit	×
	Speed limit	×
	Tool angle monitor	×

3.2. Checkable DX200/YRC1000/YRC1000micro system alarms

The DX200/YRC1000/YRC1000micro system alarms which can be checked and avoided by using the MOVCHK function are listed in the table below.

Table 5   Alarms which can be checked and avoided with MOVCHK function

Alarm name	Alarm number (DX200)	Alarm number (YRC1000)	Alarm number (YRC1000micro)
Pulse limit	4416	4416	4416
Excessive segment	4414	4414	4414
Cubic interference	4903	4903	4903
Interpolated action unable	4684	4684	4684

> **NOTE**   The interference check between the cube and the manipulator with the MOVCHK function is not supported around the wrist singular point (B axis angle is about 0).

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3.3. Interference check function setting

This section describes the functions set before using the MOVCHK instruction. When you use the MOVCHK instruction for the interference check between the robot and the interfering object, register the interference area and the robot tool interference.

3.3.1. Interference area registration

Register a cube on the system side to be used for the interference check on the interference area setting screen. The MOVCHK instruction uses only a cube that has the reference coordinate set to [Base] and the monitored part set to [Whole].

Figure 2   How to register interference area
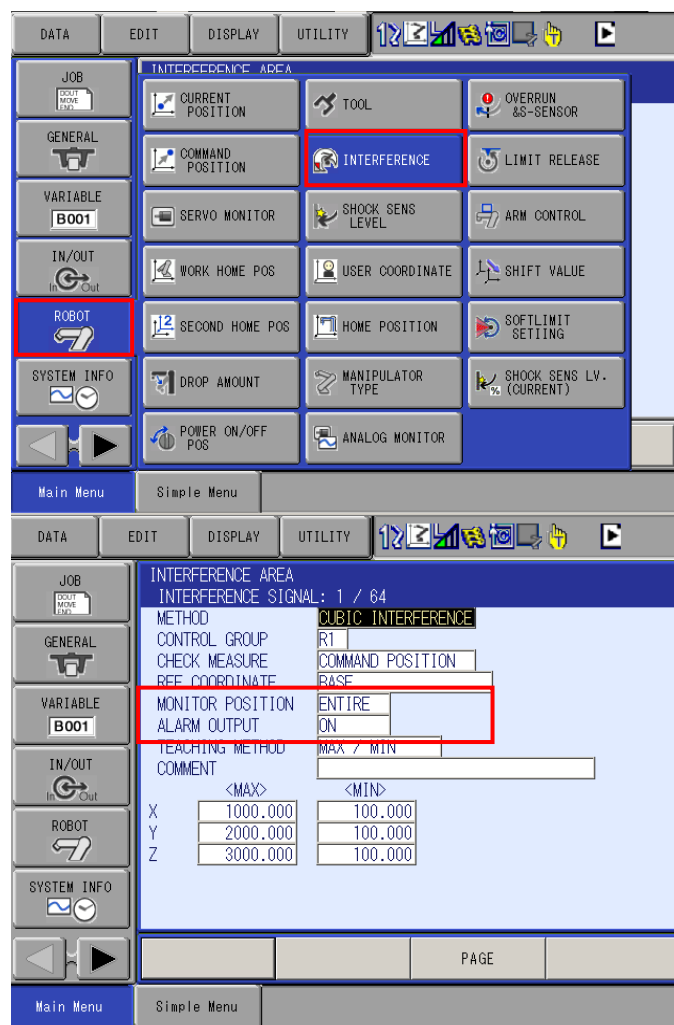
| NOTE | The interference area setting is read when DX200/YRC1000/ YRC1000micro is started. When you changed this setting, restart DX200/YRC1000/YRC1000micro. |

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3.3.2.   Tool interference registration

Register a tool used for the interference check on the tool interference screen.

Figure 3   Interfering tool registration
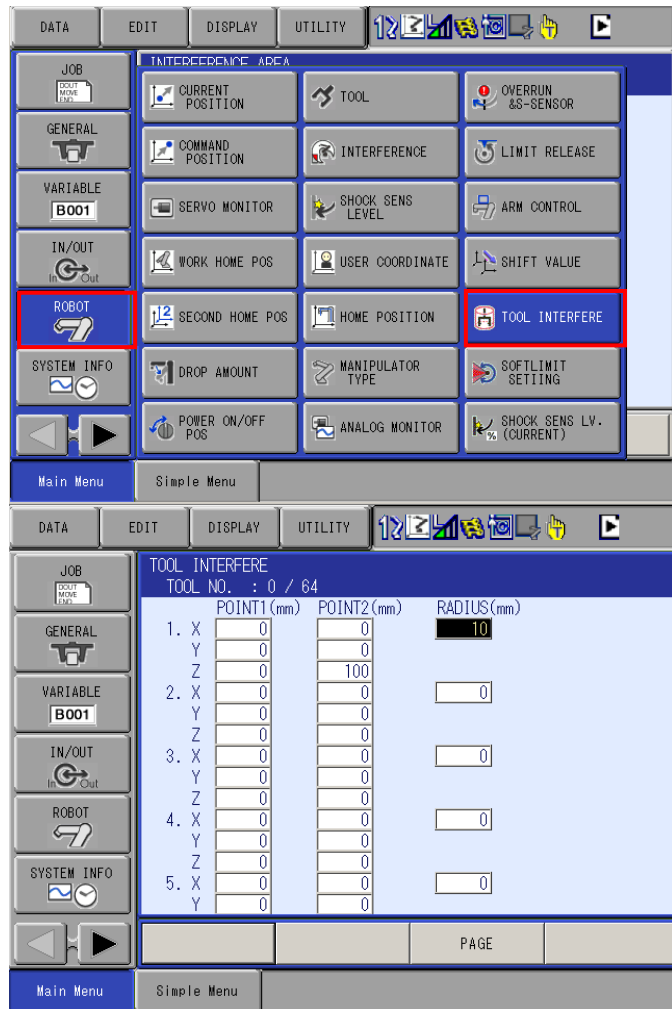
NOTE	The tool interference setting is read when DX200/YRC1000/ YRC1000micro is started. When you changed this setting, restart DX200/YRC1000/YRC1000micro.

3.4. Picking procedure

This section describes the start point, through-point, and target point used in the MOVCHK and INCMOV instructions.

Assuming a picking action for loosely piled workpieces, this function uses the MOVCHK instruction to check for interference with the set cube model and various alarms when linearly traveling from the start point to the through-point and from the through-point to the target point before the picking action with the INCMOV instruction. If the operation is judged as possible, MOVJ and MOVL are used to move to the start point, then the INCMOV instructions are used to move to the through-point and the target point respectively.

Figure 4   Example of picking procedure
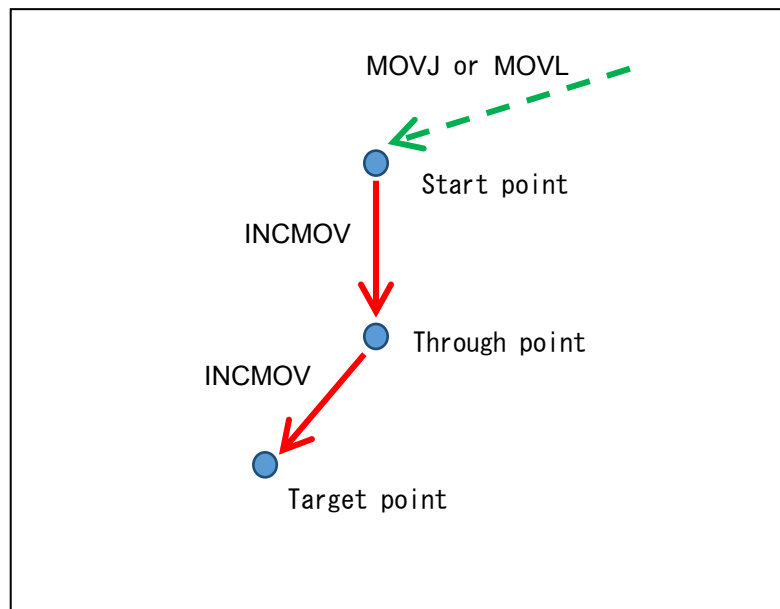
| NOTE | The postures at the through-point and the target point may be different from the ones registered in the P-variables. |

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3.4.1.   Start point (P2)

A waiting point over the pallet. It is the first point of the P-variables specified in the arguments for the MOVCHK instruction or the start point of the first action for the INCMOV instruction. Use the MO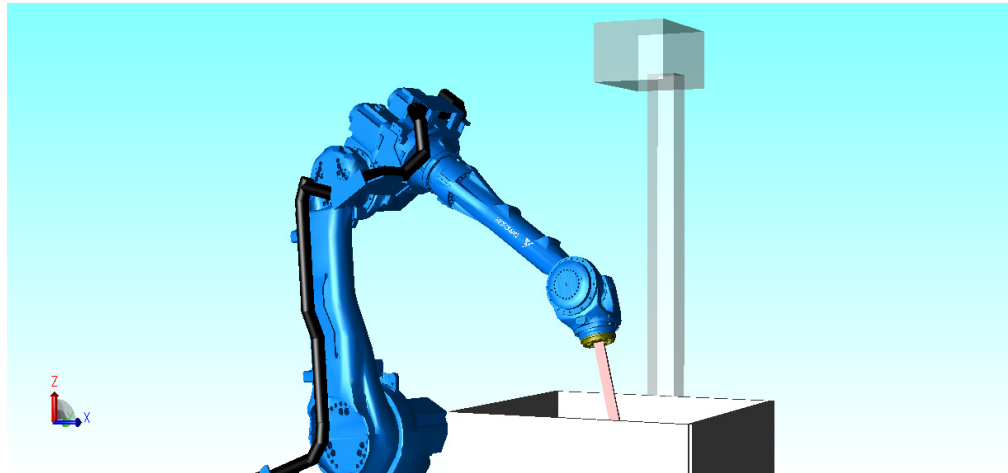VJ or MOVL instruction to move to this point. Use the pulse coordinate system when teaching the position/posture with the P-variable specified as the start point.
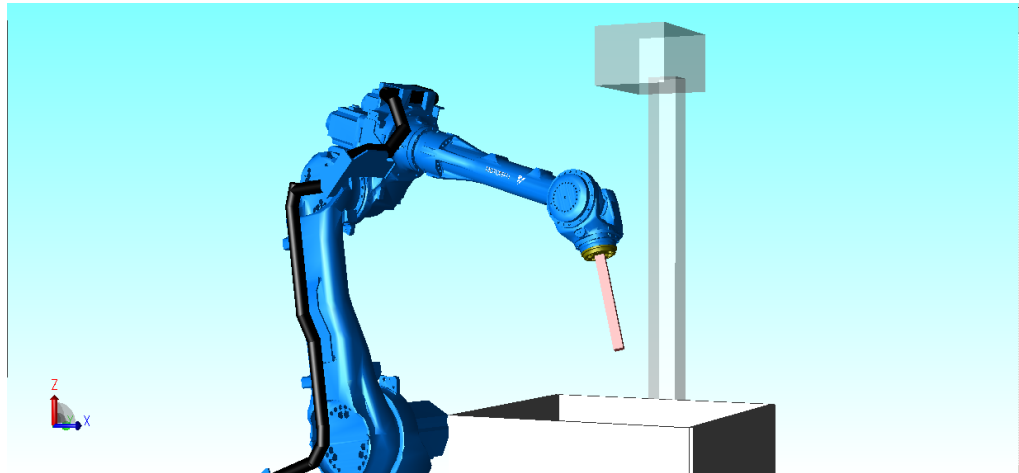
NOTE	The MOVCHK (pre-operation check) function uses the robot posture information. Therefore, use MOVJ or MOVL instead of INCMOV to move to the start point.

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3.4.2.   Through-point (P3)

An approach position for a workpiece. It is the second point of the P-variables specified in the arguments for the MOVCHK instruction or the end point of the first action for the INCMOV instruction. Use the INCMOV instruction to move to this point. Use the robot coordinate system when teaching the position/posture with the P-variable specified as the through-point.

3.4.3.   Target point (P4)

A picking position of a workpiece. It is the third point of the P-variables specified in the arguments for the MOVCHK instruction or the end point of the second action for the INCMOV instruction. Use the INCMOV instruction to move to this point.
Use the robot coordinate system when teaching the position/posture with the P-variable specified as the target point.

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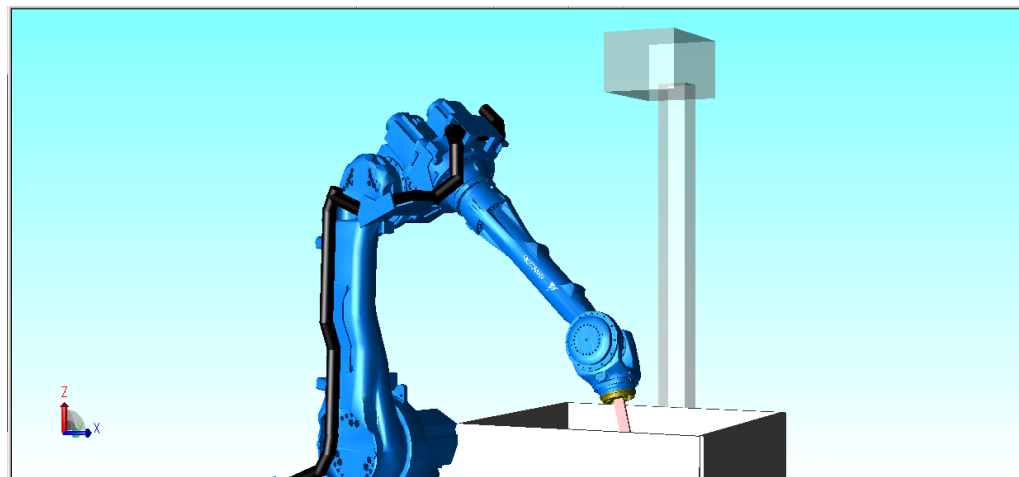
3.5. Sample job

This section describes examples of using the MOVCHK function.

3.5.1. INCMOV (Singular point passage function)

This job uses the INCMOV function to linearly travel the robot.

This sample performs a linear movement using the position, speed, and position level registered in the S-variable S001.

The operation is interrupted when the universal input #10 is set ON. Set UNTIL=0 when you do not use the UNTIL function.

When the command is completed, the status is output to the B-variable B100. For details of the status, refer to chapter 2.2 "Status (return value)".

```
JOB: INCMOV run
0000 NOP
0001 INCMOVE SNo=1 UNTIL=10
0002 PAUSE B0100<>1
0003 END
```

3.5.2. MOVCHK (Pre-operation check function)

This job checks for DX200/YRC1000/YRC1000micro system alarms on a path in advance of an operation by the INCMOV function.

This sample checks for DX200/YRC1000/YRC1000micro system alarms on a linear movement path by the INCMOV function with the position, speed, and position level registered in the S-variable S001. For the checkable system alarms, refer to chapter 3.2 "Checkable DX200/YRC1000/YRC1000micro system alarms".

```
JOB:MOVCHK run
0000 NOP
0001 MOVCHK SNo=1 cLV=1 margin=0
0002 PAUSE B102<>1
0003 END
```

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3.5.3. INCSET (Pre-registration function)

This job registers operation information before using the INCMOV, MOVCHK, or cMOVCHK function. Execute this job only once in advance.

This sample registered the information in the S-variable S001 which is used to move from a position of the P-variable P063 through a position of P064 with a translational speed 800 [mm/sec] or lower, rotating speed 180 [deg/sec] or lower, and positioning accuracy 2 [mm] or higher, and to a position of P065 with a translational speed 300 [mm/sec] or lower, rotating speed 180 [deg/sec] or lower, and positioning accuracy 0.1 [mm] or higher.

```
JOB:INCSET run
0000 NOP
0001 INCSET PATH=2 P1=63 P2=64 P4=65 V1=100 VR1=180 V2=100 VR2=180 PL1=2 PL2=0
0002 END
```

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Figure 5   Registration of an start-point and the target-point

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3.5.4.   Picking operation (Pre-operation check function + Singular point passage function)

This job uses the MOVCHK instruction to check in advance that it is possible to move to a position of the recognition result from the vision or other, then uses the INCMOV instruction for picking.

For this sample, the picking (P010-P011-P012) and pulling (P020-P021-P022) operations are registered in advance in the S-variables S001 and S002 respectively.

First, the sample executes the master job (Sample-IncMaster.JBI) without a control group for the I/O signal initialization, and executes the operation job (Sample-IncMov) and the recognition job (Sample-CWork_Recognition) with the independent control. The recognition job waits for the picking completion (OT#(2)=ON). After that, it performs the recognition and stores the recognition result in P010 (approach position), P011 (picking position), and P021 (approach position). Then, the sample checks for DX200/YRC1000/YRC1000micro system alarms on linear movement paths by the INCMOV function to the positions in the stored recognition result. For the checkable system alarms, refer to chapter 3.2 "Checkable DX200/YRC1000/YRC1000micro system alarms". If the check is OK, it outputs the recognition completion (OT#(1)=ON) and returns to the top of the loop.

The operation job waits for the recognition completion (OT#(1)=ON). After that, it moves to a position of the P-variable P010 by the MOVJ instruction, then to P011 and P012 by the INCMOV instruction. After the movement is completed, the sample grips a workpiece by the hand operation. Then, it moves from the current position to positions of P021 and P022 by the INCMOV instruction. After the movement is completed, it outputs the picking completion (OT#(2)=ON), places the workpiece, then returns to the top of the loop.

```
JOB:Sample-IncMaster
0000 NOP
0001 DOUT OT#(1) OFF
0002 DOUT OT#(2) ON
0003 PSTART JOB:Sample-IncMov SUB1
0004 PSTART JOB:Sample-CWork_Recognition SUB2
0005 PWAIT SUB1
0006 PWAIT SUB2
0007 END
```

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```
JOB:Sample-IncMov
0000 NOP
0001'* ****引数*********************
0002'* ****Argument****************
0003'* SNo   : S変数番号
0004'*         S variable for
0005'*         setting storage
0006'* UNTIL : Until用汎用入力信号
0007'*         General In for
0008'*         until signal
0009'*****************************
0010'*
0011'*
0012'*****ループ開始************
0013'*****Loop start************
0014*LOOP
0015 MOVJ VJ=60.00
0016'******認識結果待ち*********
0017'*****Recognition wait******
0018 ADVSTOP
0019 WAIT OT#(1)=ON
0020 DOUT OT#(1) OFF
0021'*******ピッキング開始*********
0022'*******Picking start*********
0023 INCMOV SNo=1 UNTIL=0
0024 CALL JOB:Grip
0025 GETS PX020 $PX000
0026 INCMOV SNo=2 UNTIL=0
0027'*******ピッキング終了*********
0028'*******Picking end***********
0029 DOUT OT#(2) ON
0030 JUMP *LOOP IF B100<>1
0031'*******置き開始*********
0032'*******Setting start****
0033 MOVJ VJ=60.00
0034 MOVL V=300.0
0035 CALL JOB:UnGrip
0036 MOVL V=600.0
0037 MOVJ VJ=60.00
0038'*******置き終了*********
0039'*******Setting end******
0040 JUMP *LOOP
0041 END
```

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```
JOB:Sample-CWork_Recognition
0000 NOP
0001'******************************
0002' 認識結果を P11,P12,P21 に
0003' ロボット座標系でセットして下さい
0004'Please set a recognition result
0005'in a robot coordinate system
0006'in P11, P12, P21
0007'P11(ｱﾌﾟﾛｰﾁ点),P12(ﾋﾟｯｷﾝｸﾞ点)
0008'P21(ｱﾌﾟﾛｰﾁ点)
0009'P11(Approach point),
0010'P12(Picking point),
0011'P21(Approach point)
0012'******************************
0013'* ****引数*******************
0014'* ****Argument***************
0015'* SNo    : S 変数番号
0016'*          S variable for
0017'*          setting storage
0018'* cLV    : チェックレベル
0019'*          Check level
0020'* Margin : 干渉マージン
0021'*          Interference margin
0022'******************************
0023'*****ループ開始************
0024'*****Loop start************
0025*LOOP
0026'****ﾋﾟｯｷﾝｸﾞ終了待ち****
0027'****Picking wait****
0028 ADVSTOP
0029 WAIT OT#(2)=ON
0030 DOUT OT#(2) OFF
0031*RETRY
0032'Recognition
0033'
0034'
0035'
0036'
0037'******************************
0038'****認識結果をセット
0039'****Set recognition result
0040 CNVRT PX011 PX000 RF
0041 CNVRT PX012 PX001 RF
0042 CNVRT PX021 PX000 RF
0043'****動作可能かﾁｪｯｸ
0044'*Check whether or not I can pick
0045 cMOVCHK SNo=1 cLV=1 Margin=1
0046 JUMP *RETRY IF B103<>1
0047'
0048'
0049'****認識終了********
0050'****Recognition end**
0051 DOUT OT#(1) ON
0052 JUMP *LOOP
0053 END
```

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4. Alarm List

Alarms shown on the screen of the programming pendant are described below.

Table   6   Alarm List

Alarm code	Alarm name	Sub code	Description
8000	MOTOPLUS ERROR	0	<Cause> An error occurred in the API of MotoPlus application. <Solution> Restart the RC. If the same error occurs repeatedly, contact your YASKAWA representative.
8000	MOTOPLUS ERROR	1	<Cause> Creation of MotoPlus thread failed. <Solution> Confirm whether the RC parameter (S1D306=1,S1D307=15) is correctly set.
8000	MOTOPLUS ERROR	2	<Cause> A system error occurred in the RC. <Solution> Restart the RC. If the same error occurs repeatedly, contact your YASKAWA representative.

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Alarm code	Alarm name	Sub code	Description
8000	MOTOPLUS ERROR	3	<Cause> MotoPlus application received an undefined user demand from the job. <Solution> Confirm that skillsend is not used in the job. Also, confirm that no unsupported macro job is used.
8000	MOTOPLUS ERROR	4	<Cause> MotoPlus application received an invalid argument from the job. <Solution> Confirm whether the argument value of the vision command used in the job is valid.
8000	MOTOPLUS ERROR	12	<Cause> MotoPlus application failed to write variables in the programming pendant. <Solution> Confirm that the variable number specified in the job is within the range of each variable.

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Alarm code	Alarm name	Sub code	Description
8000	MOTOPLUS ERROR	13	<Cause> MotoPlus application failed to write P variable in the programming pendant. <Solution> Restart the RC. If the same error occurs repeatedly, contact your YASKAWA representative.
8000	MOTOPLUS ERROR	15	<Cause> The IO number for UNTIL specified as an argument of INCMOVE is invalid. <Solution> Specify the argument of INCMOVE within the range of general-purpose input.
8000	MOTOPLUS ERROR	22	<Cause> MS3START (vision command) was consecutively executed 5 times or more in the job. <Solution> Correct the job so that the number of consecutive command execution to one scanner is limited to 4 times.

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Alarm code	Alarm name	Sub code	Description
8000	MOTOPLUS ERROR	23	<Cause> Before a process in the scanner is completed, another command is issued to the same scanner. <Solution> Do not issue plural commands to one scanner at the same time.
8000	MOTOPLUS ERROR	24	<Cause> The command is executed, when MotoPlus is in a state that can not receive the command. <Solution> Make sure the MotoPlus app startup has completed. MotoPlus app startup is not completed, restart the RC.
8000	MOTOPLUS ERROR	26	<Cause> Failed to create a message queue. <Solution> Restart the RC. If the same error occurs repeatedly, contact your YASKAWA representative.

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Alarm code	Alarm name	Sub code	Description
8006	INCMOV ERROR	0	<Cause> It failed to read variables. <Solution> Check that the positions are stored with the robot coordinate system in the P-variables for the P-variable numbers of the start and target points specified in the arguments of the macro job.
8006	INCMOV ERROR	1	<Cause> It failed to read the current position of the robot. <Solution> Restart RC.
8006	INCMOV ERROR	2	<Cause> Unsupported robot. <Solution> This function is not available to the used robot.
8006	INCMOV ERROR	3	<Cause> The INCMOV function is executed with [INTERLOCK] + [NEXT]. Or, PLAY is set OFF after being executed as a test run. <Solution> Execute it as a test run or in PLAY mode.

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Alarm code	Alarm name	Sub code	Description
8006	INCMOV ERROR	4	<Cause> A wrong speed (V,VR) value is specified in the argument of INCMOVE or MOVCHK. <Solution> It must be within the range of the MOVL speed specified in the robot's parameter.
8006	INCMOV ERROR	5	<Cause> The cube model exceeds the maximum size for the MOVCHK interference check. <Solution> Check that the model set in the tool interference file for the used tool is not too long. Change the tool if too long.
8006	INCMOV ERROR	6	<Cause> An error occurred during arithmetic operation of INCMOV and MOVCHK. <Solution> Restart RC.

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Alarm code	Alarm name	Sub code	Description
8006	INCMOV ERROR	7	<Cause> The INCMOV start point is different from the start point or interruption point that was specified by the P-variable. <Solution> Move the robot to the start point specified by the P-variable or to the position where the operation was interrupted last time and execute the job again.

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5. Variable and IO List

Variables used in MOVCHK are described below. In the remarks column "Do NOT use" means that the user cannot use the variable because MOVCHK uses it.

5.1. B Variable

Table   7   B Variable List

Variable number	Variable name	Remarks
B100	INCMOVE status	For INCMOVE status storage
B102	MOVCHK status	For MOVCHK status storage
B103	cMOVCHK status	For cMOVCHK status storage
B119	Reserved by MOVCHK system	Do Not use
B120	Reserved by MOVCHK system	Do Not use
B121	Reserved by MOVCHK system	Do Not use
B122	Reserved by MOVCHK system	Do Not use
B123	Reserved by MOVCHK system	Do Not use
B124	Reserved by MOVCHK system	Do Not use
B125	Reserved by MOVCHK system	Do Not use

5.2. I Variable

Table   8   I Variable List

Variable number	Variable name	Remarks
I122	Reserved by MOVCHK system	Do Not use
I123	Reserved by MOVCHK system	Do Not use
I124	Reserved by MOVCHK system	Do Not use
I125	Reserved by MOVCHK system	Do Not use

5.3. S Variable

Table   9   S Variable List

Variable number	Variable name	Remarks
S89	Reserved by MOVCHK system	Do Not use
S90	Reserved by MOVCHK system	Do Not use
S91	Reserved by MOVCHK system	Do Not use
S92	Reserved by MOVCHK system	Do Not use
S93	MOVCHK version information	Do Not use

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5.4. General-Purpose Output

Table   10   General-Purpose Output List

OG#	OT#	Remarks
30	233	Reserved by MOVCHK system
	234	Reserved by MOVCHK system
	235	Reserved by MOVCHK system
	236	Reserved by MOVCHK system

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DX200/YRC1000/YRC1000micro
MOVCHK Function
(Pre-operation check, Singular point passage)
INSTRUCTIONS

For inquiries or after-sales service on this product, contact your local YASKAWA representative as shown below.

YASKAWA

YASKAWA ELECTRIC CORPORATION

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