

## DX200 OPTIONS INSTRUCTIONS

### FOR TWIN-DRIVE AXIS SEPARATION FUNCTION

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

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#### MOTOMAN INSTRUCTIONS

MOTOMAN-□□□ INSTRUCTIONS  
DX200 INSTRUCTIONS  
DX200 OPERATOR'S MANUAL (for each purpose)  
DX200 MAINTENANCE MANUAL

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

Part Number: 179103-1CD  
Revision: 0

MANUAL NO.

**HW1484279**

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## MANDATORY

- This manual explains the Twin-Drive Axis Separation Function of the DX200 system. Read this manual carefully and be sure to understand its contents before handling the DX200.
- General items related to safety are listed in Chapter 1: Safety of the DX200 Instructions. To ensure correct and safe operation, carefully read the DX200 Instructions before reading this manual.



## CAUTION

- Some drawings in this manual are shown with the protective covers or shields removed for clarity. Be sure all covers and shields are replaced before operating this product.
- The drawings and photos in this manual are representative examples and differences may exist between them and the delivered product.
- YASKAWA may modify this model without notice when necessary due to product improvements, modifications, or changes in specifications.  
If such modification is made, the manual number will also be revised.
- If your copy of the manual is damaged or lost, contact a YASKAWA representative to order a new copy. The representatives are listed on the back cover. Be sure to tell the representative the manual number listed on the front cover.
- YASKAWA is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids your product's warranty.

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](http://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 “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 “CAUTION” and “WARNING”.



### 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.

**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.

*Fig. : 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.

*Fig. : 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 the manipulator 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 DX200	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.

## 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 <sup>TM</sup> are omitted.

## Safeguarding Tips

All operators, programmers, maintenance personnel, supervisors, and anyone working near the system must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. General safeguarding tips are as follows:

- Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation of this equipment, the operator's manuals, the system equipment, and options and accessories should be permitted to operate this equipment.
- Improper connections can damage the equipment. All connections must be made within the standard voltage and current ratings of the equipment.
- The system must be placed in Emergency Stop (E-Stop) mode whenever it is not in use.
- In accordance with ANSI/RIA R15.06-2012, section 4.2.5, Sources of Energy, use lockout/tagout procedures during equipment maintenance. Refer also to Section 1910.147 (29CFR, Part 1910), Occupational Safety and Health Standards for General Industry (OSHA).

## Mechanical Safety Devices

The safe operation of this equipment is ultimately the users responsibility. The conditions under which the equipment will be operated safely should be reviewed by the user. The user must be aware of the various national codes, ANSI/RIA R15.06-2012 safety standards, and other local codes that may pertain to the installation and use of this equipment.

Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. The following safety equipment is provided as standard:

- Safety barriers
- Door interlocks
- Emergency stop palm buttons located on operator station

Check all safety equipment frequently for proper operation. Repair or replace any non-functioning safety equipment immediately.

## Programming, Operation, and Maintenance Safety

All operators, programmers, maintenance personnel, supervisors, and anyone working near the system must become familiar with the operation of this equipment. Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation, manuals, electrical design, and equipment interconnections of this equipment should be permitted to program, or maintain the system. All personnel involved with the operation of the equipment must understand potential dangers of operation.

- Inspect the equipment to be sure no potentially hazardous conditions exist. Be sure the area is clean and free of water, oil, debris, etc.
- Be sure that all safeguards are in place. Check all safety equipment for proper operation. Repair or replace any non-functioning safety equipment immediately.
- Check the E-Stop button on the operator station for proper operation before programming. The equipment must be placed in Emergency Stop (E-Stop) mode whenever it is not in use.
- Back up all programs and jobs onto suitable media before program changes are made. To avoid loss of information, programs, or jobs, a backup must always be made before any service procedures are done and before any changes are made to options, accessories, or equipment.
- Any modifications to the controller unit can cause severe personal injury or death, as well as damage to the robot! Do not make any modifications to the controller unit. Making any changes without the written permission from YASKAWA will void the warranty.
- Some operations require a standard passwords and some require special passwords.
- The equipment allows modifications of the software for maximum performance. Care must be taken when making these modifications. All modifications made to the software will change the way the equipment operates and can cause severe personal injury or death, as well as damage parts of the system. Double check all modifications under every mode of operation to ensure that the changes have not created hazards or dangerous situations.
- This equipment has multiple sources of electrical supply. Electrical interconnections are made between the controller and other equipment. Disconnect and lockout/tagout all electrical circuits before making any modifications or connections.
- Do not perform any maintenance procedures before reading and understanding the proper procedures in the appropriate manual.
- Use proper replacement parts.
- Improper connections can damage the equipment. All connections must be made within the standard voltage and current ratings of the equipment.

## **Maintenance Safety**

Turn the power OFF and disconnect and lockout/tagout all electrical circuits before making any modifications or connections.

Perform only the maintenance described in this manual. Maintenance other than specified in this manual should be performed only by YASKAWA-trained, qualified personnel.

## **Summary of Warning Information**

This manual is provided to help users establish safe conditions for operating the equipment. Specific considerations and precautions are also described in the manual, but appear in the form of Dangers, Warnings, Cautions, and Notes.

It is important that users operate the equipment in accordance with this instruction manual and any additional information which may be provided by YASKAWA. Address any questions regarding the safe and proper operation of the equipment to YASKAWA Customer Support.

## Customer Support Information

If you need assistance with any aspect of your Twin-Drive Axis Separation Function of the DX200, please contact YASKAWA Customer Support at the following 24-hour telephone number:

**(937) 847-3200**

For **routine** technical inquiries, you can also contact YASKAWA Customer Support at the following e-mail address:

[techsupport@motoman.com](mailto:techsupport@motoman.com)

When using e-mail to contact YASKAWA Customer Support, please provide a detailed description of your issue, along with complete contact information. Please allow approximately 24 to 36 hours for a response to your inquiry.



Please use e-mail for **routine** inquiries only. If you have an urgent or emergency need for service, replacement parts, or information, you must contact YASKAWA Customer Support at the telephone number shown above.

Please have the following information ready before you call Customer Support:

• System	Twin-Drive Axis Separation Function
• Primary Application	_____
• Controller	DX200
• Software Version	Access this information on the Programming Pendant's LCD display screen by selecting {MAIN MENU} - {SYSTEM INFO} - {VERSION}
• Robot Serial Number	Located on the robot data plate
• Robot Sales Order Number	Located on the DX200 controller data plate

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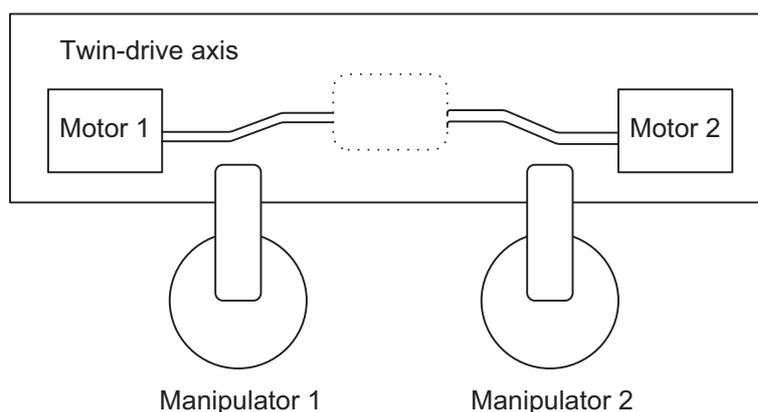
## 1 Outline of Function

A twin-drive axis is used as a positioner for setting long workpieces, and consists of two motors on the ends of the axis where the workpieces are held. These motors rotate simultaneously in the same direction.

By using the twin-drive axis separation function, these two motors can be separately controlled and rotate independently.

As an example of use, a system consisting of two manipulators for welding and a twin-drive axis as a positioner is shown below. In this system, the two motors of the twin-drive axis are separately controlled by the twin-drive axis separation function, and an operation performed by one manipulator and one motor in a coordinated motion and an operation performed by the other manipulator and the other motor in a coordinated motion are performed in parallel by using the independent control function. After that, the separately-controlled motors are set as the one twin-drive axis, and the separately-processed workpieces are simultaneously rotated in the same direction and processed by the twin synchronous system of the two manipulators and the twin-drive axis.

Fig. 1-1: Example of System with Two Manipulators and a Twin-Drive Axis



## 2 Applicable Types

Among the types of mechanisms which support the twin-drive, this twin-drive axis separation function can be used only in the mechanism which is the same as TWIN-2, and cannot be used in the mechanism which is the same as TWIN-3A or TWIN-3B.

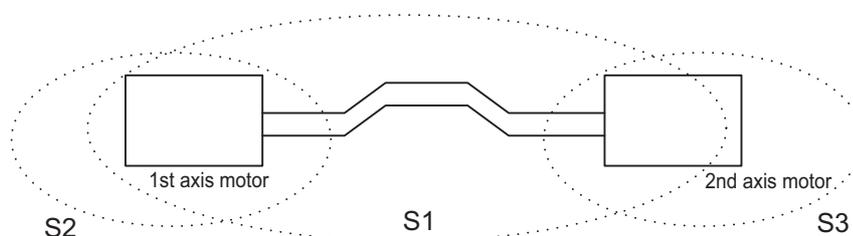
### 3 Control Group

In the twin-drive axis separation function, three station groups are used. The control groups and the controlled axes correspond as follows:

1. Station group 1 (S1) --- Twin-drive axis
2. Station group 2 (S2) --- 1st axis of S1 (twin-drive axis)
3. Station group 3 (S3) --- 2nd axis of S1 (twin-drive axis)

Thus, when using an external axis as a whole as a twin-drive axis, use the station group 1. When using the motors of the twin-drive axis separately, select the station group 2 for the 1st axis motor and the station group 3 for the 2nd axis motor.

*Fig. 3-1: Twin-Drive Axis and Control Group*



## 4 Restrictions When Using the Independent Control Function

In the twin-drive axis separation function, even if the control groups are different, the controlled motor may be the same. Thus, if the job including S1 as the control group and the job including S2 or S3 as the control group are executed by using the independent control function (see “DX200 OPTIONS INSTRUCTIONS FOR INDEPENDENT/COORDINATED CONTROL FUNCTION (165836-1CD)” for details), the alarm “4103: PARALLEL START INSTRUCTION ERROR [10]” will occur.

<Example>

If the following jobs are executed, the alarm “4103: PARALLEL START INSTRUCTION ERROR [10]” will occur because the same motor is used for the 1st axis of S1 and the 1st axis of S2.

NOP

PSTART JOB: S1 SUB1 (S1: job of the station 1)

PSTART JOB: S2 SUB2 (S2: job of the station 2)

END

An example of creating a job using the twin-drive axis separation function is shown below. In this job example, the twin synchronous system (see “DX200 OPTIONS INSTRUCTIONS FOR INDEPENDENT/COORDINATED CONTROL FUNCTION (165836-1CD)” for details) and the independent control function are used.

<Example>

<pre> NOP PSTART JOB: R1S2 SUB1 PSTART JOB: R2S3 SUB2 </pre>	<pre> } } } </pre>	<p>The job using the manipulator 1 and the 1st axis of the twin-drive axis (S2), and the job using the manipulator 2 and the 2nd axis of the twin-drive axis (S3) are executed by using the independent control function.</p> <p>The 1st axis and the 2nd axis of the twin-drive axis operate independently.</p>
<pre> PWAIT SUB1 PWAIT SUB2 </pre>	<pre> } } </pre>	<p>Waits for completion of the job R1S2.</p> <p>Waits for completion of the job R2S3.</p>
<pre> PSTART JOB: R2S1 SUB2 SYNC SUB1 PSTART JOB: R1S1 SUB1 </pre>	<pre> } } </pre>	<p>The manipulator 1, the manipulator 2, and the twin-drive axis (S1) operate in the twin synchronous motion.</p>
<pre> PWAIT SUB1 PWAIT SUB2 END </pre>	<pre> } } } </pre>	<p>Waits for completion of the job R2S1.</p> <p>Waits for completion of the job R1S1.</p>

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Twin-Drive Axis Separation Function	4	Restrictions When Using the Independent Control Function
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## Description of the job

- R1S2: job using the manipulator 1 and the 1st axis of the twin-drive axis (S2)
- R2S3: job using the manipulator 2 and the 2nd axis of the twin-drive axis (S3)
- R1S1: job using the manipulator 1 and the twin-drive axis (S1)
- R2S1: job using the manipulator 2 and the twin-drive axis (S1)

## 5 Home Position Calibration

- **Home Position Calibration (see “DX200 INSTRUCTIONS (165292-1CD) for details)**

For the home position calibration of the three station groups configured in the twin-drive axis separation function, the home position calibration of S2 and S3 is performed automatically by performing the home position calibration of the twin-drive axis (S1). At this time, the absolute data of S2 become the same as the 1st axis of S1, and the absolute data of S3 become the same as the 2nd axis of S1.

- **Modification of Absolute Data**

When the absolute data of the 1st axis of S1 are modified, the absolute data of S2 are also modified to the same values. When the absolute data of the 2nd axis of S1 are modified, the absolute data of S3 are also modified to the same values.

## 6 Precautions

Make sure to read “DX200 OPTIONS INSTRUCTIONS FOR TWIN DRIVE FUNCTION (165308-1CD)” before using the twin-drive axis separation function.

When using the twin-drive axis separation function, observe the following precautions.

### 6.1 Precautions When Setting the Station Axis

When using the twin-drive axis separation function, settings of the station axis must be performed in the maintenance mode. At this time, observe the following precautions for settings.

Also, for the operation procedure of the maintenance mode, refer to “DX200 INSTRUCTIONS (165292-1CD)”.

#### 6.1.1 Setting Mechanical Specifications

When using a station axis, enter the following data as the mechanical specifications:

- MOTION RANGE (+)
- MOTION RANGE (-)
- REDUCTION RATIO (NUMER)
- REDUCTION RATIO (DENOM)

In the twin-drive axis separation function, the 1st axis of S1 and the 1st axis of S2 use the same motor, and the 2nd axis of S1 and the 1st axis of S3 use the same motor. Thus, the above-mentioned data set for the 1st axis of S1 and the 1st axis of S2 must be the same, and for the 2nd axis of S1 and the 1st axis of S3 must be the same.

#### 6.1.2 Setting Motor Specifications

When using a station axis, enter the following data as the motor specifications:

- ROTATION DIRECTION (NORMAL/REVERSE)
- MAX. RPM
- ACCELERATION TIME
- INERTIA RATIO

In the twin-drive axis separation function, the 1st axis of S1 and the 1st axis of S2 use the same motor, and the 2nd axis of S1 and the 1st axis of S3 use the same- motor. Thus, the above-mentioned data set for the 1st axis of S1 and the 1st axis of S2 must be the same, and for the 2nd axis of S1 and the 1st axis of S3 must be the same.

## 6.2 Precautions When Using the Twin-Drive Axis Separation Function

Note carefully that after the two motors of the twin-drive axis are operated independently by using the twin-drive axis separation function, if the two motors are operated together as the twin-drive axis, the positions of the two motors will be deviated. In the following job, for example, after operating the two motors of the twin-drive axis independently in the lines 2 and 3, make sure to move the two motors to the same positions as the taught position of the twin-drive axis (S1) at the step 1 in the job R2S1 before operating the two motors as the twin-drive axis in the lines 6 and 7.

<Example>

NOP

PSTART JOB: R1S2 SUB1

PSTART JOB: R2S3 SUB2

PWAIT SUB1

PWAIT SUB2

PSTART JOB: R2S1 SUB2 SYNC SUB1

PSTART JOB: R1S1 SUB1

PWAIT SUB1

PWAIT SUB2

END

# DX200 OPTIONS INSTRUCTIONS

## FOR TWIN DRIVE AXIS SEPARATION FUNCTION

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

# YASKAWA

MANUAL NO.

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