

DX200 OPTIONS INSTRUCTIONS

FOR THERMAL SPRAY SPEED CONTROL FUNCTION

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

MOTOMAN INSTRUCTIONS

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

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

Part Number: 165261-1CD
Revision: 0



MANDATORY

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



CAUTION

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

Notes for Safe Operation

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

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



WARNING

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



CAUTION

Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury to personnel and damage to equipment. It may also be used to alert against unsafe practices.



MANDATORY

Always be sure to follow explicitly the items listed under this heading.



PROHIBITED

Must never be performed.

Even items described as "CAUTION" may result in a serious accident in some situations.

At any rate, be sure to follow these important items



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



WARNING

- Before operating the manipulator, check that servo power is turned OFF pressing the emergency stop buttons on the front door of the DX200 and the programming pendant. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.

Injury or damage to machinery may result if the emergency stop circuit cannot stop the manipulator during an emergency. The manipulator should not be used if the emergency stop buttons do not function.

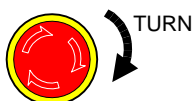
Figure 1: Emergency Stop Button



- Once the emergency stop button is released, clear the cell of all items which could interfere with the operation of the manipulator. Then turn the servo power ON.

Injury may result from unintentional or unexpected manipulator motion.

Figure 2: Release of Emergency Stop



- Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:
 - View the manipulator from the front whenever possible.
 - Always follow the predetermined operating procedure.
 - Keep in mind the emergency response measures against the manipulator's unexpected motion toward you.
 - Ensure that you have a safe place to retreat in case of emergency.

Improper or unintended manipulator operation may result in injury.

- Confirm that no person is present in the P-point maximum envelope of the manipulator and that you are in a safe location before:
 - Turning ON the power for the DX200.
 - Moving the manipulator with the programming pendant.
 - Running the system in the check mode.
 - Performing automatic operations.

Injury may result if anyone enters the P-point maximum envelope of the manipulator during operation. Always press an emergency stop button immediately if there is a problem.

The emergency stop buttons are located on the right of front door of the DX200 and the programming pendant.



CAUTION

- Perform the following inspection procedures prior to conducting manipulator teaching. If problems are found, repair them immediately, and be sure that all other necessary processing has been performed.
 - Check for problems in manipulator movement.
 - Check for damage to insulation and sheathing of external wires.
- Always return the programming pendant to the hook on the DX200 cabinet after use.

The programming pendant can be damaged if it is left in the P-point maximum envelope of the manipulator's work area, on the floor, or near fixtures.

- Read and understand the Explanation of the Warning Labels 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

Thermal Spray Speed Control

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

Equipment		Manual Designation
Programming Pendant	Character Keys	The keys which have characters printed on them are denoted with []. ex. [ENTER]
	Symbol Keys	The keys which have a symbol printed on them are not denoted with [] but depicted with a small picture. ex. page key  The cursor key is an exception, and a picture is not shown.
	Axis Keys Number Keys	"Axis Keys" and "Number Keys" are generic names for the keys for axis operation and number input.
	Keys pressed simultaneously	When two keys are to be pressed simultaneously, the keys are shown with a "+" sign between them, ex. [SHIFT]+[COORD]
	Displays	The menu displayed in the programming pendant is denoted with { }. ex. {JOB}

Description of the Operation Procedure

In the explanation of the operation procedure, the expression "Select ●●●" means that the cursor is moved to the object item and the SELECT key is pressed, or that the item is directly selected by touching the screen.

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1 Functional Overview

When performing the thermal spray operation to the rotating workpieces such as the conical, discoid, and spherical shapes with the conventional manipulator, the user had to adjust the manipulator speed in accordance with the workpiece radius by adding the teaching points to change the manipulator speed in each step. In this case, since the thermal spraying speed could not be changed continuously, the thickness of coating was uneven.

However, this function can automatically adjust the manipulator speed to eliminate uneven coating thickness by allowing the manipulator to continuously change its motion speed between the taught (programmed) steps. With this function, the users will be able to reduce teaching time and improve quality in performing the thermal spray operation on the rotating workpieces such as the conical, discoid, and spherical shapes.

The following two instructions are added to this function.

- Speed control start instruction (SPEEDON)
Starts the thermal spray speed control function.
- Speed control end instruction (SPEEDOF)
Ends the thermal spray speed control function.

2 Notes on Using This Function

When using the thermal spray speed control function, note the following points.

1. The function is intended for the MOVL and MOVC instructions. It does not function for other move instructions.
2. This function cannot be used in the coordinated jobs.
3. Omit specifying the speed of move instruction (MOVL, MOVC) in the SPEEDON section (the section where the speed control function is effective). If the speed is specified, the manipulator moves in the specified speed.
4. To avoid speed fluctuations between the steps, only one path shall be specified for the SPEEDON section.
5. Pay due attention to the manipulator as it increases its speed when passing by the area closer to the rotation axis (the user coordinates).
6. The manipulator proceeds with the operation when it is restarted after the HOLD or emergency stop status. However, the operation will not be continued in the following cases:
 - If the DX200 is turned OFF
 - If the cursor is moved
7. When the in-guard safe operation maximum speed (one of the motion speed setting parameters) is set to the manipulator, the maximum speed of the manipulator will be limited by this parameter even in the SPEEDON section.



- Use only the move instructions (MOVL, MOVC) in the SPEEDON section. Any use of other instructions may cause malfunction.
- Be sure to omit specifying the speed of move instructions (MOVL, MOVC). Specifying the speed of move instructions may cause malfunction.

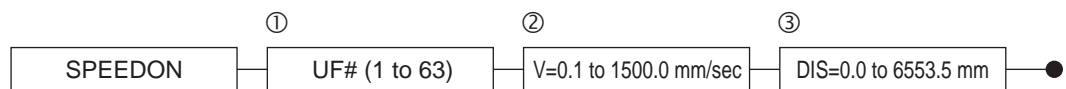
3 Instructions for This Function

Specify the speed-controlled section with the instruction specially intended for this function described in this chapter. The function takes effect on the move instructions (MOVL, MOVC) included in the specified section.

3.1 Description of Instructions

3.1.1 SPEEDON

The SPEEDON instruction starts the thermal spray speed control function. The additional items of this instruction are described as follows.



① User Frame UF#() (Setting Range: 1 to 63)

Teach the center of the axis which rotates the workpiece (workpiece rotation center). In this process, teach the rotative axis so that it will be set to the Z-axis direction of the user frame.

② Velocity V= (Setting Range: 0.1 to 1500.0 mm/sec)

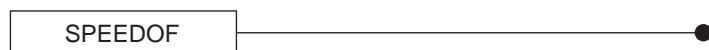
Specify the speed (initial speed) at the step where the thermal spray operation starts. The speed control will be performed based on the speed set in this process.

③ Distance DIS= (Setting Range: 0.0 to 6553.5 mm)

Specify the distance from the workpiece rotation center to the point where thermal spray starts. The speed control will be performed based on the distance set in this process.

3.1.2 SPEEDOF

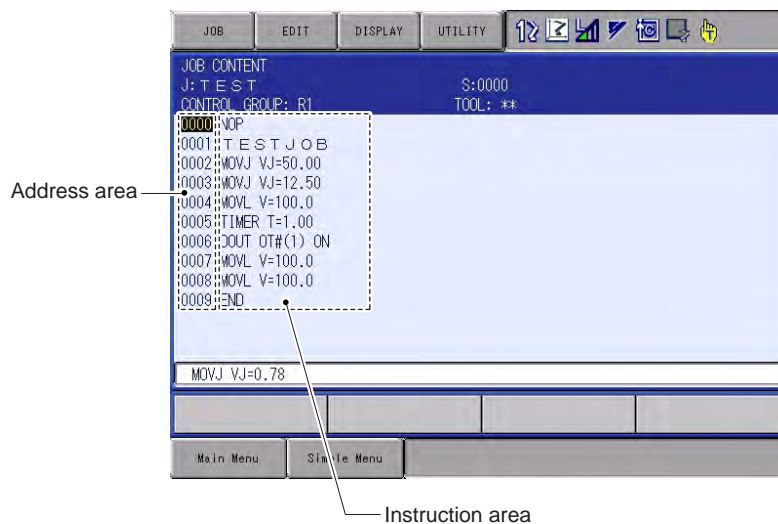
The SPEEDOF instruction ends the thermal spray speed control function. The additional item of this instruction is described as follows.



3.2 Inserting Instructions

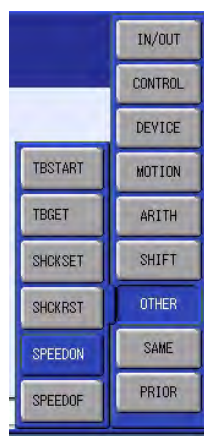
The instructions can be inserted when the cursor is in the address area of the JOB CONTENT screen in the teach mode.

1. Select {JOB} from the Main Menu.
2. Select {JOB}.
3. Move the cursor to the address area.

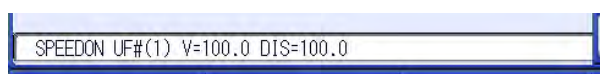


3.2.1 Inserting SPEEDON Instruction

1. Point the cursor to the line immediately prior to the position where the SPEEDON instruction is to be inserted.
2. Press [INFORM LIST].
 - A list of instructions appears.



3. Select the SPEEDON instruction.
 - The SPEEDON instruction is displayed on the input buffer line.



4. Modify the values as necessary.

– <To Register Without Changing the Data>

When registering the instruction on the input buffer line without changing the data, proceed to the step 5.

<To Edit the Additional Items>

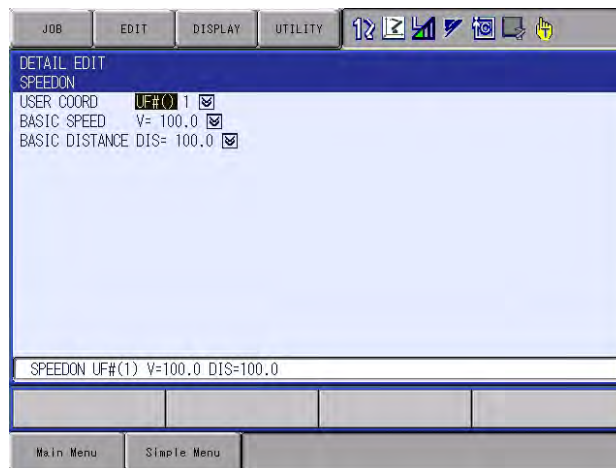
• Changing the Numeric Data

When modifying data of an additional item, point the cursor to the desired data on the input buffer line, input a new value using the numeric keys and press [ENTER].

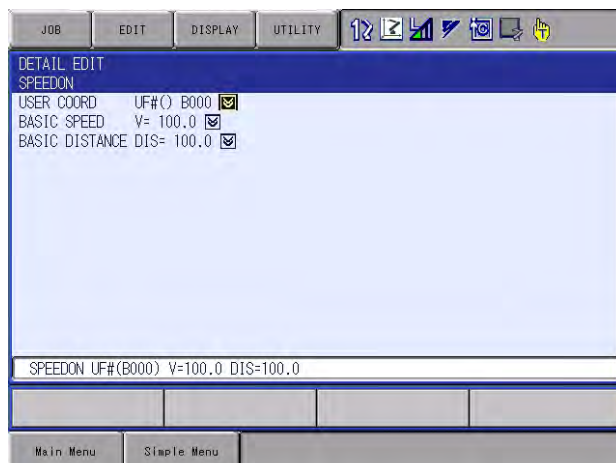


• Adding, Modifying, or Deleting the Additional Item

When adding, modifying, or deleting an additional item, point the cursor to the instruction on the input buffer line and press [SELECT] to display the DETAIL EDIT screen.



Select of the desired item, and edit.



Pressing [ENTER] after editing the additional item closes the DETAIL EDIT screen and displays the JOB CONTENT screen.

5. Press [INSERT] and [ENTER].

– The instruction on the input buffer line is inserted in the JOB.

3.2.2 Inserting SPEEDOF Instruction

1. Point the cursor to the line immediately prior to the position where the SPEEDOF instruction is to be inserted.
2. Press [INFORM LIST].
 - A list of instructions appears.



3. Select the SPEEDOF instruction.
 - The SPEEDOF instruction is displayed on the input buffer line.

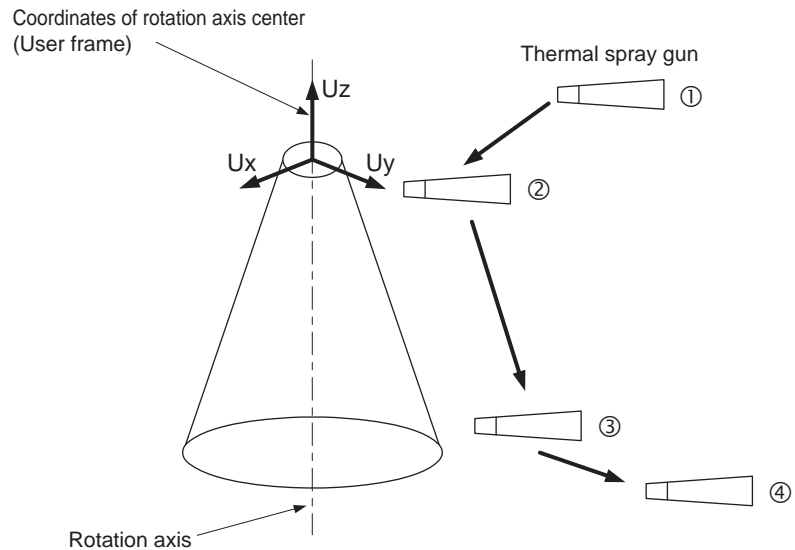


4. Press [INSERT] and [ENTER].
 - The instruction on the input buffer line is inserted in the JOB.

4 JOB Examples

4.1 JOB for Conical Workpiece

The following JOB is an example of a conical workpiece.



0000 NOP

0001 MOVJ VJ=100.00

The thermal spray gun moves to the standby point ①.

0002 MOVL V=100.0

The thermal spray gun moves to the thermal spray start point ②.

0003 SPEEDON UF#(1) V=100.0 DIS=100.0

The thermal spray speed control starts.

Operation Conditions

Coordinates of rotation axis center = UF#(1)

Reference velocity = 100.0 mm/sec

Reference distance = 100.0 mm

0004 MOVL

The thermal spray gun moves to the thermal spraying operation point ③.

0005 SPEEDOF

The thermal spray speed control ends.

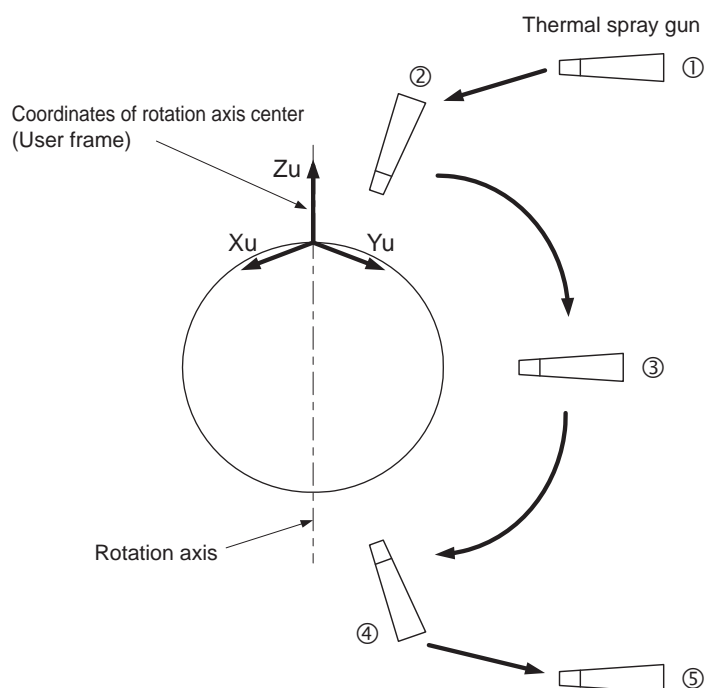
0006 MOVJ VJ=100.0

The thermal spray gun moves to the standby point ④.

0007 END

4.2 JOB for Spherical Workpiece

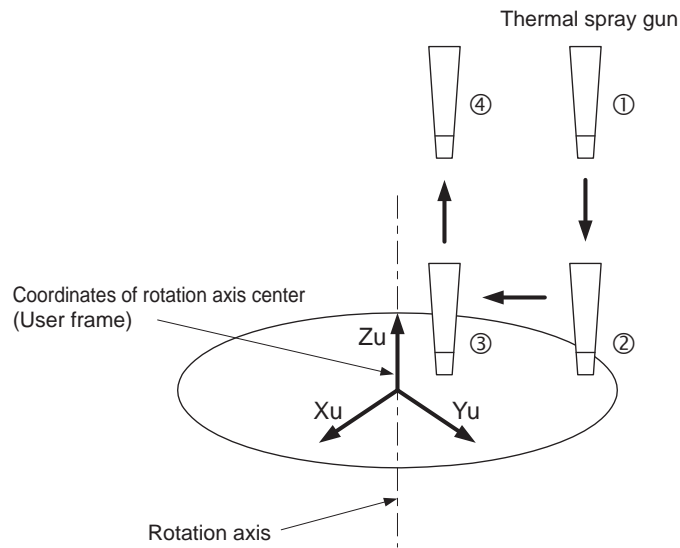
The following JOB is an example of a spherical workpiece.



0000	NOP	
0001	MOVJ VJ=100.00	The thermal spray gun moves to the standby point ① .
0002	MOVC V=100.0	The thermal spray gun moves to the thermal spray start point ② .
0003	SPEEDON UF#(1) V=100.0 DIS=100.0	The thermal spray speed control starts. Operation Conditions Coordinates of rotation axis center = UF#(1) Reference velocity = 100.0 mm/sec Reference distance = 100.0 mm
0004	MOVC	The thermal spray gun moves to the thermal spraying operation point ③ .
0005	MOVC	The thermal spray gun moves to the thermal spraying operation point ④ .
0006	SPEEDOF	The thermal spray speed control ends.
0007	MOVJ VJ=100.0	The thermal spray gun moves to the standby point ⑤ .
0008	END	

4.3 JOB for Discoid Workpiece

The following JOB is an example of a discoid workpiece.



0000 NOP

0001 MOVJ VJ=100.00

The thermal spray gun moves to the standby point ①.

0002 MOVL V=100.0

The thermal spray gun moves to the thermal spray start point ②.

0003 SPEEDON UF#(1) V=100.0 DIS=100.0

The thermal spray speed control starts.

Operation Conditions

Coordinates of rotation axis center = UF#(1)

Reference velocity = 100.0 mm/sec

Reference distance = 100.0 mm

0004 MOVL

The thermal spray gun moves to the thermal spraying operation point ③.

0005 SPEEDOFF

The thermal spray speed control ends.

0006 MOVJ VJ=100.0

The thermal spray gun moves to the standby point ④.

0007 END

5 Instruction List

The instructions for the thermal spray speed control function are listed as follows.

- Numeric or alphabetical data is indicated in the parenthesis "<>".
- If there is more than one item in a format column, select one of the items.

Table 5-1: Instructions for Thermal Spray Speed Control Function

SPEEDON	Function	Starts the thermal spray speed control function.	
	Additional Items	UF#(<User Frame Number>)	1 to 63
		V=<Reference Velocity in mm/sec>	0.1 to 1500.0
		DIS=<Reference Distance in mm>	0.0 to 6553.5
Example	SPEEDON UF#(1) V=100.0 DIS=100.0		
SPEEDOF	Function	Ends the thermal spray speed control function.	
	Additional Items	None	
	Example	SPEEDOF	

DX200 OPTIONS INSTRUCTIONS

FOR THERMAL SPRAY SPEED CONTROL FUNCTION

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