

DX200 OPTIONS INSTRUCTIONS

FOR TCP 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 manuals above correspond to specific usage.
Be sure to use the appropriate manual.

Part Number: 165276-1CD
Revision: 0



MANDATORY

- This manual explains the TCP 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 Instruction 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 when the emergency stop buttons on the front door of the DX200 and programming pendant are pressed. 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.

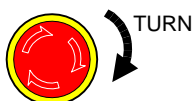
Figure 1: Emergency Stop Button



- 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 persons are present in the P-point maximum envelope of the manipulator and that you are in a safe location before:
 - Turning ON the DX200 power
 - 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 are problems. The emergency stop buttons are located on the right of the 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

TCP Function

Descriptions of the programming pendant keys, 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.

Registered Trademark

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

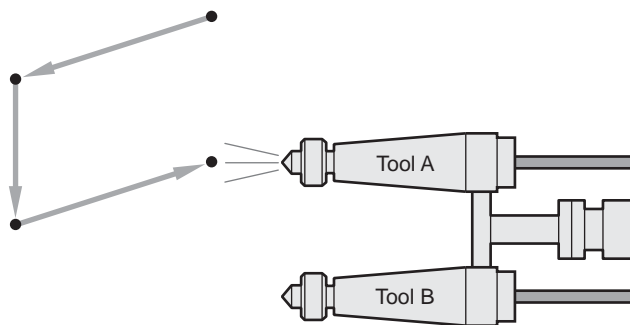
1	TCP Function	1-1
1.1	Job Preparation	1-2
2	Registration of Instructions	2-1
2.1	TCPON Instruction.....	2-1
2.2	TCPOF Instruction.....	2-4
3	Examples of the TCP Function	3-1
3.1	System with Two Manipulators.....	3-1
3.1.1	Independent Operation (MOVx + MOVx)	3-1
3.1.1.1	Job	3-2
3.1.2	Coordinated Operation (SMOVx + MOVx)	3-3
3.1.2.1	Job	3-4
4	Instruction List.....	4-1

1 TCP Function

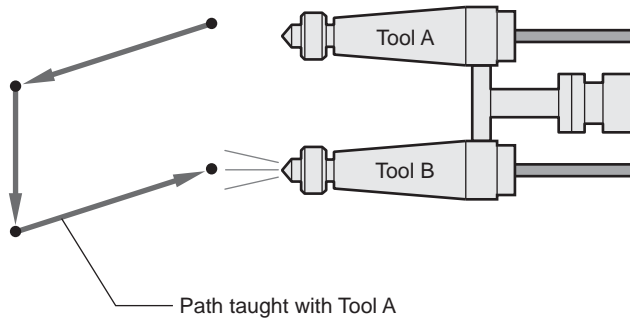
The TCP (Tool Center Point) function is to use a tool on the path taught with another tool. Several tools can be used for the same path with this function.

For example, the following figure shows a painting system with two tools. One tool is used for undercoat paint operation; the other is used for the top coat paint operation. To put the top coat after the undercoat, teach a path to either one of the two tools, then the teaching for the other tool is not necessary.

1. After teaching with Tool A, put the undercoat using Tool A.



2. With the TCP function, put the top coat using Tool B.

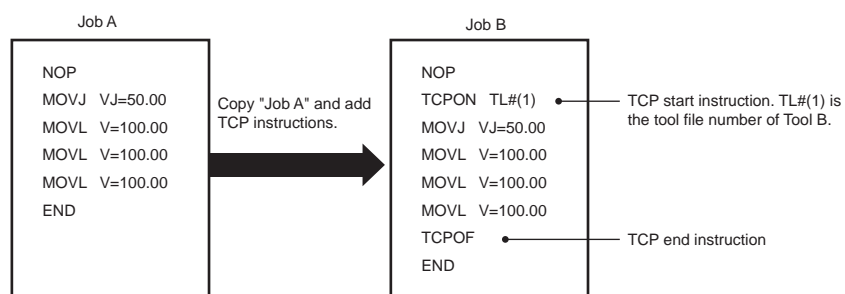


1.1 Job Preparation

The job copied from the job taught with Tool A, defined as "Job A", can be defined as "Job B".

Add the TCP instructions before and after the sections where Tool B is to be used in Job B.

Set a tool file number for Tool B in the TCPON instruction.



2 Registration of Instructions

2.1 TCPON Instruction

TCPON is an instruction to start the TCP function in which the tool with the specified tool number starts operating the taught path.



If a manipulator designation (RB1 to 8) is omitted in the coordinated system, the TCP function of a manipulator on the slave side will be executed.

1. Move the cursor to address area.
2. Move the cursor to the line where the TCPON instruction is to be registered.
3. Press [INFORM LIST].
 - The instruction list dialog appears.
 - The cursor moves to the instruction list dialog while the cursor in the address area changes to an underbar.



2 Registration of Instructions

2.1 TCPON Instruction

4. Select {TCPON}.

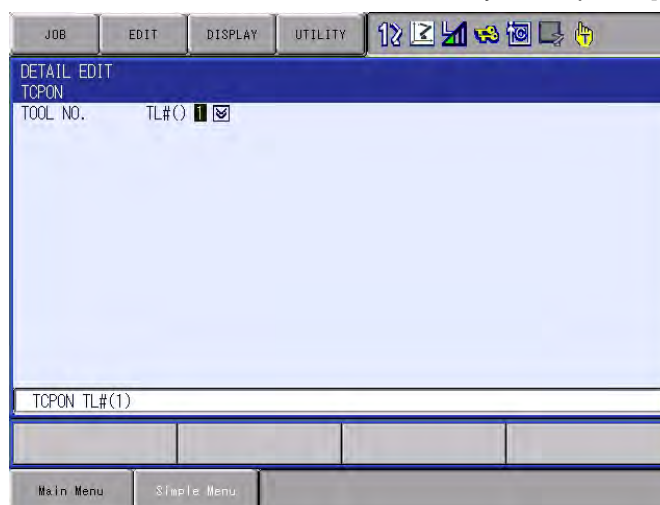
- The TCPON instruction appears with the previously registered additional items in the input buffer line.



5. Press [SELECT] again.

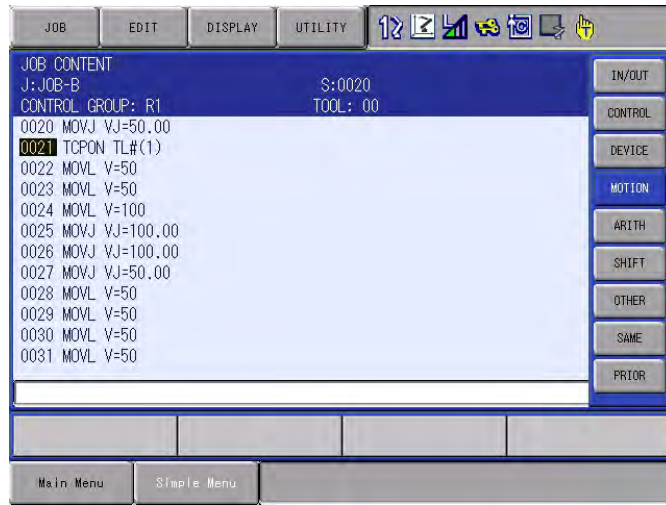
6. Enter a tool file number in the detail edit display.

- (1) Specify a tool file number from 0 to 63.
- (2) Move the cursor over to the file number, and press [SELECT].
- (3) Enter the tool file number with number keys, and press [ENTER].



7. Press [ENTER]

- (1) The input buffer line shows the data set for the operation.
- (2) Press [ENTER] again to register the data.



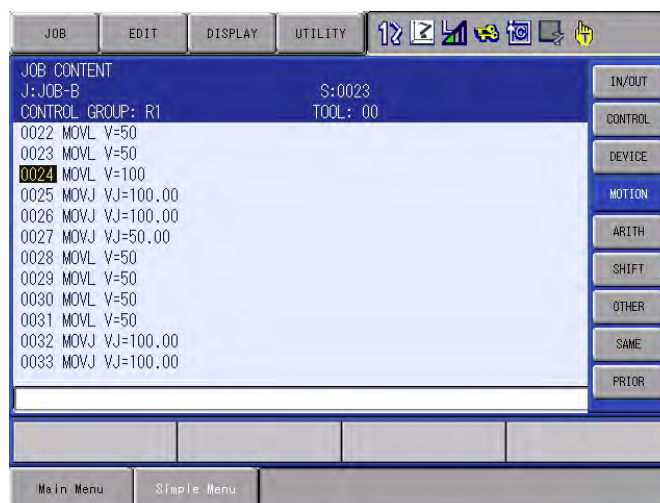
2.2 TCPOF Instruction

TCPOF is an instruction to end the TCP function and change the operation tool back to a taught tool.

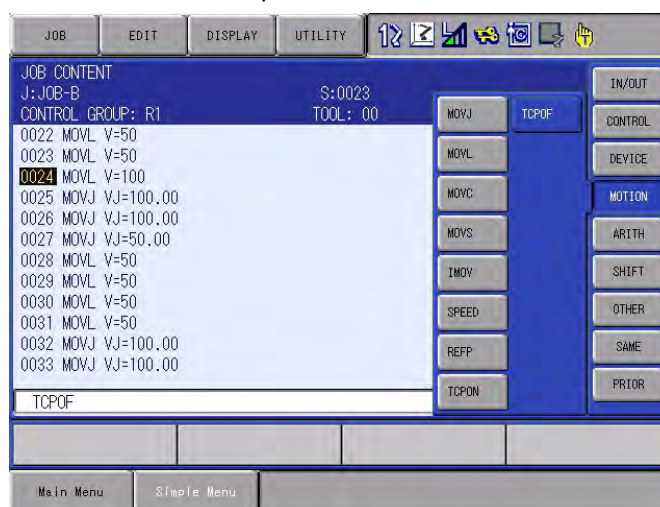


If a manipulator designation (RB1 to 8) is omitted in the coordinated system, the TCP function of a manipulator on the slave side will be terminated.

1. Move the cursor to address area.
2. Move the cursor to the line where the TCPOF instruction is to be registered.
3. Press [INFORM LIST].
 - The instruction list dialog appears.
 - The cursor moves to the instruction list dialog while the cursor in the address area changes to an underbar.

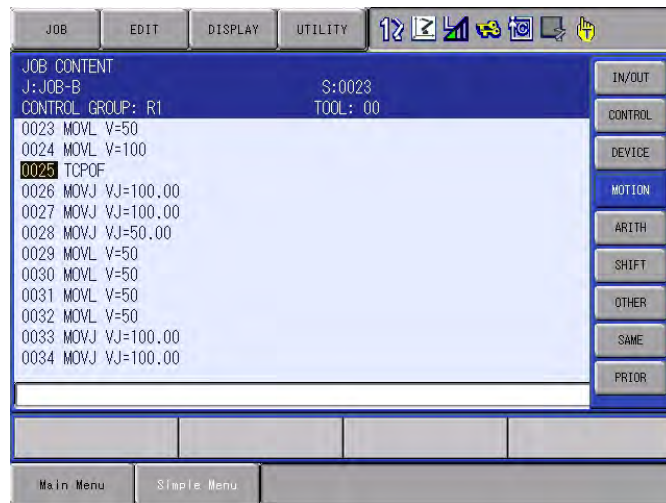


4. Select {TCPOF}.
 - The TCPOF instruction appears with the previously registered additional items in the input buffer line.



5. Press [ENTER].

- The contents displayed in the input buffer line are registered.



3 Examples of the TCP Function

3.1 System with Two Manipulators

3.1.1 Independent Operation (MOVx + MOVx)

1. Prepare two jobs taught with Tool 0 and Tool 1 as shown in *Fig. 3-1*.
2. Operate the tools with the TCP instruction, respectively changing the Tool 0 and Tool 1 to Tool 2 and Tool 3.
The tool 2 and tool 3 move exactly the same as the tool 0 and tool 1, as shown in *Fig. 3-2*.

Fig. 3-1: Figure A

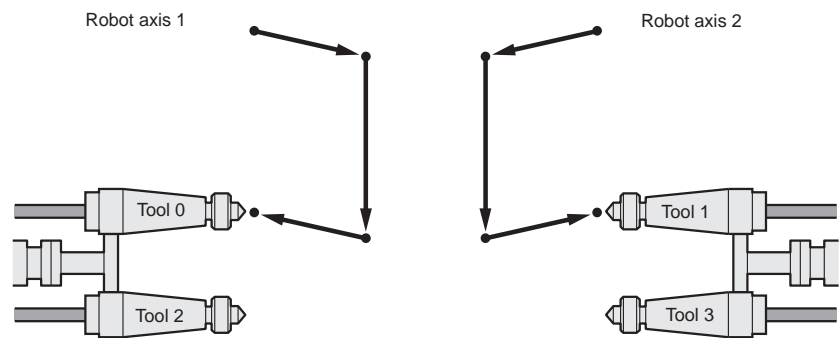
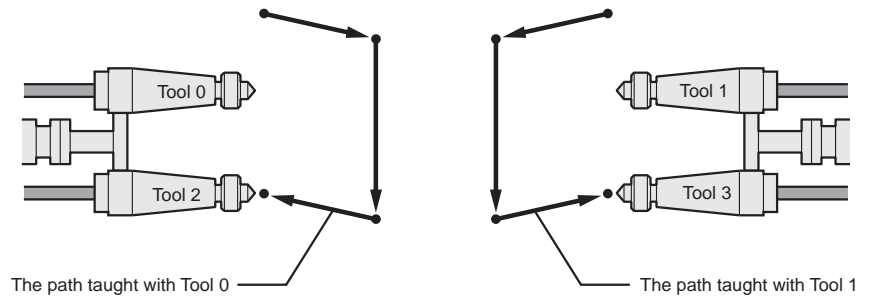


Fig. 3-2: Figure B



3.1.1.1 Job

- The following is the job taught with the Tool 0 and Tool 1.

```
0000 NOP
0001 MOVL
      +MOVL
0002 MOVL
      +MOVL
0003 MOVL
      +MOVL
0004 MOVL
      +MOVL
0005 END
```

- The following is the job with the TCP instruction for the Tool 2 and Tool 3.

```
0000 NOP
0001 TCPON RB1 TL#(2)
0002 TCPON RB2 TL#(3)
0003 MOVL
      +MOVL
0004 MOVL
      +MOVL
0005 MOVL
      +MOVL
0006 MOVL
      +MOVL
0007 TCPOF RB1
0008 TCPOF RB2
0009 END
```


3.1.2 Coordinated Operation (SMOVx + MOVx)

1. Prepare a job taught with Tool 1 on the master side as shown in *Fig. 3-3*.
2. Operate the tools on the master side with the TCP instruction, changing the Tool 1 to Tool 2.
The tool 2 moves exactly the same as the tool 1, as shown in *Fig. 3-4*.
 - Note that there is no change in robot axis 1 on the slave side.
 - The position of the Tool 2 on the master side is changed to the position taught with the Tool 1.

Fig. 3-3: Figure A

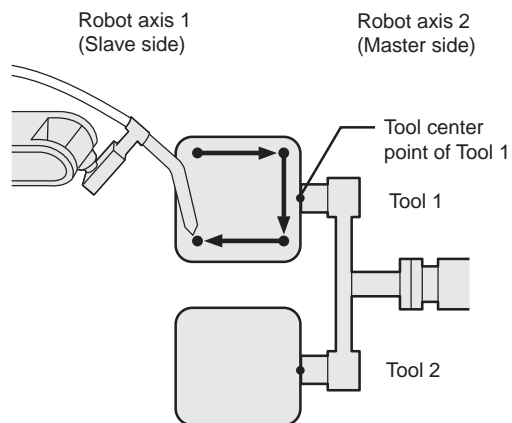
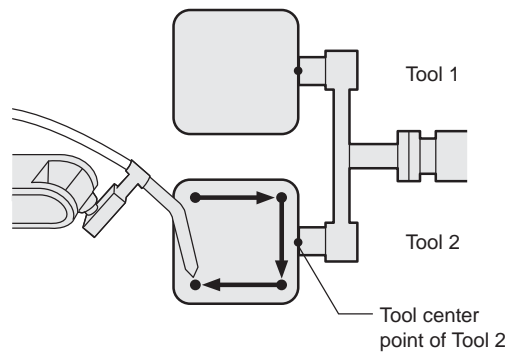


Fig. 3-4: Figure B



3.1.2.1 Job

- The following is the job taught with the Tool 1.

```
0000 NOP
0001 SMOVL
      +MOVL
0002 SMOVL
      +MOVL
0003 SMOVL
      +MOVL
0004 SMOVL
      +MOVL
0005 END
```

- The following is the job with the TCP instruction for the Tool 2.

```
0000 NOP
0001 TCPON RB2 TL#(2)
0002 SMOVL
      +MOVL
0003 SMOVL
      +MOVL
0004 SMOVL
      +MOVL
0005 SMOVL
      +MOVL
0006 TCPOF RB2
0007 END
```

4 Instruction List

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.

TCPON	Function	Starts the TCP function.	
	Format	TL# (<Tool File Number>)	
		RB1 to 8	The slave side starts the TCP function if designation is omitted.
	Example	TCPON RB1 TL#(1)	
TCPOF	Function	Ends the TCP function.	
	Format	RB1 to 8	The slave side terminates the TCP function in case of omitting designation.
	Example	TCPOF TCPOF RB1	

DX200 OPTIONS INSTRUCTIONS

FOR TCP FUNTION

HEAD OFFICE

2-1 Kurosakishiroishi, Yahatanishi-ku, Kitakyushu 806-0004, Japan
Phone +81-93-645-7745 Fax +81-93-645-7746

YASKAWA America Inc. M Robotics Division
100 Automation Way, Miamisburg, OH 45342, U.S.A.
Phone +1-937-847-6200 Fax +1-937-847-6277

YASKAWA Nordic AB
Box 504 Verkstadsgatan 2, PO Box 504 SE-385 25 Torsås, Sweden
Phone +46-480-417-800 Fax +46-486-414-10

YASKAWA Europe GmbH Robotics Div.
Yaskawastrasse 1, 85391 Allershausen, Germany
Phone +49-8166-90-0 Fax +49-8166-90-103

YASKAWA Electric Korea Co., Ltd
9F, KYOBO Securities Bldg., 26-4, Yeoido-Dong Yeounggeungpo-ku, Seoul, Korea
Phone +82-2-784-7844 Fax +82-2-784-8495

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.
252/246, 4th Floor. Muang Thai-Phatra Office Tower II Rachadaphisek Road,
Huaykwang Bangkok, 10320, Thailand
Phone +66-2-693-2200 Fax +66-2-693-4200

YASKAWA Shougang Robot Co. Ltd.
1015, Boxuenan Rd. Maluzhen, Jiading District, Shanghai, China
Phone +86-21-5950-3521 Fax +86-20-3878-0651

YASKAWA ELECTRIC CHINA Co., Ltd.
12F Carlton Building, No. 21-42 Huanghe Road, Shanghai 200003, China
Phone +86-21-5385-2200 Fax +86-21-5385-3299

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

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