YASKAWA

YRC1000 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
YRC1000 INSTRUCTIONS
YRC1000 OPERATOR'S MANUAL (GENERAL) (SUBJECT SPECIFIC)
YRC1000 MAINTENANCE MANUAL
YRC1000 ALARM CODES (MAJOR ALARMS) (MINOR ALARMS)

The YRC1000 operator's manual above corresponds to specific usage. Be sure to use the appropriate manual.
The YRC1000 operator's manual above consists of "GENERAL" and "SUBJECT SPECIFIC".
The YRC1000 alarm codes above consists of "MAJOR ALARMS" and "MINOR ALARMS".

Please have the following information available when contacting Yaskawa Customer Support:
- System
- Primary Application
- Software Version *(Located on Programming Pendant by selecting: {Main Menu} - {System Info} - {Version})*
  Robot Serial Number *(Located on robot data plate)*
  Robot Sales Order Number *(Located on controller data plate)*

Part Number: 178668-1CD
Revision: 0

MANUAL NO.
HW1483374

DANGER

- This manual explains the TCP function of the YRC1000 system. Read this manual carefully and be sure to understand its contents before handling the YRC1000. Any matter not described in this manual must be regarded as "prohibited" or "improper".
- General information related to safety are described in "Chapter 1. Safety" of the YRC1000 INSTRUCTIONS. To ensure correct and safe operation, carefully read "Chapter 1. Safety" of the YRC1000 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.

NOTES FOR SAFE OPERATION

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

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".

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 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 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 YRC1000 and on the right of the programming pendant.

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

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.
- Always return the programming pendant to the hook on the YRC1000 cabinet 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

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
YRC1000 controller	YRC1000
YRC1000 programming pendant	Programming pendant
Cable between the manipulator and the controller	Manipulator cable

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

Equipment		Manual Designation
Programming Pendant	Character Keys /Symbol Keys	The keys which have characters or its symbol printed on them are denoted with [ ]. ex. [ENTER]
	Axis Keys /Numeric Keys	[Axis Key] and [Numeric Key] are generic names for the keys for axis operation and number input.
	Keys pressed simultaneously	When two keys are to be pressed simultaneously, the keys are shown with a “+” sign between them, ex. [SHIFT]+[COORD]
	Displays	The menu displayed in the programming pendant is denoted with { }. ex. {JOB}

Description of the Operation Procedure

In the explanation of the operation procedure, the expression "Select • • • " means that the cursor is moved to the object item and [SELECT] 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 ^{TM} are omitted.

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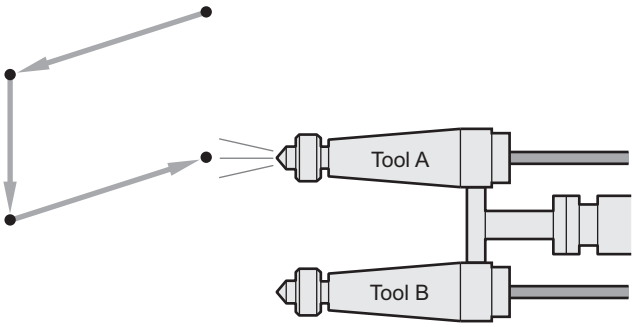
1 TCP Function

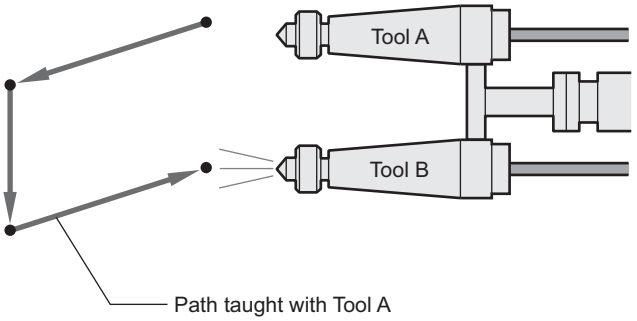
The TCP (Tool Center Point) function is to use a tool on the path taught with another tool. Several tools can be used for the same path with this function.

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.

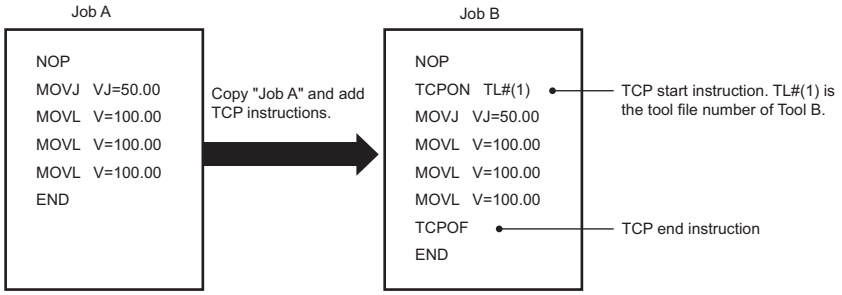


1.1 Job Preparation

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.



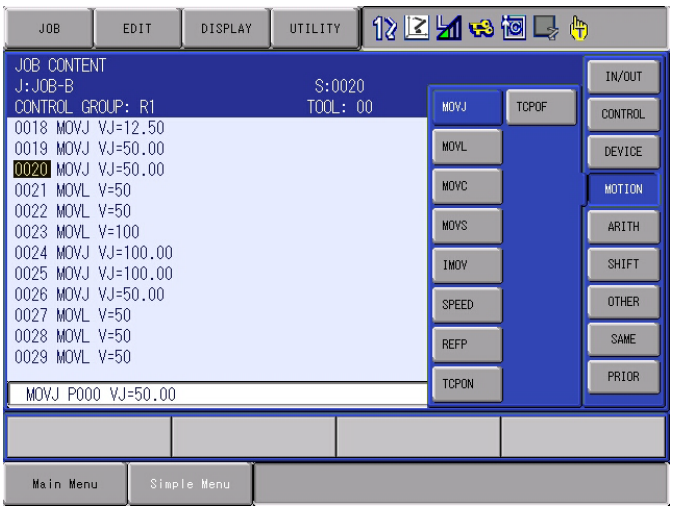
2 Registration of Instructions

2.1 TCPON Instruction

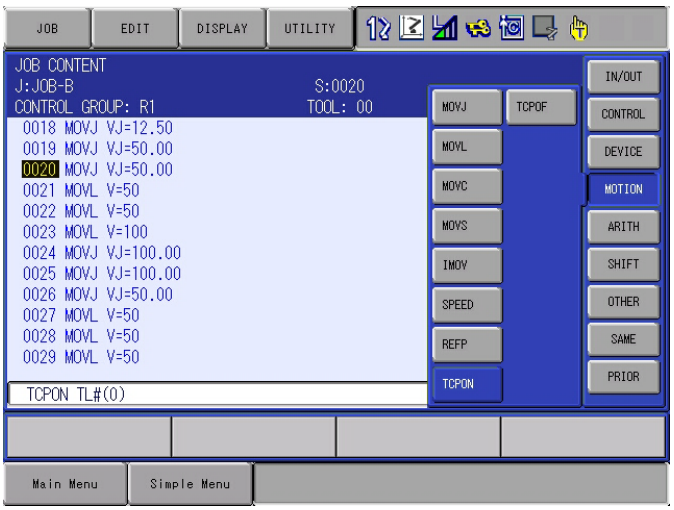
TCPON is an instruction to start the TCP function in which the tool with the specified tool number starts operating the taught path.

NOTE 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.

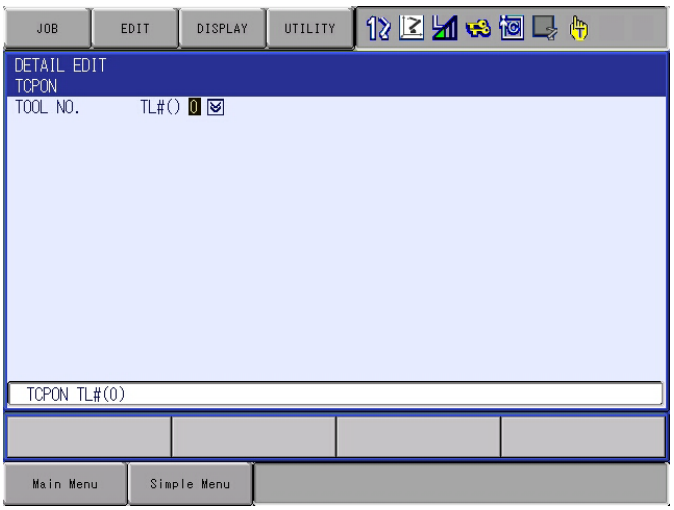
1. Move the cursor to address area.
2. Move the cursor to the line where the TCPON instruction is to be registered.
3. Press [INFORM LIST].
   – The instruction list dialog appears.
   – The cursor moves to the instruction list dialog while the cursor in the address area changes to an underbar.



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.

NOTE 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. A.
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. B.

Fig. 3-1: Figure A

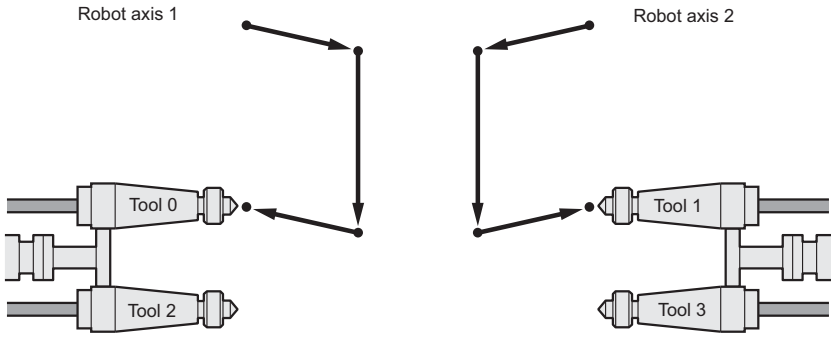
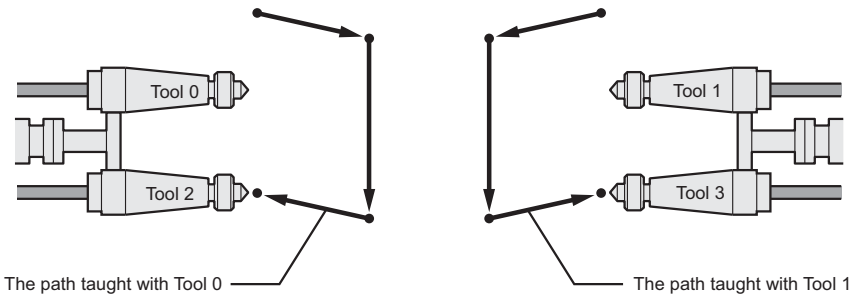


Fig. 3-2: Figure B



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. A.
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. B.
   - 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

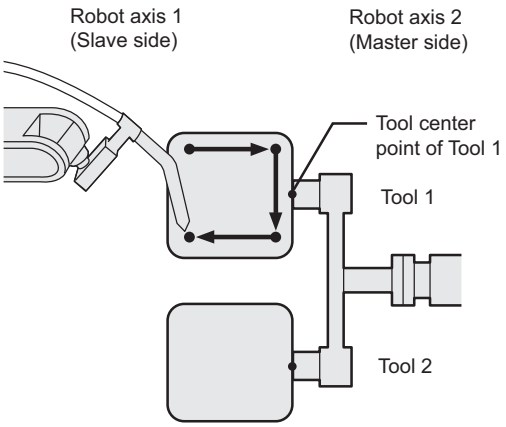
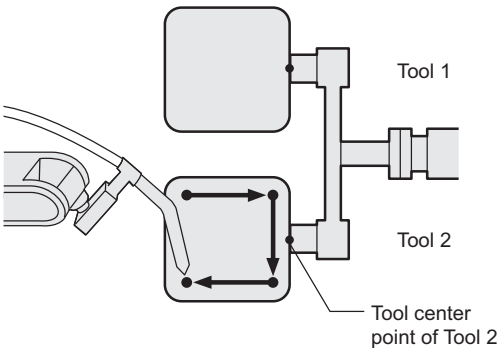


Fig. 3-4: Figure B



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>)	0 to 63
		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	

YRC1000 OPTIONS
INSTRUCTIONS

FOR TCP FUNTION

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