

DX200 INSTRUCTIONS

FOR PMT 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: 165260-1CD
Revision: 0



MANDATORY

- This manual explains the PMT function (Position Modification Function for Tool Deformation) 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.

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.

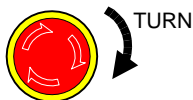
Figure 1: Emergency Stop Button



- 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 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

PMT Function

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.

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.

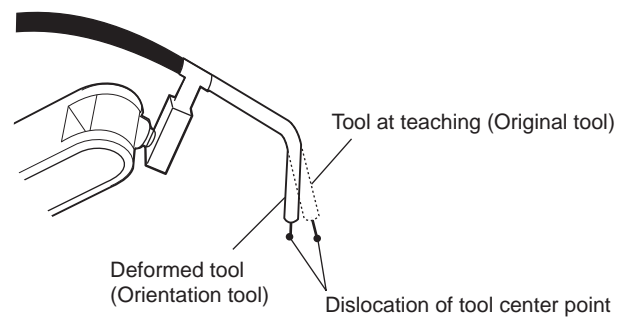
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1 PMT Function

The PMT function corrects the position data when the tool is deformed during operation (PMT: Position Modification for Tool Deformation). When a tool inadvertently collides with peripheral jigs or walls during operation and is deformed, the tool center point will be dislocated and the taught position of the job programmed would be shifted; it requires a great deal of time and effort for correction. In such a case, the PMT function can be used to correct the position data easily and accurately.

By specifying the desired job, the position data of the taught tool dimensions before deformation are converted automatically to the position data of the tool dimensions after deformation.

In the PMT function, the tool before deformation is called “the original tool” and the tool after deformation is called “the orientation tool”.



```

0016 MOVJ
0017 WAIT IN#(1)=0
0018 MOVL V=70

```

Position data of the step taught by the original tool is converted.

NOTE

- For a job in which teaching is performed by using several types of tools, only the position data obtained by the specified original tool is converted.
- The position variables are not converted in the PMT function.

2 Data Conversion by PMT Function

2.1 Outline



When the PMT function is used, the tool dimensions and the job taught position data are rewritten. In order to secure the data, prepare the backup files beforehand.

The data can be converted by the PMT function using instructions or the programming pendant.

2.1.1 PMT data conversion by instruction

The following window is a job example (PMT0) to convert the data by instructions.

Carry out Job PMT0 to convert the data using the PMT function.

The screenshot shows a CNC control window with the following program content:

```

JOB CONTENT
J: PMT0                      S: 0000
CONTROL GROUP: R1           TOOL: **
0000 NOP
0001 'tool data backup
0002 GETTOOL PMTDATA TL#(0)
0003 'calculate tool data
0004 CALL JOB: TOOL0
0005 SETTOOL TL#(0) P000
0006 PMT TL#(0) JOB: WORK1 JOB: WORK0
0007 PMT TL#(0) JOB: WORK11 JOB: WORK10
0008 END
MOVJ VJ=0.78
  
```

Callouts from the right side of the image explain the instructions:

- 0001: Saves the tool constants used before deformation as the original tool data.
- 0002: Calls the job to obtain the amount of tool deformation.
- 0005: Sets the tool constants after deformation.
- 0006: Job : Converts WORK1 using the PMT function.
- 0007: Job : Converts WORK11 using the PMT function.

Refer to *Section 2.2 "PMT Data Conversion by Instruction"* for the programming of each instruction, GETTOOL, SETTOOL, and PMT. Before converting the data, prepare a job, like TOOL0 in the preceding example, to obtain the amount of tool deformation by using a touch sensor or other device.



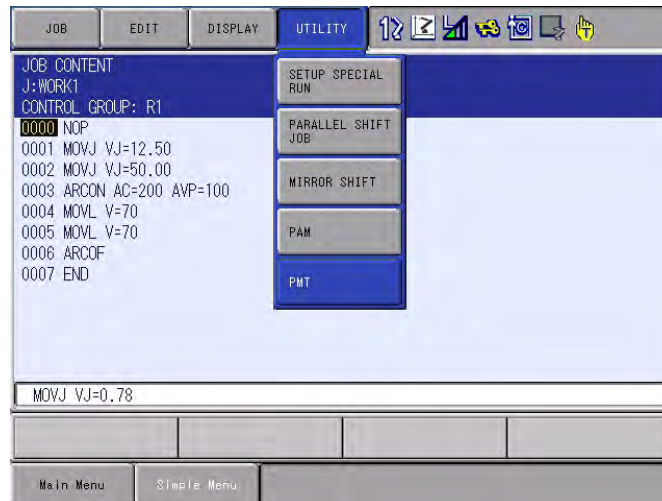
- Before converting the data by a PMT instruction, be sure to save the data of the original tool by using a GETTOOL instruction.
- For a system with the independent control function enabled, do not use PSTART, an independent control instruction, to start a job that includes a PMT instruction.

2.1.2 PMT data conversion by programming pendant

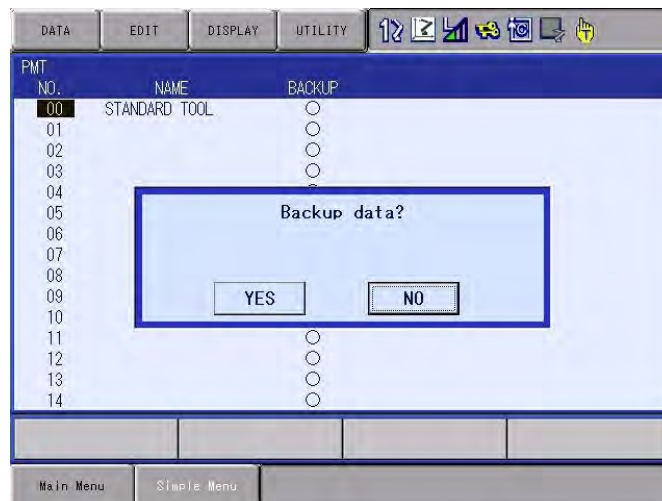
The following outline describes how to convert the data by using the programming pendant.

Refer to Section 2.3 "PMT Data Conversion by Programming Pendant" for more information.

1. Select {PMT} under {UTILITY} in JOB CONTENT window.



2. Save the tool constants used before the tool deformation as the original tool data.



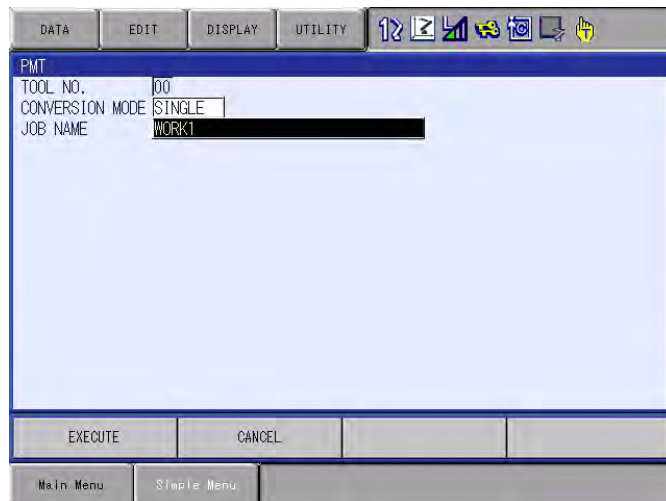
2 Data Conversion by PMT Function

2.1 Outline

- Set the new tool constants to be used after the tool's deformation.



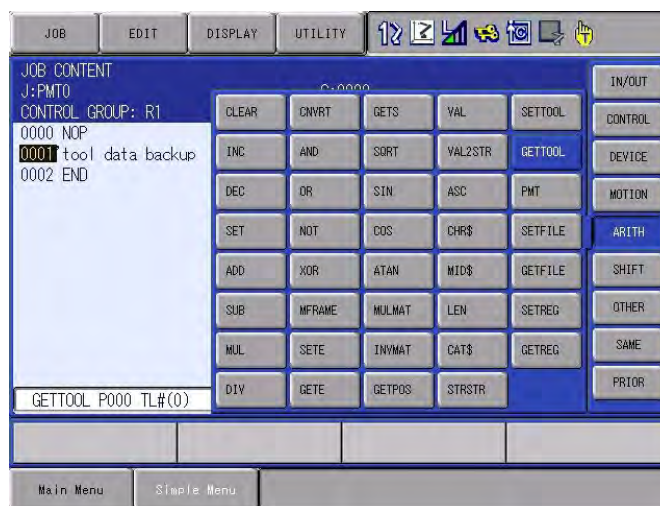
- Convert the data of WORK1 using the PMT function.



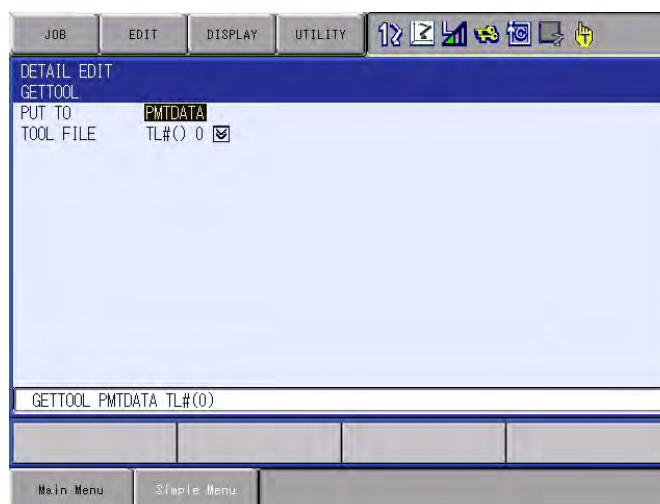
2.2 PMT Data Conversion by Instruction

2.2.1 Registering GETTOOL Instruction

1. Press [INFORM LIST]
2. Select the instruction group “ARITH”
3. Select “GETTOOL”
 - The instruction appears, with the same additional items that were previously set, in the input buffer line.



4. Select any additional items in the DETAIL EDIT window
 - (1) Press [SELECT] two times, and the DETAIL EDIT window of the GETTOOL instruction appears.
 - (2) Move the cursor to “PUT TO” and press [SELECT]. The selection dialog box appears.
 - (3) Select “PMT DATA,” and the following window appears.



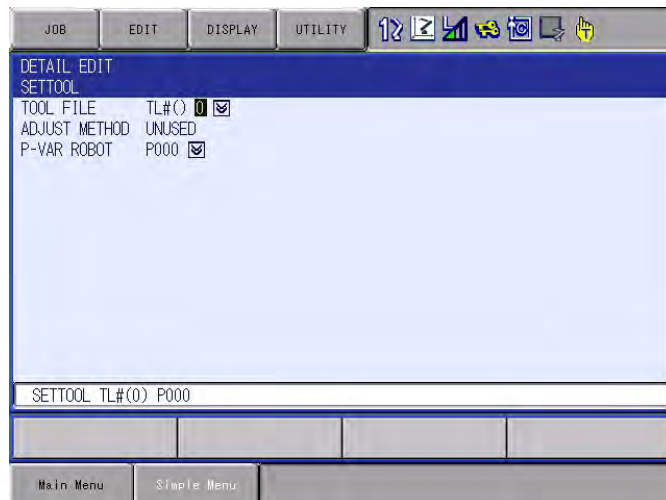
5. Press [ENTER]
 - The GETTOOL instruction with the additional items is added to the program for the job.
 - To cancel these settings, press [CANCEL], and the JOB CONTENT window reappears.

2.2.2 Registering SETTOOL Instruction

1. Press [INFORM LIST]
2. Select the instruction group "ARITH"
3. Select "SETTOOL"
 - The instruction appears, with the same additional items that were previously set, in the input buffer line.



4. Select any additional items in the DETAIL EDIT window
 - (1) Press [SELECT] two times, and the DETAIL EDIT window of the SETTOOL instruction appears.
 - (2) Set the TOOL FILE and the P-VAR ROBOT.



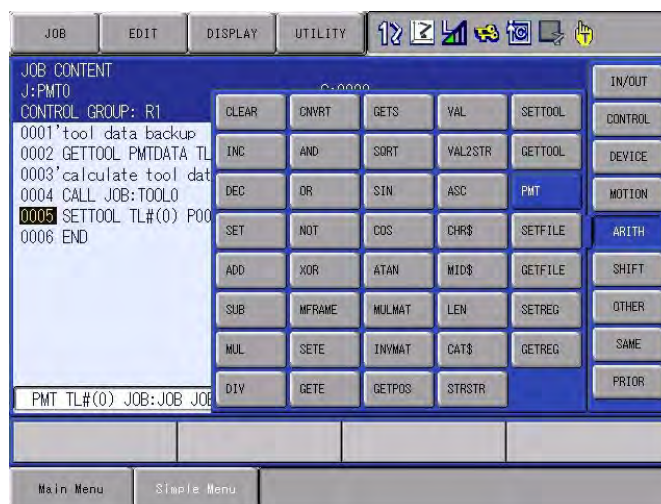
5. Press [ENTER]
 - The SETTOOL instruction is registered with the additional items.
 - To cancel these settings, press [CANCEL], and the JOB CONTENT window reappears.

2.2.3 Registering PMT Instruction

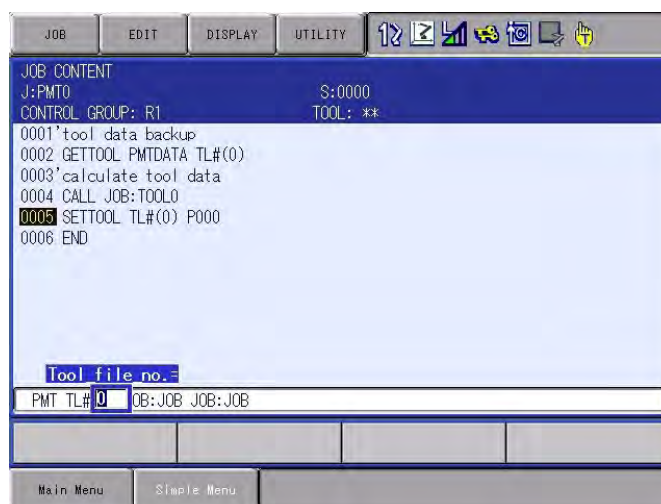


Add PMT instructions for the number of jobs to be converted.

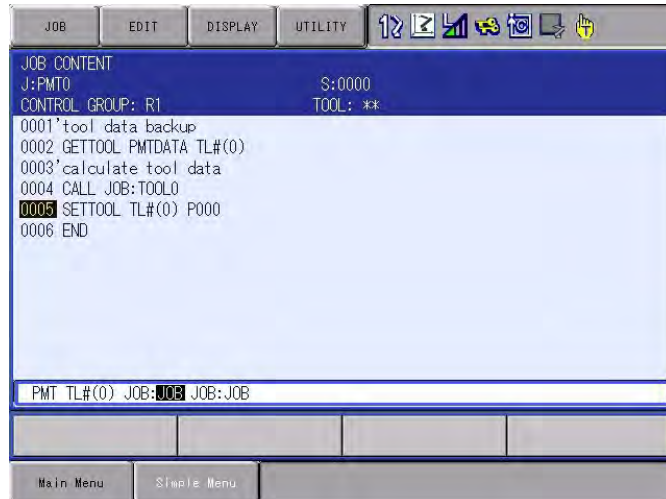
1. Press [INFORM LIST]
2. Select the instruction group "ARITH"
3. Select "PMT" instruction
 - The instruction appears, with the same additional items that were previously set, in the input buffer line.



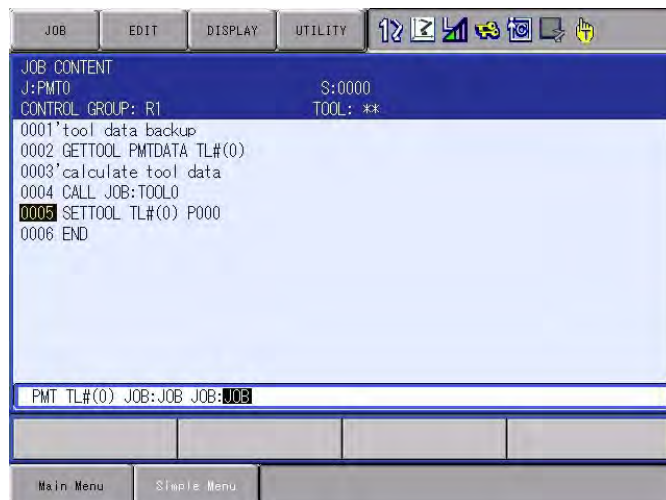
4. Select any additional items
 - (1) Move the cursor to the tool file number and push [Select]. Then, it becomes possible to input the number by "Numeric Value."



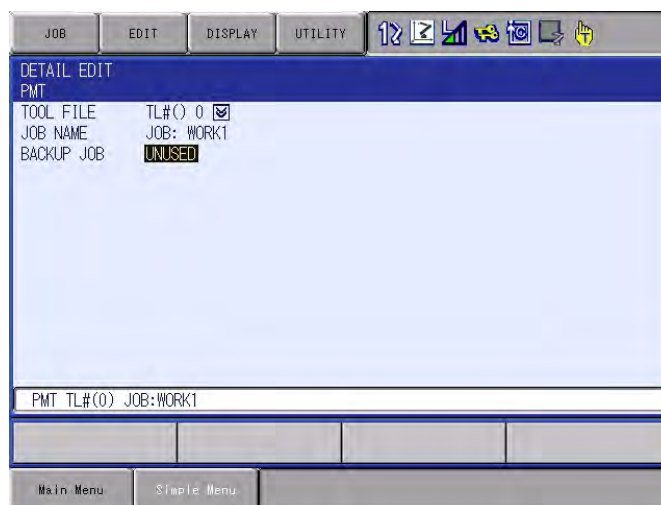
- (2) Move the cursor to the name of the job of which data is to be converted, and press [SELECT]. A list of jobs appears.
- (3) Select the job subject to conversion for PMT function.
 - Push "Page." Then, the screen changes to a text input screen. It is also possible to input a job name in the text input screen.



- (4) Move the cursor to the name of the job to save the data, and press [SELECT]. A list of jobs appears.
 - Push "Page." Then, the screen changes to a text input screen. It is also possible to input a job name in the text input screen.



- (5) When the name of the job to save the data does not have to be specified, move the cursor to “PMT,” and press [SELECT]. The DETAIL EDIT window appears.
- For the “BACKUP JOB,” select “UNUSED”.



5. Press [ENTER]

- The PMT instruction with the additional items is added to the program.



2.3 PMT Data Conversion by Programming Pendant

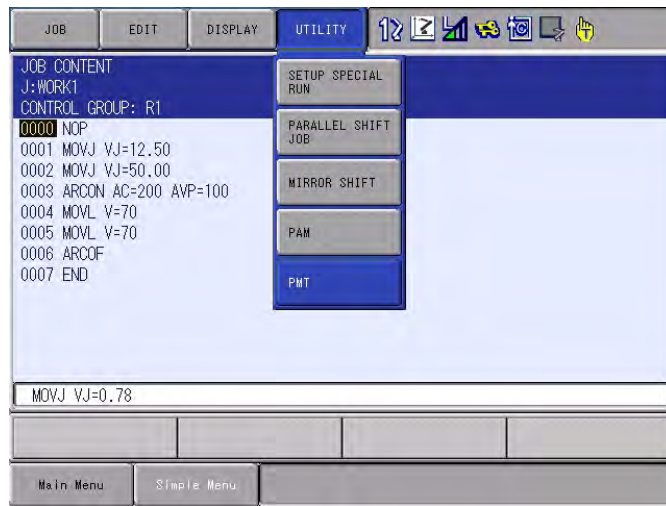
NOTE

When the PMT function is used, the tool dimensions and the job taught position data are rewritten.

In order to secure the data, prepare the backup files beforehand.

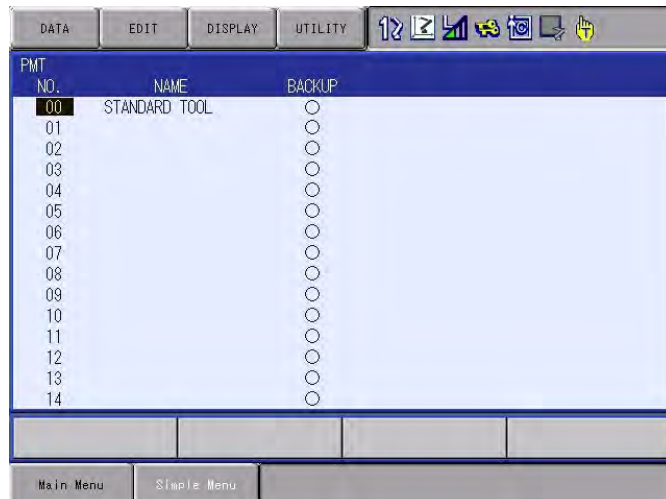
1. Select {UTILITY} from the main menu in the job contents window in teach mode

– The JOB CONTENT window appears.



2. Select {PMT}

– The PMT window appears.



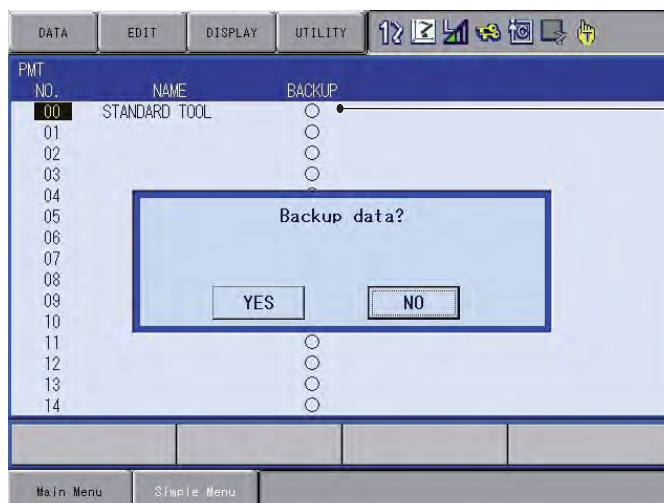
2 Data Conversion by PMT Function

2.3 PMT Data Conversion by Programming Pendant

3. Select No. of the tool for conversion

– The confirmation dialog to save the tool dimensions before deformation appears.

- (1) Select "NO" if the tool dimensions after deformation are already registered.
Select "YES" if the tool dimensions after deformation are not registered yet.



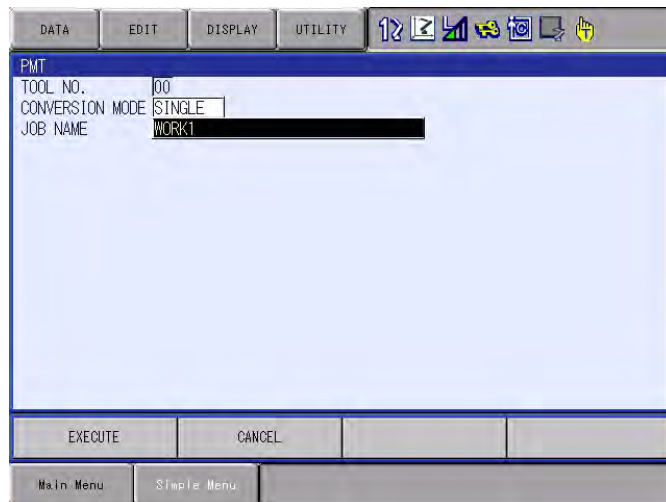
4. Register and confirm tool dimensions

- (1) Set the tool dimensions by inputting with the Numeric Keys or by selecting {TOOL CALIBRATION} of {UTILITY}.
 - For details of methods to set tool dimensions, refer to "8.3 Tool Data Setting" of the DX200 Instruction manual.
- (2) Confirm the tool dimensions before and after the PMT conversion (ORIGINAL TOOL and ORIENTATION TOOL), then select "EXECUTE".



5. Select "CONVERSION MODE".

- The following three methods are available for selecting a job.



- Method 1: SINGLE
When only the specified job is to be converted, select "SINGLE" from "CONVERSION MODE".
- Method 2: RELATED
When the jobs related to the specified job are to be converted together, select "RELATED" from "CONVERSION MODE".
- Method 3: ALL
When all the jobs registered in DX200 are to be converted, select "ALL" from "CONVERSION MODE".

6. Select the job for conversion

- Select "JOB NAME" to display the Job List, then select the job to be converted.

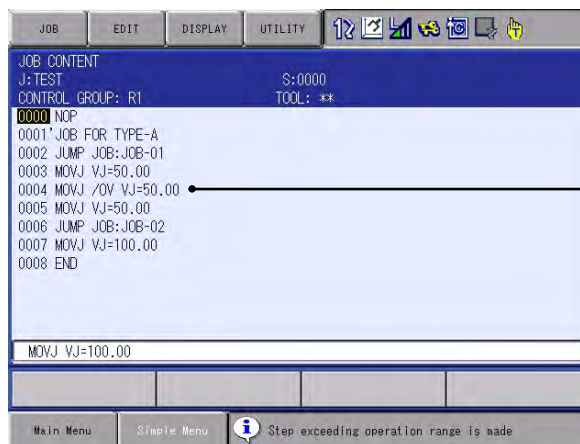
7. Select "EXECUTE"

- Job conversion is performed based on the settings of conversion mode.
- The window returns to the JOB CONTENT window when the conversion is completed.

NOTE

For a job after conversion, be sure to confirm the path after conversion by performing FWD/BWD operations.

If the steps beyond the manipulator's range of motion are created, "/OV" will be indicated in the corresponding step as shown in the following window. The "/OV" will disappear by correcting the positions.



In the step which is out of the manipulator's range of motion, "/OV" is indicated for a move instruction.

However, if any step beyond the scope of operation is created at the time of conversion, it is also possible to indicate an error and not to allow conversion by setting Parameter S2C390. (Refer to *Chapter 5 Parameter on page 5-1*)

In this case, "Error 2790: Step exceeding operation range (J: Job name, L: Line number)" is indicated.

3 Tool Data Backup History

The modification history of the tool constants can be viewed in the TOOL BACKUP window.

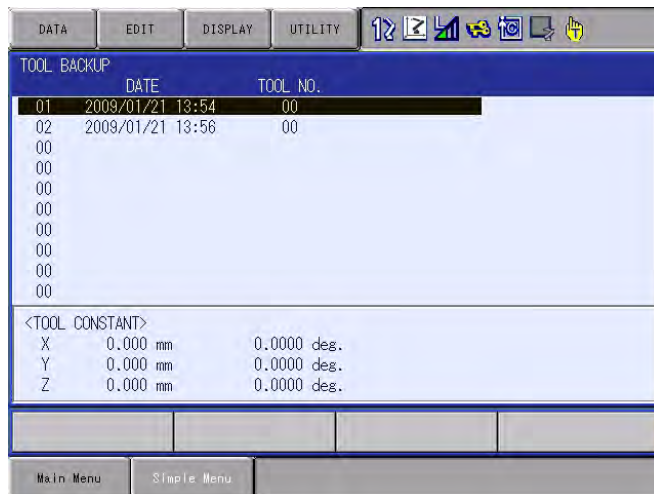
The history of the tool data backup is updated when a GETTOOL instruction with "PMTDATA" added is carried out.

When a GETTOOL instruction is carried out and the data of the original tool and the orientation tool are the same, only the execution date and time in the backup history are updated.

The backup history would be also updated when the original tool is saved in operating PMT function with the programming pendant.

3.1 Tool Backup Window

1. Select "ROBOT" under the main menu
2. Select {TOOL BACKUP}
 - The TOOL BACKUP window appears.



4 Instruction List for PMT Function

GETTOOL	Function	Gets the data from a tool file.	
	Additional items	Tool data storage directory P, PMTDATA ^{a)}	—
		Tool file TL# (<Tool file number>)	0 to 63
	Example	GETTOOL PMTDATA TL# (0) GETTOOL P000 TL# (0)	
SETTOOL	Function	Rewrites the data in the tool file.	
	Additional items	Tool file TL# (<Tool file number>)	0 to 63
		Adjustment method +, -	—
		Position variable robot P	—
	Example	SETTOOL TL# (0) P000 SETTOOL TL# (0) +P000	
PMT	Function	Converts the data.	
	Additional items	Tool file TL# (<Tool file number>)	0 to 63
		Name of the job of which data is subjected to conversion JOB:	
		Name of the job where the data is to be saved ^{b)} JOB:	
	Example	PMT TL# (0) JOB:WORK1 PMT TL# (0) JOB:WORK1 JOB:WORK0	

a. When “PMTDATA” is selected for the storage destination of the tool data, the specified data from the tool file is saved as the data of the backup tool.

b. When the name of the job specified as the job to save the data does not exist, the job used before converting the data (the job of which data is to be converted) is saved with the specified job name (JOB COPY).

When the name of the job specified as the job to save the data already exists, the specified job is rewritten by the job used before converting the data.

5 Parameter

Parameter No.	Meaning	Units	Initial Value
S3C1192	The allowable difference (values of X, Y, and Z) between the present tool constant and the tool data automatic setting in the operation of a SETTOOL instruction.	0.001mm	20000
S2C390	0 : Conventional mode (conversion by /OV) 1 : Conversion after confirmation of limit checks at once (no conversion by /OV)	–	0

6 Alarm List

Alarm Number	Alarm Name	Sub Code	Meaning	Cause	Remedy
4605	SETTOOL ERROR	1	The difference between the current tool constant and a new set value exceeded the allowable range (parameter set value).	Setting error	(1)Check the following settings. ·Correct the job so that the setting value of tag is allowable value. ·Set the allowance amount of the tool data automatic setting function maximum deviation (S3C1192) to large value.
4126	CANNOT EXECUTE AUTO PMT	1	System error	Software operation error occurred	(1)Reset the alarm, and then try again. (2)If the alarm occurs again, save the CMOS.BIN in maintenance mode, and then contact your Yaskawa representative about occurrence status (operating procedure).
		2	PBOX cannot be edited.	Setting error	(1)Check the following settings. ·I/O status of the edit prohibit signal The edit prohibit signal cannot input.
		3	The source job cannot be edited.	Setting error	(1)Check the following settings. ·The prohibit status of source job If the source job is protected from editing, it cannot be edited.
		4	The converted job cannot be edited.	Setting error	(1)Check the following settings. ·The prohibit status of converted job If the converted job is protected from editing, it cannot be edited.
		5	The memory area for job area is insufficient.	Software operation error occurred	(1)Reset the alarm. (2)If the error occurs again, delete unused jobs. (3)If the error occurs again after the previous measures were executed, initialize the job file in the maintenance mode, and then load the saved job file. In that case, delete the unused jobs. (4)If the error occurs again though the previous measures were executed, save the CMOS.BIN in maintenance mode, and then contact your Yaskawa representative about occurrence status (operating procedure).

Alarm Number	Alarm Name	Sub Code	Meaning	Cause	Remedy
		6	The source job is not exist.	Setting error	(1)Check the following settings. ·Presence of the specified source job The job which does not exist cannot be set to the source job.
		7	The memory area for position data of the job is insufficient.	Software operation error occurred	(1)Reset the alarm. (2)when the error occurs again, if there is an unnecessary teaching position, delete it. (3)If the error occurs again after the previous measures were executed, initialize the job file in the maintenance mode, and then load the saved job file. In that case, delete the unused jobs. (4)If the error occurs again though the previous measures were executed, save the CMOS.BIN in maintenance mode, and then contact your Yaskawa representative about occurrence status (operating procedure).
		8	The job under execution is specified as the conversion job.	Setting error	(1)Check the following settings. ·Execution status of the source job ·Execution status of the converted job The job under execution is specified for the source / converted job. Execute conversion operation after ending the job execution.

DX200 INSTRUCTIONS

FOR PMT FUNCTION

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