Compound Commands Reference Manual

- This reference manual does not guarantee the results of any operation conducted by a customer. Please pay sufficient attention when performing the operation.

- This reference manual describes the following robot models-SCR, STCR, SHR, STHR- as representative examples. As commands and formats vary depending on the robot model, please refer to each instruction manual together with this reference.

- For any questions, please feel free to contact us at the address below.

1. Compound Commands

About compound commands

A compound command is the combination of commands to operate the robot.

A series of robot movements can be executed with one command.

The number of compound commands

Compound commands contain 235 sets of main routines, I1 to I235, and 6 sets (standard) of subroutines, %1 to %6. Compound commands also can be executed via the PLC.

One compound command can contain up to 64 characters.

If the input characters exceed the above number, the command next to the input command cannot be used at every 64 characters. (For example: When describing the command containing 70 characters in the command I1, the next command I2 has to use the remaining 6 characters. Thus, the command I2 cannot be used.)

One subroutine can contain up to 256 characters.

Format of compound command

The format of compound command has following rules:

An example of compound commands is outlined in the Figure1.

Format rules

- One compound command can contain up to 64 characters. If the input characters exceed the above number, the command next to the input command cannot be used at every 64 characters.
- One subroutine can contain up to 256 characters and cannot be exceeded.
- Input "/" between commands.
- Input "/" at the beginning and the end of each command.
- When the next command is to be executed after completion of the robot movement (i.e. "PM"), input "//" after the command.
- Input "//" after the jump statement (i.e. "JP") or before the command of the jumping destination.

"%1":
Subroutines are useful for common movements.

"//":
With "//", the completion of the robot movement 11 is to be awaited.

//PM1//@ZB0404+/%1//!A G, FF/JZ*A1//!Q G//*A1/11//!E//

"%Z":
With "%Z", the command "B0404 + command" can be executed.
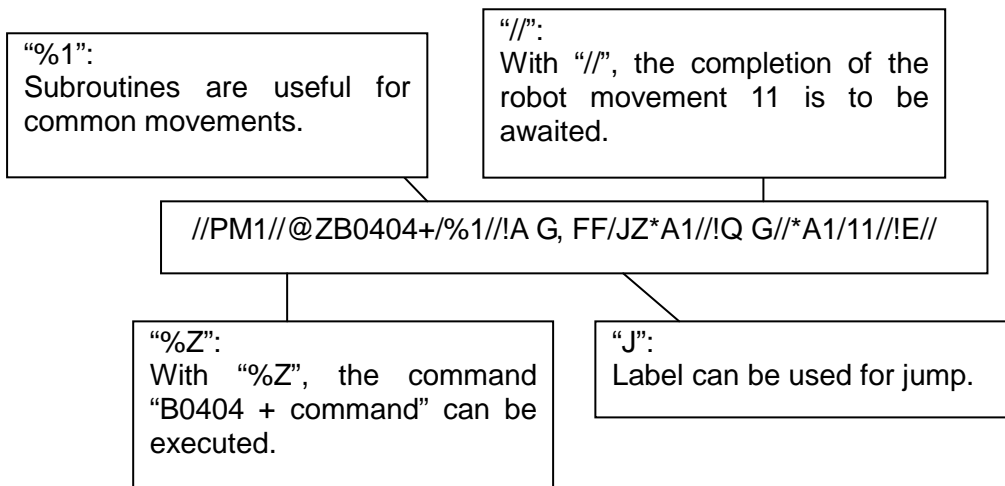
"J":
Label can be used for jump.

Figure 1: Example format of compound commands

Compound commands-to-PLC correspondence

Compound commands can be executed via the PLC. The compound commands and PLC are corresponding to each other as the figure below.

Compound commands	PLC
1	15h
2	16h
…	…
233	FDh
234	FEh

Figure 2: Compound commands-to-PLC correspondence

2. Making Compound Commands

This section illustrates the procedure for making compound commands by using a virtual system (Figure 3).

Designated setting point

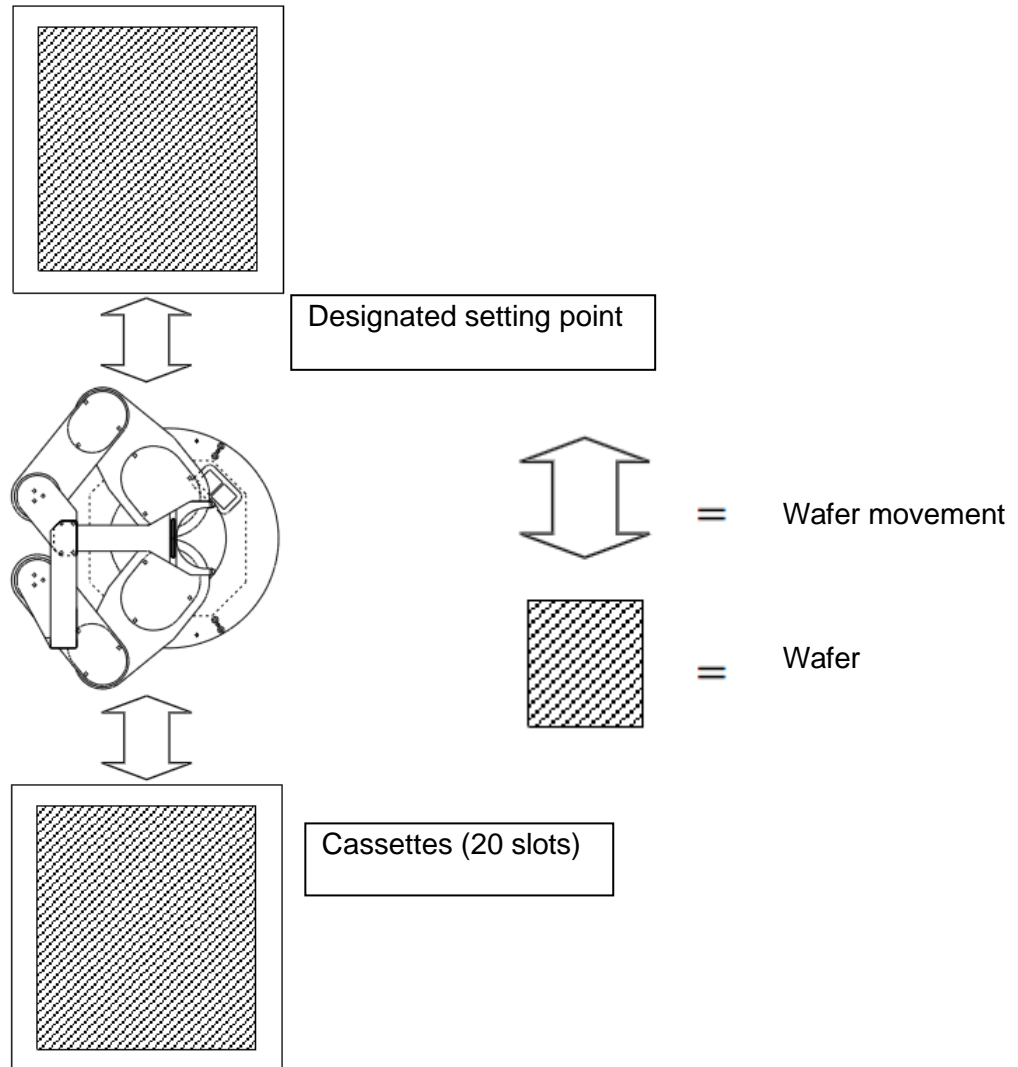= Wafer movement

= Wafer

Cassettes (20 slots)

Figure 3: Outline of virtual system

Making procedure
- Allocation of teaching points
- Allocation of compound commands
- Draws flow chart
- Makes commands
- Debug

2-1 Allocation of Teaching Points

Allocate the necessary points for a system. The necessary points for the virtual system (Figure 3) are allocated as the chart below.

System position \ Arm position		Upper Arm		Lower Arm	
		Lower position	Upper position	Lower position	Upper position
Designated setting point		1	2	11	12
Cassette	1st slot	26	56	226	256
	…	…	…	…	…
	20th slot	45	85	245	285

Table 1: Teaching points

(*Please refer to the Figure 4 about the explanation of upper Arm and lower Arm)
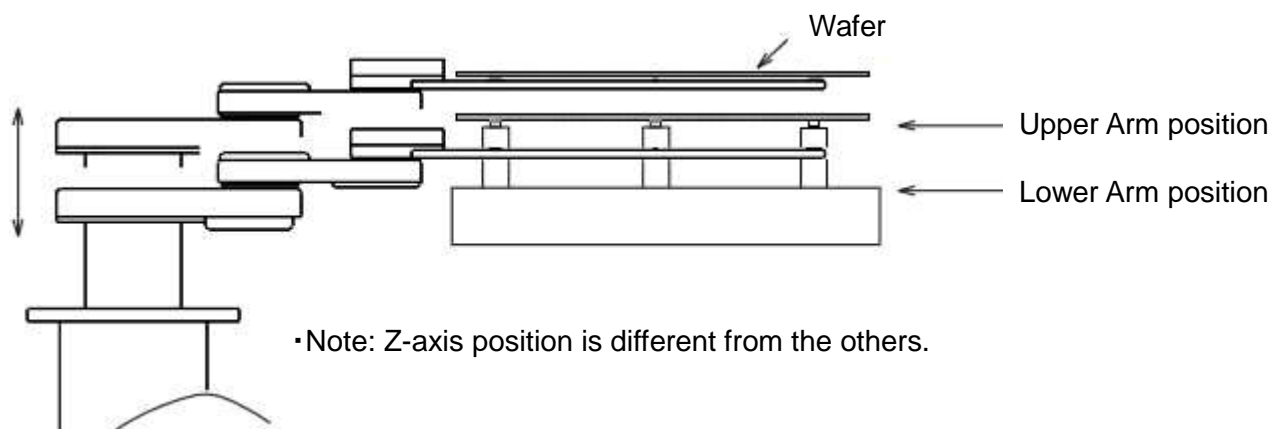
Upper Arm: The position where a wafer is picked up, or the position where the Arm is extended to place a wafer.

Lower Arm: The position where a wafer is placed, or the position where the Arm is extended to pick up a wafer.

Figure 4: Upper Arm and lower Arm

2-2 Allocation of Compound Commands

Make a list of robot movements and allocate to the compound commands.

Robot movements:
- Pick up a wafer from a cassette
- Place a wafer to a cassette
- Pick up a wafer from a designated setting point
- Place a wafer to a designated setting point
- Move to a standby position for picking up a wafer from a designated setting point
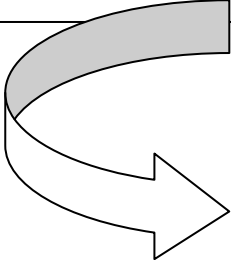
ALLOCATION

Compound commands:

- 20h Upper Arm: Move to a standby position for picking up a wafer from a designated setting point
- 24h Upper Arm: Place a wafer to a designated setting point
- 26h Upper Arm: Pick up a wafer from a designated setting point

- 30h Lower Arm: Move to a standby position for picking up a wafer from a designated setting point
- 34h Lower Arm: Place a wafer to a designated setting point
- 36h Lower Arm: Pick up a wafer from a designated setting point

- 41h Upper Arm: Place a wafer to the 1st slot of the cassette
:…
- 54h Upper Arm: Place a wafer to the 20th slot of the cassette
- 61h Upper Arm: Pick up a wafer from the 1st slot of the cassette
…
- 74h Upper Arm: Pick up a wafer from the 20th slot of the cassette
- 81h Lower Arm: Place a wafer to the 1st slot of the cassette
…
- 94h Lower Arm: Place a wafer to the 20th slot of the cassette
- A1h Lower Arm: Pick up a wafer from the 1st slot of the cassette
…
- B4h Lower Arm: Pick up a wafer from the 20th slot of the cassette

Figure 5: Allocation of compound commands
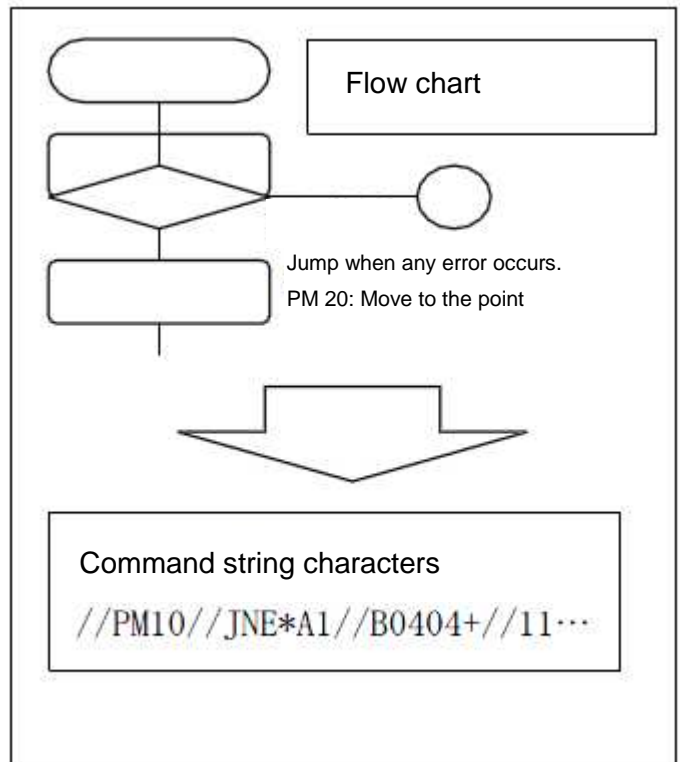
2-3 Draws Flow Chart

Draw a flow chart of compound commands by taking account of the number of characters for compound commands and the use of subroutines.

Please refer to the "3. Example of making compound commands" described in this reference manual.

2-4 Makes Commands

Make command character strings based on the flow chart.

Please refer to the "3. Example of making compound commands" described in this reference manual.

Flow chart

Jump when any error occurs.
PM 20: Move to the point

Command string characters

$//PM10//JNE*A1//B0404+//11\cdots$

2-5 Debug

Run debug by operating the robot. Teach the points and transfer the compound commands.

Execute the command from the PLC or a PC to confirm the movements. If there are any faults or problems in the movements, review the commands.

3. Example of Making Compound Commands

Some examples from "2-2 Allocation of Compound Commands" are outlined below.

3-1 Command 41h Upper Arm: Place a wafer to the 1st slot of the cassette

Place a wafer to the 1st slot of the cassette by using the upper Arm.

Example of command character strings:

//@XPM56/@YPM26/%1//!E//

Explanations:

/ : The beginning of the command

/@XPM56 : Designate the upper position of the upper Arm for the 1st slot of the cassette (*)

/@YPM26 : Designate the lower position of the upper Arm for the 1st slot of the cassette (*)

/%1 : Subroutine call for placing

/ : Wait for the completion of subroutine call

/!E// : The completion of the command

*For other commands for placing, change the contents of @X and @Y only. (For example: For command 32h, change to @XPM57 and @YPM27.)

3-2 Command 61h: Upper Arm: Pick up a wafer from the 1st slot of the cassette

Pick up a wafer from the 1st slot of the cassette by using the upper Arm.

Example of command character strings:

//@XPM26/@YPM56/%2//!E//

Explanations:

/ : The beginning of the command

/@XPM26 : Designate the lower position of the upper Arm for the 1st slot of the cassette (*)

/@YPM56 : Designate the upper position of the upper Arm for the 1st slot of the cassette (*)

/%2 : Subroutine call for pick-up

/ : Wait for the completion of subroutine call

/!E// : The completion of the command

3-3 Subroutine %1 wafer placing

- Set the point for upper position of the Arm to @X
- Set the point for lower position of the Arm to @Y

Example of command character strings:

//%X// M4%Y//11/13//%R//

Explanations:

/	: The beginning of the command
/%X	: Move to the upper position of the Arm
/	: Wait for the completion
/M4%Y	: Lower Z-axis to the lower position of the Arm
/	: Wait for the completion
/11	: Origin back of upper Arm
/13	: Origin back of lower Arm
/	: Wait for the completion
/%R//	: The completion of subroutine

3-4 Subroutine %2 wafer pick-up

- Set the point for lower position of the Arm to @X
- Set the point for upper position of the Arm to @Y

Example of command character strings:

//%X//M4%Y//11/13//%R//

Explanations:

/	: The beginning of the command
/%X	: Move to the lower position of the Arm
/	: Wait for the completion
/M4%Y	: Rise Z-axis to the upper position of the Arm
/	: Wait for the completion
/11	: Origin back of upper Arm
/13	: Origin back of lower Arm
/	: Wait for the completion

This concludes the elementary guide to the compound commands.