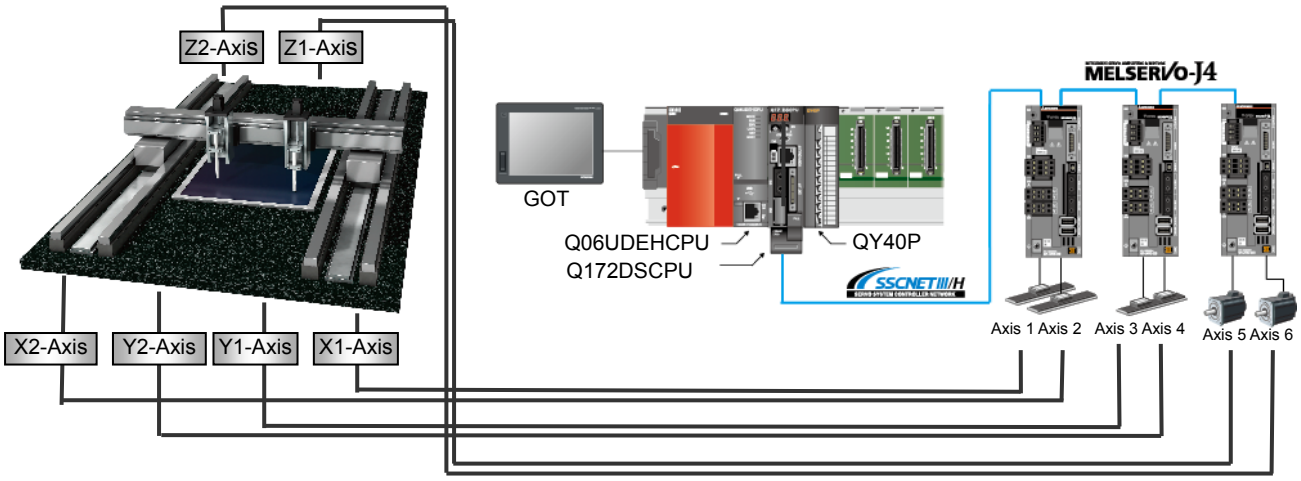
Gantry Application

[System Configuration]



[Mitsubishi solution]

Motion CPU: Q172DSCPU **Servo Amplifier: MR-J4W2-B** **Linear Servo Motor: LM-H3**
PLC CPU: Q06UDEHCPU **GOT: GT16**-V** **Rotary Servo Motor: HG-KR**
Main Base Unit: Q35DB **Output Module: QY40P**
Programming Software: MELSOFT MT Works2 (Motion), MELSOFT GX Works2 (PLC), MELSOFT GT Works3 (GOT)
Motion CPU operating system software: SW8DNC-SV22QL

[Operation description]

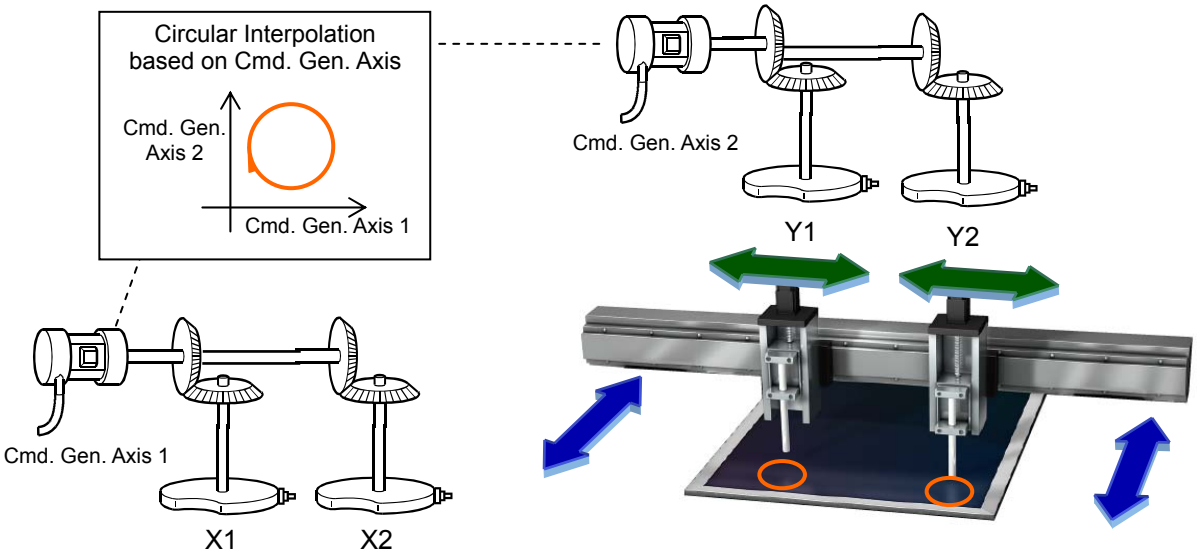
The provided sample program controls the X-Axis tandem movement, Y-Axis multi-head movement, and the Z-Axis nozzle positioning (in a dispenser machine based example) demonstrating the gantry application.

[Control points]

Point1: Highly accurate and responsive positioning is carried out through direct translation of positioning commands to the machine via usage of linear servo motors on the X and Y-Axis, eliminating of backlash in a gearing system.

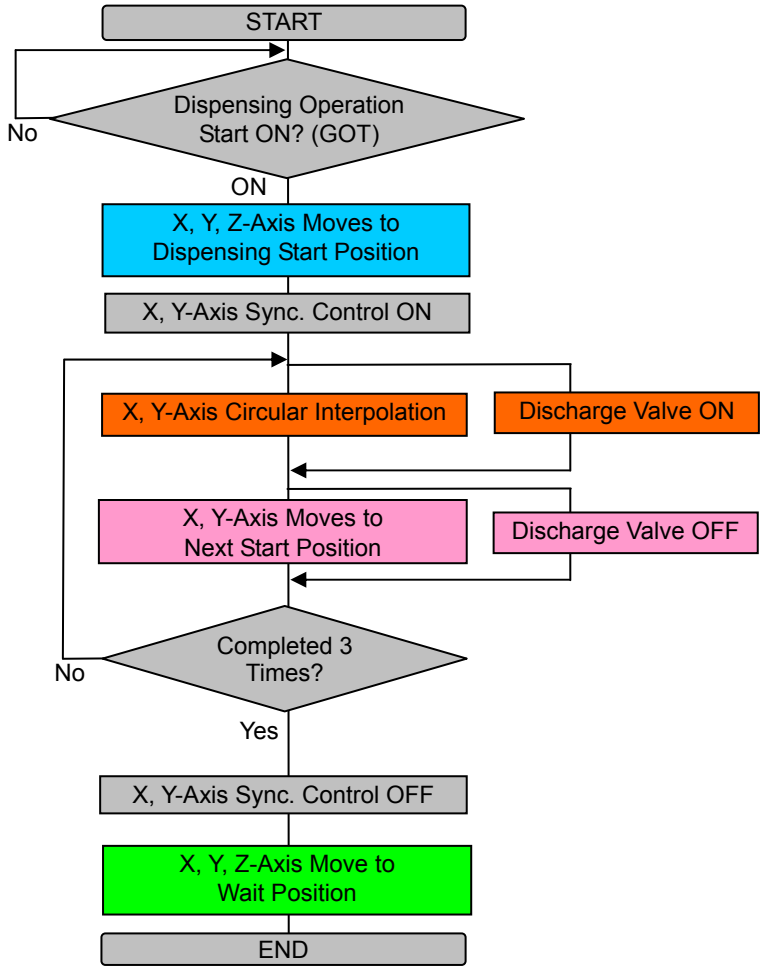
Point2: Simple machine design is achieved through a multi-head configuration (Y-Axis) of two motors moving simultaneously on the same single stator coil.

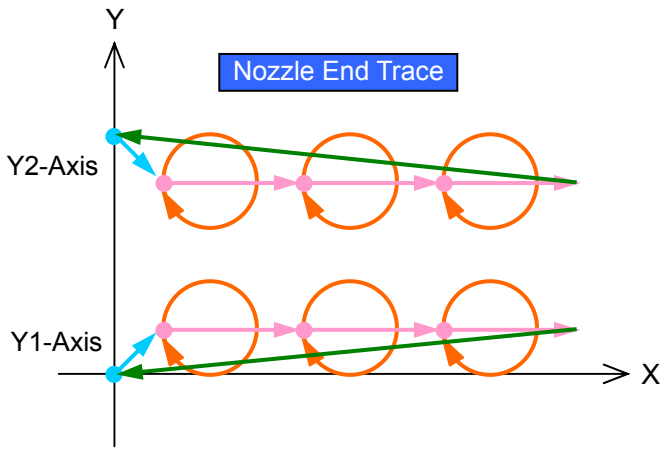
Point3: The X-Axis tandem movements and the Command Generation Axis based interpolation operations are implemented through the high performance “Advanced Synchronous Control” function. Also, synchronous interpolation through the multi-head configuration can also be achieved easily.



[Operation Flowchart]

The machine moves to the dispensing operation start position with the GOT start switch, completes 3 perfect circular movements (Z-Axis) and then returns to the wait position.





[GOT Sample screen]

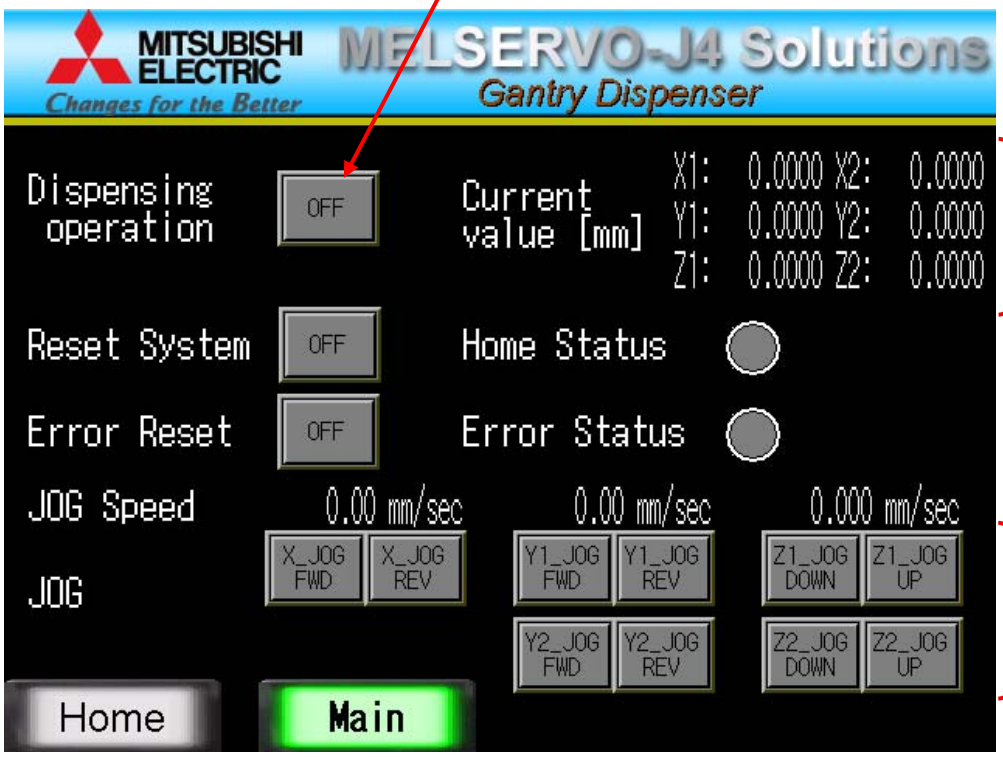
[GOT Home screen]

Language Selection

Screen Selection

Dispenser Operation Button
The dispenser operation (Refer to page 2) is carried.

[GOT Main Screen]

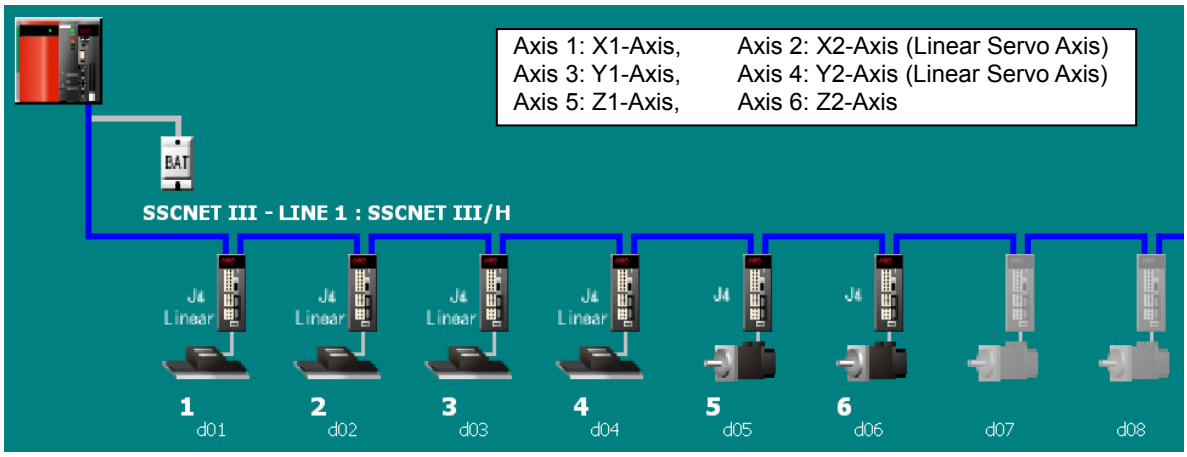


Current Value
Displays each axis current value.

JOG Operation Button
Each axis can be move forward or reverse (up or down).

(Note): Sample screen as default are set for English environment. When using Japanese environment, it's possible to switch to Japanese for GOT monitoring data in GT Designer 3 Language change the preview column from [2] to [1].

[System Setting]



[Servo Data Setting]

Item	Axis1	Axis2	Axis3	Axis4	Axis5	Axis6
Fixed Parameter	**Set the fixed parameters for each axis and their data is fixed based on the mechanical system, etc.**					
Unit Setting	0:mm	0:mm	0:mm	0:mm	0:mm	0:mm
Number of Pulses/Rev.	10[PLS]	10[PLS]	10[PLS]	10[PLS]	4194304[PLS]	4194304[PLS]
Travel Value/Rev.	0.5[µm]	0.5[µm]	0.5[µm]	0.5[µm]	5000.0[µm]	5000.0[µm]
Backlash Compensation	0.0[µm]	0.0[µm]	0.0[µm]	0.0[µm]	0.0[µm]	0.0[µm]
Upper Stroke Limit	3000000.0[µm]	3000000.0[µm]	2000000.0[µm]	2000000.0[µm]	1000000.0[µm]	1000000.0[µm]
Lower Stroke Limit	-100000.0[µm]	-100000.0[µm]	-200000.0[µm]	-200000.0[µm]	-100000.0[µm]	-100000.0[µm]
Command In-position	10.0[µm]	10.0[µm]	10.0[µm]	10.0[µm]	10.0[µm]	10.0[µm]
Sp. Ctrl. 10x Mult. for Deg.	-	-	-	-	-	-
Home Position Return Data	**Set the data to execute the home position return.**					
OPR Direction	0:Reverse Direction	0:Reverse Direction	0:Reverse Direction	0:Reverse Direction	0:Reverse Direction	0:Reverse Direction
OPR Method	2:Data Set Type 1	2:Data Set Type 1	2:Data Set Type 1	2:Data Set Type 1	2:Data Set Type 1	2:Data Set Type 1
Home Position Address	0.0[µm]	0.0[µm]	0.0[µm]	1000000.0[µm]	0.0[µm]	0.0[µm]

X-Axis, Y-Axis Linear Encoder Resolution: 0.05[µm]

Z-Axis Travel Value/Revolution: 5[mm]

[Parameter Block]

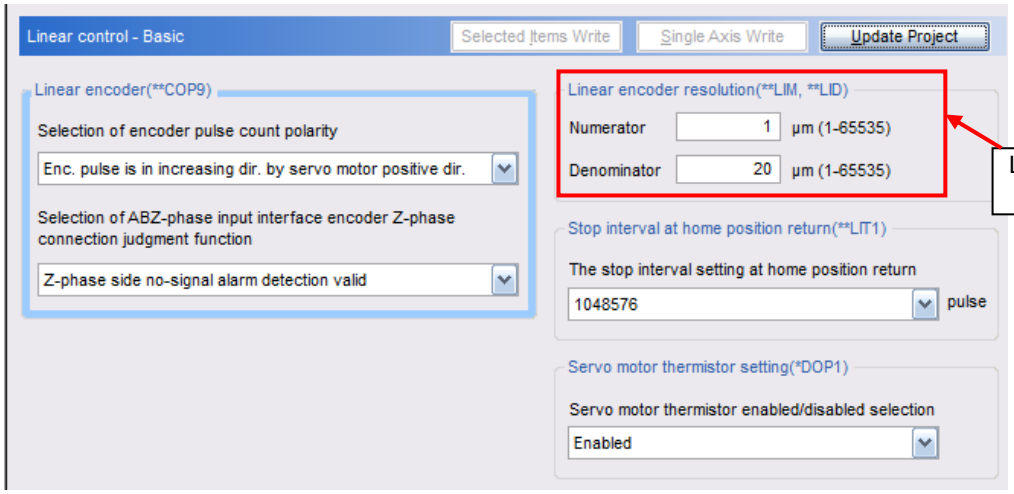
Item	Block No.1	Block No.2
Parameter Block	**Set the data such as the acceleration/decelera**	
Interpolation Control Unit	0:mm	0:mm
Speed Limit Value	120000.00[mm/min]	15000.00[mm/min]
Acceleration Time	100[ms]	100[ms]
Deceleration Time	100[ms]	100[ms]
Rapid Stop Deceleration Time	100[ms]	100[ms]
S-curve Ratio	0[%]	0[%]
Torque Limit Value	300[%]	300[%]
Deceleration Process on STOP	0:Deceleration Stop	0:Deceleration Stop
Allowable Error Range for Circular Interpolation	10.0[µm]	10.0[µm]
Bias Speed at Start	0.00[mm/min]	0.00[mm/min]
Acceleration/Deceleration System	0:Trapezoid/S-curve	0:Trapezoid/S-curve
Advanced S-curve Acceleration/Decelerat...	**Set the data of advanced S-curve acceleration, smoothly.**	

Block No.1: Usage for X-Axis, Y-Axis
Block No.2: Usage for Z-Axis

[Servo Parameter]

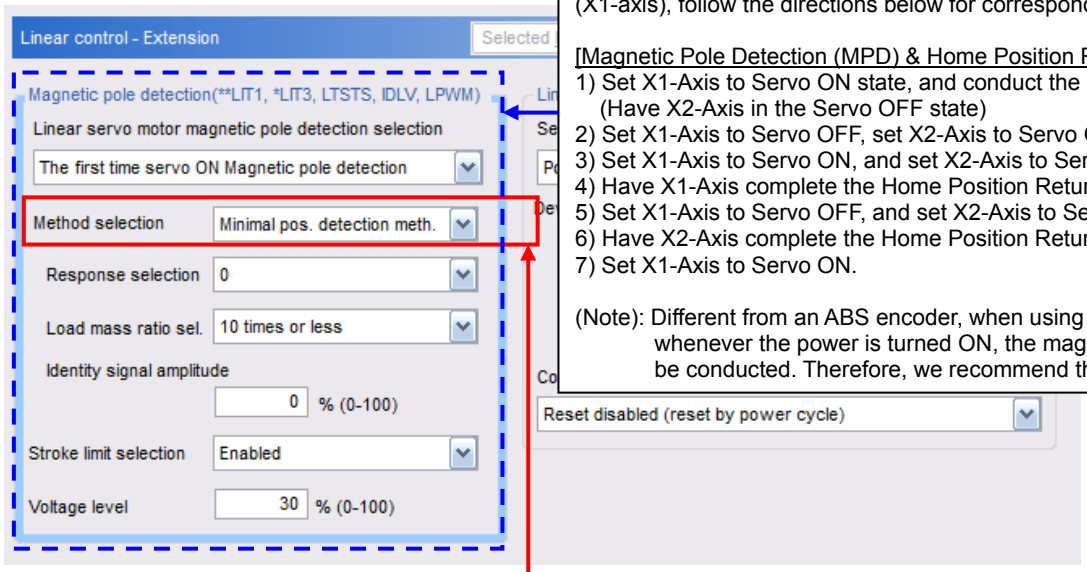
Parameter setting example using Linear servo motors for conducting tandem operation.

(1) Linear Control – Basic Settings



Linear Encoder Resolution
0.05 [µm]

(2) Linear Control – Extension Settings



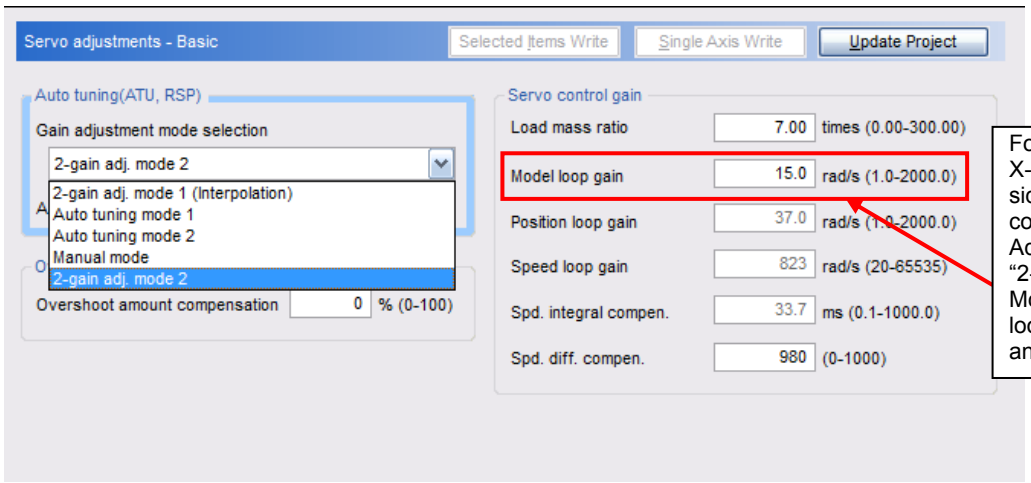
In order to perform the magnetic pole detection for the tandem operation axis (X1-axis), follow the directions below for corresponding axis.

[Magnetic Pole Detection (MPD) & Home Position Return (HPR) Guide]
1) Set X1-Axis to Servo ON state, and conduct the MPD.
   (Have X2-Axis in the Servo OFF state)
2) Set X1-Axis to Servo OFF, set X2-Axis to Servo ON, and conduct the MPD.
3) Set X1-Axis to Servo ON, and set X2-Axis to Servo OFF.
4) Have X1-Axis complete the Home Position Return (DOG. Scale Type, etc.)
5) Set X1-Axis to Servo OFF, and set X2-Axis to Servo ON.
6) Have X2-Axis complete the Home Position Return (Data Set Type, etc.)
7) Set X1-Axis to Servo ON.

(Note): Different from an ABS encoder, when using a linear INC encoder, whenever the power is turned ON, the magnetic pole detection must be conducted. Therefore, we recommend the use of an ABS encoder.

For the MPD method corresponding to the tandem axis (X-axis), we recommend to use the “Minimal Pos. Detection Meth”.

(3) Servo adjustments – Basic Settings



For the tandem operation X-Axis to create same primary side delay based on the command value. Set the “Gain Adjustment Mode Selection” to “2-gain adj. mode 2” or “Manual Mode”. Make sure the model loop gain setting of X1-Axis and X2-Axis are the same.

[Synchronous Control Parameters]

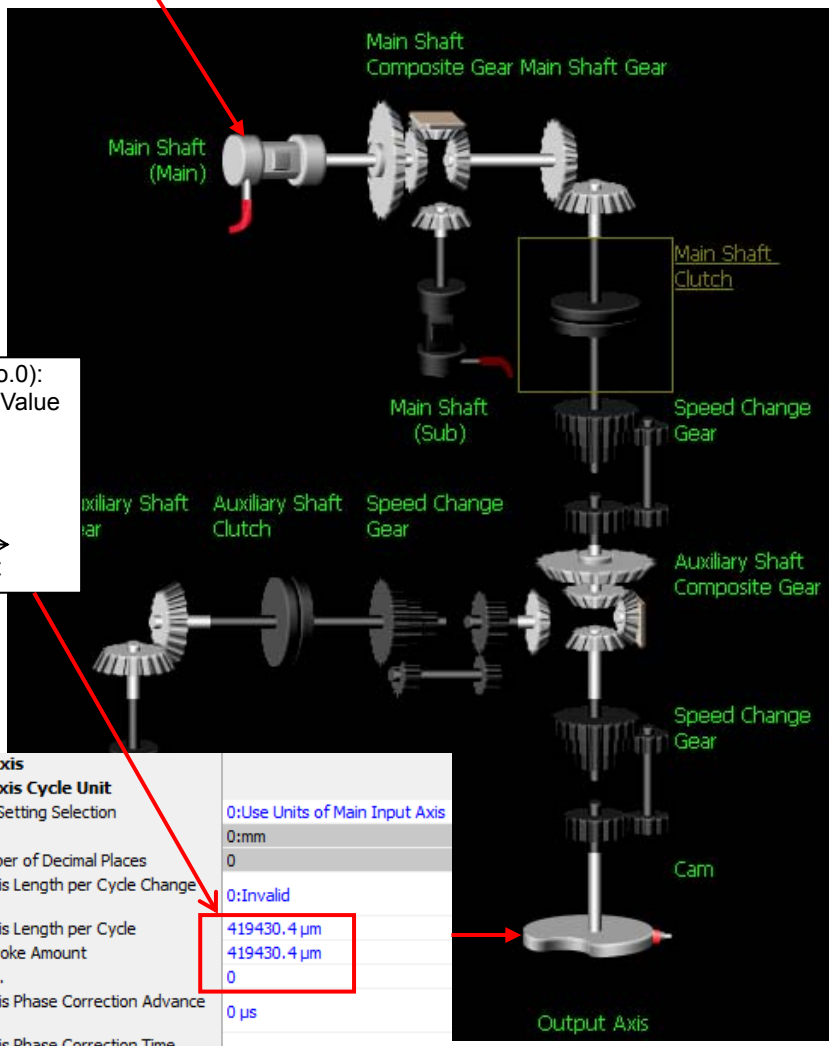
(1) Input Axis Parameters

Item	Axis 1	Axis 2
Command Generation Axis		
Valid Setting	1:Valid	1:Valid
Unit Setting	0:mm	0:mm
Upper Stroke Limit	214748364.7 µm	214748364.7 µm
Lower Stroke Limit	-214748364.8 µm	-214748364.8 µm
Command In-position Range	10.0 µm	10.0 µm
Sp. Ctrl. 10x Mult. for Deg.	-	-
Length per Cycle	0.0 µm	0.0 µm
JOG Speed Limit Value	120000.00 mm/min	120000.00 mm/min
JOG Operation Parameter Block Setting	1	1
Acceleration/deceleration Time Change Parameter	**Set acceleration/deceleration time at spe**	

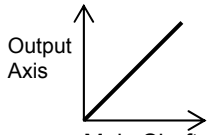
(2) Synchronous Parameters

Main Shaft	
Main Input Axis	
Type	201:Command Generation Axis
Axis No.	1

X-Axis (Axis 1, Axis 2): Set the Command Generation Axis No to 1
Y-Axis (Axis 3, Axis 4): Set the Command Generation Axis No to 2



Linear Cam (Cam No.0):
Input Value =Output Value



Output Axis	
Cam Axis Cycle Unit	
Unit Setting Selection	0:Use Units of Main Input Axis
Unit	0:mm
Number of Decimal Places	0
Cam Axis Length per Cycle Change Setting	0:Invalid
Cam Axis Length per Cycle	419430.4 µm
Cam Stroke Amount	419430.4 µm
Cam No.	0
Cam Axis Phase Correction Advance Time	0 µs
Cam Axis Phase Correction Time Constant	10 ms
Synchronous Control Parameter Block No.	1
Output Axis Smoothing Time Constant	0 ms

[Devices used in this program]

Device No.	Content	Device No.	Content
B0	Dispensing operation start (GOT)	W0	X-Axis JOG speed setting (GOT): x 0.01 [mm/sec]
B1	Home position return (GOT)	W1	
B2	Error Reset (GOT)	W2	Y-Axis JOG speed setting (GOT): x 0.01[mm/sec]
B5	Home position return complete lamp (GOT)	W3	
B6	Error lamp (GOT)	W4	Z-Axis JOG speed setting (GOT): x 0.01[mm/sec]
B7	Tandem Axis(X-Axis) AX 1, 2 Position Deviation Excessive	W5	
B8	Multi-head Axis(Y-Axis) AX 3, 4 Position Collision	PY10	Discharge valve 1 (Y1-Axis side)
B11	X-Axis JOG forward (GOT)	PY11	Discharge valve 2 (Y2-Axis side)
B12	X-Axis JOG reverse (GOT)		
B13	Y1-Axis JOG forward (GOT)		
B14	Y1-Axis JOG reverse (GOT)		
B15	Y2-Axis JOG forward (GOT)		
B16	Y2-Axis JOG reverse (GOT)		
B17	Z1-Axis JOG upward (GOT)		
B18	Z1-Axis JOG downward (GOT)		
B19	Z2-Axis JOG upward (GOT)		
B1A	Z2-Axis JOG downward (GOT)		

⚠ Cautions

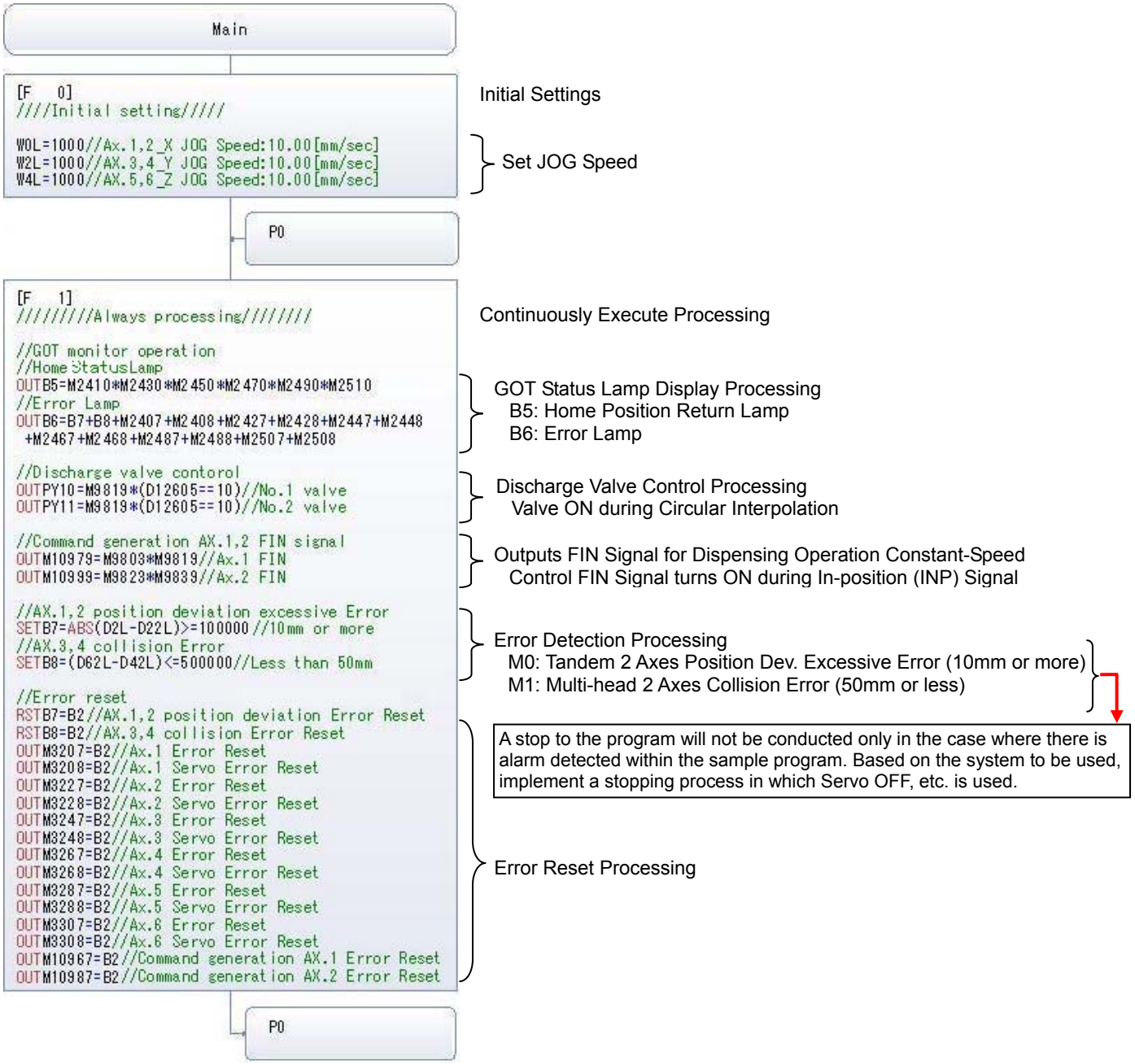
- When diverting the sample program to the actual system, be sure to verify that there are no problems with control in the system.
- Add interlock conditions in the target system where considered necessary.

[Content of Motion SFC sample programs]

Program Structure

No.	Program Name	Automatic Start	Execution Task	Operation Summary
0	Main	Yes	Normal	Main Operation
1	Motion control	Yes	Normal	Motion Control
2	Home Position	No	Normal	Home Position Return
3	JOG operation	No	Normal	JOG Operation
4	Dispensing	No	Normal	Dispensing Operation

(1) No.0 Main: Main Operation Normal Task [Automatic Start]
This program continuously runs certain processes and initiates starting settings.



(2) No.1 Motion control: Normal Task [Automatic Start]

Each Motion control task is initiated when started from the GOT screen.

(3) No.2 Home position: Home Position Return Normal Task

This program activates the home position return servo program for all axes.

(4) No.3 JOG operation: Normal Task

Executes the JOG operation for each axis

X-Axis (Axis 1, 2) Synchronous Control Start

When GOT JOG switch is ON,
corresponding JOG command bit will turn ON.

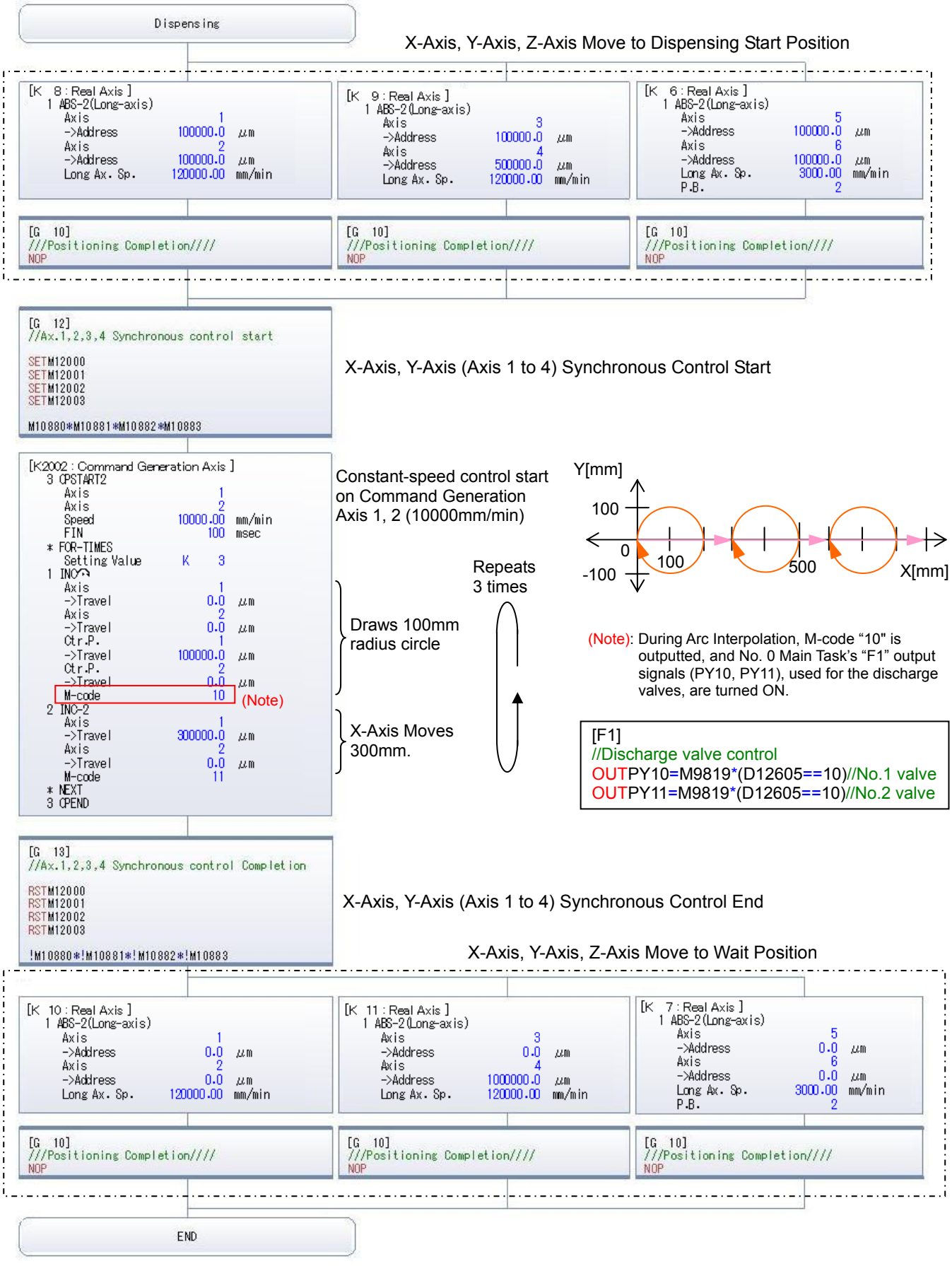
<GOT>
B11: X-Axis JOG forward
B12: X-Axis JOG reverse
B13: Y1-Axis JOG forward
B14: Y1-Axis JOG reverse
B15: Y2-Axis JOG forward
B16: Y2-Axis JOG reverse
B17: Z1-Axis JOG downward
B18: Z1-Axis JOG upward
B19: Z2-Axis JOG downward
B1A: Z2-Axis JOG upward

W0L: X-Axis JOG Speed Setting
W2L: Y-Axis JOG Speed Setting
W4L: Z-Axis JOG Speed Setting

X-Axis (Axis 1, 2) Synchronous Control End

(5) No.4 Dispensing: Dispensing Operation Normal Task

After positioning to the dispensing start point, the dispensing operation follows a trace pattern that is based on the command generation axis's controlled circular/linear interpolation.



END