Screw Tightening Machine

[System Configuration]

[Operation Description]

(1) After the tool is positioned in the screw tightening respect with X and Y-axis, Z-axis is lowered with the positioning control.

(2) When a screw comes in contact with a work, the Z-axis pushes it and it is switched from positioning control to press-fit control, and the rotating axis is driven with speed control.

(3) When the Z-axis reaches a predetermined value or less, even rotating axis also switches to press-fit control. When the speed of the tightened screw is equal to or less than a certain value, the torque of rotating axis will change to the tightening torque of the screw.

(4) After a certain period of tightening time with tightening torque, Z-axis and rotating axis return in positioning control mode to the retracted position.

[Control Points]

Point1: The torque sensor is not used, and the screw tightening becomes possible by additionally controlling the speed and the torque of the rotating axis in the process in open loop.

Point2: By the press-fit control, torque is not suddenly changed when switching to torque control from position control, smooth operation is possible.

Point3: The ladder program such as the control mode switching of the rotating axis and Z-axis can be described by the function block.
[Operation Flowchart]

**X, Y and Z-Axis**
- Move to the home position

**X and Y-Axis**
- Move to the screwing position

**Z-Axis**
- After the descent, switch to press-fit control to push the screw to make contact

**Rotating Axis**
- After speed control start, switches to press-fit control
- Change in torque tightening target torque

**Z and Rotating Axis**
- After specified waiting time, Z-axis and the rotating axis are stopped
- It returns to the home position

[Operation Time Chart]

**Z-Axis**
- Position control
- Press-fit control
- Position control

**Rotating-Axis**
- Speed control
- Press-fit control
- Position control
- Speed command change
- Torque command change
- Press-fit → Position control
[Using the sample program]

[Sample program configuration]

<table>
<thead>
<tr>
<th>File name</th>
<th>Description</th>
<th>Model</th>
<th>Programming tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vol10_Screw_PL.C.gxw</td>
<td>Ladder program</td>
<td>Q04UDEHCPU</td>
<td>MELSOFT GX Works2</td>
</tr>
<tr>
<td>Vol10_Screw_Motion.pcw</td>
<td>Simple Motion setting file</td>
<td>QD77MS4</td>
<td></td>
</tr>
<tr>
<td>Vol10_Screw_GOT.GTX</td>
<td>GOT monitoring data</td>
<td>GT27**-V (640x480)</td>
<td>MELSOFT GT Works3</td>
</tr>
</tbody>
</table>

[Typical machinery configuration]

It is necessary to connect the servo amplifier and the servo motor with the third axis (Z-axis) and the fourth axis (rotating axis) to operate the sample program (A virtual servo cannot be used).

1) The working range and the machine starting point are set as shown in figure.

![Diagram of machinery configuration](image)

1. Z-axis (Downward +)
2. Screw length Up to 50mm
3. Tool tip position 100mm
4. Machine home position
5. Working area
6. X-axis 200mm
7. Y-axis 200mm
8. 200mm

2) Each axis has been set as shown in the table below.

<table>
<thead>
<tr>
<th>Axis No.</th>
<th>Connecting Axis</th>
<th>Servo motor</th>
<th>Machinery configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>X-Axis</td>
<td>HG-KR43</td>
<td>Ball screw (pitch 10mm), Reduction ratio1/2</td>
</tr>
<tr>
<td>2</td>
<td>Y-Axis</td>
<td>HG-KR43</td>
<td>Ball screw (pitch 10mm), Reduction ratio1/2</td>
</tr>
<tr>
<td>3</td>
<td>Z-Axis</td>
<td>HG-KR43B</td>
<td>Ball screw (pitch 10mm), Reduction ratio1/2</td>
</tr>
<tr>
<td>4</td>
<td>Rotating Axis</td>
<td>HG-KR43</td>
<td>Connected to a tool</td>
</tr>
</tbody>
</table>

3) The home position return for all axes has been set in as data set method in the initial state.
   Set it to be an appropriate starting point return method to each axis when actually start a machine.
[Start-up]
1. Decompress the downloaded files to any folder in your PC.
2. Double clicking decompressed files to open the corresponding engineering tool.
3. Ladder program and GOT monitoring data as default are set for English environment. When using Japanese environment, it's possible to switch to Japanese for ladder program in GX Works2 [Tool] -> [Select Language] menu and for GOT monitoring data in GT Works3 Language change the preview column from [2] to [1].
4. Change the model settings according to models to be used.
5. Write the sample program data to PLC CPU, Simple Motion and GOT.
6. After writing all the programs, reset the PLC CPU.

[Operating method]
Start operation by using the GOT touch button.
If you do not have GOT, operate the device with the appropriate touch button in GT Works3’s simulator function (Note) or GX Works2’s device test function.
(Note): When using GT Works3’s simulator function, click on the "communication setup" tab of "Simulator setup" and select “USB” or "CPU(RS-232)" from the pull-down menu of "connection".

1. When you start-up the system, touch “Reset system” button on the GOT Main screen to perform machine home position return operation. Home position return complete HPR lamp and auto operation enable lamp turn on when operation is completed normally.
2. After home position return completion, set the length and size of the screw tightening, tightening torque, tightening time and the position of the screw holes on [Setting screen]. After setting, it will start automatic operation when you touch the operation start switch on [main screen]. If you touch the STOP switch during automatic operation, automatic operation will be stopped.
3. Each axis can be operated independently by using the JOG touch buttons.

<table>
<thead>
<tr>
<th>Operation</th>
<th>GOT touch key</th>
<th>Device No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine HPR</td>
<td>[Main] Home position set</td>
<td>B02</td>
</tr>
<tr>
<td>High speed HPR</td>
<td>[Main] Return to Home position</td>
<td>B03</td>
</tr>
<tr>
<td>Automatic operation start</td>
<td>[Main] RUN</td>
<td>B00</td>
</tr>
<tr>
<td>Automatic operation stop</td>
<td>[Main] STOP</td>
<td>B01</td>
</tr>
<tr>
<td>Screw hole position setting (X-coordinate)</td>
<td>[Setting] X-coordinate value</td>
<td>D110</td>
</tr>
<tr>
<td>Screw hole position setting (Y-coordinate)</td>
<td>[Setting] Y-coordinate value</td>
<td>D120</td>
</tr>
<tr>
<td>Screw size setting</td>
<td>[Setting] M2 to M5, Manual Setting</td>
<td>B06 to B0A, B0B</td>
</tr>
<tr>
<td>Screw length setting</td>
<td>[Setting] Screw length</td>
<td>D150</td>
</tr>
<tr>
<td>Tightening torque</td>
<td>[Setting] Tightening torque value</td>
<td>D107</td>
</tr>
<tr>
<td>Tightening time</td>
<td>[Setting] Tightening time</td>
<td>D104</td>
</tr>
<tr>
<td>(Note) Tightening torque</td>
<td>[Setting] Tightening torque value</td>
<td>D100</td>
</tr>
<tr>
<td>(Note) Screw pitch</td>
<td>[Setting] Screw pitch value</td>
<td>D101</td>
</tr>
<tr>
<td>Each axis JOG operation (forward)</td>
<td>[Manual operation] FWD for each axis</td>
<td>B10,B12,B14,B16</td>
</tr>
<tr>
<td>Each axis JOG operation (reverse)</td>
<td>[Manual operation] REV of each axis</td>
<td>B11,B13,B15,B17</td>
</tr>
<tr>
<td>Each axis JOG speed</td>
<td>[Manual operation] Speed value of each axis</td>
<td>D200,D202,D204,D206</td>
</tr>
</tbody>
</table>

(Note): When [Manual Setting] is selected in the screw size setting, it is possible to input the tightening torque and screw pitch manually. When M2 to M5 is selected, the numerical value is automatically set.
[GOT Sample screen]

[Language Selection]

[Screen Selection]

[Operation stop switch]
Automatic operation will stop with ON during automatic operation.

[Setup screw size]
Change on [Setting] screen.

[Operation start switch]
When this switch is turned ON while automatic operation lamp is ON, automatic operations will start.

[Machine HPR switch]
Turn ON for the mechanical zero return. Completion of homing lamp lights up when is successfully completed.

[High speed HPR switch]
Turn ON for high speed HPR. All axes will return to the retracted position.

[Error lamp]
Error lamp lights up when error occurs. Release it by turning ON the reset switch.
Tightening torque (D100) and screw pitch (D101) are entered using the GOT recipe function.

<table>
<thead>
<tr>
<th>Screw Size</th>
<th>M2</th>
<th>M2.5</th>
<th>M3</th>
<th>M4</th>
<th>M5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tightening torque (D100) (Note)</td>
<td>134 (0.174Nm)</td>
<td>274 (0.356Nm)</td>
<td>488 (0.634Nm)</td>
<td>1139 (1.48Nm)</td>
<td>2292 (2.98Nm)</td>
</tr>
<tr>
<td>Screw pitch (D101)</td>
<td>400 (400μm)</td>
<td>450 (450μm)</td>
<td>500 (500μm)</td>
<td>700 (700μm)</td>
<td>750 (750μm)</td>
</tr>
</tbody>
</table>

(Note): The value of D100 is set in a ratio (0.1% unit) for the rated torque (1.3Nm) of the servo motor HG-KR43.

Feed current position X, Y, Z-axis and rotating axis are displayed.

The operating state, current value, and speed for each axis are displayed.
[Operation check method]
1. Start the digital oscilloscope function of Simple Motion module setting tool.
2. A trigger condition is automatic operation start (B0). During automatic operation, speed waveform of each axis is registered.
3. Check collected waveforms with operation pattern.

⚠️ 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.
**[Simple Motion Settings]**

**[System Settings]**

**[Parameters]**

The table below lists the items that changed from the default value.

<table>
<thead>
<tr>
<th>Items</th>
<th>Axis 1</th>
<th>Axis 2</th>
<th>Axis 3</th>
<th>Axis 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pr.1  Unit setting</td>
<td>0: mm</td>
<td>0: mm</td>
<td>0: mm</td>
<td>2: degree</td>
</tr>
<tr>
<td>Pr.2  Number of pulses per rotation (AP)</td>
<td>4194304PLS</td>
<td>4194304PLS</td>
<td>4194304PLS</td>
<td>4194304PLS</td>
</tr>
<tr>
<td>Pr.3  Movement amount per rotation (AL)</td>
<td>5000.0μm</td>
<td>5000.0μm</td>
<td>5000.0μm</td>
<td>360.00000°/degree</td>
</tr>
<tr>
<td>Pr.8  Speed limit value</td>
<td>2000.00mm/min</td>
<td>2000.00mm/min</td>
<td>2000.00mm/min</td>
<td>72000.00000degree/min</td>
</tr>
<tr>
<td>Pr.12 Software stroke limit upper limit value</td>
<td>220000.0μm</td>
<td>220000.0μm</td>
<td>110000.0μm</td>
<td>0.00000°/degree</td>
</tr>
<tr>
<td>Pr.13 Software stroke limit lower limit value</td>
<td>-20000.0μm</td>
<td>-20000.0μm</td>
<td>-20000.0μm</td>
<td>0.00000°/degree</td>
</tr>
<tr>
<td>Pr.15 Software stroke limit valid/invalid setting</td>
<td>Valid</td>
<td>Valid</td>
<td>Valid</td>
<td>Invalid</td>
</tr>
<tr>
<td>Pr.21 Current feed value during speed control</td>
<td>0: Do not update current feed value</td>
<td>0: Do not update current feed value</td>
<td>0: Do not update current feed value</td>
<td>1: Update current feed value</td>
</tr>
<tr>
<td>Pr.22 Input signal logic selection lower limit</td>
<td>1: Positive logic</td>
<td>1: Positive logic</td>
<td>1: Positive logic</td>
<td>1: Positive logic</td>
</tr>
<tr>
<td>Pr.22 Input signal logic selection upper limit</td>
<td>1: Positive logic</td>
<td>1: Positive logic</td>
<td>1: Positive logic</td>
<td>1: Positive logic</td>
</tr>
<tr>
<td>Pr.80 External input signal selection</td>
<td>2: Buffer memory of QD77MS</td>
<td>2: Buffer memory of QD77MS</td>
<td>2: Buffer memory of QD77MS</td>
<td>2: Buffer memory of QD77MS</td>
</tr>
<tr>
<td>Pr.82 Forced stop valid/invalid selection</td>
<td>1: Invalid</td>
<td>1: Invalid</td>
<td>1: Invalid</td>
<td>1: Invalid</td>
</tr>
<tr>
<td>Pr.31 OPR speed limit value</td>
<td>1000.00mm/min</td>
<td>1000.00mm/min</td>
<td>1000.00mm/min</td>
<td>360000.00000°/degree/min</td>
</tr>
<tr>
<td>Pr.43 OPR method</td>
<td>6: Data set method</td>
<td>6: Data set method</td>
<td>6: Data set method</td>
<td>6: Data set method</td>
</tr>
<tr>
<td>Pr.46 OPR speed</td>
<td>1000.00mm/min</td>
<td>1000.00mm/min</td>
<td>1000.00mm/min</td>
<td>360000.00000°/degree/min</td>
</tr>
</tbody>
</table>

**Blue**: Default value  
**Black**: Set point

Reset according to the actual device for the setting of stroke limit and home position return.
[Positioning Data]

Axis-1: X-axis automatic operation

- Set the screw hole position in GOT.
- Default value: 100000.0 μm

Axis-2: Y-axis automatic operation

Axis-3: Z-axis automatic operation:

- Set the distance from the home position to the work. The control mode is switched to press-fit control along the descending.
- Speed during press-fit control is set automatically according to the pitch of screw.

Axis-4: Rotating axis

- 120r/min (2 revolutions per second)
### [Sample Ladder Program Configuration]

<table>
<thead>
<tr>
<th>Device No.</th>
<th>Content</th>
<th>Device No.</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>B00</td>
<td>Operation start</td>
<td>D100</td>
<td>Tightening torque (%)</td>
</tr>
<tr>
<td>B01</td>
<td>Operation stop</td>
<td>D101</td>
<td>Screw pitch (μm)</td>
</tr>
<tr>
<td>B02</td>
<td>Machine HPR</td>
<td>D102</td>
<td>Speed limit value of the Z-axis press-fit control</td>
</tr>
<tr>
<td>B03</td>
<td>High speed HPR</td>
<td>D104</td>
<td>Tightening time</td>
</tr>
<tr>
<td>B04</td>
<td>Error reset</td>
<td>D107</td>
<td>Target torque during press-fit control of the Z-axis</td>
</tr>
<tr>
<td>B06</td>
<td>Screw setting (M2)</td>
<td>D110</td>
<td>Screw hole position (X-coordinate)</td>
</tr>
<tr>
<td>B07</td>
<td>Screw setting (M2.5)</td>
<td>D111</td>
<td></td>
</tr>
<tr>
<td>B08</td>
<td>Screw setting (M3)</td>
<td>D120</td>
<td>Screw hole position (Y-coordinate)</td>
</tr>
<tr>
<td>B09</td>
<td>Screw setting (M4)</td>
<td>D121</td>
<td></td>
</tr>
<tr>
<td>B0A</td>
<td>Screw setting (M5)</td>
<td>D140</td>
<td>Screw size setting</td>
</tr>
<tr>
<td>B0B</td>
<td>Screw setting (Manual)</td>
<td>D150</td>
<td>Screw length</td>
</tr>
<tr>
<td>B0D</td>
<td>Home position return complete lamp</td>
<td>D152</td>
<td>Switching position in the Z-axis press-fit control</td>
</tr>
<tr>
<td>B0E</td>
<td>Error lamp</td>
<td>D200</td>
<td>X-axis JOG speed</td>
</tr>
<tr>
<td>B10</td>
<td>X-axis JOG operation (forward)</td>
<td>D201</td>
<td></td>
</tr>
<tr>
<td>B11</td>
<td>X-axis JOG operation (reverse)</td>
<td>D202</td>
<td>Y-axis JOG speed</td>
</tr>
<tr>
<td>B12</td>
<td>Y-axis JOG operation (forward)</td>
<td>D203</td>
<td></td>
</tr>
<tr>
<td>B13</td>
<td>Y-axis JOG operation (reverse)</td>
<td>D204</td>
<td>Z-axis JOG speed</td>
</tr>
<tr>
<td>B14</td>
<td>Z-axis JOG operation (forward)</td>
<td>D205</td>
<td></td>
</tr>
<tr>
<td>B15</td>
<td>Z-axis JOG operation (reverse)</td>
<td>D206</td>
<td>Rotating axis JOG speed (r/min)</td>
</tr>
<tr>
<td>B16</td>
<td>Rotating axis JOG operation (forward)</td>
<td>D207</td>
<td></td>
</tr>
<tr>
<td>B17</td>
<td>Rotating axis JOG operation (reverse)</td>
<td>D208</td>
<td>Rotating axis JOG speed (degree/min)</td>
</tr>
<tr>
<td>B20</td>
<td>Automatic operation permission lamp</td>
<td>D209</td>
<td></td>
</tr>
</tbody>
</table>

### [Used Devices in this program]

#### [User devices]
<table>
<thead>
<tr>
<th>Device No.</th>
<th>Device No.</th>
<th>Content</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>X00</td>
<td>Y00</td>
<td>QD77 ready</td>
<td>PLC ready</td>
</tr>
<tr>
<td>X08</td>
<td>Y01</td>
<td>Axis 1 error detection</td>
<td>All axis servo ON</td>
</tr>
<tr>
<td>X09</td>
<td></td>
<td>Axis 2 error detection</td>
<td></td>
</tr>
<tr>
<td>X0A</td>
<td></td>
<td>Axis 3 error detection</td>
<td></td>
</tr>
<tr>
<td>X0B</td>
<td></td>
<td>Axis 4 error detection</td>
<td></td>
</tr>
<tr>
<td>X14</td>
<td></td>
<td>Axis 1 positioning completion</td>
<td></td>
</tr>
<tr>
<td>X15</td>
<td></td>
<td>Axis 2 positioning completion</td>
<td></td>
</tr>
<tr>
<td>U0\G800</td>
<td>U0\G1502</td>
<td>X-axis current position (GOT)</td>
<td>X-axis error reset</td>
</tr>
<tr>
<td>U0\G809</td>
<td>U0\G1602</td>
<td>X-axis operation state (GOT)</td>
<td>Y-axis error reset</td>
</tr>
<tr>
<td>U0\G812</td>
<td>U0\G1702</td>
<td>X-axis speed (GOT)</td>
<td>Z-axis error reset</td>
</tr>
<tr>
<td>U0\G817</td>
<td>U0\G1802</td>
<td>X-axis status</td>
<td>Rotating axis error reset</td>
</tr>
<tr>
<td>U0\G856</td>
<td>U0\G1890</td>
<td>X-axis current value (GOT)</td>
<td>Rotating axis press-fit mode target torque</td>
</tr>
<tr>
<td>U0\G900</td>
<td>U0\G2006</td>
<td>Y-axis current position (GOT)</td>
<td>X-axis positioning address</td>
</tr>
<tr>
<td>U0\G909</td>
<td>U0\G8006</td>
<td>Y-axis operation state (GOT)</td>
<td>Y-axis positioning address</td>
</tr>
<tr>
<td>U0\G912</td>
<td></td>
<td>Y-axis speed (GOT)</td>
<td></td>
</tr>
<tr>
<td>U0\G917</td>
<td></td>
<td>Y-axis status</td>
<td></td>
</tr>
<tr>
<td>U0\G956</td>
<td></td>
<td>Y-axis current value (GOT)</td>
<td></td>
</tr>
<tr>
<td>U0\G1000</td>
<td></td>
<td>Z-axis current position (GOT)</td>
<td></td>
</tr>
<tr>
<td>U0\G1009</td>
<td></td>
<td>Z-axis operation state (GOT)</td>
<td></td>
</tr>
<tr>
<td>U0\G1012</td>
<td></td>
<td>Z-axis speed (GOT)</td>
<td></td>
</tr>
<tr>
<td>U0\G1017</td>
<td></td>
<td>Z-axis status</td>
<td></td>
</tr>
<tr>
<td>U0\G1054</td>
<td></td>
<td>Z-axis motor rotation speed</td>
<td></td>
</tr>
<tr>
<td>U0\G1056</td>
<td></td>
<td>Z-axis current value (GOT)</td>
<td></td>
</tr>
<tr>
<td>U0\G1100</td>
<td></td>
<td>Rotating axis current position (GOT)</td>
<td></td>
</tr>
<tr>
<td>U0\G1109</td>
<td></td>
<td>Rotating axis operation state (GOT)</td>
<td></td>
</tr>
<tr>
<td>U0\G1112</td>
<td></td>
<td>Rotating axis speed (GOT)</td>
<td></td>
</tr>
<tr>
<td>U0\G1117</td>
<td></td>
<td>Rotating axis status</td>
<td></td>
</tr>
<tr>
<td>U0\G1154</td>
<td></td>
<td>Rotating axis motor rotation speed</td>
<td></td>
</tr>
<tr>
<td>U0\G1156</td>
<td></td>
<td>Rotating axis current value (GOT)</td>
<td></td>
</tr>
</tbody>
</table>
[Ladder program]

QD77MS Simple Motion module start-up

| MOV | K488 | D100 | Tightening torque
|-----|------|------|-------------------|
| MOV | K560 | D101 | Screw pitch
|     |      |     | 0.5mm
| MOV | K560 | D107 | Torque press-fit
|     |      |     | 50.0%
| MOV | K1000000 | D110 | Screw hole position
|     |       |     | X-coordinate
|     |       |     | 100.0000mm
| MOV | K1000000 | D120 | Screw hole position
|     |       |     | Y-coordinate
|     |       |     | 100.0000mm
| MOV | K2000000 | D150 | Screw length
|     |       |     | 20.0000mm
| MOV | K1000000 | D200 | X-axis JOG speed
|     |       |     | 1000.0000mm/min
| MOV | K1000000 | D202 | Y-axis JOG speed
|     |       |     | 1000.0000mm/min
| MOV | K1000000 | D204 | Z-axis JOG speed
|     |       |     | 1000.0000mm/min
| MOV | K100  | D206 | Rotating axis JOG speed
|     |       |     | 100r/min
| MOV | K30  | D104 | Tightening time
|     |      |     | 3.0s

Data Initialization: Initialization of the input devices in GOT

| MOV | K488 | D100 | Tightening torque
|-----|------|------|-------------------|
| MOV | K560 | D101 | Screw pitch
|     |      |     | 0.5mm
| MOV | K560 | D107 | Torque press-fit
|     |      |     | 50.0%
| MOV | K1000000 | D110 | Screw hole position
|     |       |     | X-coordinate
|     |       |     | 100.0000mm
| MOV | K1000000 | D120 | Screw hole position
|     |       |     | Y-coordinate
|     |       |     | 100.0000mm
| MOV | K2000000 | D150 | Screw length
|     |       |     | 20.0000mm
| MOV | K1000000 | D200 | X-axis JOG speed
|     |       |     | 1000.0000mm/min
| MOV | K1000000 | D202 | Y-axis JOG speed
|     |       |     | 1000.0000mm/min
| MOV | K1000000 | D204 | Z-axis JOG speed
|     |       |     | 1000.0000mm/min
| MOV | K100  | D206 | Rotating axis JOG speed
|     |       |     | 100r/min
| MOV | K30  | D104 | Tightening time
|     |      |     | 3.0s
In this sample program, the axis rotates at 120 [r/min] during press-fit control, that is, two revolutions per second, for screw tightening. At this time, Z-axis is lowered by 2 revolution per second, then the screw is advanced by the thread pitch (D101) × 2 [mm] per second.

Therefore, the speed limit value (D102) is calculated by the following formula:

\[
\text{Speed limit value during Z-axis press-fit control (D102)} \times 10^{-2} \text{ mm/min} = \text{Screw pitch (D101)} \times 10^{-3} \text{ mm} \times \frac{60 \text{s}}{1 \text{ min}} \times \frac{2 \text{ rev}}{1 \text{ s}}
\]

\[
\therefore \text{Z-axis speed limit value (D102)} = \text{Screw pitch (D101)} \times 12
\]
### Rotating axis

- **JOG operation FB**

### Machine Home Position Return

#### X-axis
- **Machine HPR FB**

#### Y-axis
- **Machine HPR FB**
Z-axis
Machine HPR FB

Rotating axis
Machine HPR FB

High Speed Home Position Return

X-axis
High-speed HPR FB
Automatic Operation

Before X and Y-axis positioning start FB execution, set the positioning data of both axis set in GOT screen.

X-axis
Positioning start FB

Y-axis
Positioning start FB

X-axis
Positioning complete signal ON

Y-axis
Positioning complete signal ON
After positioning completion of the X and Y-axis, Z-axis positioning starts
Z-axis press-fit control mode switching FB

Press-fit control mode
Target torque:
Setting of D107
(Actual force depends on the ball screw type)

Press-fit control mode
Speed limit value:
Setting of D102

Press-fit control mode
Accel./decel. time:
100ms

Press-fit Control mode
Time constant pushing:
1000ms

Control mode automatic changing selection:
1 (current feed value passing)

After passing the address set in D152, the control mode switches to press-fit control.
When the current feed value of the Z-axis exceeds 95mm, the control switching flag for press-fit control of the rotating axis turns ON.

Set rotating axis position to No.1.

Rotating axis
Positioning start FB
Rotating axis press-fit control mode switching FB

Press-fit control
Target torque: 10%
(The tightening starts smoothly.)

Speed limit value during press-fit control:
43200.000 deg/min
= 120 r/min = 2 r/s
(Two revolutions per second)

Control mode automatic switching selection:
0 (no changing condition)
After FB execution, immediately control mode change.
When the screw is tight, and Z-axis motor speed has become 5r/min or less, the torque of the rotating axis changes to tightening torque.

Motor speed of the rotating axis 5r/min or less, and tightening time for the number of seconds set by the D104 in a state where more than 95% of tightening torque has been output. Then stop the motor of the Z-axis and the rotating axis.

After one second wait time, high speed HPR start-up of the Z-axis.

When Z-Axis is increased to 90mm, start HPR of the rotating axis.

Automatic operation complete flag ON when Z-Axis is increased to 50mm.

When automatic operation complete flag turns ON, also Z-axis and rotating axis switches to waiting status. Internal relay reset.
Automatic Operation Stop Processing

- **X-axis**
  - Operation stop FB

- **Y-axis**
  - Operation stop FB

- **Z-axis**
  - Operation stop FB
Error Reset

GOT Monitoring Signals
Set M2.5 screw

Set M3 screw
(Initial value)

Set M4 screw

Set M5 screw

Manual setting

Automatic operation enable lamp lighting