OPERATION AND MAINTENANCE MANUAL

MCH-500
MCH-800

FANUC 0i/18i/21iMB、0iMC

永績經營 091-T2-04-001 VERSION: 2.0

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TABLE OF CONTENTS

INTRODUCTION........................................................................................................... 1
WARNINGS.................................................................................................................... 2
FEATURES OF MCH-500/800.................................................................................. 3

1. SAFETY PRECAUTIONS
   1-1 GENERAL SAFETY PRECAUTIONS...................................................... 1-1
   1-2 SAFETY PRECAUTIONS FOR OPERATING THE MACHINE......................... 1-2
   1-3 PRECAUTIONS FOR USING THE ELECTRICAL COMPONENTS AND THE NC CONTROLLER.......................................................... 1-3
   1-4 ILLUSTRATION OF OPERATING ZONES.............................................. 1-4
   1-5 LOCATION AND CONTENT OF WARNING SIGNS.............................. 1-5

2. INTRODUCTION TO THE MACHINE
   2-1 LAYOUT AND LIST OF COMPONENTS............................................... 2-1
   2-2 DIMENSIONS............................................................................................... 2-2
   2-3 MACHINE SPECIFICATIONS................................................................. 2-4
   2-4 TOOL SPECIFICATIONS............................................................................. 2-5
   2-5 STANDARD ACCESSORIES AND OPTIONAL ACCESSORIES.................... 2-8
      2-5-1 STANDARD ACCESSORIES.............................................................. 2-8
      2-5-2 OPTIONAL ACCESSORIES................................................................. 2-9
   2-6 SPINDLE POWER AND TORQUE .............................................................. 2-10
   2-7 SOUND LEVEL............................................................................................ 2-10
3. PREPARATIONS FOR INSTALLATION

3-1 REQUIREMENTS OF THE ENVIRONMENT......................... 3-1
3-2 FOUNDATION DRAWINGS............................................... 3-2
3-3 REQUIREMENT OF THE FOUNDATION............................ 3-8
   3-3-1 METHOD FOR CONSTRUCTING THE FOUNDATION............ 3-8
   3-3-2 NOTES FOR THE CONSTRUCTION OF THE FOUNDATION..... 3-8
3-4 REQUIREMENT OF POWER SOURCES............................... 3-10
   3-4-1 REQUIREMENT OF ELECTRICAL POWER.................... 3-10
   3-4-2 PNEUMATIC REQUIREMENTS.................................. 3-11
3-5 OPERATION ENVIRONMENT FOR THE NC MACHINE............. 3-12
3-6 NOTES FOR TURNING ON THE MACHINE AFTER INSTALLATION.... 3-13
   3-6-1 BEFORE TURNING ON THE MACHINE......................... 3-13
   3-6-2 AFTER TURNING ON THE MACHINE........................... 3-14

4. TRANSPORTATION AND LEVELING

4-1 PRECAUTION FOR TRANSPORTATION............................ 4-1
   4-1-1 MCH-500........................................................... 4-1
   4-1-2 MCH-800........................................................... 4-2
4-2 LEVEL ADJUSTMENT.................................................. 4-3
   4-2-1 METHOD OF LEVELING FOR MC-500 ......................... 4-4
   4-2-2 METHOD OF LEVELING FOR MC-800 ......................... 4-8
5. DIMENSIONS FOR MACHINING

5-1 DIAGRAM FOR TABLE DIMENSIONS................................. 5-1
5-2 RANGE OF MACHINING AND MAXIMUM WORKPIECE DIMENSION................................................................. 5-3
5-3 TRAVEL FOR AXES AND ZERO POINT POSITION............ 5-6

6. NC CONTROL FUNCTION

6-1 G FUNCTION........................................................................... 6-1
6-2 F FUNCTION........................................................................... 6-6
6-3 S FUNCTION........................................................................... 6-6
6-4 T FUNCTION........................................................................... 6-6
6-5 M FUNCTION........................................................................... 6-7

7. OPERATIONS

7-1 CRT/MDI OPERATION AND DISPLAY.................................... 7-1
  7-1-1 EXPLANATION OF THE KEYBOARD................................. 7-3
  7-1-2 FUNCTION KEYS............................................................... 7-5
  7-1-3 FUNCTION KEYS AND SOFT KEYS................................. 7-6
  7-1-4 SOFT KEYS....................................................................... 7-7
  7-1-5 HELP FUNCTION............................................................... 7-23
  7-1-6 GRAPHICS DISPLAY.......................................................... 7-24
7-2 CONTROL PANEL................................................................. 7-26
7-3 FUNCTION AND OPERATION OF THE OPERATION PANEL.............................................................................. 7-27
7-4 MACHINE OPERATION.......................................................... 7-34
7-4-1 TURN ON THE MACHINE .................................................. 7-34
7-4-2 TURN OFF THE MACHINE ............................................. 7-35

7-5 HANDLE MODE ..................................................................... 7-36
7-5-1 MACHINE ZERO RETURN ............................................. 7-36
7-5-2 RAPID TRAVERSE ...................................................... 7-37
7-5-3 JOG .............................................................................. 7-37
7-5-4 HANDLE FEED ............................................................. 7-38

7-6 AUTO MODE OPERATION .................................................. 7-39
7-6-1 MANUAL DATA INPUT (MDI) ........................................ 7-39
7-6-2 START AUTO OPERATION ........................................... 7-40
7-6-3 STOP AUTO OPERATION .............................................. 7-41
7-6-4 MANUAL INTERRUPTION (OPTIONAL FUNCTION) .......... 7-41
7-6-5 PROGRAM RESTART (OPTIONAL) ............................... 7-42
7-6-6 EDIT OPERATION ........................................................ 7-45
7-6-7 SOFTWARE OPERATOR’S PANEL ................................. 7-57

7-7 INDEX TABLE ..................................................................... 7-58

7-8 LOADING TOOLS TO THE SPINDLE OR UNLOADING TOOLS FROM THE SPINDLE .................................................. 7-59

7-9 AUTOMATIC START FOR CHIP CONVEYOR ................. 7-60

7-10 AUTOMATIC LUBRICATION SYSTEM FOR SLIDEWAY .. 7-61

7-11 INTERLOCK OF AXES ...................................................... 7-62

8. AUTOMATIC TOOL CHANGING (ATC) SYSTEM

8-1 OPERATING PANEL FOR ATC .......................................... 8-1
8-2 OPERATING PROCEDURE FOR ATC ................................. 8-3
9. AUTOMATIC PALLET CHANGE (APC) SYSTEM

9-1 OPERATING PANEL FOR APC............................................. 9-1
9-2 PROCEDURE FOR APC OPERATION.................................... 9-3
9-3 OPERATING FOR APC PROGRAM........................................ 9-9
9-4 AUTO IN AND OUT FOR SINGLE PALLET......................... 9-12
9-5 MAINTENANCE (VALID IN MDI MODE)............................ 9-15
9-6 DATA ADDRESS FOR APC................................................ 9-16
9-7 KEEP RELAY FOR APC..................................................... 9-17
9-8 MANUAL B AXIS ZERO RETURN...................................... 9-18
9-9 ADJUSTMENT OF THE PALLET EXCHANGING POSITION........... 9-19
10. MAINTENANCE AND ADJUSTMENT

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-1 ROUTINE CHECKUPS</td>
<td>10-1</td>
</tr>
<tr>
<td>10-2 LUBRICANT AND SUPPLY, THE PNEUMATIC AND MAINTENANCE</td>
<td>10-2</td>
</tr>
<tr>
<td>10-2-1 AUTOMATIC LUBRICATION SYSTEM FOR SLIDEWAY</td>
<td>10-2</td>
</tr>
<tr>
<td>10-2-2 DIAGRAM FOR LUBRICATION</td>
<td>10-3</td>
</tr>
<tr>
<td>10-2-3 PNEUMATIC FILTER</td>
<td>10-4</td>
</tr>
<tr>
<td>10-2-4 MAINTENANCE FOR PNEUMATIC FILTER</td>
<td>10-5</td>
</tr>
<tr>
<td>10-2-5 LUBRICATION OIL EXCHANGE PROCESS FOR INDEX TABLE</td>
<td>10-9</td>
</tr>
<tr>
<td>10-3 ALARM MESSAGE DISPLAY</td>
<td>10-11</td>
</tr>
<tr>
<td>10-3-1 NC ALARM</td>
<td>10-11</td>
</tr>
<tr>
<td>10-3-2 MECHANICAL ALARM</td>
<td>10-11</td>
</tr>
<tr>
<td>10-3-3 MECHANICAL WARNING MESSAGES DISPLAY</td>
<td>10-12</td>
</tr>
<tr>
<td>10-4 SETTING FOR PARAMETERS</td>
<td>10-18</td>
</tr>
<tr>
<td>10-5 OVERTRAVEL</td>
<td>10-20</td>
</tr>
<tr>
<td>10-6 REPLACING BATTERIES</td>
<td>10-21</td>
</tr>
<tr>
<td>10-6-1 CHANGING BATTERIES</td>
<td>10-21</td>
</tr>
<tr>
<td>10-7 ADJUSTMENT OF B AXIS BACKLASH</td>
<td>10-23</td>
</tr>
<tr>
<td>10-8 SETTING FOR TIMER</td>
<td>10-24</td>
</tr>
<tr>
<td>10-9 DATA FOR ADDRESS</td>
<td>10-26</td>
</tr>
<tr>
<td>10-10 KEEP RELAY</td>
<td>10-27</td>
</tr>
<tr>
<td>10-11 SWITCH AND SOLENOID VALVE</td>
<td>10-41</td>
</tr>
<tr>
<td>10-11-1 SOLENOID VALVE LIST</td>
<td>10-43</td>
</tr>
<tr>
<td>10-11-2 LIMIT SWITCH AND PROXIMITY SWITCH LIST</td>
<td>10-45</td>
</tr>
</tbody>
</table>
APPENDIX

A. OPEN/CLOSE LINEAR SCALE.......................................................... A-1

B. FSSB START–UP PROCEDURE/MATERIALS
   B-1 OVERVIEW.............................................................................. B-1
   B-2 SLAVE.................................................................................. B-2
   B-3 AUTOMATIC SETTING.............................................................. B-3
      B-3-1 GENERAL CONFIGURATION(SEMI-CLOSED LOOP) B-6
      B-3-2 GENERAL CONFIGURATION(CLOSED LOOP)........... B-8

C. AUTOMATIC TOOL LENGTH MEASURE........................................ C-1

D. X \ Z \ Y AXIS ORIGIN ADJUSTING
   D-1 X AXIS ORIGIN ADJUSTING.................................................. D-1
   D-2 Z AXIS ORIGIN ADJUSTING.................................................. D-4
   D-3 Y AXIS ORIGIN ADJUSTING.................................................. D-5

E. CALL A/B PALLET MACRO PROGRAM.................................... E-1
This manual is written specifically for MCH-500 and MCH-800. This manual provides information about installations, operations, basic maintenance and routine checkups of these machines. This manual instructs you how to operate the machine safely and correctly. Please read this manual carefully before installation and operation.

Please be advised that this manual and warning signs on the machines are important and must be fully understood. Programming references are given in the manual of the FANUC controller.

Please obey the following rules when using the machine:

1. Do not operate this machine unless you are well-trained and completely understand the functions and features of the machine.

2. Do not continue operating a machine if any faulty function is detected.

3. Do not use in the potential explosive environment.
WARNINGS

To prevent from serious injuries, the employers and owners must provide necessary protections and equipments for installations and operations. The employers and owners must also provide thorough training courses for the operators and they must carefully supervise all operations and obey the following safety regulations:

1. This machine can be operated only by those who are well-trained and fully understand the features and specifications of the machine as well as safety rules for operating the machine.

2. Do not put any portion of your body on any moving component of the machine. Do not enter the work space of the machine unless the power of the machine is off.

3. Do not wear loose clothing or gloves since they may be tangled in the machine. Tighten your clothes, especially the cuffs.

4. Wear safety glasses and safety shoes during operations.

5. Do not operate or maintain this machine unless properly trained and supervised.

6. Make sure the spindle is stopped before changing or adjusting work pieces, fixtures, and tools.

7. Do not use flammable or toxic coolant.

8. If the operator suspect the safety of operating the machine, he or she must stop using this machine immediately and report to the manufacturer within 30 days.

9. Chip conveyor will action when auto tool change, then please don’t into the machine.
FEATURES OF MCH - 500/800

This machine is a horizontal machining center designed for metal cutting. Like steel, iron, copper, aluminum and stainless the others material please don't cut by this machine. It automatically changes tools for milling, drilling, boring, and tapping. Please do not use this machine for other purposes.

Special features are as follows.

1. The diameter of the spindle is 100mm, it mounted with NN type double-row roller bearings, especially adapted for heavy cutting.

2. Direct gear drive is employed for driving the spindle with two gears range. Full horse power output can be obtained in merely 200rpm.

3. Spindle and transmission gears are equipped with forced cooling system to reduce heat increase to ensure accuracy.

4. Counter-balance is adopted for spindle drawing device to eliminate damage of spindle bearing.

5. The headstock is mounted on the sliding surface of the column with all together 8 surfaces in contact so as to enhance rigidity and allow heavy cutting.

6. Headstock and column are symmetric construction designed, which enables thermal transformation to be reduced to the least.

7. The machine bed is one piece "T" form united construction with excellent rigidity feature.

8. X, Y and Z axes slideways are alloy steel and cast iron united dorm forged, and heat treated, hardened and ground to upgrade hardness, wear-resistance, vibration-absorbing and rust-resistance, etc.
9. An auxiliary pneumatic system is adopted to Z axis slideways to reduce friction of column feed by semi-floating way.

This can make column movement smooth without stick-stiff, which not only increases accuracy but also reduces the wear of turcite-B of sliding surfaces.

10. All 3 axes ball screws are pre-tensioned, this can reduce effect caused by thermal expansion.

11. The rotation of working table is driven by servo motor, and coupling is adopted for indexing of table.

12. The 3 axes support bearing housings are forged with saddle, bed and column, and processed by double column (five faces) machining center to obtain excellent precision.

13. Both front and rear sides of bed are mounted with a chip conveyor for quick chip delivering to reduce the influence form chip heat.

14. The sideways and ball screws are forced lubricated by a piston type forced lubrication system controlled by PMC to retain smooth and steady movement.

15. Automatic pallet changer (APC) is shuttle type designed to save space. Paddle device for pallet rotation makes unloading workpiece convenient. APC changing mechanism adopts hydraulic, gear driven shuttle arm to ensure excellent reliability of movement of APC.

16. Magazine is mounted on the left side and electric cabinets on the right side of bed. The floor space of machine is reduced its minimum.

17. Electric cabinets are equipped with heat exchange system which can avoid the electric parts damage caused by over heat.

18. Enclosed splash guard keeps working environment from pollution and ensures safety / security.
1. SAFETY PRECAUTIONS

1-1 GENERAL SAFETY PRECAUTIONS........................................ 1-1

1-2 SAFETY PRECAUTIONS FOR OPERATING THE MACHINE.............................................................................. 1-2

1-3 PRECAUTIONS FOR USING THE ELECTRICAL COMPONENTS AND THE NC CONTROLLER.............................. 1-3

1-4 ILLUSTRATION OF OPERATING ZONES........................................ 1-4

1-5 LOCATION AND CONTENT OF WARNING SIGNS............... 1-5
1. SAFETY PRECAUTIONS

Safety concerns are very important in preventing accidents from happening and in ensuring normal operations of the machine.

1-1 GENERAL SAFETY PRECAUTIONS

The following general safety precautions are helpful in preventing accidents from happening. In other words, they help your company promote productions.

1. Wear safety glasses.

2. Wear safety shoes.

3. Wear work clothes. Tighten the clothes, especially the cuffs.

4. Do not wear gloves when operating the machine.

5. The environment of machine must bright and clean. Keep the places for storing work pieces clean.

6. Do not blow metal chips and dusts around the high voltage controller and the NC controller.

7. Make sure that the floor where the machine and the operator stand are sturdy.
1-2 SAFETY PRECAUTIONS FOR OPERATING THE MACHINE

The operators must fully understand this manual and the following safety precautions before operating the machine.

1. The operators or maintenance personnel must be aware of all the warning labels on the machine. Do not remove or damage the warning labels.

2. To prevent any objects from entering the high voltage controller and the NC controller, do not leave their covers open unless for the purpose of adjustment or maintenance.

3. Do not alter the positions of limit switch to change travels.

4. Use designated tools to adjust, repair, and maintain the machine.

5. In case of any faulty function, stop operating the machine and press the emergency button immediately.

6. Please note the following before starting the machine.
   
   (1) Do not put your hands on any movable component of the machines, such as ATC, APC, and the work table.
   
   (2) Do not use your hands to clean tools or chips on the work table. Cleaning work can be performed only after the machine is stopped.
   
   (3) Make sure that the machine is stopped before adjusting the coolant nozzle.

7. Standard shut-down procedures:
   
   (1) Turn off the power switch.
   
   (2) Clean the work table.
   
   (3) Cover the slideways to prevent dusts from entering.

8. Do not load or unload tools until spindle is EXACT STOP.

9. During the maintenance, the machine must be in the status of complete stop.
1. SAFETY PRECAUTIONS

1-3 PRECAUTIONS FOR USING THE ELECTRICAL COMPONENTS AND THE NC CONTROLLER

Please note the following guidelines for routine maintenance and checkups.

1. Do not strike on the NC controller or heavily press on the control panel.

2. Use electrical cords specified in the manual. Do not use lengthy electrical cords. Cover the electrical cords if they lie on the ground.

3. NC parameters can be altered by authorized technicians only.

4. Do not change the parameters of the high-voltage control panel or other buttons.

5. Do not overload power sockets or electrical cords.

6. Turn off the NC controller, high-voltage control panel and the main power before inspecting electrical components. Make sure that the switches are locked in the “OFF” positions so that the switches cannot be accidentally turned on.

7. Do not contact electrical components with wet tools.

8. Use designated and qualified fuses only. Do not use fuses with higher capacities or use cooper cords to replace fuses.

9. Do not leave the door of the NC controller open since direct sunlight or flashes will damage the controller.

10. Even the main switch in machine is shut off the electricity still remains in the wire form main source in customer’s factory to the main switch in machine.
1-4 ILLUSTRATION OF OPERATING ZONE

A : Operation panel zone
B : A.P.C. operation zone
C : Loading, unloading workpieces zone
D : Loading, unloading tools region
1-5 LOCATION AND CONTENT OF WARNING SIGNS
SAFETY INSTRUCTIONS

To prevent serious injuries, the employers and owners must provide necessary protections and equipments for installations and operations. The employers and owners must also provide thorough training courses for the operators and they must carefully supervise all operations and obey the following safety regulations:

1. This machine can be operated only by those who are well-trained and fully understand the features and specifications of the machine as well as safety rules for operating the machine.
2. Do not put any portion of your body on any moving component of the machine. Do not enter the work space of the machine unless the power of the machine is off.
3. Do not wear loose clothing or gloves since they may be tangled in the machine. Tighten your clothes, especially the cuffs.
4. Wear safety glasses and safety shoes during operations.
5. Do not operate or maintain this machine unless properly trained and supervised.
6. Make sure the spindle is stopped before changing or adjusting work pieces, fixtures, and tools.
7. Do not use flammable or toxic coolant.
8. If the operator suspect the safety of operating the machine, he or she must stop using this machine immediately and report to the manufacturer within 30 days. IT IS A SAFETY VIOLATION TO REMOVE ANY ONE OF THE WARNING SIGNS FROM THE MACHINE.
1. SAFETY PRECAUTIONS

![Diagram of machine parts]

**LUBRICATION CHART**

<table>
<thead>
<tr>
<th>NO</th>
<th>LUBRICATION</th>
<th>INTERVAL</th>
<th>CAPACITY</th>
<th>CHINESE PETROLEUM CORP</th>
<th>SHELL OIL</th>
<th>MOBIL OIL</th>
<th>ESSO</th>
<th>ISO CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HYDRAULIC UNIT</td>
<td>EVERY YEAR</td>
<td>100 l</td>
<td>CPC CIRCULATION OIL R22</td>
<td>SHELL TELLUS OIL C32</td>
<td>MOBIL DTE LIGHT</td>
<td>TERRASSO 32</td>
<td>CB-32</td>
</tr>
<tr>
<td>2</td>
<td>SPINDLE GEAR BOX</td>
<td>6 l</td>
<td>CPC CIRCULATION OIL R22</td>
<td>SHELL TELLUS OIL C32</td>
<td>MOBIL DTE LIGHT</td>
<td>TERRASSO 32</td>
<td>CB-32</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>AIR CONTROL UNIT</td>
<td>TIMELY LUBRICATION</td>
<td>0.06 l</td>
<td>CPC WAY LUBRICANT OIL 68</td>
<td>SHELL TUNNA OIL 182</td>
<td>MOBIL VACRA NO.2</td>
<td>FERUS K68</td>
<td>G-88</td>
</tr>
<tr>
<td>4</td>
<td>SLIDWAYS</td>
<td>LUBRICATION</td>
<td>3 l</td>
<td>CPC WAY LUBRICANT OIL 68</td>
<td>SHELL TUNNA OIL 182</td>
<td>MOBIL VACRA NO.2</td>
<td>FERUS K68</td>
<td>G-88</td>
</tr>
<tr>
<td>5</td>
<td>INDEX TABLE</td>
<td>EVERY 5 YEARS</td>
<td>4 l</td>
<td>CPC EP LUBRICANT HD-660</td>
<td>SHELL OMAHA OIL 460</td>
<td>MOBIL GEAR OIL 834</td>
<td>ESSEX SPARTAN EP460</td>
<td>CC-480</td>
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**Remark** Maintenance interval is counted on the basis of working 8 hours per day.
# The Interval of Maintenance

<table>
<thead>
<tr>
<th>No</th>
<th>Section</th>
<th>Parts</th>
<th>Interval</th>
<th>Methods of Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hydraulic Tank</td>
<td>Paper Filter</td>
<td>Every Year</td>
<td>Change. The filter gauge must be replaced when the indicator is up to maximum.</td>
</tr>
<tr>
<td>2</td>
<td>Heat Exchanger</td>
<td>Air Filter</td>
<td>1-2 Weeks</td>
<td>Please wash by using air blast gun or water. If dirty oil contained, neutral detergent is required.</td>
</tr>
<tr>
<td>3</td>
<td>Cooler</td>
<td>Paper Filter</td>
<td>Every Year</td>
<td>Change. The filter gauge must be replaced when the indicator is up to maximum.</td>
</tr>
<tr>
<td>4</td>
<td>Column</td>
<td>Air Control Unit</td>
<td>Every Day</td>
<td>Please disconnect the air pipe and release the water remained inside the filter element every day after the power turned off.</td>
</tr>
<tr>
<td>5</td>
<td>Oil Cylinder</td>
<td>Air Filter</td>
<td>Semi-Annually</td>
<td>Please wash by using air blast gun or water. If dirty oil contained, neutral detergent is required.</td>
</tr>
<tr>
<td>6</td>
<td>Spindle Motor</td>
<td>Cooling Fan</td>
<td>Every Year</td>
<td>Please clean the inlet by using air blast gun.</td>
</tr>
</tbody>
</table>

Remark: Maintenance interval is counted on the basis of working 8 hours per day.
WARNING

DO NOT TOUCH
KEEP HANDS AWAY
1. SAFETY PRECAUTIONS

12

WARNING
1. Set control in manual mode before working near spindle.
2. Turn off and lock out power at electrical panel before servicing.

13

WARNING
Unexpected objects may fly out, and cause injury.

1. Keep the doors closed during machining.
2. Keep interlocks and other safety devices in place and functioning.
THE LOCATION OF SOLENOID

1. Magazine Positioning.
2. Magazine C.W.
3. Magazine C.C.W.
4. Arm in Middle Position.
5. Arm Forwarding Magazine.
6. Arm in Middle Position.
7. Arm Forwarding Spindle.
8. Arm Contraction.
10. Arm Rightwarding.
11. Arm Leftwarding.
CAUTION:
Use the tool-shank as shown above
### The Interval of Maintenance

<table>
<thead>
<tr>
<th>NO.</th>
<th>Parts</th>
<th>The Interval of Maintenance</th>
<th>The Way of Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pressure valve</td>
<td>6 months</td>
<td>Release the gear and take the filter element out, then have it cleaned by air blast.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>One year</td>
<td>Release the gear and replace a new filter element, model 4335-04.</td>
</tr>
<tr>
<td>2</td>
<td>Filter</td>
<td>Filter element &quot;A&quot; goes up to the top</td>
<td>Take the filter element, model 4344-01, out by turn and replace a new one.</td>
</tr>
<tr>
<td></td>
<td>Release valve</td>
<td>Before full</td>
<td>Turn the release valve &quot;Q&quot; to vertical position to enable the filtered water be released.</td>
</tr>
<tr>
<td>3</td>
<td>Oil regulator</td>
<td>To fill the circulation oil R32</td>
<td>While the oil is filled, the oil feeding volume can be adjusted by turning the &quot;G&quot; knob in either CW or CCW direction, then push the &quot;G&quot; knob to fix the volume adjusted.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>before it goes empty, max capacity is 0.15 liter.</td>
<td></td>
</tr>
</tbody>
</table>
2. INTRODUCTION TO THE MACHINE

2-1 LAYOUT AND LIST OF COMPONENTS................................. 2-1
2-2 DIMENSIONS...................................................................... 2-2
2-3 MACHINE SPECIFICATIONS............................................. 2-4
2-4 TOOL SPECIFICATIONS.................................................... 2-5
2-5 STANDARD ACCESSORIES AND OPTIONAL ACCESSORIES........................................................................................................... 2-8
   2-5-1 STANDARD ACCESSORIES........................................... 2-8
   2-5-2 OPTIONAL ACCESSORIES........................................... 2-9
2-6 SPINDLE POWER AND TORQUE ........................................ 2-10
2-7 SOUND LEVEL...................................................................... 2-10
2. INTRODUCTION TO THE MACHINE

2-1 LAYOUT AND LIST OF COMPONENTS

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>1. Tool Magazine (ATC)</td>
<td>10. Chip Box (Option)</td>
</tr>
<tr>
<td>2. Column</td>
<td>11. Chip Conveyor (Option)</td>
</tr>
<tr>
<td>3. Y-axis Servo Motor</td>
<td>12. Table</td>
</tr>
<tr>
<td>4. Guard</td>
<td>13. Coolant Tank</td>
</tr>
<tr>
<td>5. Pallet</td>
<td>14. Gun Drill Motor (Option)</td>
</tr>
<tr>
<td>6. Headstock</td>
<td>15. Coolant Motor</td>
</tr>
<tr>
<td>7. Electrical Cabinet</td>
<td>16. Level-Adjusting Bolt</td>
</tr>
<tr>
<td>8. APC Control Panel</td>
<td>17. APC Control Panel</td>
</tr>
</tbody>
</table>

[Diagram of machine components]
2-2 DIMENSIONS

MCH - 500

Dimensions:
- Width: 4085 mm
- Depth: 3170 mm
- Height: 2960 mm
- Other dimensions as labeled in the diagram.
## 2-3 MACHINE SPECIFICATIONS

### 1. METRIC

<table>
<thead>
<tr>
<th>TABLE</th>
<th>MCH - 500</th>
<th>MCH - 800</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pallet dimensions</td>
<td>500×500mm</td>
<td>800×800mm</td>
</tr>
<tr>
<td>Min. indexing angle</td>
<td>1°</td>
<td></td>
</tr>
<tr>
<td>Max. table load</td>
<td>800kgw</td>
<td>2000kgw</td>
</tr>
<tr>
<td>TRAVEL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Longitudinal travel (X)</td>
<td>750mm</td>
<td>1350mm</td>
</tr>
<tr>
<td>Vertical travel (Y)</td>
<td>680mm</td>
<td>1000mm</td>
</tr>
<tr>
<td>Cross travel (Z)</td>
<td>600mm</td>
<td>1000mm</td>
</tr>
<tr>
<td>Distance of spindle end to table center</td>
<td>180-780mm</td>
<td>300-1300mm</td>
</tr>
<tr>
<td>Distance of spindle center to table</td>
<td>50-730mm</td>
<td>50-1050mm</td>
</tr>
</tbody>
</table>

### SPINDLE

<table>
<thead>
<tr>
<th>Spindle nose</th>
<th>NT40, 50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spindle speeds</td>
<td>STANDARD: 4500 r.p.m, OPTION: 6000 r.p.m</td>
</tr>
<tr>
<td>Spindle speed range</td>
<td>Two gears variable</td>
</tr>
</tbody>
</table>

### FEED

| Cutting feed                       | 10000mm/min | 5000mm/min |
| Rapid traverse                     | 15m/min     | 10m/min    |
| Min. input increment               | 0.001mm     | 0.001mm    |

### ATC (Automatic Tool Changer)

| Tool storage capacity              | STANDARD: 60, OPTION: 90 & 120 |
| Max. tool Dia x Length             | φ110×400mm, φ110×500mm |
| Max. tool weight                   | 20kgw, 20kgw |
| Tool selection                     | bi-direction tool selection |

### MOTORS

| Spindle motor (Rated output for 30 minutes) | 18.5kw (24.5HP) |

### MACHINE SPACE AND WEIGHT

| Floor space                        | 3170×4920mm, 4410×6495mm |
| Machine weight                     | 15000kgw, 24000kgw |

2-5
### TABLE

<table>
<thead>
<tr>
<th></th>
<th>MCH - 500</th>
<th>MCH - 800</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pallet dimensions</td>
<td>19.69×19.69 inch</td>
<td>31.50×31.50 inch</td>
</tr>
<tr>
<td>Min. indexing angle</td>
<td></td>
<td>1°</td>
</tr>
<tr>
<td>Max. table load</td>
<td>1760 lbs</td>
<td>4400 lbs</td>
</tr>
</tbody>
</table>

### TRAVEL

<table>
<thead>
<tr>
<th></th>
<th>MCH - 500</th>
<th>MCH - 800</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longitudinal travel (X)</td>
<td>29.53 inch</td>
<td>53.15 inch</td>
</tr>
<tr>
<td>Vertical travel (Y)</td>
<td>26.77 inch</td>
<td>39.37 inch</td>
</tr>
<tr>
<td>Cross travel (Z)</td>
<td>23.62 inch</td>
<td>39.37 inch</td>
</tr>
<tr>
<td>Distance of spindle end to table center</td>
<td>7.09-30.71 inch</td>
<td>11.81-51.18 inch</td>
</tr>
<tr>
<td>Distance of spindle center to table surface</td>
<td>1.97-28.74 inch</td>
<td>1.97-41.34 inch</td>
</tr>
</tbody>
</table>

### SPINDLE

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Spindle nose</td>
<td>NT40 、50</td>
</tr>
<tr>
<td>Spindle speeds</td>
<td>STANDARD:4500 r.p.m</td>
</tr>
<tr>
<td></td>
<td>OPTION:6000 r.p.m</td>
</tr>
<tr>
<td>Spindle speed range</td>
<td>Two gears variable</td>
</tr>
</tbody>
</table>

### FEED

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting feed</td>
<td>393.70 inch/min</td>
</tr>
<tr>
<td></td>
<td>196.85 inch/min</td>
</tr>
<tr>
<td>Rapid traverse</td>
<td>590.55 inch/min</td>
</tr>
<tr>
<td></td>
<td>393.70 inch/min</td>
</tr>
<tr>
<td>Min. input increment</td>
<td>0.0001 inch</td>
</tr>
<tr>
<td></td>
<td>0.0001 inch</td>
</tr>
</tbody>
</table>

### ATC (Automatic Tool Changer)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tool storage capacity</td>
<td>STANDARD:60</td>
</tr>
<tr>
<td></td>
<td>OPTION:90 &amp; 120</td>
</tr>
<tr>
<td>Max. tool Dia × Length</td>
<td>φ 110×400mm</td>
</tr>
<tr>
<td></td>
<td>φ 110×500mm</td>
</tr>
<tr>
<td>Max. tool weight</td>
<td>20 kgw</td>
</tr>
<tr>
<td></td>
<td>20 kgw</td>
</tr>
<tr>
<td>Tool selection</td>
<td>bi-direction tool selection</td>
</tr>
</tbody>
</table>

### MOTORS

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Spindle motor (Rated output for 30 minutes)</td>
<td>18.5kw (24.5HP)</td>
</tr>
</tbody>
</table>

### MACHINE SPACE AND WEIGHT

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Floor space</td>
<td>124.80×193.70 inch</td>
</tr>
<tr>
<td></td>
<td>173.62×255.71 inch</td>
</tr>
<tr>
<td>Machine weight</td>
<td>33000 lbs</td>
</tr>
<tr>
<td></td>
<td>52800 lbs</td>
</tr>
</tbody>
</table>
2-4 TOOL SPECIFICATIONS

TOOL SHANK DIAGRAM BT50

PULL STUD DIAGRAM BT 50
Drawing of DIN tool shank

<table>
<thead>
<tr>
<th>Unit</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIN40</td>
<td>mm</td>
<td>68.5</td>
<td>φ 63.55</td>
<td>56.25</td>
<td>11.1</td>
<td>19.1</td>
<td>60°</td>
<td>44.45</td>
<td>3.2</td>
<td>M16×2P</td>
</tr>
<tr>
<td>DIN50</td>
<td>mm</td>
<td>101.7</td>
<td>φ 97.5</td>
<td>91.25</td>
<td>11.1</td>
<td>19.1</td>
<td>60°</td>
<td>69.85</td>
<td>3.2</td>
<td>M24×3P</td>
</tr>
</tbody>
</table>
If the ATC mechanism is designed using the DIN tool shank, specific pull studs, shown in the diagram, must be used.
## 2-5 STANDARD ACCESSORIES AND OPTIONAL ACCESSORIES

### 2-5-1 STANDARD ACCESSORIES

<table>
<thead>
<tr>
<th>MCH - 500 / 800 STANDARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. SPINDLE COOLING DEVICE</td>
</tr>
<tr>
<td>2. HEAT EXCHANGER</td>
</tr>
<tr>
<td>3. AUTOMATIC PALLET CHANGER WITH MANUAL ROTATION</td>
</tr>
<tr>
<td>4. REMOVABLE TYPE MANUAL PULSE GENERATOR</td>
</tr>
<tr>
<td>5. X Y Z AXES LINER SCALE</td>
</tr>
<tr>
<td>6. FLOOD COOLANT DEVICE</td>
</tr>
<tr>
<td>7. COOLANT TANK</td>
</tr>
<tr>
<td>8. SPIRAL TYPE CHIP CONVEYORS</td>
</tr>
<tr>
<td>9. SPINDLE LOAD METER</td>
</tr>
<tr>
<td>10. SPINDLE SPEED METER</td>
</tr>
<tr>
<td>11. AUTOMATIC POWER CUT-OFF DEVICE</td>
</tr>
<tr>
<td>12. CALL LIGHT</td>
</tr>
<tr>
<td>13. WORK LIGHT</td>
</tr>
<tr>
<td>14. TOOL KIT</td>
</tr>
</tbody>
</table>
2. INTRODUCTION TO THE MACHINE

2-5-2 OPTIONAL ACCESSORIES

<table>
<thead>
<tr>
<th>MCH - 500 / 800</th>
<th>OPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ATC TOOL STORAGE : 90 &amp; 120</td>
<td></td>
</tr>
<tr>
<td>2. COOLANT SYSTEM : SHOWER COOLANT · COOLANT GUN · OIL HOLE COOLANT</td>
<td></td>
</tr>
<tr>
<td>3. OIL MIST DEVICE</td>
<td></td>
</tr>
<tr>
<td>4. FLAT TYPE CHIP CONVEYOR</td>
<td></td>
</tr>
<tr>
<td>5. CHIP WAGON</td>
<td></td>
</tr>
<tr>
<td>6. AUTOMATIC CENTERING DEVICE</td>
<td></td>
</tr>
<tr>
<td>7. TOOL BREAKAGE DETECTION DEVICE</td>
<td></td>
</tr>
<tr>
<td>8. TOOL LENGTH MEASURING DEVICE</td>
<td></td>
</tr>
<tr>
<td>9. AUTOMATIC WORKPIECE MEASURING DEVICE</td>
<td></td>
</tr>
<tr>
<td>10. ADDITION CALL LIGHT</td>
<td></td>
</tr>
<tr>
<td>11. BUZZER DEVICE</td>
<td></td>
</tr>
</tbody>
</table>


2-6 SPINDLE POWER AND TORQUE

MCH-500/800

LOW(1 : 0.2013)

HIGH(1 : 1.1560)

MOTOR: $\alpha$ 15/7000i

2-7 SOUND LEVEL

The sound pressure level at the operator's position according to Japanese industrial Standard JIS B6004 :1980( Method of sound measurement for machine tools ) is under 80 dbA.
3. PREPARATIONS FOR INSTALLATION

3-1 REQUIREMENTS OF THE ENVIRONMENT............................ 3-1
3-2 FOUNDATION DRAWINGS.................................................. 3-2
3-3 REQUIREMENT OF THE FOUNDATION............................... 3-8
   3-3-1 METHOD FOR CONSTRUCTING THE FOUNDATION...................... 3-8
   3-3-2 NOTES FOR THE CONSTRUCTION OF THE FOUNDATION............... 3-8
3-4 REQUIREMENT OF POWER SOURCES................................. 3-10
   3-4-1 REQUIREMENT OF ELECTRICAL POWER........................... 3-10
   3-4-2 PNEUMATIC REQUIREMENTS....................................... 3-11
3-5 OPERATION ENVIRONMENT FOR THE NC MACHINE.......... 3-12
3-6 NOTES FOR TURNING ON THE MACHINE AFTER INSTALLATION........ 3-13
   3-6-1 BEFORE TURNING ON THE MACHINE............................ 3-13
   3-6-2 AFTER TURNING ON THE MACHINE............................. 3-14
3. PREPARATIONS FOR INSTALLATION

3-1 REQUIREMENTS OF THE ENVIRONMENT

In order to obtain the best designed performance of the machine, conditions of the environment, such as room temperature, dusts, and vibrations must be taken into account.

If the room temperature changes rapidly, the precision of the machine will be significantly decreased.

Therefore, the machine must be installed in an environment which is free of direct sunlight and far away from heat sources, such as heat exchangers.

The environment must also be well ventilated.

In the case in which the machine has to be installed in a humid or unclean environment, the slideways and electrical components must be inspected regularly to detect abrasions or rusts. The slideways and electrical components can be easily damaged under bad environmental conditions. A dusty and humid environment will also damage the NC controller. (See Section 3-5 for more information.)

Vibrations will decrease the precision of the machine. Thus the machine must be installed in a place far away from objects that might cause vibrations.
THE FOUNDATION BY CLAMPING OF MCH-500
3. PREPARATIONS FOR INSTALLATION

THE FOUNDATION BY BOLTING OF MCH-500
3. PREPARATIONS FOR INSTALLATION

THE FOUNDATION BY BOLTING OF MCH-500+6APC
THE FOUNDATION BY CLAMPING OF MCH-800
3. PREPARATIONS FOR INSTALLATION

THE FOUNDATION BY BOLTING OF MCH-800
3-3 REQUIREMENTS OF THE FOUNDATION

3-3-1 METHOD FOR CONSTRUCTING THE FOUNDATION

Locations for installing the machine:

The machine must be installed in a location which is free of direct sunlight, without rapid temperature changes, far away from heat sources or vibrational objects, and well ventilated.

3-3-2 NOTES FOR THE CONSTRUCTION OF THE FOUNDATION

1. The foundation under the machine must be capable of supporting at least 5 ton/m² of compressional pressure. If the soils are too soft and cannot support the specified pressure, soil piles must be installed.

2. The construction of the foundation must be performed at least 4 weeks before the installation of the machine.

3. Please refer to the foundation drawings for digging the foundation. The digging depth must be 150-200 mm deeper than that shown in the drawings since a layer of 150-200 mm stones will be placed on the ground.

4. The mixed ratio of the RC for the foundation is Concrete: Sand: Stone = 1:2:4. The tolerance of the foundation level must be within 15 mm.

5. Holes must be reserved for foundation bolts by inserting wooden patterns before pouring RC into the foundation. The locations of the bolts are shown in the foundation drawings. Please refer to the foundation drawings for the size of the holes to be reserved. Draft of the patterns is 1/50-2/50. The length of the pattern must be longer than that of the hole, so that the patterns can be raised 25 mm above ground for the purpose of removing the patterns.
6. The locations for burying foundation bolts are shown in the foundation drawings. The bolts must be buried by the customers when installing the machine.

7. During installation, the machine must be positioned so that the reserved holes on the machine line up with the holes on the foundation. Each foundation bolt is inserted through the level adjusting block as well as the machine. As shown in Figure 1, the length of the bolt (above ground) is $a+b+c$. Note that the reserved lengths (d) of all the bolts must be equal.

8. Insert a wedge around each level adjusting block under the machine. Then place the level on the work table and perform coarse adjustment.

9. Pouring water into the foundation holes to keep the holes wet for 1-2 days before pouring concrete. Before pouring concrete, the water must be drained away and the holes must be cleaned. The mixed ratio of the RC is Concrete: Sand: Stones=1:1.5:1.5. The RC is poured until it reaches 1/3 of the level adjusting block. Keep the RC wet for several days after pouring.

10. Do not adjust the level of the machine until at least 2 weeks after pouring concrete. Remove the wedges after the adjustment.
3-4 REQUIREMENT OF POWER SOURCES

3-4-1 REQUIREMENT OF ELECTRICAL POWER

<table>
<thead>
<tr>
<th>MODEL</th>
<th>POWER SOURCE</th>
<th>POWER CONSUMPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCH-500</td>
<td>45 KVA</td>
<td>41.556 KW</td>
</tr>
<tr>
<td>MCH-800</td>
<td>45 KVA</td>
<td>43.556 KW</td>
</tr>
</tbody>
</table>

Note that the machine requires 220/200 V ±10% of Voltage. A transformer can be used if necessary.

The customers must connect the electrical cord between the machine and electrical socket themselves. Please refer to the following table for selecting electrical cords with suitable cross section areas.

<table>
<thead>
<tr>
<th>MODEL</th>
<th>Cross section areas of electrical cord</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCH-500</td>
<td>30 mm²</td>
</tr>
<tr>
<td>MCH-800</td>
<td>30 mm²</td>
</tr>
</tbody>
</table>

The cross section areas listed above are calculated based on 220 V power sources. If the power is not of 220 V, please follow your local standards to select electrical cords.

Please refer to the following table for the cross section areas of ground cords.

<table>
<thead>
<tr>
<th>Electrical cord cross section areas</th>
<th>Minimum ground cord cross section areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>S (mm²)</td>
<td>S (mm²)</td>
</tr>
<tr>
<td>S ≤ 16</td>
<td>S</td>
</tr>
<tr>
<td>16 &lt; S ≤ 35</td>
<td>16</td>
</tr>
<tr>
<td>S &gt; 35</td>
<td>S/2</td>
</tr>
</tbody>
</table>
3-4-2 PNEUMATIC REQUIREMENTS

The machine uses air to clean the spindle tapper, pallet and the floating of Z axis. The customers must prepare air pumps themselves. The requirements of air pressures and the air flowrates are listed as follows:

<table>
<thead>
<tr>
<th>MODEL</th>
<th>AIR PRESSURE</th>
<th>FLOWRATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCH-500</td>
<td>6 kgf/cm²</td>
<td>500 l/min</td>
</tr>
<tr>
<td>MCH-800</td>
<td>6 kgf/cm²</td>
<td>500 l/min</td>
</tr>
</tbody>
</table>

The machine is equipped with an air filter and an adjusting device, which are used to filter dusts and collect vapors, respectively. If the temperature of the supplied air is higher than that of the machine, the vapors will become water. As a result, the spindle tapper, and the tool shank, thus the precision of the machine will be decreased. Therefore, try to keep the temperature of the supplied airs as low as possible.
3-5 OPERATION ENVIRONMENT FOR THE NC MACHINE

1. Temperature
   Operation : 0 ℃ ~ 45 ℃
   Storage or transportation : -20 ℃ ~ 60 ℃

2. Temperature Change Rate
   Maximum allowable temperature change rate : 1.1 ℃/min

3. Humidity
   Relative humidity : 95 %

4. Vibrations
   Operation : ≤ 0.5 G

5. Electrical Power Capacity
   (1) Power source for the NC controller : 10 KVA
   (2) Power source for the machine (including the NC controller):

<table>
<thead>
<tr>
<th>MODEL</th>
<th>POWER SOURCE</th>
<th>POWER CONSUMPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCH-500</td>
<td>45 KVA</td>
<td>41.556 KW</td>
</tr>
<tr>
<td>MCH-800</td>
<td>45 KVA</td>
<td>43.556 KW</td>
</tr>
</tbody>
</table>

   (3) Current
   The calculation of currents depends on local power sources, and the formula is given as follows:
   \[ A = \frac{1000 \times KW}{1.73 \times V \times \text{FACTOR}} \]
   \[ \text{FACTOR} = 0.8 \]

6. Voltage :
   200/220 V ± 10 %
   60/50 Hz ± 1 Hz

   (1) If local power voltages are not of 200V/220V, a transformer is required.
   (2) If local power voltages are not stable, a voltage stabilizer is required.
3. PREPARATIONS FOR INSTALLATION

3-6 NOTES FOR TURNING ON THE MACHINE AFTER INSTALLATION

3-6-1 BEFORE TURNING ON THE MACHINE

1. Check the electrical power source entering the machine to ensure that it is 3-phase, 60 Hz (or 50 Hz), 200V (or 220V) Ac power.

2. Check the electrical cord connecting to the machine to ensure that the cord and phases are connected correctly.

3. Check if the external ground cord is well installed or not.

4. Check if the locking components (for transportation purposes) are removed or not.

5. Check if the foundation blots are tightened and make sure that the machine is in good level condition or not.

6. Check if all the pipes are well connected or not.

7. Check if the enclosed guard and the door are function appropriately or not.

8. Check if there is enough oil in the slideways or not, and pump oils several times manually.

9. Check the spindle and tool shank to see if there is any loosing components or not.

10. Check the limit switches and blocks.

11. Check if there is any unnecessary object around the machine or not.
3-6-2 AFTER TURNING ON THE MACHINE

1. Check the direction of motion of the chip conveyor.
2. Check if the emergency stop function works or not.
3. Check if the power can be turned on and off normally or not.
4. Check if all the buttons and switches function or not.
5. Move the axes slowly to check if the lubricants are supplied normally or not.
6. Move the axes slowly to check if the limit switches function normally or not.
7. Check if the machine performs zero return normally or not.
8. Check if the spindle rotates normally or not.
9. Check if the interlock switch of the door function normally or not.
10. Check if the machine can be controlled by a program or not.
11. Check if there is any oil leak or not.
4. TRANSPORTATION AND LEVELING

4-1 PRECAUTION FOR TRANSPORTATION................................. 4-1
  4-1-1 MCH-500................................................................. 4-1
  4-1-2 MCH-800................................................................. 4-2
4-2 LEVEL ADJUSTMENT....................................................... 4-3
  4-2-1 METHOD OF LEVELING FOR MCH-500....................... 4-4
  4-2-2 METHOD OF LEVELING FOR MCH-800....................... 4-8
4. TRANSPORTATION AND LEVELING

4-1 PRECAUTION FOR TRANSPORTATION

4-1-1 MCH-500

1. Use the crane capable of hoisting at least 16 tons load.

2. Take out the wire ropes attached to the MCH-500: two $\varphi \, 3/4" \times 3450$mm wire ropes and one $\varphi \, 3/4" \times 6800$mm.

3. There are two hangers on each front (APC) and rear (hydraulic unit) sides. Use two $\varphi \, 3/4" \times 3450$mm wire ropes to buckle the two hooks on the APC sides. Pass them through the enclosed splash guard and buckle the hanger of the crane. Use $\varphi \, 3/4" \times 6800$mm wire rope to buckle the rear hook and pass it through the hanger of the crane, then buckle the other rear hook. The layouts of iron ropes for hoisting M.C. are as follows.

4. Apply wooden pieces or pads to sections where the wire ropes contact the machine. This will protect them.

5. Transportation should be with care according to the local crane operating regulations.
4-1-2 MCH-800

1. Use the crane capable of hoisting at least 25 tons load.

2. Take out three wire ropes φ3/4"x10100mm attached to the MCH-800.

3. Use the first wire rope to buckle the two harriers (1, 2) on the right side of the bed. Use the second iron rope to buckle the hooks (1, 2) on the right side of the bed. Use the third iron rope to buckle the two hooks (3) on the side of hydraulic unit. Use the crane to buckle the three iron ropes. The layouts of the iron ropes for hoisting M.C. are as follows.

4. Apply wooden pieces or pads to sections where the wire ropes contact the machine. This will protect them.

5. Transportation should be with care according to the local crane operating regulations.
Levelness is a major factor that affects the precision of the machine. It will also affect the life cycle of the machine.

To adjust the levelness of the machine, first, install the machine on a good level surface. Use the level adjusting bolts on the bed of the machine to roughly adjust the levelness. Second, place a level (about 200mm long, 0.02mm/m minimum measurement) on the work table. Adjust the level adjusting bolts again so that the errors in the forward-backward and left-right directions are within 0.04mm/m, as shown in the figure. Finally, tighten the bolts carefully.

If vibrations occur due to the unbalance of the machine or discrete cutting traces appear on the work piece after cutting, then the level adjusting bolts must be adjusted again. Perform daily checkups of levelness in the first 2-3 days after the installation. Perform monthly checkups within the first 6 months. After 6 months, the levelness must be checked once in three months.
4-2-1 MOTHOD OF LEVELING FOR MCH-500

DISTRIBUTION DIAGRAM OF LEVEL ADJUSTING BOLTS FOR MCH-500
Straightness of the table movement in X axis direction.

Method: Put the leveling gauge on the table. Adjust bolts (3) (4) (10) (11) (12) for leveling and move the table in the X-axis direction. The requirement for accuracy is within 0.04 mm/m.

(1) Squareness between Y and Z axis.

Method: Put the square gauge on the table. Inspect the Y-Z face. Set the meter to zero. Move the headstock downward.

1. If the meter reads “+”, it shows that the column inclines backward. Please adjust bolts (7) (15) for ascent. In addition, adjust bolts (6) (14) in 1/2 feed amount taken above for ascent.

2. If the meter reads “−”, it shows that the column inclines forward. Please adjust bolts (7) (15) for descent. In addition, adjust bolts (6) (14) in 1/2 feed amount taken above for ascent.
(2) Squareness between X and Y axis.

Method: Rotate the square gauge to inspect the X-Y face. Set the meter to zero. Move the headstock downward.

1. If the meter reads “+”, it shows that the column inclines rightward. Please adjust bolts (13) (14) (15) for ascent, and bolts (5) (6) (7) for descent.

2. If the meter reads “−” it shows that the column inclines leftward. Please adjust bolts (7) (15) for descent. In addition, adjust bolts (6) (14) in 1/2 feed amount taken above for ascent.

(3) Parallelism of Z axial movement to the spindle center line.

Method: Mounting a test bar to the spindle to check the accuracy of vertical direction and horizontal direction:

The reading value of (a) is related to the leveling of machine. The reading value of (b) is related to the install accuracy.
(4) Parallelism of the table surface to the X and Z axis movement.

Method: C-D: If the side of D is higher, adjust the screw (7) (15) for descent or (5) (13) for ascent. If the side of C is higher, adjust the screws (5) (13) for ascent or (7) (15) for descent. It needs not to adjust the accuracy of the A-B for the reason of being original accuracy for the machine.

The adjusting method (1)–(5) can be proceeded repeatly for the best leveling. The level adjusting bolts on APC can be adjusted if necessary.
4-2-2 METHOD OF LEVELING FOR MCH-800

DISTRIBUTION DIAGRAM OF LEVEL ADJUSTING BOLTS FOR MCH-800
(1) Straightness of the table movement in X axis direction.

Method: Put the leveling gauge on the table. Adjust bolts (4) (5) (6) (7) (8) for leveling and move the table in the X-axis direction. The requirement for accuracy is within 0.04 mm/m.

(2) Squareness between Y and Z axis.

Method: Put the square gauge on the table. Inspect the Y-Z face. Set the meter to zero. Move the headstock downward.

1. If the meter reads “+”, it shows that the column inclines backward. Please adjust bolts (12) (24) for ascent. In addition, adjust bolts (11) (23) in 2/3 feed amount taken above for ascent.

2. If the meter reads “−”, it shows that the column inclines forward. Please adjust bolts (12) (24) for descent. In addition, adjust bolts (11) (23) in 2/3 feed amount taken above for ascent.
(3) Squareness between X and Y axis.

**Method:** Rotate the square gauge to inspect the X-Y face. Set the meter to zero. Move the headstock downward.

3. If the meter reads "+", it shows that the column inclines rightward. Please adjust bolts (21) (22) (23) (24) for ascent, and bolts (9) (10) (11) (12) for descent.

4. If the meter reads "−" it shows that the column inclines leftward. Please adjust bolts (21) (22) (23) (24) for descent. In addition, adjust bolts (9) (10) (11) (12) in 1/2 feed amount taken above for ascent.

(4) Parallelism of Z axial movement to the spindle center line.

**Method:** mounting a test bar to the spindle to check the accuracy of vertical direction and horizontal direction:

The reading value of (a) is related to the leveling of machine. The reading value of (b) is related to the install accuracy.
(5) Parallelism of the table surface to the X and Z axis movement.

Method: C-D: If the side of D is higher, adjust the screw (12) (24) for descent or (9) (21) for ascent. If the side of C is higher, adjust the screws (9)(21) for ascent or (12) (24) for descent. It needs not to adjust the accuracy of the A-B for the reason of being original accuracy for the machine.

The adjusting method (1)~(5) can be proceeded repeatly for the best leveling. The level adjusting bolts on APC can be adjusted if necessary.
5. DIMENSIONS FOR MACHINING

5-1 DIAGRAM FOR TABLE DIMENSIONS............................... 5-1
5-2 RANGE OF MACHINING AND MAXIMUM WORKPIECE
   DIMENSION................................................................. 5-3
5-3 TRAVEL FOR AXES AND ZERO POINT POSITION............ 5-6
5. DIMENSIONS FOR MACHINING

5-1 DIAGRAM FOR TABLE DIMENSIONS

MCH - 500
MCH – 800

[Diagram showing dimensions and layout for a machining center operation and maintenance manual.]
5-2 RANGE OF MACHINING AND MAXIMUM WORKPIECE DIMENSION

MCH - 500
SIZES FOR MAXIMUM WORKPIECE

Remark: Dimensions in parentheses are the machining dimensions for MCH - 500.
## 5-3 TRAVEL FOR AXES AND ZERO POINT POSITION

<table>
<thead>
<tr>
<th></th>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCH - 500</td>
<td>750mm</td>
<td>680mm</td>
<td>600mm</td>
</tr>
<tr>
<td>MCH - 800</td>
<td>1350mm</td>
<td>1000mm</td>
<td>1000mm</td>
</tr>
</tbody>
</table>
6. NC CONTROL FUNCTION

6-1 G FUNCTION .......................................................... 6-1
6-2 F FUNCTION .......................................................... 6-6
6-3 S FUNCTION .......................................................... 6-6
6-4 T FUNCTION .......................................................... 6-6
6-5 M FUNCTION .......................................................... 6-7
6. NC CONTROL FUNCTION

6-1 G FUNCTION

The G code are divided into the following types

One-shot G code: The G code is effective only in the block in which it is specified.

Model G code: The G code is effective until another G code of the same group is specified.

[ Example ]

G01 and G00 are model G codes in the group 01.

\[
\begin{align*}
G01 & \quad X_{________} ; \\
& \quad \{ \\
& \quad \quad Z_{________} ; \\
& \quad \quad \quad \text{G01 is valid in range} \\
& \quad \quad X_{________} ; \\
& \quad \} \\
G00 & \quad Z_{________} ;
\end{align*}
\]
## Lists of G Codes

<table>
<thead>
<tr>
<th>G code</th>
<th>Group</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>G00</td>
<td>00</td>
<td>Positioning</td>
</tr>
<tr>
<td>G01</td>
<td>01</td>
<td>Linear interpolation</td>
</tr>
<tr>
<td>G02</td>
<td></td>
<td>Circular interpolation CW</td>
</tr>
<tr>
<td>G03</td>
<td></td>
<td>Circular interpolation CCW</td>
</tr>
<tr>
<td>G04</td>
<td>00</td>
<td>Dwell</td>
</tr>
<tr>
<td>G09</td>
<td>00</td>
<td>Exact stop</td>
</tr>
<tr>
<td>G10</td>
<td></td>
<td>Data setting</td>
</tr>
<tr>
<td>G11</td>
<td></td>
<td>Data setting mode cancel (option)</td>
</tr>
<tr>
<td>G15</td>
<td>17</td>
<td>Polar coordinates command cancel</td>
</tr>
<tr>
<td>G16</td>
<td>17</td>
<td>Polar coordinates command</td>
</tr>
<tr>
<td>G17</td>
<td>02</td>
<td>XY plane selection</td>
</tr>
<tr>
<td>G18</td>
<td>02</td>
<td>ZX plane selection</td>
</tr>
<tr>
<td>G19</td>
<td>02</td>
<td>YZ plane selection</td>
</tr>
<tr>
<td>G20</td>
<td>06</td>
<td>Inch input</td>
</tr>
<tr>
<td>G21</td>
<td>06</td>
<td>Metric input</td>
</tr>
<tr>
<td>G22</td>
<td>04</td>
<td>Stored stroke limit ON</td>
</tr>
<tr>
<td>G23</td>
<td>04</td>
<td>Stored stroke limit OFF</td>
</tr>
<tr>
<td>G27</td>
<td>00</td>
<td>Reference point return check</td>
</tr>
<tr>
<td>G28</td>
<td>00</td>
<td>Reference point return</td>
</tr>
<tr>
<td>G29</td>
<td>00</td>
<td>Retrun from reference point</td>
</tr>
<tr>
<td>G30</td>
<td>00</td>
<td>Return to 2nd, 3rd, 4th reference</td>
</tr>
<tr>
<td>G31</td>
<td>00</td>
<td>Skip function (option)</td>
</tr>
<tr>
<td>G37</td>
<td>00</td>
<td>Tool length measurement (option)</td>
</tr>
<tr>
<td>G40</td>
<td>07</td>
<td>Cutter radius compensation cancel</td>
</tr>
<tr>
<td>G41</td>
<td>07</td>
<td>Cutter radius compensation left</td>
</tr>
<tr>
<td>G42</td>
<td>07</td>
<td>Cutter radius compensation right</td>
</tr>
<tr>
<td>G code</td>
<td>Group</td>
<td>Function</td>
</tr>
<tr>
<td>--------</td>
<td>-------</td>
<td>-----------------------------------------</td>
</tr>
<tr>
<td>G43</td>
<td>08</td>
<td>Tool length compensation +</td>
</tr>
<tr>
<td>G44</td>
<td>00</td>
<td>Tool length compensation -</td>
</tr>
<tr>
<td>G45</td>
<td></td>
<td>Tool offset increase (option)</td>
</tr>
<tr>
<td>G46</td>
<td>00</td>
<td>Tool offset decrease (option)</td>
</tr>
<tr>
<td>G47</td>
<td></td>
<td>Tool offset double increase (option)</td>
</tr>
<tr>
<td>G48</td>
<td></td>
<td>Tool offset double decrease (option)</td>
</tr>
<tr>
<td>G49</td>
<td>08</td>
<td>Tool length compensation cancel</td>
</tr>
<tr>
<td>G50</td>
<td></td>
<td>Scaling cancel (option)</td>
</tr>
<tr>
<td>G51</td>
<td>11</td>
<td>Scaling (option)</td>
</tr>
<tr>
<td>G52</td>
<td>00</td>
<td>Local coordinate system setting</td>
</tr>
<tr>
<td>G53</td>
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<td>Machine coordinate system selection</td>
</tr>
<tr>
<td>G54</td>
<td></td>
<td>Work coordinate system 1 selection</td>
</tr>
<tr>
<td>G55</td>
<td></td>
<td>Work coordinate system 2 selection</td>
</tr>
<tr>
<td>G56</td>
<td>14</td>
<td>Work coordinate system 3 selection</td>
</tr>
<tr>
<td>G57</td>
<td></td>
<td>Work coordinate system 4 selection</td>
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<tr>
<td>G58</td>
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<td>Work coordinate system 5 selection</td>
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<td>G59</td>
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<td>Work coordinate system 6 selection</td>
</tr>
<tr>
<td>G60</td>
<td>00</td>
<td>Single direction positioning (option)</td>
</tr>
<tr>
<td>G61</td>
<td></td>
<td>Exact stop mode (option)</td>
</tr>
<tr>
<td>G62</td>
<td>15</td>
<td>Auto feedrote adjusting mode (option)</td>
</tr>
<tr>
<td>G63</td>
<td></td>
<td>Tapping mode (option)</td>
</tr>
<tr>
<td>G64</td>
<td></td>
<td>Cutting mode (option)</td>
</tr>
<tr>
<td>G65</td>
<td>00</td>
<td>Macro call</td>
</tr>
<tr>
<td>G66</td>
<td>12</td>
<td>Macro modal call A/B</td>
</tr>
<tr>
<td>G67</td>
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<td>Macro model cancel A/B</td>
</tr>
<tr>
<td>G code</td>
<td>Group</td>
<td>Function</td>
</tr>
<tr>
<td>--------</td>
<td>-------</td>
<td>----------------------------------------------</td>
</tr>
<tr>
<td>G68</td>
<td>16</td>
<td>Coordinate system rotation (option)</td>
</tr>
<tr>
<td>G69</td>
<td></td>
<td>Coordinate system rotation cancel (option)</td>
</tr>
<tr>
<td>G73</td>
<td></td>
<td>Peck drilling cycle</td>
</tr>
<tr>
<td>G74</td>
<td></td>
<td>Counter tapping cycle</td>
</tr>
<tr>
<td>G76</td>
<td></td>
<td>Fine boring cycle</td>
</tr>
<tr>
<td>G80</td>
<td></td>
<td>Canned cycle cancel</td>
</tr>
<tr>
<td>G81</td>
<td></td>
<td>Drilling cycle</td>
</tr>
<tr>
<td>G82</td>
<td></td>
<td>Drilling cycle</td>
</tr>
<tr>
<td>G83</td>
<td>09</td>
<td>Peck drilling cycle</td>
</tr>
<tr>
<td>G84</td>
<td></td>
<td>Tapping cycle</td>
</tr>
<tr>
<td>G85</td>
<td></td>
<td>Boring cycle</td>
</tr>
<tr>
<td>G86</td>
<td></td>
<td>boring cycle</td>
</tr>
<tr>
<td>G87</td>
<td></td>
<td>Back boring cycle</td>
</tr>
<tr>
<td>G88</td>
<td></td>
<td>Boring cycle</td>
</tr>
<tr>
<td>G89</td>
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<td>Boring cycle</td>
</tr>
<tr>
<td>G90</td>
<td>03</td>
<td>Absolute command</td>
</tr>
<tr>
<td>G91</td>
<td></td>
<td>Incremental command</td>
</tr>
<tr>
<td>G92</td>
<td>00</td>
<td>Work coordinate change</td>
</tr>
<tr>
<td>G94</td>
<td>05</td>
<td>Feed per minute</td>
</tr>
<tr>
<td>G95</td>
<td></td>
<td>Feed per revolution</td>
</tr>
<tr>
<td>G96</td>
<td>13</td>
<td>Const speed control</td>
</tr>
<tr>
<td>G97</td>
<td></td>
<td>Const speed control cancel</td>
</tr>
<tr>
<td>G98</td>
<td>10</td>
<td>Canned cycle initial point return</td>
</tr>
<tr>
<td>G99</td>
<td></td>
<td>Canned cycle R point return</td>
</tr>
</tbody>
</table>
NOTE:

1. Modal G codes have the following initial conditions when the power is turned on or the system is reset to the clear state (bit 6 of parameter No.3402).
   (1) Those G codes marked ▲ in Table 3 are specified automatically.
   (2) G20 and G21 retain their original conditions.
   (3) When the power is turned on, G22 is specified automatically. When the system is reset, G22 and G23 retain their original conditions.
   (4) G00 or G01 is automatically selected depending on the setting of bit 0 of parameter No.3402.
   (5) G90 or G91 is automatically selected depending on the setting of bit 3 of parameter No.3402.

2. The G codes of group 00, except G10 and G11, are one-shot G codes.

3. If a G code that does not appear in the G code list is specified, or a G code whose options are not supported is specified, alarm No.010 is displayed.

4. Multiple G codes of different groups can be specified in a single block. When multiple G codes of one group are specified in a block, the G code specified last is effective.

5. If any G code of group 01 is specified in a canned cycle mode, the canned cycle is automatically canceled and the G80 condition is entered. However, a G code of group 01 is not affected by any of the canned cycle G codes.

6. A G code is displayed from each group.
6-2 F FUNCTION

The feedrate of linear interpolation (G01) · circular interpolation (G02) and canned cycles is determined by the value following the F code.

Range : 1 - 5000 mm/min

6-3 S FUNCTION

The speed of spindle is determined by the value following the S code. It is allowed to assign the speed of spindle in the mode of MEMORY or TAPE but M03 or M04 should be fitted.

Range : 35 - 4500 r.p.m.

6-4 T FUNCTION

The tool number is selected by using the T command. When executing the T code, the magazine will stop rotating until the appointed tool arrives at the tool changing position.

Note : Please refer to chapter 8 AUTOMATIC TOOL CHANGING SYSTEM.
## 6-5 M FUNCTION

<table>
<thead>
<tr>
<th>M CODE</th>
<th>FUNCTION</th>
<th>REMARK</th>
</tr>
</thead>
<tbody>
<tr>
<td>M00</td>
<td>Program stop</td>
<td></td>
</tr>
<tr>
<td>M01</td>
<td>Option stop</td>
<td></td>
</tr>
<tr>
<td>M02</td>
<td>End of program</td>
<td></td>
</tr>
<tr>
<td>M03</td>
<td>Spindle forward rotation</td>
<td></td>
</tr>
<tr>
<td>M04</td>
<td>Spindle reverse rotation</td>
<td></td>
</tr>
<tr>
<td>M05</td>
<td>Spindle stop</td>
<td></td>
</tr>
<tr>
<td>M06</td>
<td>Automatic tool change</td>
<td></td>
</tr>
<tr>
<td>M07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M08</td>
<td>Coolant on</td>
<td></td>
</tr>
<tr>
<td>M09</td>
<td>Coolant off</td>
<td></td>
</tr>
<tr>
<td>M10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M12</td>
<td>4th axis (B axis) clamp</td>
<td>OPTION</td>
</tr>
<tr>
<td>M13</td>
<td>4th axis (B axis) unclamp</td>
<td>OPTION</td>
</tr>
<tr>
<td>M14</td>
<td>Shower coolant on</td>
<td>OPTION</td>
</tr>
<tr>
<td>M15</td>
<td>Shower coolant off</td>
<td>OPTION</td>
</tr>
<tr>
<td>M16</td>
<td>Oil hole device on</td>
<td>OPTION</td>
</tr>
<tr>
<td>M17</td>
<td>Oil hole device off</td>
<td>OPTION</td>
</tr>
<tr>
<td>M18</td>
<td>Auto lubricate on for once</td>
<td></td>
</tr>
<tr>
<td>M19</td>
<td>Spindle orientation</td>
<td></td>
</tr>
<tr>
<td>M20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M22</td>
<td>B AXIS PIN UP</td>
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</tr>
<tr>
<td>M23</td>
<td>B AXIS PIN DOWN</td>
<td></td>
</tr>
<tr>
<td>M24</td>
<td>Oil mist on</td>
<td>OPTION</td>
</tr>
<tr>
<td>M25</td>
<td>Oil mist off</td>
<td>OPTION</td>
</tr>
<tr>
<td>M CODE</td>
<td>FUNCTION</td>
<td>REMARK</td>
</tr>
<tr>
<td>--------</td>
<td>----------------------------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>M26</td>
<td>Automatic tool length measurement ON</td>
<td>OPTION</td>
</tr>
<tr>
<td>M27</td>
<td>Automatic tool length measurement OFF</td>
<td>OPTION</td>
</tr>
<tr>
<td>M28</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M29</td>
<td>Rigid tapping</td>
<td></td>
</tr>
<tr>
<td>M30</td>
<td>End of program</td>
<td></td>
</tr>
<tr>
<td>M31</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M32</td>
<td>Programming air blowing on</td>
<td></td>
</tr>
<tr>
<td>M33</td>
<td>Programming air blowing off</td>
<td></td>
</tr>
<tr>
<td>M34</td>
<td>Chip clean on</td>
<td>OPTION</td>
</tr>
<tr>
<td>M35</td>
<td>Chip clean off</td>
<td>OPTION</td>
</tr>
<tr>
<td>M36</td>
<td>Automatic chip conveyor on</td>
<td></td>
</tr>
<tr>
<td>M37</td>
<td>Automatic chip conveyor off</td>
<td></td>
</tr>
<tr>
<td>M38</td>
<td>Spindle air blow on</td>
<td></td>
</tr>
<tr>
<td>M39</td>
<td>Spindle air blow off</td>
<td></td>
</tr>
<tr>
<td>M40</td>
<td>Coolant through spindle on</td>
<td>OPTION</td>
</tr>
<tr>
<td>M41</td>
<td>Coolant through spindle off</td>
<td>OPTION</td>
</tr>
<tr>
<td>M42</td>
<td>M42 ON</td>
<td>OPTION</td>
</tr>
<tr>
<td>M43</td>
<td>M42 OFF</td>
<td>OPTION</td>
</tr>
<tr>
<td>M44</td>
<td>M44 ON</td>
<td>OPTION</td>
</tr>
<tr>
<td>M45</td>
<td>M44 OFF</td>
<td>OPTION</td>
</tr>
<tr>
<td>M46</td>
<td>M46 ON</td>
<td>OPTION</td>
</tr>
<tr>
<td>M47</td>
<td>M46 OFF</td>
<td>OPTION</td>
</tr>
<tr>
<td>M48</td>
<td>M48 ON</td>
<td>OPTION</td>
</tr>
<tr>
<td>M49</td>
<td>M48 OFF</td>
<td>OPTION</td>
</tr>
<tr>
<td>M50</td>
<td>Automatic pallet change for only one pallet</td>
<td></td>
</tr>
<tr>
<td>M51</td>
<td>Check if APC READY is on or not</td>
<td></td>
</tr>
<tr>
<td>M52</td>
<td>Feedrate override not valid</td>
<td></td>
</tr>
</tbody>
</table>
### 6. NC CONTROL FUNCTION

<table>
<thead>
<tr>
<th>M CODE</th>
<th>FUNCTION</th>
<th>REMARK</th>
</tr>
</thead>
<tbody>
<tr>
<td>M53</td>
<td>Feedrate override valid</td>
<td></td>
</tr>
<tr>
<td>M54</td>
<td>Index table up</td>
<td></td>
</tr>
<tr>
<td>M55</td>
<td>Index table down</td>
<td></td>
</tr>
<tr>
<td>M56</td>
<td>APC door up</td>
<td></td>
</tr>
<tr>
<td>M57</td>
<td>APC door down</td>
<td></td>
</tr>
<tr>
<td>M58</td>
<td>Pallet up</td>
<td></td>
</tr>
<tr>
<td>M59</td>
<td>Pallet down</td>
<td></td>
</tr>
<tr>
<td>M60</td>
<td>Automatic pallet change</td>
<td></td>
</tr>
<tr>
<td>M61</td>
<td>Pallet A moves out</td>
<td></td>
</tr>
<tr>
<td>M62</td>
<td>Pallet B moves in</td>
<td></td>
</tr>
<tr>
<td>M63</td>
<td>Pallet B moves out</td>
<td></td>
</tr>
<tr>
<td>M64</td>
<td>Pallet A moves in</td>
<td></td>
</tr>
<tr>
<td>M65</td>
<td>Shuttle moves forward</td>
<td></td>
</tr>
<tr>
<td>M66</td>
<td>Shuttle moves backward</td>
<td></td>
</tr>
<tr>
<td>M67</td>
<td>Shuttle moves left</td>
<td></td>
</tr>
<tr>
<td>M68</td>
<td>Shuttle moves right</td>
<td></td>
</tr>
<tr>
<td>M69</td>
<td>Shuttle retract to the center</td>
<td></td>
</tr>
<tr>
<td>M70</td>
<td>Mirror image cancel</td>
<td></td>
</tr>
<tr>
<td>M71</td>
<td>X axis mirror image</td>
<td></td>
</tr>
<tr>
<td>M72</td>
<td>Y axis mirror image</td>
<td></td>
</tr>
<tr>
<td>M73</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M74</td>
<td>A axis mirror image</td>
<td></td>
</tr>
<tr>
<td>M75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M76</td>
<td>Arm moves towards the spindle</td>
<td></td>
</tr>
<tr>
<td>M77</td>
<td>Arm returns from the spindle</td>
<td></td>
</tr>
<tr>
<td>M78</td>
<td>ATC door up</td>
<td></td>
</tr>
<tr>
<td>M79</td>
<td>ATC door down</td>
<td></td>
</tr>
<tr>
<td>M CODE</td>
<td>FUNCTION</td>
<td>REMARK</td>
</tr>
<tr>
<td>--------</td>
<td>-------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>M80</td>
<td>Arm moves towards magazine</td>
<td></td>
</tr>
<tr>
<td>M81</td>
<td>Arm returns from magazine</td>
<td></td>
</tr>
<tr>
<td>M82</td>
<td>Arm moves left</td>
<td></td>
</tr>
<tr>
<td>M83</td>
<td>Arm moves right</td>
<td></td>
</tr>
<tr>
<td>M84</td>
<td>Arm moves forward</td>
<td></td>
</tr>
<tr>
<td>M85</td>
<td>Arm moves backward</td>
<td></td>
</tr>
<tr>
<td>M86</td>
<td>Arm rotates $+180^\circ$</td>
<td></td>
</tr>
<tr>
<td>M87</td>
<td>Arm rotates $-180^\circ$</td>
<td></td>
</tr>
<tr>
<td>M88</td>
<td>Tool unclamp</td>
<td></td>
</tr>
<tr>
<td>M89</td>
<td>Tool clamp</td>
<td></td>
</tr>
<tr>
<td>M90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M91</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M92</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M93</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M94</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M95</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M96</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M97</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M98</td>
<td>Call subprogram</td>
<td></td>
</tr>
<tr>
<td>M99</td>
<td>End of sub-program</td>
<td></td>
</tr>
</tbody>
</table>
7. OPERATIONS

7-1 CRT/MDI OPERATION AND DISPLAY................................. 7-1
  7-1-1 EXPLANATION OF THE KEYBOARD.......................... 7-3
  7-1-2 FUNCTION KEYS............................................ 7-5
  7-1-3 FUNCTION KEYS AND SOFT KEYS............................ 7-6
  7-1-4 SOFT KEYS.................................................. 7-7
  7-1-5 HELP FUNCTION............................................ 7-23
  7-1-6 GRAPHICS DISPLAY........................................ 7-24

7-2 CONTROL PANEL.................................................... 7-26

7-3 FUNCTION AND OPERATION OF THE OPERATION PANEL................................. 7-27

7-4 MACHINE OPERATION............................................. 7-34
  7-4-1 TURN ON THE MACHINE................................. 7-34
  7-4-2 TURN OFF THE MACHINE............................... 7-35

7-5 HANDLE MODE.................................................... 7-36
  7-5-1 MACHINE ZERO RETURN................................. 7-36
  7-5-2 RAPID TRAVERSE........................................ 7-37
  7-5-3 JOG......................................................... 7-37
  7-5-4 HANDLE FEED............................................. 7-38

7-6 AUTO MODE OPERATION.......................................... 7-39
  7-6-1 MANUAL DATA INPUT(MDI).............................. 7-39
  7-6-2 START AUTO OPERATION................................. 7-40
7-6-3 STOP AUTO OPERATION.................................................... 7-41
7-6-4 MANUAL INTERRUPTION (OPTIONAL FUNCTION) . 7-41
7-6-5 PROGRAM RESTART(OPTIONAL) ................................. 7-42
7-6-6 EDIT OPERATION.......................................................... 7-45
7-6-7 SOFTWARE OPERATOR`S PANEL................................. 7-57

7-7 INDEX TABLE........................................................................ 7-58

7-8 LOADING TOOLS TO THE SPINDLE OR UNLOADING TOOLS FROM THE SPINDLE.............................................. 7-59
7-9 AUTOMATIC START FOR CHIP CONVEYOR...................... 7-60
7-10 AUTOMATIC LUBRICATION SYSTEM FOR SLIDEWAY... 7-61
7-11 INTERLOCK OF AXES....................................................... 7-62
7. OPERATIONS

7-1 CRT/MDI OPERATION AND DISPLAY

a. 9" Monochrome CRT/MDI Unit

b. 7.2" Monochrome/ 8.4"Color LCD/MDI Unit
c. Key Location of MDI

![Diagram of MDI Key Location]

- **Address/numeric keys**
- **Function keys**
- **Cursor move keys**
- **Page change keys**

**Key Functions:**
- **SHIFT key**
- **Cancel key**
- **INPUT key**
- **Edit keys**
- **HELP key**
- **RESET key**

---

d. Stand-Alone Type

**Standard MDI Unit**

![Diagram of Stand-Alone MDI Unit]

- **Help key**
- **Reset key**
- **Address/numeric keys**
- **Edit keys**
- **Cancel (CAN) key**
- **Input key**

**Key Functions:**
- **Shift key**
- **Page change keys**
- **Cursor keys**

---

7-2
### 7-1-1 EXPLANATION OF THE KEYBOARD

<table>
<thead>
<tr>
<th>NO.</th>
<th>NAME</th>
<th>EXPLANATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power ON and OFF buttons</td>
<td>Press theses buttons to turn CNC power ON and OFF.</td>
</tr>
<tr>
<td></td>
<td>![ON/OFF buttons]</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>RESET key</td>
<td>Press this key to reset the CNC, to cancel an alarm, etc.</td>
</tr>
<tr>
<td></td>
<td>![RESET]</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>HELP key</td>
<td>Press this button to use the help function when uncertain about the operation of an MDI dey (help function).</td>
</tr>
<tr>
<td></td>
<td>![HELP]</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Soft keys</td>
<td>The soft keys have various functions, according to the Applications. The soft key functions are displayed at the bottom of the CRT screen.</td>
</tr>
<tr>
<td>5</td>
<td>Address and numeric keys</td>
<td>Press these keys to input alphabetic, numeric, and other characters.</td>
</tr>
<tr>
<td></td>
<td>![Address and numeric keys]</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>SHIFT key</td>
<td>Some keys have two characters on their keytop. Pressing the (SHIFT) key switches the characters. Special character E is displayed on the screen when a character indicated at the bottom right corner on the key top can be entered.</td>
</tr>
<tr>
<td></td>
<td>![SHIFT]</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>INPUT key</td>
<td>When an address or a numerical key is pressed, the data is input to the buffer, and it is displayed on the CRT screen. To copy the data in the key input buffer to the offset register, etc., press the INPUT key. This key is equivalent to the [INPUT] key of the soft keys, and either can be pressed to produce the same result.</td>
</tr>
<tr>
<td></td>
<td>![INPUT]</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Cancel key</td>
<td>Press this key to delete the last character or symbol input buffer. When the key input buffer displays.</td>
</tr>
<tr>
<td></td>
<td>![Cancel]</td>
<td>and the cancel key is pressed, Z is canceled and &gt;N001X100_Z is displayed.</td>
</tr>
</tbody>
</table>

> N001X100Z_
<table>
<thead>
<tr>
<th>NO.</th>
<th>NAME</th>
<th>EXPLANATION</th>
</tr>
</thead>
</table>
| 9   | Program edit keys           | Press these keys when editing the program.  
|     | ALTER, INSERT, DELETE       | : Alteration.  
|     |                             | : Insertion.  
|     |                             | : Deletion.  |
| 10  | Function keys               | Press theses keys to switch display screens for each function.  
|     | POS, PROG, ...              | |
| 11  | Cursor move keys            | There are four different cursor move keys.  
|     |                             | : This key is used to move the cursor to the right or in the forward direction. The cursor is moved in short units in the forward direction.  
|     |                             | : This key is used to move the cursor to the left or in the reverse direction. The cursor is moved in short units in the reverse direction.  
|     |                             | : This key is used to move the cursor in a downward or forward direction. The cursor is moved in large units in the forward direction.  
|     |                             | : This key is used to move the cursor in an upward or reverse direction. The cursor is moved in large units in the reverse direction.  |
| 12  | Page change keys            | Two kinds of page change keys are described below.  
|     | PAGE, PAGE                  | : This key is used to changeover the page on the CRT screen in the forward direction.  
|     |                             | : This key is used to changeover the page on the CRT screen in the reverse direction.  |
7. OPERATIONS

7-1-2 FUNCTION KEYS

POS: Press this key to display the position screen.

PROG: Press this key to display the program screen.

OFFSET SETTING: Press this key to display the offset/setting screen.

SYSTEM: Press this key to display the system screen.

MESSAGE: Press this key to display the message screen.

GRAPH: Press this key to display the graphics screen.

CUSTOM: Press this key to display the custom screen (conversational macro screen).
7-1-3 FUNCTION KEYS AND SOFT KEYS

1. Press a function key on the MDI panel. The chapter selection soft keys that belong to the selected function appear.

2. Press one of the chapter selection soft keys. The screen for the selected chapter appears. If the soft key for a target chapter is not displayed, press the continuous menu key (next-menu key).

In some cases, additional chapters can be selected within a chapter.

3. When the target chapter screen is displayed, press the operation selection key to display data to be manipulated.

4. To redisplay the chapter selection soft keys, press the return menu key.

The general screen display procedure is explained above. However, the actual display procedure varies from one screen to another. For details, see the description of individual operations.
7-1-4 SOFT KEYS

The symbols in the following figures mean as shown below:

- Indicates screens
- Indicates a screen that can be displayed by pressing a function key(*1)
- Indicates a soft key(*2)
- Indicates input from the MDI panel.
- Indicates a soft key displayed in green.
- Indicates the continuous menu key(rightmost soft key)(*3).

*1: Press function keys to switch between screens that are used frequently.

*2: Some soft keys are not displayed depending on the option configuration.

*3: In some cases, the continuous menu key is omitted when the 14"CRT display or 9.5"LCD, 8.4" LCD is used.
POSITION SCREEN

Soft key transition triggered by the function key POS

- **Absolute coordinate display**
  - [ABS] (OPRT)
  - [PTSPRE] [EXEC]
  - [RUNPRE] [EXEC]

- **Relative coordinate display**
  - [REL] (OPRT)
  - (Axis or numeral) [PRESET]
  - [ORIGIN] [ALLEXE]
  - [Axis name] [EXEC]
  - [PTSPRE] [EXEC]
  - [RUNPRE] [EXEC]

- **Current position display**
  - [ALL] (OPRT)
  - (Axis or numeral) [PRESET]
  - [ORIGIN] [ALLEXE]
  - [Axis name] [EXEC]
  - [PTSPRE] [EXEC]
  - [RUNPRE] [EXEC]

- **Handle interruption**
  - [HNOL] (OPRT)
  - [PTSPRE] [EXEC]
  - [RUNPRE] [EXEC]

- **Monitor screen**
  - [MONI] (OPRT)
  - [PTSPRE] [EXEC]
  - [RUNPRE] [EXEC]
7. OPERATIONS

PROGRAM SCREEN

Soft key transition triggered by the function key PROG in the MEM mode

(1) See "When the soft key [BG-EDT] is

[PRGRM] [OPRT]
(1)

[O number] [O SRH]
[N number] [N SRH]
[REWIND]

[P TYPE]
[Q TYPE]

[F SRH] [CAN] [EXEC]

Program check display screen

[CHECK] [ABS] [REL] [OPRT]

[BG-EDT] See "When the soft key [BG-EDT] is

[O number] [O SRH]
[N number] [N SRH]
[REWIND]

[P TYPE]
[Q TYPE]

[F SRH] [CAN] [EXEC]

Current block display screen

[CURRNT] [OPRT] [BG-EDT] See "When the soft key [BG-EDT] is

Next block display screen

[NEXT] [OPRT] [BG-EDT] See "When the soft key [BG-EDT] is

Program restart display screen

[RSTR] [OPRT] [BG-EDT] See "When the soft key [BG-EDT] is

(2) (Continued on the next page)
(2) [FLSDL] [PRGRM] \(\rightarrow\) Return to (1) (Program display)

File directory display screen

- [DIR] [OPRT] [SELECT] [File No.] [F SET] [EXEC]

Schedule operation display screen

- [SCHDUL] [OPRT] [CLEAR] [CAN] [EXEC]

(Schedule data) [INPUT]
7. OPERATIONS

PROGRAM SCREEN

Soft key transition triggered by the function key in the EDIT mode

Program display

PRGRM

(OPRT)

BG-EDT

O number

SRH

[SRH ↓]

REWIND

SRH

↑

[SRH ↑]

F SRH

N number

CAN

READ

CHAIN

STOP

CAN

PUNCH

STOP

CAN

DELETE

CAN

O number

EXEC

EX-EDT

[O number]

EXEC

COPY

[CRSR→]

[CRSR←]

[BTM]

[ALL]

MOVE

[CRSR→]

[CRSR←]

[BTM]

[ALL]

MERGE

[CRSR→]

[BTM]

CHANGE

(Address)

BEFORE

(Address)

AFTER

[SKIP]

[1-EXEC]

EXEC

See "When the soft key [BG-EDT] is pressed"

(1) Continued on the next page)
(1) Program directory display

[LIB] [(OPRT) [BG-EDT] See "When the soft key [BG-EDT] is pressed"
(O number) [O SRH] Return to the program

[READ]

[CHAIN] [STOP] [CAN] (O number) [EXEC]

[PUNCH]

[STOP] [CAN] (O number) [EXEC]

Graphic Conversational Programming (M series)

[C.A.P.] [(OPRT) PRGRM ] Return to the program

[GMENU]

(G number) [BLOCK] (Data) [INPUT] INSERT
When a G number is omitted, the standard screen appears.

[(OPRT)] [INPUT]

Floppy directory display

[FLOPPY] PRGRM ] Return to the program

[DIR] [(OPRT) [F SRH] (Numeral) [F SET] [CAN] [EXEC]

[READ]

(Numeral) [F SET] [CAN] [EXEC]

[PUNCH]

(Numeral) [F SET] [CAN] [EXEC]

[DELETE]

(Numeral) [F SET] [CAN] [EXEC]
7. OPERATIONS

PROGRAM SCREEN

Soft key transition triggered by the function key in the MDI mode

PROG

Program display

[PRGRM] → [OPRT] → [BG-EDT] → See "When the soft key [BG-EDT] is pressed"

Program input screen

[MDI] → [OPRT] → [BG-EDT] → See "When the soft key [BG-EDT] is pressed"
[START] → [CAN] → [EXEC]
(Address) → [SRH?]
(Address) → [SRH?]
[REWIND]

Current block display screen

[CURRNT] → [OPRT] → [BG-EDT] → See "When the soft key [BG-EDT] is pressed"

Next block display screen

[NEXT] → [OPRT] → [BG-EDT] → See "When the soft key [BG-EDT] is pressed"

Program restart display screen

[RSTR] → [OPRT] → [BG-EDT] → See "When the soft key [BG-EDT] is pressed"
PROGRAM SCREEN

Soft key transition triggered by the function key in the HNDL, JOG, or REF mode

- **Program display**
  - [PRGRM] [OPRT] [BG-EDT] → See "When the soft key [BG-EDT] is pressed"

- **Current block display screen**
  - [CURRNT] [OPRT] [BG-EDT] → See "When the soft key [BG-EDT] is pressed"

- **Next block display screen**
  - [NEXT] [OPRT] [BG-EDT] → See "When the soft key [BG-EDT] is pressed"

- **Program restart display screen**
  - [RSTR] [OPRT] [BG-EDT] → See "When the soft key [BG-EDT] is pressed"
(1) Program directory display

- [LIB] (O number) [OPRT] [BG-EDIT] [O SRH] Return to the program
- [READ] [CHAIN] [STOP] [CAN] (O number) [EXEC]
- [PUNCH] [STOP] [CAN] (O number) [EXEC]

Graphic Conversational Programming

- [C.A.P.] [PRGMR] [G.MENU] [G number] [BLOCK] (Data) [LINE] [CHAMF] [CNR.R] [INPUT]
- When a G number is omitted, the standard screen appears.

Floppy directory display

- [FLOPPY] [PRGMR] [DIR] [OPRT] [FSRH] (Numeral) [F SET] [CAN] [EXEC]
- [READ] (Numeral) [F SET] (Numeral) [O SET] [STOP] [CAN] [EXEC]
- [PUNCH] (Numeral) [F SET] (Numeral) [O SET] [STOP] [CAN] [EXEC]
- [DELETE] (Numeral) [F SET] [CAN] [EXEC]
OFFSET/SETTING SCREEN (M series)

Soft key transition triggered by the function key

OFFSET SETTING

Tool offset screen

[OFFSET] [(OPRT)]
(Number) [NO SRH]
(Axis name) [INP.C.]
(Numeral) [+INPUT]
(Numeral) [INPUT]

Setting screen

[SETTING] [(OPRT)]
(Number) [NO SRH]
(IN-1) [INP.C.]
(OFF-0) [INP.C.]
(Numeral) [+INPUT]
(Numeral) [INPUT]

Work coordinate system setting screen

[WORK] [(OPRT)]
(Number) [NO SRH]
(Numeral) [+INPUT]
(Numeral) [INPUT]

Macro variables display screen

[MACRO] [(OPRT)]
(Number) [NO SRH]
(Axis name) [INP.C.]
(Numeral) [INP.C.]

Menu programming screen

[MENU] [(OPRT)]
(Number) [SELECT]

Software operator’s panel screen

[OPR]

Tool life management setting screen

[TOOLLF] [(OPRT)]
(Number) [NO SRH]
[CLEAR] [CAN]
[EXEC] [EXEC]
(Numeral) [INPUT]
MACHINING CENTER OPERATION AND MAINTENANCE MANUAL

SYSTEM SCREEN

Soft key transition triggered by the function key SYSTEM

Parameter screen

[PARAM] [OPRT] (Number) [NO SRH]
[ON:1] [OFF:0]
[Numeral] [+INPUT]
[Numeral] [INPUT]
[READ] [CAN] [EXEC]
[PUNCH] [CAN] [EXEC]

To enter a file number: Press N, enter a file number, then press INPUT on the PRGRM

Diagnosis screen

[DGNOS] [OPRT] (Number) [NO SRH]

PMC screen

[PMC] [PMCLAD] [SEARCH] [TOP] [BOTTOM] [SRCH]
[SEARCH] [W-SRCH] [N-SRCH]
[ADDRESS] [SYMBOL]
[TRIGER] [TRGON] [TRGOFF] [START]
[DUMP] [SEARCH]
[DPARA] [NDPARA]
[TRGSRC] [BYTE] [WORD] [D.WORD]
[INIT] [WINDOW]
[CANCEL] [WIDTH] [DELETE] [SELECT]

(Continued on the next page)
Pitch error compensation screen

- [PITCH] — [OPRT]
- (No.) — [NO]
- [ON:1] — SRH
- [OFF:0]

- (Numeral) — [+INPUT]
- (Numeral) — [INPUT]

- [READ]

- [CAN] — [EXEC]

- [PUNCH] — [CAN] — [EXEC]

To enter a file number: Press N, enter a number, then press INPUT on the PRGRM screen.

Servo parameter screen

- [SV.PRM] — [SV.SET]
- [SV.SET] — [OPRT]
- [SV.TUN] — [OPRT]

- [ON:1] — [OFF:0]

- (Numeral) — [INPUT]

- [TRNSF]

Spindle parameter screen

- [SP.PRM] — [SP.SET]

- [SP.SET] — [OPRT]
- [SP.TUN] — [OPRT]
- [SP.MON]

- [ON:1] — [OFF:0]

- [INPUT]

Waveform diagnosis screen

- [W.DGS] — [W.PRM]

- [W.PRM] — [STSRT]

- [STSRT] — [TIME? ]

- [? TIME]

- [H-DOBL]

- [H-HALF]

- [W.GRPH]

- [W.GRPH] — [STSRT]

- [CH-1?]

- [CH-1?]

- [V-DOBL]

- [V-DOBL]

- [V-HALF]

- [V-HALF]
7. OPERATIONS

MESSAGE SCREEN
- Soft key transition triggered by the function key
- MESSAGE
  - Alarm display screen
    - [ALARM]
  - Message display screen
    - [MSG]
  - Alarm history screen
    - [HISTORY] — [(OPRT)] — [CLEAR]

HELP SCREEN
- Soft key transition triggered by the function key
- HELP
  - Alarm detail screen
    - [1 ALAM] — [(OPRT)] — [SELECT]
  - Operation method screen
    - [2 OPR] — [(OPRT)] — [SELECT]
  - Parameter table screen
    - [3 PARA]
GRAPHIC SCREEN (M series) Soft key transition triggered by the function key

Tool path graphics

**GRAPH**

- **[PARAM]**
- **[EXEC]**
  - ![OPRT]
  - ![AUTO]
  - ![STSRT]
  - ![STOP]
  - ![REVIND]
  - ![CLEAR]
- **[ZOOM]**
  - ![OPRT]
    - ![EXEC]
      - ![→]
      - ![↑]
      - ![↓]
- **[POS]**

Solid graphics

**GRAPH**

- **[PARAM]**
- **[BLANK]**
  - ![OPRT]
    - ![ANEW]
    - ![+ROT]
    - ![+TILT]
- **[EXEC]**
  - ![OPRT]
    - ![A.ST]
    - ![F.ST]
    - ![STOP]
    - ![REWIND]
- **[REVIEW]**
  - ![OPRT]
    - ![ANEW]
    - ![+ROT]
    - ![+TILT]
- **[3-PLN]**
  - ![OPRT]
    - ![^]
7-1-5 HELP FUNCTION

The help function displays on the screen detailed information about alarms issued in the CNC and about CNC operations. The following information is displayed.

1. Press the HELP key on the MDI panel. HELP (INITIAL MENU) screen is displayed.

![HELP (INITIAL MENU) Screen]

HELP (INITIAL MENU) O1234 N00001

***** HELP *****
1. ALARM DETAIL
2. OPERATION METHOD
3. PARAMETER TABLE

MEM **** *** *** 10:12:25
[ 1 ALM ] [ 2 OPR ] [ 3 PARA ]

2. Detailed information of alarms:

① Press the soft key [1 ALM].
② Enter the alarm number.
③ Press soft key [SELECT]

3. OPERATION METHOD:

① Press the soft key [2 OPR].
② Enter an item NO. from the keyboard.
③ Press soft key [SELECT]

4. PARAMETER TABLE:

① Press the soft key [3 PARA].

5. To exit from the help screen, press the HELP key or another function key.
7-1-6 GRAPHICS DISPLAY

Procedure:

1. Press function key [GRAPH].

2. Press soft key [PARAM].

3. Move the cursor with the cursor keys to a parameter to set.

4. Enter data, then press the [INPUT] key.

5. Repeat steps 2 and 3 until all required parameters are specified.

6. Press soft key [GRAPH].

7. Automatic operation is started and machine movement is drawn on the screen.
## GRAPHICS PARAMETER EXPLANATION

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>EXPLANATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>AXES</td>
<td>Specify the plane to use for drawing. The user can choose from the following six coordinate systems.</td>
</tr>
<tr>
<td>RANGE(Max., Min.)</td>
<td>Set the graphic range displayed on the screen by specifying maximum and minimum values along each axis.</td>
</tr>
<tr>
<td>SCALE</td>
<td>Set the graphic magnification</td>
</tr>
<tr>
<td></td>
<td>The setting range is 0 to 10000(unit : 0.01 time).</td>
</tr>
<tr>
<td>GRAPHIC CENTER</td>
<td>X= _</td>
</tr>
<tr>
<td></td>
<td>Y= _</td>
</tr>
<tr>
<td></td>
<td>Z= _</td>
</tr>
<tr>
<td></td>
<td>Set the coordinate value on the workpiece coordinate system at graphic center.</td>
</tr>
<tr>
<td>PROGRAM STOP</td>
<td>N= _</td>
</tr>
<tr>
<td></td>
<td>Set the sequence No. of the end block when necessary to partially display.</td>
</tr>
<tr>
<td>AUTO ERASE</td>
<td>When the AUTO operation is started under reset condition, the program is executed after deleting the previous drawing automatically (Automatic deleting = 1). It is possible not to delete the previous drawing by graphic parameter (Automatic deleting = 0).</td>
</tr>
</tbody>
</table>
7-2 CONTROL PANEL
7-3 FUNCTION AND OPERATION OF THE OPERATION PANEL

<table>
<thead>
<tr>
<th>NC FUNCTION</th>
<th>OP. FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBK</td>
<td>SINGLE BLOCK (SBK): Only one block will be executed at a time in auto mode.</td>
</tr>
<tr>
<td>BDT</td>
<td>BLOCK DELETE (BDT): Block started with (/) will be neglected in auto mode.</td>
</tr>
<tr>
<td>DRN</td>
<td>DRY RUN (DRN): The feedrate specified in the program is disabled. The real feedrate is determined by using the “JOG FEEDRATE SWITCH” on the panel.</td>
</tr>
<tr>
<td>OP. STOP</td>
<td>OP. STOP: The program will stop when M01 is read in auto mode.</td>
</tr>
<tr>
<td>MST</td>
<td>MST: The M, S, and T commands are disabled.</td>
</tr>
<tr>
<td>RESTART</td>
<td>PROGRAM RESTART (RESTART): After replacing broken tools or taking a break during operation, this function allows the operator to specify the sequence number in a program where he or she wants to restart the program.</td>
</tr>
<tr>
<td>Z LOCK</td>
<td>Z LOCK: The Z axis will be locked. (It must zero return, when restart the program)</td>
</tr>
<tr>
<td>MC LOCK</td>
<td>MC LOCK: The X,Y and Z axes will be locked. (It must zero return, when restart the program)</td>
</tr>
<tr>
<td>AUT OFF</td>
<td>AUT OFF: If the button is pressed, power will be cut off when M00,M01,M02 0r M30 in the program is executed.</td>
</tr>
<tr>
<td>DOOR.IT</td>
<td>DOOR.IT: When auto tool change, axis move and spindle rotate stop, then press this button that safety door open for interlock switch release.</td>
</tr>
<tr>
<td>M.G</td>
<td>MANUAL GUIDE (M.G): One single screen provides handy operation guidance for programming through machine operation.</td>
</tr>
<tr>
<td>O.T.REL</td>
<td>O.T.REL: If the axes do not return to the reference point before operating the machine, the default travel limit will not function, and the moving parts may overtravel or even trigger limit switches. As a result, the machine will be in the state of emergency stop (EMG). This situation an be released by holding the this button on for several seconds until the READY light on the control panel is on. Then turn the hand wheels to move the axes to their normal workspace.</td>
</tr>
<tr>
<td>Function</td>
<td>Description</td>
</tr>
<tr>
<td>-----------</td>
<td>--------------------------------------------------------------</td>
</tr>
<tr>
<td>LIGHT</td>
<td>To turn on/off the working light on the machine.</td>
</tr>
<tr>
<td>OIL MIST</td>
<td>Oil mist will be ejected from the nozzles (option).</td>
</tr>
<tr>
<td>CHIP CW</td>
<td>The chip conveyor will rotate to remove the chip from the machine.</td>
</tr>
<tr>
<td>CHIP CCW</td>
<td>The chip conveyor will rotate to remove the chip from the machine (option).</td>
</tr>
<tr>
<td>SHOWER</td>
<td>Coolant will be ejected from the cover (option).</td>
</tr>
<tr>
<td>COOLANT</td>
<td>Coolant will be ejected from the nozzles.</td>
</tr>
<tr>
<td>AIR BLOW</td>
<td>Air blow will be ejected from the nozzle.</td>
</tr>
<tr>
<td>OIL HOLE</td>
<td>Coolant will be ejected from the tool (option).</td>
</tr>
</tbody>
</table>
TOOL MONITOR: Display spindle tool number and prepare tool number.

CW: Magazine rotate by CW button in manual mode.

CCW: Magazine rotate by CCW button in manual mode.
MODE SELECTOR

Turn this switch to select the following operation modes: HANDLE, JOG, PAPID, ZERO RETURN, MDI (MANUAL DATA INPUT), EDIT, MEM (MEMORY), and DNC.

PROGRAM PROTECT

The switch must be turned to the UNLOCK position to edit the program or data. Normally this switch is turned to LOCK position, the mode can protect the data.

FEEDRATE

To adjust the feedrate in JOG mode or DRY RUN (0~4000mm/min). This function is used in auto mode associated with the command, but it is disabled when executing G84 and G74 (Tapping mode).
To select the axis to be moved in JOG and RAPID modes.

To push axis direction button and "rapid" button in RAPID mode, the feedrate is RAPID.

To push axis direction button in RAPID mode, the feedrate is JOG.

The program will be executed by pushing the "CYCLE START" button.

The program can be stopped by pressing the "FEED HOLD" button. It can be restarted by pushing the "CYCLE START" button.

When the S command is stored in memory, the spindle can be started or stopped by pushing these buttons in manual mode. In addition, the spindle stop button is pressed in ZERO RETURN mode, the spindle can be oriented.
SPINDLE LOAD

Display the load of the spindle motor.

ZERO RETURN

Zero return for each axis will be performed when the corresponding button is pressed in ZERO RETURN mode.

EMERGENCY STOP

To stop the machine in case of emergency.

SPINDLE SPEED OVERRIDE

The spindle speed can be override by using this switch.

Range: 50-120%
Operation

Turn to the “AUTO”, the cycle start push button is valid, and turn to the “MANUAL”, the cycle start push button is invalid.
◎ POWER: The lamp will lighting when the switch on the electrical cabinet is turned ON.

◎ READY: The lamp will lighting after turning on the machine.

◎ LUBRICATION ALARM: The alarm will occur when the lubricant in the tank is not enough, and the program will stopped. Lubricant must be injected in order to restart the program.

◎ TOOL NUMBER ALARM: The alarm will occur when the T code is out of range. For example, if the tool capacity is 60, the command T61 will trigger this alarm signal.

◎ SPINDEL ORIENT: When the spindle orientation, it will lighting.

◎ TOOL CLAMP: When spindle tool clamp, the lamp will light
7. OPERATIONS

◎ TOOL UNCLAMP : When spindle tool unclamp, the lamp will light.

◎ ATC : When auto tool change, the lamp will flash.

◎ APC : When auto pallet change, the lamp will flash.
7-4 MACHINE OPERATION

7-4-1 TURN ON THE MACHINE

(1) Turn on the electrical power supply.

(2) Turn on the power switch on the electrical cabinet.

(3) Press the power on button (green) on the operation panel.

(4) Release the EMERGENCY STOP button on the operation panel.

(5) Press the START button on the lubricant tank to inject the lubricant to the slideways. Then move each axis.

(6) Perform zero return for each axis so that travel limit in memory will be effective.

(7) Select the desired mode and start operation.
(1) Let one block of a program be completed and then press the RESET key to finish the work. Press the Z-AXIS ZERO RETURN button to move the spindle. The unload the tool and put it back in the tool magazine manually or by automatic operation.

(2) Clean the machine and then put anti-rust oil on the work table and spindle.

(3) Move each axis to the middle of its travel to keep the balance of the machine.

(4) Press the EMERGENCY STOP button on the operation panel.

(5) Press the power off button on the operation panel.

(6) Turn off the electrical power supply.

(7) Turn off the power switch on the electrical cabinet.
7-5 HANDLE MODE

7-5-1 MACHINE ZERO RETURN

(1) Turn the mode selector to the ZERO RETURN position.

(2) Press down the desired zero return button and the corresponding lamp will light when the zero return is finished.

Note that normally zero return of each axis is performed immediately after turning on the machine.

The position of zero return already stored in the memory when B axis zero return once time after use absolute motor. It hasn't to press B-zero return button every power on, except the batteries are exhausted or all the data stored in the memory was erased. It can reference chapter 9-8.
7-5-2 RAPID TRAVERSE

(1) Turn the mode selector to the RAPID position.

(2) Select the axis.

(3) Select the override rate (L, 25, 50, or 100 %)

(4) Select the direction by pressing "+" or "-" key.

7-5-3 JOG

(1) Turn the mode selector to the JOG position.

(2) Select the axis.

(3) Select the speed by adjusting the JOG FEEDRATE SWITCH.

(4) Select the direction by pressing + or - key.
7-5-4 HANDLE FEED

(1) Turn the mode selector to the HANDLE position.

(2) Select the axis. (The switch is on the M.P.G.)

(3) The displacement for each wheel step is 0.001mm (X1), 0.01mm (X10) or 0.1mm (X100) per measuring unit.
7-6 AUTO MODE OPERATION

7-6-1 MANUAL DATA INPUT (MDI): A single block of commands can be executed from CRT/MDI input.

(1) Turn the mode selector to the MDI mode.

(2) Press the PROG function key on the MDI panel to select the program screen. The following screen appears:

```
PROGRAM (MDI) 0010 00002;
O0000;

G00 G90 G94 G40 G80 G50 G54 G69
G17 G22 G21 G49 G98 G67 G64 G15
B HM
T D
F S
>_
MDI ***** *** *** 20:40:05
```

(3) Input data.

(4) Press the INSERT key.

(5) Repeat (3) and (4) to enter more data.

(6) Press the cycle start key.
7-6-2 START AUTO OPERATION

a. MEMORY

(1) Turn the mode selector to the MEM mode.

(2) Select the program to be executed.

(3) Press the START button, and then the program will be executed. The lamp above the CYCLE START button will light. When necessary, press the FEED HOLD button to pause the execution. Press the CYCLE START button again to continue executing the program.

b. DNC

(1) To utilize ATA reader or connect a personal computer to CNC controller through an RS-232-C port for transmit program, then turn the mode selector to the DNC mode.

(2) Press the “CYCLE START” button, and then the program will be executed. The lamp above the “CYCLE START” button will light. When necessary, press the “FEED HOLD” button to pause the execution. Press the “CYCLE START” button again to continue executing the program.
7-6-3 STOP AUTO OPERATION

1. COMMANDS OF STOPPING AUTO OPERATION

(1) M00 (PROGRAM STOP): The program will stop at the block where M00 is read and other statuses remain unchanged. The next block will be executed if the CYCLE START button is pressed.

(2) M01 (OPTIONAL STOP): This command is the same as M00 except that it will be effective only when the OPT. STOP button is pressed.

(3) M02, M30: Auto mode operation will be stopped when M02 (PROGRAM FINISHED) or M30 is read. The only difference is that the cursor will return to the beginning of the program when M30 is read.

2. Auto operation can be stopped when the FEED HOLD button is pressed. Press the "CYCLE START" button to continue executing the program.

7-6-4 MANUAL INTERRUPTION (OPTIONAL FUNCTION)

Manual Pulse Generator (M.P.G.) will also be effective in auto operation mode by using this optional function. To use this function, press the CALL LIGHT button and keep it down to select an axis. Then use the other hand to rotate M.P.G.
7-6-5 PROGRAM RESTART (OPTIONAL)

Use this function to assign the sequence number that the program will restart from after replacing a broken tool or taking a break.

BROKEN TOOL (P TYPE)

(1) Press "Feed Hold" to escape the tool, and replace it with a new one. Modify the offset amount if it varies.

(2) Turn the program re-start switch on the machine operator's panel ON.

(3) Press "PRGRM" to display the present program.

(4) Find the program head. Press "RESET" During memory operation, select "AUTO" mode, and press 0 ↑

(5) If the same sequence number appears more than once, the location of the target block must be specified. Specify a frequency and a sequence number.

\[
\begin{array}{c}
N \quad 0000 \quad 000000 \\
\downarrow \\
\text{Frequency} \quad \text{Sequence number}
\end{array}
\]

\[
\begin{array}{c}
N \quad 000000 \\
\downarrow \\
\text{Sequence number}
\end{array}
\]

(7) After completion of block search, the CRT screen is changed to the program re-start screen.

<table>
<thead>
<tr>
<th>PROGRAM RESTART</th>
<th>O0002</th>
<th>N01000</th>
</tr>
</thead>
<tbody>
<tr>
<td>DESTINATION</td>
<td>M 1</td>
<td>2</td>
</tr>
<tr>
<td>X 57.096</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Y 56.877</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Z 56.943</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>DISTANCE TO GO</td>
<td>* * * * * * * * * * * * * *</td>
<td></td>
</tr>
<tr>
<td>1 X 1.459</td>
<td>T * * * * * * * *</td>
<td></td>
</tr>
<tr>
<td>2 Y 10.309</td>
<td>S * * * * * * * *</td>
<td></td>
</tr>
<tr>
<td>3 Z 7.320</td>
<td>S 0</td>
<td></td>
</tr>
<tr>
<td>MEM</td>
<td>* * * * * * * * * *</td>
<td></td>
</tr>
</tbody>
</table>

(DESTINATION) shows the position where the machining operation is re-started.

(DISTANCE TO GO) shows the distance between the current tool position and the machining re-start position. The figure at the left side of the axis name shows the order (parameter setting) described later when the tool moves to the re-start position.

M........... Shows M-code commanded recently 14 times in the past.

T........... Shows M-code commanded recently 2 times in the past.

S........... Shows s-code command in the last.

B........... Shows B-code command in the last.

Display the most previously commanded code in the head. Each code is cleared with the program re-start command and the cycle start command in reset conditions.

(8) Turn the program re-start switch OFF. At this time, the figure at the left side of axis name (distance to go) flickers.
(9) Check the screen, and if M, S, T or B code should be output, select the MDI mode, and output M, S, T or B code from MDI. Each code in this case is not displayed on the program re-start screen.

(10) During memory operation, select "AUTO" mode, and check that the distance of (DISTANCE TO GO) is correct, and that the tool does not hit against the work and others. If it is about to collide with an obstacle, move the tool manually to the location where it does not collide, then press "Cycle Start" button. At this time, the tool moves to the machining re-start position in the dry run mode by one axis in the order set to the parameters (No. 0124 to 0127), thus re-starting machining operation in succession.
7-6-6 EDIT OPERATION

1. PROGRAM REGISTRATION FROM RS-232C(PC→MT)

(1) Select EDIT mode.

(2) Turn the program protect to WRITE.

(3) Press function key \textit{PROG}.

(4) Press right most soft key \textit{PGM}.

(5) \begin{enumerate}
\item Key in address 0.
\item Key in the program number.
\end{enumerate}

(6) Key in 0~9999 for input all program.

(7) Press soft key [READ]

(8) Press soft key [EXEC]

2. PROGRAM REGISTRATION FROM CRT/MDI PANEL.

(1) Set the mode selector switch to EDIT.

(2) Turn the program protect key to WRITE.

(3) Press function key \textit{PROG}. Make sure that the program text is displayed.

(4) Key in address 0.

(5) Key in program number.

(6) Push the INSRT key.

With the above procedure, the program number is registered to the memory. Thereafter, key in respective words of the program and press the INSRT key to register them.
3. PROGRAM DELETION

Delete one program

(1) Set the mode selector switch to EDIT.

(2) Press function key PROG.

(3) Turn the program protect key to WRITE.

(4) Input address 0.

(5) Key in the program number to be deleted.

(6) Press the DELETE key. The program with the entered program number is deleted.

Delete all programs

(1) Set the mode selector switch to EDIT.

(2) Press PROG to display the program screen.

(3) Turn the program protect key to WRITE.

(4) Key in 0-9999.

(5) Press edit key DELETE to delete all programs.
4. OUTPUTTING A PROGRAM

(1) Make sure the output device is ready for output.

   For the two-path control, select the tool post for which a program to be output is used with the tool post selection switch.

(2) To output to a NC program, specify the punch code system (ISO or EIA) using a parameter.

(3) Press the EDIT switch on the machine operator's panel.

(4) Press function key PROG, then the program contents display screen or program directory screen appears.

(5) Press soft key [(OPRT)].

(6) Press the rightmost soft key (next-menu key).

(7) Enter address O.

(8) Enter a program number. If-9999 is entered, all programs stored in memory are output.

   To output multiple programs at one time, enter a range as follows: O△△△△, O□□□□.

   Programs No.△△△△ to No.□□□□ are output.

   The program library screen displays program numbers in ascending order when bit 4(SOR) of parameter No.3107 is set to 1.

(9) Press soft keys [PUNCH] and [EXEC]

   The specified program or programs are output.
5. SEARCH

Scanning a program

(1) Press the cursor key ➡️.  
The cursor moves forward word by word on the screen; the cursor is displayed at a selected word.

(2) Press the cursor key ←.  
The cursor moves backward word by word on the screen; the cursor is displayed at a selected word.

(3) Holding down the cursor key ➡️ or ← scans words continuously.

(4) The first word of the next block is searched for when the cursor key ➡️ is pressed.

(5) The first word of the previous block is searched for when the cursor key ↑ is pressed.

(6) Holding down the cursor key ↓ or ↑ moves the cursor to the head of a block continuously.

(7) Pressing the page key PAGE displays the next page and searches for the first word of the page.

(8) Pressing the page key PAGE displays the previous page and searches for the first word of the page.

(9) Holding down the page key PAGE or PAGE displays one page after another.
Searching a word

(1) Key in address S.

(2) Key in 1 2.

* S12 cannot be searched for is only S1 is keyed in.

* S09 cannot be searched for by keying in only S9.

To search for S09, be sure to key in S09.

(3) Pressing the [SRH ↓] key starts search operation.

  Upon completion of search operation, the cursor is displayed at S12.
  Pressing the [SRH ↑] key rather than the [SRH ↓] key performs search operation in the reverse direction.

Searching an address

(1) Key in address M.

(2) Press the [SRH ↓] key.

  Upon completion of search operation, the cursor is displayed at M03.

  Pressing the [SRH ↑] key rather than the [SRH ↓] key performs search operation in the reverse direction.
Heading a program

METHOD 1:

(1) Press \text{RESET} when the program screen is selected in EDIT mode.

When the cursor has returned to the start of the program, the contents of the program are displayed from its start on the screen.

METHOD 2:

Search for the program number.

(1) Press address \text{O}, when a program screen is selected in the MEMORY or EDIT mode.

(2) Input a program number.

(3) Press the soft key [O SRH].

METHOD 3:

(1) Select [MEMORY] or [EDIT] mode.

(2) Press \text{PROG}.

(3) Press the [(OPRT)] key.

(4) Press the [REWIND] key.

METHOD 4:

(1) Select [MEMORY] or [EDIT] mode.

(2) Press \text{PROG}.

(3) Press address \text{O}

(4) Press \text{CURSOR} key.
6 INSERTING A WORD

(1) Search for or scan the word immediately before a word to be inserted.

(2) Key in an address to be inserted.

(3) Key in data.

(4) Press the \textbf{INSERT} key.

\textit{Altering a word}

(1) Search for or scan the word to be altered.

(2) Key in an address to be inserted.

(3) Key in data.

(4) Press the \textbf{ALTER} key.
7. DELETING A WORD

(1) Search for or scan a word to be deleted.

(2) Press the DELETE key.

Deleting a block

(1) Search for or scan address N for a block to be deleted.

(2) Key in EOB

(3) Press the DELETE.

Deleting multiple blocks

(1) Search for or scan a word in the first block of a portion to be deleted.

(2) Key in address N.

(3) Key in the sequence number for the last block of the portion to be deleted.

(4) Press the DELETE key.
8. PROGRAM NUMBER SEARCH

METHOD 1:

(1) Select EDIT or MEMORY mode.

(2) Press [PROG] to display the program screen.

(3) Key in address [ ].

(4) Key in a program number to be searched for.

(5) Press the [O SRH] key.

(6) Upon completion of search operation, the program number searched for is displayed in the upper-right corner of the CRT screen. If the program is not found, P/S alarm No. 71 occurs.

METHOD 2:

(1) Select EDIT or MEMORY mode.

(2) Press [PROG] to display the program screen.

(3) Press the [O SRH] key.

In this case, the next program in the directory is searched for.
9. SEQUENCE NUMBER SEARCH

(1) Select MEMORY mode.

(2) Press PROG.

(3) If the program contains a sequence number to be searched for, perform the operations 4 to 7 below.

(4) Key in address N.

(5) Key in a sequence number to be searched for.

(6) Press the [N SRH] key.

(7) Upon completion of search operation, the sequence number searched for is displayed in the upper-right corner of the CRT screen.

   If the specified sequence number is not found in the program currently selected, P/S alarm No.060 occurs.
10. AUTOMATIC INSERT SEQUENCE NO.

1. Sequence No. setting 1. Procedure as follows:

(1) Select the MDI mode.

(2) Press function key OFFSET SETING.

(3) Press soft key [SETTING] to display the setting data screen.

This screen consists of several pages.

(4) Press page key PAGE or PAGE until the desired screen is displayed.

An example of the setting data screen is shown below.

```
SETTING (HANDY) 00001 N00000
PARAMETER WRITE = 1 (0:DISABLE 1:ENABLE)
TV CHECK = 0 (0:OFF 1:ON)
PUNCH CODE = 1 (0:EIA 1:ISO)
INPUT UNIT = 0 (0:MM 1:INCH)
I/O CHANNEL = 0 (0-3:CHANNEL NO.)
SEQUENCE NO. = 0 (0:OFF 1:ON)
TAPE FORMAT = 0 (0:NO CNV 1:F15)
SEQUENCE STOP = 0(PROGRAM NO.)
SEQUENCE STOP = 0(SEQUENCE NO.)
```

(5) Move the cursor to the sequence No., then press [1 : ON]

2. Select the edit mode.

3. Press function key PROG.

4. Key in address N and key in start value, ex: N10.

5. Press INSERT key.

6. Edit a signal block.

7. Press EOB key.

8. Press INSERT key, then perform automatic sequence number insertion.
11. BACKGROUND EDITING

(1) Enter EDIT or MEMORY mode.

(2) Press function key PROG.

(3) Press soft key [(OPRT)], then press soft key [BG-EDT].
   
   The background editing screen is displayed [PROGRAM(BG-EDT) is displayed at the top left of the screen].

(4) Edit a program on the background editing screen in the same way as for ordinary program editing.

(5) After editing is completed, press soft key [(OPRT)], then press soft key [BG-EDT]. The edited program is registered in foreground program memory.
1. Press function key [OFFSET SETTING].

2. Press the continuous menu key [ ], then press chapter selection soft key [OPR].

3. The screen consists of several pages. Press page key PAGE or PAGE until the desired screen is displayed.

4. Move the cursor to the desired switch by pressing cursor key or .

6. Push the cursor move key or to match the mark ■ to an arbitrary position and set the desired condition.
7-7 INDEX TABLE

(1) Set the mode selector switch to MDI.

(2) Press the PROGRAM button.

(3) Press the PAGE button until "MDI" is displayed on the left upper part of the screen.

(4) Input $B \square \square . ; \rightarrow \text{INSERT}$

rotation angle

(5) At last, press the buttons of "START" or "PROGRAM" for executing. The pallet is going to rotate according to the angle assigned in the program.
7-8 LOADING TOOLS TO THE SPINDLE OR UNLOADING TOOLS FROM THE SPINDLE

(1) Stop the spindle

(2) Set the mode selector to manual mode (HANDLE, JOG, RAPID).

(3) Support the tool with the hand carefully. The tool can be taken out by means of pressing the TOOL UNCLAMP button on the operation panel.

(4) When mounting tools, clean the tapper part of the tool shank and the spindle inner hole. Thrust the tool into the spindle. Then, the tool can be clamped by pressing and unpressing the TOOL UNCLAMP button.

NOTE: That the tool may need to be wrapped to protect your hand. Make sure that the tool has been correctly clamped before releasing the button.
7-9 AUTOMATIC START FOR CHIP CONVEYOR

The conveyor NO.1 stands by the column. The conveyor NO.2 stands by the APC. The flat type option is the conveyor NO.3

Power on

- Program start (M06)
- Chip conveyor start (NO.1,2,3)
  - one minute
- Chip conveyor stop (NO.1,2)
- Chip conveyor continue start (NO.3)
  - one minute
- Chip conveyor stop (NO.3)

Instructions:

1. The starting time is set by PMC: one minute.

2. Manual operation is allowed and has no influences on timing.

3. The conveyors can be started without the influence of timing. They stop until M37 is executed or the button for the chip conveyor is pressed.

4. It is allowed for any conditions to press the chip conveyor button to stop the chip conveyor.

5. Never go into the machine when the chip conveyor starts. If it is needed to enter the machine, the chip conveyor should be confirmed to be in the stop state to avoid hazards.
7-10 AUTOMATIC LUBRICATION SYSTEM FOR SLIDEWAY

Oil will be bleeped once automatically when the NC power is on. Afterwards, oil is bleeded at the time interval of ten minutes. If three axes are all motionless, the oil is not bleeded until one axis moves.

Remark : (1) The time interval is set to TIMER1 : 600000(ten minutes)
(2) The time for bleeding oil is set by PMC : 30 seconds.
(3) M18 automatic oil bleeding once.
7-11 INTERLOCK OF AXES

1. X-axis and Proximity for shuttle backward (LS33):
   If the proximity is off, the X-axis can’t be moved.

2. Y-axis and the proximity for the tool changing arm moving right (LS15):
   If the switch on, Y-axis can not move.

3. Z-axis and the proximity for the tool changing arm moving towards the spindle (LS32):
   If the switch on, Z-axis can not move.

4. B-axis and the proximity for the shuttle forward (LS32):
   If the switch on, B-axis can not rotate.

5. Cutting feed (every axis) and the limit switch under the table:
   If the proximity is off, the cutting feed is not valid.

6. X, Y and Z-axis can move in the HANDLE mode even the interlock is valid.
7. KEEP RELAY

<table>
<thead>
<tr>
<th>#7</th>
<th>#6</th>
<th>#5</th>
<th>#4</th>
<th>#3</th>
<th>#2</th>
<th>#1</th>
<th>#0</th>
</tr>
</thead>
<tbody>
<tr>
<td>K02</td>
<td>ZRN.AL</td>
<td>BIL</td>
<td>ZIL</td>
<td>YIL</td>
<td>XIL</td>
<td>B.ZRN</td>
<td></td>
</tr>
</tbody>
</table>

# 0  B.ZRN  Manual B axis zero return is
  0 : unvalid
  1 : valid

# 1  XIL  X-axis interlock
  0 : valid
  1 : unvalid

# 2  YIL  Y-axis interlock
  0 : valid
  1 : unvalid

# 3  ZIL  Z-axis interlock
  0 : valid
  1 : unvalid

# 4  BIL  B-axis interlock
  0 : valid
  1 : unvalid

# 6  ZRN.AL  When X,Y,Z axes not ZERO RETURN
  0 : cycle start unvalid
  1 : cycle start valid
8. AUTOMATIC TOOL CHANGING (ATC) SYSTEM

8-1 OPERATING PANEL FOR ATC ................................................. 8-1
8-2 OPERATING PROCEDURE FOR ATC ..................................... 8-3
8-3 PROGRAMMING FOR ATC .................................................. 8-14
8-4 OPERATION FOR ATC IN SINGLE BLOCK ........................... 8-15
8-5 TOOL NUMBER ALARM ...................................................... 8-15
8-6 CONFIRMATION OF TOOL NUMBER ................................. 8-16
  8-6-1 SETTING OF COUNTER ............................................... 8-16
  8-6-2 TOOL NUMBER SETTING ............................................. 8-17
8-7 TOOL LOADING AND UNLOADING ................................... 8-19
  8-7-1 TOOLING RANGE OF ATC MAGAZINE ......................... 8-20
  8-7-2 TOOL LIMIT IN ATC MAGAZINE ................................. 8-21
8-8 ADJUSTMENT OF THE TOOL EXCHANGING POSITION .... 8-22
8. AUTOMATIC TOOL CHANGING (ATC) SYSTEM

8-1 OPERATING PANEL FOR ATC

EMERGENCY STOP

FEED HOLD

MAGAZINE

CCW

CW
# OPERATING PANEL FOR ATC

<table>
<thead>
<tr>
<th>NAME</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAGAZINE FORWARD</td>
<td>On pressing the button, the magazine will rotate C.W. The magazine can rotate a step due to pressing the button once.</td>
</tr>
<tr>
<td>MAGAZINE REVERSE</td>
<td>On pressing the button, the magazine will rotate C.C.W. The magazine can rotate a step due to pressing the button once.</td>
</tr>
<tr>
<td>EMERGENCY STOP</td>
<td>The machine stops at the moment of pressing the button. Pressing the button will function the same as the button on the main operation panel.</td>
</tr>
</tbody>
</table>

(Remark): Selecting the manual (HANDLE, JOG, RAPID) mode can operations be valid when utilizing the operating panel described above.
8-2 OPERATING PROCEDURE FOR ATC

1. The movement of $T\triangle$: The tool in the magazine is changed to the prepared position and the pot NO which is the same as the tool in the spindle will rotate to the stand-by position.

(1) The magazine rotates C.W. or C.C.W for the tool number assigned in the T command.

(2) Arm moves towards the magazine (M80)

(3) Arm moves forward (M84)

(4) Arm returns to the normal position (M81)

(5) Arm moves backward (M85)

(6) The pot NO which is the same as the tool in the spindle will rotate to the stand-by position.

If the prepared position is already has tool the ATC system will put back the tool first.

(1) The magazine rotates C.W or C.C.W to search the pot NO is same as the tool NO in the prepared position.

(2) Arm moves forward (M84)

(3) Arm moves towards the magazine (M80)

(4) Arm moves backward (M85)

(5) Arm returns to the normal position (M81)
1. The movement of $T_{△△}$

1-1 The step movement of $T_{△△}$ (not stand-by tool)

**STEP 1:**
1. Magazine rotates for orientation.
2. Arm moves towards the magazine (M80)

**STEP 2:**
1. Arm moves forward. (M84)

**STEP 3:**
1. Arm returns to the normal position. (M81)
STEP 4:

1. Arm moves backward. (M85)
1-2 The step movement of T△△ (stand-by tool)

STEP 1:
1. Magazine rotates for orientation.
2. Arm moves forward (M84).

STEP 2:
1. Arm moves towards the magazine (M80).

STEP 3:
1. Arm moves backward (M85).
STEP 4:

1. Arm returns to the normal position (M81).

2. Then turn back to 1-1 to prepared the T code tool No.
2. The movement of M06 (in these movements the other program can not be executed):

(1) Y and Z axis return to the 2nd reference point.

(2) The spindle orientation (M19)

(3) ATC door open (M78)

(4) Arm moves towards the spindle (M76)

(5) Arm moves right (M83)

(6) The spindle unclamps the tool (M88)

(7) Arm moves forward (M84)

(8) Arm rotates $+180^\circ$ or $-180^\circ$ (M87)

(9) Arm moves backward (M85)

(10) The spindle clamps the tool (M89)

(11) Arm moves left (M82)

(12) Arm returns to the normal position (M77)

(13) ATC door close (M79)
2. Diagrams illustrating the movement of M06 (in these movements the other program can not be executed)

STEP 1:
1. Y and Z axis return to the 2nd reference point. (G30 G91 Y0 Z0)
2. The spindle orientation. (M19)
3. ATC door open. (M78)
4. Arm moves towards the spindle. (M76)

STEP 2:
1. Arm moves right. (M83)

STEP 3:
1. The spindle unclamps the tool. (M88)
2. Arm moves forward. (M84)
STEP 4:

1. Arm rotates $+180^\circ$ (M86) or $-180^\circ$ (M87)

STEP 5:

1. Arm moves backward. (M85)

STEP 6:

1. The spindle clamps the tool. (M89)
2. Arm moves left. (M82)
STEP 7 :

1. Arm returns to the normal position (M77)

STEP 8 :

1. ATC door close. (M79)

2. M6 command is finishing.
3. Diagrams illustrating the movement of M06 (in these movements the other program can be executed)

STEP 1:
1. Magazine rotates for orientation.
2. Arm moves forward. (M84)

STEP 2:
1. Arm moves toward the magazine. (M80)

STEP 3:
1. Arm moves backward (M85)
STEP 4:
1. Arm returns to the normal position (M81)

STEP 5:
1. Magazine can rotate.
8-3 PROGRAMMING FOR ATC

We can program M06 and T △△ in different block or in the same block.

T △△ : The tool in the magazine is changed to the prepared position and the pot NO which is the same as the tool in the spindle will rotate to the stand-by position.

M06 : Change the tool in the spindle and prepared position, and then put the tool back to the magazine.

T△△ M06 : The tool in the magazine is changed to the spindle, and then put the tool back to the magazine.

Remark : Executing ATC MACRO Program

```
O9003;
#100 = #4003;
G91 G30 Y0 Z0;
M06;
G#100;
M99;
```
8-4 OPERATION FOR ATC IN SINGLE BLOCK

When single block button is pressed the movement of ATC, APC can move step by step or continues depend on the setting of KEEP RELAY K4.1

(1) KEEP RELAY K4.1 = 1 : When executing ATC, APC command, it is necessary to press " CYCLE START " to let ATC, APC system execute next movement.

(2) KEEP RELAY K4.1 = 0 : When executing ATC, APC command, it will execute all the movements then stop.

NOTE : When the machine is executing the tool change command, press the " FEED HOLD " button, the ATC system will stop until press the " CYCLE START " button again then execute the remain movements.

8-5 TOOL NUMBER ALARM

Tool number alarm appears under the conditions as follows:

The tool number T△△ is out of tool range.

It is necessary to press " RESET " to restart the machine.

NOTE : If T△△ M06 in the same block, and T△△ is in the spindle, it will ignore this block.
8-6 CONFIRMATION OF TOOL NUMBER

If the tool installed on the spindle after executing the T△△M06 command is incorrect, there may be something wrong with the setting of tool number and magazine. The tool number setting must be performed and confirmed at the beginning of operation. The procedures for setting of tool number are as follows:

8-6-1 SETTING OF COUNTER

(1) Press function key [SYSTEM].

(2) Press the softkey of [PMC] ↔ [PMCPRM] ↔ [COUNTER] then the screen displays the following:

<table>
<thead>
<tr>
<th>PMC PRM (COUNTER)</th>
<th>#001</th>
<th>MONIT</th>
<th>RUN</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO 01 C00</td>
<td>△△(NOTE1)</td>
<td>△△(NOTE2)</td>
<td></td>
</tr>
<tr>
<td>02 C04</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

NOTE 1: The capacity of tool magazine it is a fixed number.

MCH-500, MCH-800: 60(STANDARD)

90 & 120(OPTION)

NOTE 2: This is the number of tool at the stand-by position of tool Magazine, If this value is not identical to that of the tool number at the stand-by position, errors will occur. In this case, the value must be changed so that it is identical to that of the tool number at the stand-by position.
8-6-2 TOOL NUMBER SETTING

(1) Open the program protect key and turn to MDI mode.

(2) Press [PMC] ↦ [PMCP RM] ↦ [DATA] key, then the screen display as following:

<table>
<thead>
<tr>
<th>PMC DATA TBL CONTROL</th>
<th>MONIT</th>
<th>RUN</th>
</tr>
</thead>
<tbody>
<tr>
<td>GROUP</td>
<td>TABLE COUNTS=2</td>
<td></td>
</tr>
<tr>
<td>NO</td>
<td>ADDRESS</td>
<td>PARAMETER</td>
</tr>
<tr>
<td>001</td>
<td>D0000</td>
<td>00000001</td>
</tr>
<tr>
<td>002</td>
<td>D0010</td>
<td>00000001</td>
</tr>
</tbody>
</table>

(NOTE 3)

PARAMETER

<table>
<thead>
<tr>
<th>#7</th>
<th>#6</th>
<th>#5</th>
<th>#4</th>
<th>#3</th>
<th>#2</th>
<th>#1</th>
<th>#0</th>
</tr>
</thead>
</table>

0: Binary format  
1: BCD format  
0: without protection for input  
1: with protection for input

(NOTE 4) Capacity of DATA TABLE

MCH-500、MCH-800: 10
(3) Press [G.DATA] key, screen display as following:

<table>
<thead>
<tr>
<th>PMC PRM (DATA) 001/001</th>
<th>MONIT RUN</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO</td>
<td>ADDRESS</td>
</tr>
<tr>
<td>000</td>
<td>D0000</td>
</tr>
<tr>
<td>001</td>
<td>D0001</td>
</tr>
<tr>
<td>002</td>
<td>D0002</td>
</tr>
<tr>
<td>003</td>
<td>D0003</td>
</tr>
<tr>
<td>.</td>
<td>.</td>
</tr>
<tr>
<td>.</td>
<td>.</td>
</tr>
<tr>
<td>008</td>
<td>.</td>
</tr>
<tr>
<td>009</td>
<td>.</td>
</tr>
</tbody>
</table>

**NOTE5**: Number of tool in pre-tool pot.

**NOTE6**: NO. of tool in the spindle or NO. of last tool in spindle.

**NOTE7**: NO. of tool in the spindle.
8-7 TOOL LOADING AND UNLOADING

Tools can be loaded or unloaded on the operating positions D (please refer to page 1-4). However, it is inhibited for the safety consideration to enter the magazine for loading or unloading tools.

The mode selection should be in the handle mode. The magazine can rotates C.W direction for pressing the C.W button and C.C.W direction for the C.C.W button.

NOTE: The tool limit of ATC magazine shown as following Fig.(8-8-1,8-8-2)
When the tool shape is within this range, the tools can be loaded in a row.
(Ex. boring bar, etc.)

Even-numbered pot

Maximum diameter tools arranged at every other pot

55 (2.2)

U center tool

Even-numbered pot

Maximum diameter tools arranged in a row

55 (2.2)

120 (4.7)

70°

160 (6.3)

80 (3.15)

130 (5.1)

30°

120 (4.7)

360 (14.2)

Note: Figure in parentheses ( ) signifies an inch value.

When mounting a U center tool (U200, U180), it should be set on the even-numbered tool pot with the adjacent tools empty.

When mounting two or more U center tools, they should be set on the tool pots at every three empty pots.
8. AUTOMATIC TOOL CHANGING (ATC) SYSTEM

8-7-2 TOOL LIMIT IN ATC MAGAZINE

Max. tool length: 400mm (15.7")
Max. tool weight: 20kgf (44 lbs)
Max. tool diameter:

1. When inserting the tools continuously: φ 110mm (4.3")
2. When both adjacent pots are empty: φ 245mm (9.6")
8-8 ADJUSTMENT OF THE TOOL EXCHANGING POSITION

1. Perform Y and Z axes return to the 2nd reference point (G91 G30 Y0 Z0) in MDI mode.

2. **INPUT M19** command in MDI mode for spindle orientation with out tool in the spindle then check the two fixed keys on the spindle whether they are on the same line of horizontal. If not, change the value of the parameter (0iMB/21iMB/18iMB: 4031) until they are on the same line of horizontal.

3. Input M code (M19 $\rightarrow$ M78 $\rightarrow$ M76 $\rightarrow$ M83) arm moves towards the spindle then to check if distance is 3mm from tool arm to end of spindle and fixed key of spindle in middle of half circle of tool arm. If not return arm to the normal position (M82 $\rightarrow$ M77) then change the value of the parameter of Y and Z axis 2nd reference point (Y axis: 0iMB/21iMB/18iMB: 1241, Z axis 0iMB/21iMB/18iMB: 1241) Repeat step from (1) to (3) until the tool changing position is correct.

4. Input M code [M88 $\rightarrow$ M84 $\rightarrow$ M86 (M87) $\rightarrow$ M85 $\rightarrow$ M89] to arm rotates 180° to check if position is correct at other side, if not repeat above steps for adjust.

5. Input M code (M82 $\rightarrow$ M77 $\rightarrow$ M79) to return tool arm to normal position after position is correct, then insert the tool into the spindle. Input M code (M19 $\rightarrow$ M76 $\rightarrow$ M83) to let ATC arm catch tool in MDI mode to see if any problem (the distance is 0.1mm between arm and tool shank). If not input M code [M88 $\rightarrow$ M84 $\rightarrow$ M83(M87) $\rightarrow$ M85 $\rightarrow$ M89 $\rightarrow$ M77] for ATC in single block. Then insert M6 for auto tool change test if above steps are all right.
9. AUTOMATIC PALLET CHANGE (APC) SYSTEM

9-1 OPERATING PANEL FOR APC............................................... 9-1
9-2 PROCEDURE FOR APC OPERATION.................................. 9-3
9-3 OPERATING FOR APC PROGRAM....................................... 9-9
9-4 AUTO IN AND OUT FOR SINGLE PALLET.......................... 9-12
9-5 MAINTENANCE (VALID IN MDI MODE)............................... 9-15
9-6 DATA ADDRESS FOR APC................................................ 9-16
9-7 KEEP RELAY FOR APC...................................................... 9-17
9-8 MANUAL B AXIS ZERO RETURN......................................... 9-18
9-9 ADJUSTMENT OF THE PALLET EXCHANGING POSITION......................................................... 9-19
9. AUTOMATIC PALLET CHANGE (APC) SYSTEM

9-1 OPERATING PANEL FOR APC
### OPERATING PANEL FOR AUTOMATIC PALLET CHANGE (APC)

<table>
<thead>
<tr>
<th>NAME</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>CYCLE START</td>
<td>Pressing the button can execute the program shown or the CRT. The function of this bottom is the same as that on the main panel.</td>
</tr>
<tr>
<td>FEED HOLD</td>
<td>Pressing the button can pause both the program and feed. The function of this bottom is the same as that on the main panel.</td>
</tr>
<tr>
<td>APC READY</td>
<td>When getting ready for work, press the bottom to confirm. APC can't be carried out until the bottom is pressed and the light is on.</td>
</tr>
<tr>
<td>EMERGENCY STOP</td>
<td>Pressing the bottom can stop the machine. The function of this button is the same as that on the main panel.</td>
</tr>
</tbody>
</table>
9-2 PROCEDURE FOR APC OPERATION

Start
↓
zero point return of both Z axis and B axis
↓
X axis 2nd reference point return (pallet A) or
X axis 3rd reference point return (pallet B)
↓
(Shuttle should be at the center) table up, and automatic door opens
↓
Shuttle forward
↓
Shuttle moves right (A) or
shuttle moves left (B)
↓
Shuttle returns
↓
Shuttle returns to the center
↓
X axis 2nd reference point return (pallet A) or
X axis 3rd reference point return (pallet B)
↓
Shuttle moves right (A) or
shuttle moves left (B)
↓
Shuttle returns to the center
↓
Shuttle return
↓
table down and APC door close
↓
End
NOTE:

(1) Shuttle forward: Shows an action to move the pallet from the APC side to the machine side.

Shuttle return: Shows an action to move the pallet from the machine side to the APC side.

(2) When X axis 2nd or 3rd reference point return is finishing, the light of "X zero return" will be flicker on operation panel.
9. AUTOMATIC PALLET CHANGE (APC) SYSTEM

DIAGRAMS ILLUSTRATING THE MOVEMENT OF APC

STEP 1:
1. 2nd reference point return of both Z axis and B axis. (G28 B0, G30 Z0)
2. X axis 3rd reference point return (pallet B) (G91 G30 P3 X0)
3. Table up. (M58)
4. Automatic door open. (M56)

STEP 2:
1. Shuttle forward. (M65)

STEP 3:
1. Shuttle moves left. (M67)
STEP 4:
1. Shuttle returns. (M66)

STEP 5:
1. Shuttle return to the center. (M69)
2. X-axis move to 2nd zero point. (G30 G91 X0)

STEP 6:
1. Shuttle moves right. (M68)
9. AUTOMATIC PALLET CHANGE (APC) SYSTEM

STEP 7:
1. Shuttle forward. (M65)

STEP 8:
1. Shuttle return to the center. (M69)

STEP 9:
1. Shuttle returns. (M66)
STEP 10:

1. Table down. (M59)

2. Automatic door close. (M57)

STEP 11:

1. Complete.
9-3 OPERATING FOR APC PROGRAM
(Warning : Never put hands on the cover when the machine is in use )

When M60 is executed it would call a program for executing cycles of pallet changing.

The program is as follows:

```
09001 ;
#100 = #4003 ;
G91 G30 Z0 ;
G28 B0 ;
M51 ;
IF [ #1003 EQ 0 ] GOTO 3 ;
IF [ #1004 EQ 0 ] GOTO 4 ;
IF [ #1000 EQ 1 ] GOTO 1 ;
IF [ #1001 EQ 1 ] GOTO 2 ;
G100 ;
#3000 = 1 (APC SIDE IS NO A OR B PALLET ) ;
N1 G30 X0 ;
M61 ;
G30 P3 X0 ;
M62 ;
G #100 ;
M99 ;
N2 G30 P3 X0 ;
M63 ;
G30 X0 ;
M64 ;
G #100 ;
M99 ;
N3 #3000 = 2 ( A PALLET NOT POSITIONING) ;
N4 #3000 = 3 ( B PALLET NOT POSITIONING) ;
```
NOTE: 1. If the alarm NO. 501 "APC SIDE IS NO A OR B PALLET " appears it implies there are no pallet A or pallet B on the APC.

2. The alarm NO.502 A PALLET NOT POSITIONING implies pallet A does not in position. (X5.5 SIGNAL OFF)

3. The alarm NO.503 "B pallet not positioning " implies the pallet B does not in position. (X5.7 SIGNAL OFF)

4. Before executing M60, B axis must zero return first (G28 B0).

5. The APC READY must be on then can execute M60 command.

6. M51: Check if the APC ready light is on or not. In case of not going on the APC ready light will flash to remind the operator.

M61: Showing the action of move pallet A from the machine to the APC.

It should satisfy the conditions as follows:

1. Z axis 2nd reference point return.

2. B axis zero point return.

3. X axis 2nd reference point return.

4. The automatic pallet charger A should be in position.

5. APC A side should be has no pallet.
M62 : Showing the action of move pallet B from the APC to the machine. It should satisfy the conditions as follows :

1. Z axis 2nd reference point return.
2. B axis zero return.
4. Pallet B must in APC side.
5. Pallet A must in APC side.

M63 : Showing the action of move pallet B from the machine to the APC. It should satisfy the conditions as follows :

1. Z axis 2nd reference point return.
2. B axis zero point return.
3. X axis 3rd reference point return.
4. The automatic pallet charger B should be in position.
5. APC B side should be has no pallet .

M64 : Showing the action of move pallet A from the APC to the machine. It should satisfy the conditions as follows :

1. Z axis 2nd reference point return.
2. B axis zero point return.
3. X axis 2nd reference point return.
4. Pallet A must in APC side.
5. Pallet B must in APC side.
9-4 AUTO IN AND OUT FOR SINGLE PALLET

M50 command can let the pallet auto in and out if the operator only use one pallet.

1. Procedure:

   B axis reference point return
   ↓
   Start
   ↓
   Z axis 2nd reference point return
   ↓ Determined by PMC
   X axis 2nd reference point return (pallet A) or
   X axis 3rd reference point return (pallet B)
   ↓
   Shuttle must at the center
   ↓
   Table up and APC door open
   ↓
   Shuttle forward
   ↓
   Shuttle move to right (A) or
   Shuttle move to left (B)
   ↓
   Shuttle return
   ↓
   Shuttle return to the center
   ↓ (Air blowing stops)
   Machine stop
   ↓ (Replace workpiece)
   Restart (by pressing cycle start button)
   ↓ (Air blowing starts)
   Shuttle move to right (A) or
   Shuttle move to left (B)
   ↓
   Shuttle forward
   ↓
   Shuttle return to the center
   ↓
   Shuttle return
   ↓
   Table down and APC door close
   ↓
   END

9-12
2. EXECUTING PROGRAM

09002 (M50):
  #100 = #4003;
G91 G30 Z0;
G28 B0;
M51;
IF [ #1003 EQ 0 ] GOTO 3;
IF [ #1004 EQ 0 ] GOTO 4;
IF [ #1000 EQ 1 ] GOTO 1;
IF [ #1001 EQ 1 ] GOTO 2;
G #100:
  #3000 = 1 (APC SIDE IS NO A OR B PALLET):
N1 G30 X0;
M61;
M00;
IF [ #1003 EQ 0 ] GOTO 3;
M64;
G #100;
M99;
N2 G30 P3 X0;
M63;
M00;
IF [ # 1004 EQ 0 ] GOTO 4;
M62;
G #100;
M99;
N3 #3000 = 2 (A PALLET NOT POSITIONING):
N4 #3000 = 3 (B PALLET NOT POSITIONING):

NOTE: 1. If the alarm NO. 501 "APC SIDE IS NO A OR B PALLET " appears it implies there are no pallet A or pallet B on the APC.

2. The alarm NO.502 A PALLET NOT POSITIONING implies pallet A does not in position. (X5.5 SIGNAL OFF)
3. The alarm NO.503 "B pallet not positioning " implies the pallet B does not in position. (X5.7 SIGNAL OFF)

4. Before executing M50, B axis must zero return first (G28 B0).

5. The APC READY must be on then can execute M50 command.
9-5 MAINTENANCE ( VALID IN MDI MODE )

Select the MDI mode while maintenance. The following M codes can control the solenoid directly.

MAINTENANCE COMMAND FORM CODE

1. M56 : Automatic door open
2. M57 : Automatic door close
3. M58 : Table up
4. M59 : Table down
5. M65 : Shuttle forward  (APC $\rightarrow$ TABLE)
6. M66 : Shuttle returns  (TABLE $\rightarrow$ APC)
7. M67 : Shuttle moves left
8. M68 : Shuttle moves right
9. M69 : Shuttle return to the center
9-6 DATA ADDRESS FOR APC

D10 : Set the part program number of pallet A

D12 : Set the part program number of pallet B

Example :

If the part program number of pallet A is 0 1234, then D10 = 1234.

If the part program number of pallet B is 0 5678, then D12 = 5678.

NOTE : 1. If the part programs of both pallet A and B are the same, set the keep relay K04.5 to 1 or D10 and D12 set the same value.

2. The program number above can be called by M30 for executing.

3. After M30 call the program for another pallet, if keep relay K4.4=0, the machine will stop the operator must press " CYCLE START " to start the new program.

4. If the operator wants to stop when the workplaces on both pallets having been machined, must be set keep relay K4.0=0, K4.4=1.

5. Set KEEP RELAY K4.0=1, K4.4 = 1 in order to alternating executions for pallet A and B.
## 9-7 KEEP RELAY FOR APC

<table>
<thead>
<tr>
<th></th>
<th>#7</th>
<th>#6</th>
<th>#5</th>
<th>#4</th>
<th>#3</th>
<th>#2</th>
<th>#1</th>
<th>#0</th>
</tr>
</thead>
</table>

# 0  M30.K  : Auto cycle start (K4.4=1)
   0 : cycle start once  
   1 : cycle start continually

# 1  ACSB  : ATC and APC stop in the SINGLE BLOCK
   0 : unvalid  
   1 : valid

# 2  PAT   : Pallet up/down check
   0 : pallet up  
   1 : pallet down

# 3  BUD   : B axis up/down check
   0 : B axis up  
   1 : B axis down

# 4  M30.C  : After M30, auto cycle start
   0 : unvalid  
   1 : valid

# 5  M30.M  : M30 call the program number in D10, D12 is
   0 : valid  
   1 : unvalid

# 6  WAIR  : Table air blowing
   0 : table does not blow the air until table down (M59)  
   1 : when table is up (M58) the air start blowing

# 7  APCL  : APC READY signal
   0 : depend on the button in APC panel  
   1 : always on
9-8 MANUAL B AXIS ZERO RETURN

When the batteries are exhausted of B axis absolute motor or the parameter stored in the memory are erased.

The signal alarm of CNC will be displayed on the screen as follows:

340  4th-axis origin return

346  APX ALARM: 4th-axis battery voltage 0

It has to replace new batteries (chapter 10-6). for require of above alarm then B axis zero return.

1. B axis zero return

(1) Set the value of keep relay K2.0 to 1 (manual B axis zero return valid)

(2) Prepare a sensor (B axis deceleration switch) which is in electrical cabinet.

(3) Turn the mode selector to the zero return position then press B zero return button.

(4) B axis begin rotation the rotation speed will be deceleration when sensor is ON (sensor touch any metal, ex. cover....etc.). Take off sensor away metal when direction is approached 0 degree then sensor will be off. The actual position is B axis zero point.

Rotation B axis to any degree once time in MDI mode when direction wasn't 0 degree then repeat 2~4 steps until it was 0 degree.

(5) Must be set the value of keep relay K2.0 to 0 for avoid B axis zero point was changed when B axis zero return finish.
9-9 ADJUSTMENT OF THE PALLETS EXCHANGING POSITION.

1. Pallet A at inside of machine

   (1) B axis zero return (G28 B0) and X axis 2nd reference point return (G91 G30 X0 : )

   (2) Input M58 in MDI mode for pallet up.

   (3) Push pallet from the machine to the APC with manual, then to check whether they will be interfere with each other.

   (4) If interferences will be occur, change the value of the parameter of X-axis 2nd reference point (0iMB/21iMB/18iMB : 1241)

   (5) Perform X-axis zero return after step 4, then repeat the step (1), (2), (3), (4) until it move the pallet is smooth.

2. Pallet B at inside of machine

   (1) B axis zero return (G28 B0) and X axis 3rd reference point return (G91 G30 X0 P3 : )

   (2) Input M58 in MDI mode for pallet up.

   (3) Push pallet from the machine to the APC with manual, then to check whether they will be interfere with each other.

   (4) If interferences will be occur, change the value of the parameter of X-axis 3rd reference point (0iMB/21iMB/18iMB : 1242)

   (5) Perform X-axis zero return after step (4), then repeat the step (1), (2), (3), (4) until it move the pallet is smooth.

3. If the pallet move are almost perfect, then test the movement of APC with M60 by single block.
10. MAINTENANCE AND ADJUSTMENT

10-1 ROUTINE CHECKUPS

10-2 LUBRICANT AND SUPPLY • THE PNEUMATIC AND MAINTENANCE

10-2-1 AUTOMATIC LUBRICATION SYSTEM FOR SLIDEWAY

10-2-2 DIAGRAM FOR LUBRICATION

10-2-3 PNEUMATIC FILTER

10-2-4 MAINTENCE FOR PNEUMATIC FILTER

10-2-5 LUBRICATION OIL EXCHANGE PROCESS FOR INDEX TABLE

10-3 ALARM MESSAGE DISPLAY

10-3-1 NC ALARM

10-3-2 MECHANICAL ALARM

10-3-3 MECHANICAL WARNING MESSAGES DISPLAY

10-4 SETTING FOR PARAMETERS

10-5 OVERTRAVERSE

10-6 REPLACING BATTERIES

10-6-1 CHANGING BATTERIES

10-7 ADJUSTMENT OF B AXIS BACKLASH

10-8 SETTING FOR TIMER
10-9 DATA FOR ADDRESS................................................................. 10-26
10-10 KEEP RELAY........................................................................ 10-27
10-11 SWITCH AND SOLENOID VALVE......................................... 10-41
    10-11-1 SOLENOID VALVE LIST............................................. 10-43
    10-11-2 LIMIT SWITCH AND PROXIMITY SWITCH LIST..... 10-45
10-12 HYDRAULIC DIAGRAM.................................................... 10-47
10-13 DOOR INTERLOCK RELEASE............................................. 10-51
10. MAINTEANCE AND ADJUSTMENT

10-1 ROUTINE CHECKUPS

1. Daily checkup
   (1) Check the lubricant is sufficient.
   (2) Remove chips on the sideways.
   (3) Clean the taper of the spindle.
   (4) Check the pneumatic air pressure.
   (5) Check the hydraulic oil and pressure.
   (6) Check whether the emergency stop and door interlock function works or not.
   (7) Check whether the all the buttons and switches function works or not.

2. Weekly checkup
   Clean the filter of heat exchanger and spindle cooler.

3. Seasonally checkup
   (1) Check the level and backlashes.

4. Six month checkup
   Position accuracy of machine.
10-2 LUBRICANT AND SUPPLY  \ THE PNEUMATIC AND MAINTENANCE

10-2-1 AUTOMATIC LUBRICATION SYSTEM FOR SLIDEWAY

Oil will gushed out once time when the NC power is on. Afterwards, oil is gushed at the time interval of ten minutes. and the oil gushed out by three axes are moving.

Remark :

(1) Set the interval time to NO. timer1 : 60000  (ten minutes).

(2) The timer for gushing oil is set by PMC : 30 seconds.

(3) M18 auto lubricate on for once.
## 10. MAINTENANCE AND ADJUSTMENT

### 10-2-2 DIAGRAM FOR LUBRICATION

![Diagram for lubrication](image)

### LUBRICATION CHART

<table>
<thead>
<tr>
<th>No.</th>
<th>Lubricating</th>
<th>Interval</th>
<th>Capacity</th>
<th>Chinese Petroleum Corp.</th>
<th>Shell Oil</th>
<th>Mobil Oil</th>
<th>Esso</th>
<th>ISO Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hydraulic Unit</td>
<td>Every Year</td>
<td>100 l</td>
<td>CPC Circulation Oil 832</td>
<td>Shell Tellus Oil C32</td>
<td>Mobil Dte Oil Light</td>
<td>Teressso 32</td>
<td>CB-32</td>
</tr>
<tr>
<td>2</td>
<td>Spindle Gear Box</td>
<td></td>
<td>6 l</td>
<td>CPC Circulation Oil 832</td>
<td>Shell Tellus Oil C32</td>
<td>Mobil Dte Oil Light</td>
<td>Teressso 32</td>
<td>CB-32</td>
</tr>
<tr>
<td>3</td>
<td>Air Control Unit</td>
<td>Timely Lubricating</td>
<td>0.05 l</td>
<td>CPC Way Lubricant Oil 68</td>
<td>Shell Tonna Oil T38</td>
<td>Mobil Vacra Oil No.2</td>
<td>Feltis 38</td>
<td>G-68</td>
</tr>
<tr>
<td>4</td>
<td>Slideways</td>
<td></td>
<td>3 l</td>
<td>CPC B.P. Lubricant HD-180</td>
<td>Shell Omala Oil 460</td>
<td>Mobil Gear Oil 634</td>
<td>Esso Spartan EP-40</td>
<td>CC-460</td>
</tr>
<tr>
<td>5</td>
<td>Index Table</td>
<td>Every 5 Years</td>
<td>4 l</td>
<td>CPC B.P. Lubricant HD-180</td>
<td>Shell Omala Oil 460</td>
<td>Mobil Gear Oil 634</td>
<td>Esso Spartan EP-40</td>
<td>CC-460</td>
</tr>
</tbody>
</table>

Remark: Maintenance interval is counted on the basis of working 8 hours per day.
### THE INTERVAL OF MAINTENANCE

<table>
<thead>
<tr>
<th>NO.</th>
<th>Parts</th>
<th>The interval of maintenance</th>
<th>The way of maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pressure valve</td>
<td>6 months</td>
<td>Release the gear and take the filter element out, then have it cleaned by air blast.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>One year</td>
<td>Release the gear and replace a new filter element, model 4338-04.</td>
</tr>
<tr>
<td>2</td>
<td>Filter</td>
<td>Filter element fill</td>
<td>Take the filter element, model 4344-01, out by turn and replace a new one.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>red indicator &quot;A&quot; goes up</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>to the top</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Release valve</td>
<td>Before full</td>
<td>Turn the release valve &quot;B&quot; to vertical position to enable the filtered water be released.</td>
</tr>
<tr>
<td>3</td>
<td>Oil regulator</td>
<td>To fill the circulation</td>
<td>While the oil is filled, the oil feeding volume can be adjusted by turning the &quot;C&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>oil R32 before it goes</td>
<td>knob in either CW or CCW direction, then push the &quot;D&quot; knob to fix the volume adjusted.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>empty, max. capacity is 0.15 liter.</td>
<td></td>
</tr>
</tbody>
</table>
10-2-4 MAINTENANCE FOR PNEUMATIC FILTER

NORGREN FILTER UNITS:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>Type NO.</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>B74G-4BK-AD1-RMN</td>
<td>General Purpose Filter</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>F74C-4BD-QD0</td>
<td>Oil Removal Filter</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>L74M-4BP-QDN</td>
<td>Lubricator</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>4314-52</td>
<td>Bracket</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>50 □ (1-10kgf/cm²)</td>
<td>Pressure Gauge</td>
<td>1</td>
</tr>
</tbody>
</table>

Characteristics:

1. Filter: 5 μm.

2. Oil Removal Filter: 0.01 μm.


5. Maximum Temperature: 79 °C

6. Quick release bayonet bowl with interlock.

7. High visibility, prismatic lens, liquid level indicator.

8. Optional service life indicator.

9. Red service life indicator that provides a visual indication of the filter element condition.
   (a) when the indicator ascend, the filter element (Porous polypropylene) must be replace.
   (b) General purpose filter can be disassembled for cleaning (6 months) and replace it every year. Lubricator element must be replace every 6 months.
A. Knob Adjusting:

Pressure Setting by:
C.W : increase.
C.C.W : decrease.

B. Gauge Pressure:

display the pressure.

C. Element:

The element can be removes solid particles and water. The element can be cleaned with air gun every 6 months and replace it every year.

D. Automatic Drain:

The automatic drain is open when the filter is not pressuried and closes when pressuried to approx. 0.35 bar. The drain operates when liquid accumulates above a certain level or when bowl pressure is reduced to zero.

E. Clamp, Slight class:

It is high visibility for liquid level indicator.

F. Bowl, metal:

Release the bowl by C.W. and installed by C.C.W.
(2) F74C (Oil Removak Filter)

A. Optional service life indicator:
   The filter indication independent by the element. If the red service life indicator is ascend to top, that the filter element must be replace.

B. Element:
   The quick release bayonet type bowl can be removed and replace it.

C. Clamp, slight class:
   It is high visibility for liquid level indicator.

D. Valve, Drain:
   The liquid drain from the bowl by manual.

E. Bowl, Metal:
   Release the bowl by C.W.and installed by C.C.W.
(3) L74M (Lubricator):

A. Fill Plug:

Release the plug to add oil R32.

B. Sight Feed dome:

A red adjusting Knob is used for applications containing one or more points of lubrication.
C.W. : increase.
C.C.W. : decrease.

C. Clamp, Sight class:

It is high visibility for liquid level indicator.

D. Valve, Drain:

The liquid drain from the bowl by manual.

E. Bowl, metal:

Release the bowl by C.W. and installed by C.C.W.
10. MAINTENANCE AND ADJUSTMENT

10-2-5 LUBRICATION OIL EXCHANGE PROCESS FOR INDEX TABLE

1. Remove the slide cover from the saddle.

2. Put an oil collection pan under the drain.

3. Remove the plugs of the drain and the oiling port.

4. Supply new oil to the oiling port and put the plug on the port.

5. Mount the slide cover on the saddle.

Warning:

While lubricating the machine, please pay attention to what as follows:

1. Use the specified lubricating oil in a given quantity whenever the machine needs to be lubricated. If oil other than the specified brand is supplied or excessively beyond the given quantity, the machine may sometimes be adversely effected.

2. Prior to supplying oil, clean thoroughly the oil port so that dust and dirt will not enter the machine.

3. Set an oil filter in each oil port, through which oil is to be supplied for lubrication. Otherwise, dust and other foreign substances will get inside the machine.
4. For proper lubrication, it is wise not to use the whole quantity of oil in the can even if the oil is new but to leave some oil remaining at the can bottom. This is because the oil at this portion within the oil may sometimes contain moisture and other foreign substances deposited on the can bottom.

5. Be sure to turn off the power to avoid hazards while changing the lubrication oil.
10-3 ALARM MESSAGE DISPLAY

The alarm led will be shown on the operation panel

10-3-1 NC ALARM

Refer to FANUC MANUAL for trouble shooting.

10-3-2 MECHANICAL ALARM

The alarm light on the operation panel will be on if the machine troubles.

TOOL NUMBER ALARM: A tool called is absents in the magazine.

LUBRICATION ALARM: The lubricating system fails or lacks lubricating oil.
10-3-3 MECHANICAL WARNING MESSAGES DISPLAY

The followings are four warning messages that might show on the screen and the procedures for correcting them.

1010 : SPINDLE ALARM

The alarm number will be displayed on the spindle controller (in the left electrical box). Please refer to the FANUC manual for details of spindle alarms.

1020 : LUBRICATION ALARM

The LUBRICANTION ALARM LED on the control panel will light. This means that lubricants need to be added.

1030 : SPINDLE COOLING ALARM

The spindle cooling unit is not functioning. The causes may be

(1) Hydraulic pressure is too low.

(2) The compressor is off.

1040 : X,Y,Z NOT ZERO RETURN

This alarm will be displayed when press the CYCLE START after power on without zero return. Please zero return X, Y, Z at zero return mode.

1050 : GEAR CHANGE ALARM 1

H ÷ L gear change hasn't finished.
1060 : GEAR CHANGE ALARM 2

L ⇒ H gear change hasn’t finished.

1070 : MAGAZINE NUMBER ALARM 1

Standby tool number isn’t the same as the tool number of arm in the state of returning tools.

1080 : MAGAZINE NUMBER ALARM 2

Standby number isn’t the same as T code number in the state of selecting tools.

1090 : MAGAZINE ALARM

Tool arm is in the magazine side or ATC door is interlocked when magazine rotating.

1100 : M6 ALARM

After the command of M6 T Ù the tool did not come to the standby position.

1110 : TOOL NUMBER ALARM

Tool number isn’t in the range from one to sixty.

1120 : PIN ALARM

Luck pin of magazine is not in the correct position.

1130 : COUNTER ALARM

The sensor for counting is abnormal.
1140 : ATC ALARM

Auto tool change hasn’t finished.

1150 : B AXIS UP ALARM

B axis up hasn’t finished.

1160 : B AXIS DOWN ALARM

B axis down hasn’t finished.

1170 : PALLET DOWN ALARM

Pallet down is not ok.

1180 : SHUTTLE ALARM

When shuttle forward finished, both of the sensors for detecting the completions of shuttle backward and forward are on.

1190 : APC ALARM

Auto pallet change hasn’t finished.

1210 : GEAR STATUS ERROR ALARM

Cause : High/low gear switch abnormal.

Solution : 1. Check gear is low or high, and corresponding signal if normal. (HIGH GEAR : X8.3; LOW GEAR : X8.5)

2. Adjusting switch to the suitable position.

3. Check solenoid valve or relay in fault. (HIGH GEAR : Y0.3; LOW GEAR : Y0.4)
10. MAINTENANCE AND ADJUSTMENT

1220: TOOL CLAMP SIG (X8.7) ABNORMAL

Cause: Tool clamp switch abnormal.

Solution: 1. Adjusting switch to the suitable position.
           2. To replace it.

1230: PALLETT NOT DOWN, CANNOT CUT

Cause: Table is up and spindle is rotating.

Solution: Executing “M59” command that table down, then restart.

1270: SPINDLE SPEED=0, CANNOT CUT

Cause: Executing “G01” command, but spindle isn’t rotating.

Solution: 1. If it want to cutting, spindle must be rotate.
           2. If without cutting, then executing “M94” command to cutting interlock cancel.

1280: COOLANT TANK TOO LOW

Cause: Coolant level too low.

Solution: 1. Add coolant to the tank.
           2. Low level detects signal “X21.3”.

1290: COOLANT (M16) PRESSURE TOO LOW

Cause: Pressure of coolant through spindle too low.

Solution: 1. Check pressure switch if fault.
           2. Adjust switch or replace it.
3. Input signal “X20.7”.

1340: COOLANT TANK TOO HIGH

Cause: Coolant level too high.

Solution:
1. If coolant of tank is full, and decrease it
2. Adjust switch or replace it.
3. Input signal “X21.2”.

1350: TOOL LIFE ALARM

Cause: NO. of uses or time is expired for tool of specify.

Solution: Please reset and replace tool of specify.

1360: NITROGEN BALANCE PRESSURE TOO LOW

Cause: Pressure too low (less than 70kgf/cm²).

Solution:
1. Replace nitrogen vase.
2. Switch is fault and replace it.
3. Input signal “X18.3”.

1370: SPINDLE OVERLOAD ALARM

Cause: Spindle load value greater than setting value.

Solution:
1. If it is in cutting condition, then check spindle speed, feedrate and cut depth if suitable.
2. If it isn’t in cutting condition, check setting value of data table if suitable.

1380: HIGH PRESSURE FILTER ALARM
10. MAINTENANCE AND ADJUSTMENT

Cause: Jam for high pressure filter.

Solution: To dismount filter, and clear it.

2051: PUSH “FEED HOLD” BUTTON AFTER TURN TO “HANDLE” MODE

Cause: ATC or APC stop (it doesn’t have in correct position).

Solution: 1. Turn to “HANDLE” mode.

2. Push “FEED HOLD” button, then ATC or APC return to correct position step by step.

2052: TABLE DOES NOT HAVE DOWN

Cause: Executing X axis moving but table is up.

Solution: Executing “M59” command, and table is down, then X axis can move.
10-4 SETTING FOR PARAMETERS

Parameters of the 0iMB/21iMB/18iMB are set by the manufacturer. Only backlashes may need to be changed by the user. If the user wants to change the settings of certain parameters, he must fully understand the meanings of the parameters because incorrect settings may cause malfunctions. Please refer to operation manual by FANUC for the meaning of each parameter.

Follow the procedure below to set parameters.

(1) Place the NC in the MDI mode or the emergency stop state.

(2) Follow the substeps below to enable writing of parameters.

1. To display the setting screen, press the SETTING function key as many times as required, or alternatively press the SETTING function key once, then the SETTING section select soft key. The first page of the setting screen appears.

2. Position the cursor on “PARAMETER WRITE” using the cursor move keys.

3. Press the (OPRT) soft key to display operation select soft keys.

4. To set “PARAMETER WRITE=” to 1, press the ON: 1 soft key, or alternatively enter 1 and press the INPUT soft key. From now on, the
parameters can be set. At the same time an alarm condition (P/S100 PARAMETER WRITE ENABLE) occurs in the CNC.

(3) To display the parameter screen, press the SYSTEM function key as many times as required, or alternatively press the SYSTEM function key once, then the PARAM section select soft key. (See “1. Displaying Parameters.”)

(4) Display the page containing the parameter you want to set, and position the cursor on the parameter. (See “1. Displaying Parameter.”)

(5) Enter data, then press the <INPUT> soft key. The parameter indicated by the cursor is set to the entered data.

(6) If parameter setting is complete, set “PARAMETER WRITE=” to 0 on the setting screen to disable further parameter setting.

(7) Reset the NC to release the alarm condition (P/S100).
If an alarm condition (P/S000 PLEASE TURN OFF POWER) occurs in the NC, turn it off before continuing operation.

BACKLASH COMPENSATION

Parameter No. 1851 shows the values of backlash compensations for all axes. If the servo motor of the Y axis is disassembled, its location will change when it is reassembled. Parameter No. 1850 is used to perform proper adjustment. Parameters.

I/O DEVICE

No. 20--No. 23 and No. 101--No. 123 are related to the settings of I/O devices.
10-5 OVERTRAVEL

1. When the travel of an axis reaches its default limit, the warning message of overtravel will be displayed on the screen. The procedures for lifting the message are as follows:

(1). Move the axis axis in the direction opposite to the overtravel.

(2). Press the RESET key.

2. If the axes do not return to the reference point before operating the machine, the default travel limit will not function, and the moving parts may overtravel or even trigger limit switches. As a result, the machine will be in the state of emergency stop (EMG). The procedures for releasing the emergency stop are as follows:

(1) Turn the EMG RELEASE switch on for several seconds until the READY light on the control panel is on.

(2) Turn the hand wheels to move the axes to their normal workspace. Carefully watch the directions when moving the axes.
10-6 REPLACING BATTERIES

10-6-1 CHANGING BATTERIES

When the power of the batteries are exhausted, the sign BAT will be displayed on the screen. The procedures for changing batteries are as follows:

1. Turn on the machine.

   (Note: if the power is not on while changing batteries, all the data stored in the memory will be erased.)

2. Remove the cover of the battery case.

3. Take out batteries.

4. Change batteries.

5. Put the cover back.

6. Turn off the machine.
WARNING
Using other than the recommended battery may result in the battery exploding. Replace the battery only with the specified battery (A02B-0200-K102).

CAUTION
Steps (1) to (3) should be completed within 30 minutes. Do not leave the control unit without a battery for any longer than the specified period. Otherwise, the content of memory may be lost. If steps (1) to (3) may not be completed within 30 minutes, save all contents of the SRAM memory to the memory card. Thus, if the contents of the SRAM memory are lost, the contents can be restored easily.
10-7 ADJUSTMENT OF B AXIS BACKLASH

1. Take off cover and servo motor.

2. Shake gear which in hole of servo motor with hand. It have to perform proper adjustment if it has backlash following.

   (1) Untighten bolt which is at sink of moon type (two pieces) and servo motor (four pieces).

   (2) Move bolt along sink of moon type (CW  increase backlash CCW  reduce backlash) at the same time, shake gear for check if adjustment is finish.

   (3) It will be finish for adjustment backlash when gear is unshake, then tighten six pieces of bolt.

   (4) Put motor.

   (5) Put cover.
## 10-8 Setting for Timer

<table>
<thead>
<tr>
<th>NO.</th>
<th>DATA</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>600000</td>
<td>INTERVAL FOR AUTOMATIC LUBRICATION</td>
</tr>
<tr>
<td>2</td>
<td>600000</td>
<td>INTERVAL FOR CHIP CONVEYOR</td>
</tr>
<tr>
<td>3</td>
<td>480</td>
<td>DOOR INTERLOCK TIMER FOR SPINDLE STOP</td>
</tr>
<tr>
<td>4</td>
<td>900000</td>
<td>INDEX AIR PRESSURE SWITCH DETECT ON TIMER</td>
</tr>
<tr>
<td>5</td>
<td>3000</td>
<td>INDEX AIR PRESSURE SWITCH DELECT</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>1000</td>
<td>COUNTER TIMER1</td>
</tr>
<tr>
<td>8</td>
<td>1000</td>
<td>COUNTER TIMER2</td>
</tr>
<tr>
<td>9</td>
<td>5000</td>
<td>PIN ALARM TIMER</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>200</td>
<td>ATC ARM MOVES FORWARD</td>
</tr>
<tr>
<td>12</td>
<td>200</td>
<td>ATC ARM MOVES BACKWARD</td>
</tr>
<tr>
<td>13</td>
<td>200</td>
<td>ATC ARM MOVES LEFT</td>
</tr>
<tr>
<td>14</td>
<td>200</td>
<td>ATC ARM MOVES RIGHT</td>
</tr>
<tr>
<td>15</td>
<td>200</td>
<td>ATC ARM + 180°</td>
</tr>
<tr>
<td>16</td>
<td>200</td>
<td>ATC ARM - 180°</td>
</tr>
<tr>
<td>17</td>
<td>200</td>
<td>TOOL CLAMP</td>
</tr>
<tr>
<td>18</td>
<td>200</td>
<td>TOOL UNCLAMP</td>
</tr>
<tr>
<td>19</td>
<td>496</td>
<td>ATC ARM MOVE TOWARD MAGAZINE</td>
</tr>
<tr>
<td>20</td>
<td>200</td>
<td>ATC ARM RETURN TO THE NORMAL POSITION</td>
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<tr>
<td>21</td>
<td>496</td>
<td>ATC ARM MOVE TOWARD SPINDLE</td>
</tr>
<tr>
<td>22</td>
<td>200</td>
<td>MAGAZINE ROTATES C.W.</td>
</tr>
<tr>
<td>23</td>
<td>200</td>
<td>MAGAZINE ROTATES C.C.W.</td>
</tr>
<tr>
<td>24</td>
<td>496</td>
<td>PIN FOR MAGAZINE ORIENTATION MOVES BACKWARD</td>
</tr>
<tr>
<td>25</td>
<td>496</td>
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<tr>
<td>26</td>
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<td>APC ALARM TIMER</td>
</tr>
<tr>
<td>28</td>
<td>3000</td>
<td>CALL LIGHT ON DELAY TIMER</td>
</tr>
<tr>
<td>29</td>
<td>4000</td>
<td>B AXIS INDEX TABLE DOWN ALARM TIMER</td>
</tr>
<tr>
<td>30</td>
<td>1496</td>
<td>B AXIS INDEX TABLE ARRIVE</td>
</tr>
<tr>
<td>31</td>
<td>1000</td>
<td>B AXIS INDEX TABLE UP</td>
</tr>
<tr>
<td>32</td>
<td>0</td>
<td>B AXIS INDEX TABLE DOWN</td>
</tr>
<tr>
<td>33</td>
<td>3000</td>
<td>TABLE UP</td>
</tr>
<tr>
<td>34</td>
<td>3000</td>
<td>TABLE DOWN</td>
</tr>
<tr>
<td>35</td>
<td>1000</td>
<td>SHUTTLE MOVES FORWARD</td>
</tr>
<tr>
<td>36</td>
<td>1000</td>
<td>SHUTTLE MOVES BACKWARD</td>
</tr>
<tr>
<td>37</td>
<td>1000</td>
<td>SHUTTLE MOVES LEFT</td>
</tr>
<tr>
<td>38</td>
<td>1000</td>
<td>SHUTTLE MOVES RIGHT</td>
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<tr>
<td>39</td>
<td>1000</td>
<td>TURRET CLAMP DELAY TIMER</td>
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<tr>
<td>40</td>
<td>1000</td>
<td>TURRET UNCLAMP DELAY TIMER</td>
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### 10. MAINTENANCE AND ADJUSTMENT

#### FIX TIMER

<table>
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<tr>
<td>01</td>
<td>500</td>
<td>LAMP FLASH ON</td>
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<tr>
<td>02</td>
<td>500</td>
<td>LAMP FLASH OFF</td>
</tr>
<tr>
<td>03</td>
<td>30000</td>
<td>AUTOMATIC LUBRICATION ON TIMER DELAY</td>
</tr>
<tr>
<td>04</td>
<td>60000</td>
<td>CHIP CONVEYOR NO.1,2 ON TIMER DELAY</td>
</tr>
<tr>
<td>05</td>
<td>60000</td>
<td>CHIP CONVEYOR NO.3 ON TIMER DELAY</td>
</tr>
<tr>
<td>06</td>
<td>500</td>
<td>DATA MOVE TIMER</td>
</tr>
<tr>
<td>07</td>
<td>1000</td>
<td>AUTO CYCLE START OFF TIMER</td>
</tr>
<tr>
<td>08</td>
<td>1000</td>
<td>AFTER M30, AUTO CYCLE START TIMER</td>
</tr>
<tr>
<td>09</td>
<td>5000</td>
<td>SPINDLE COOLING ALARM TIMER</td>
</tr>
<tr>
<td>10</td>
<td>2000</td>
<td>AUTOMATIC TOOL LENGTH MEASUREMENT OFF TIMER</td>
</tr>
<tr>
<td>11</td>
<td>5000</td>
<td>GEAR CHANGE ALARM TIMER</td>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>5000</td>
<td>B AXIS CLAMP/UNCLAMP ALARM DELAY TIMER</td>
</tr>
<tr>
<td></td>
<td></td>
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</tr>
<tr>
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<td></td>
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</tbody>
</table>
## 10-9 DATA FOR ADDRESS

<table>
<thead>
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<th>DATA</th>
<th>APPLICATION</th>
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<tbody>
<tr>
<td>D1</td>
<td></td>
<td>NUMBER OF TOOL IN PRE-TOOL POT</td>
</tr>
<tr>
<td>D2</td>
<td>BEFORE OF ARM ROTATION 180 º</td>
<td>NUMBER OF TOOL IN THE SPINDLE</td>
</tr>
<tr>
<td></td>
<td>LATER OF ARM ROTATION 180 º</td>
<td>NUMBER OF LAST TOOL IN THE SPINDLE</td>
</tr>
<tr>
<td>D3</td>
<td></td>
<td>NUMBER OF TOOL IN THE SPINDLE</td>
</tr>
<tr>
<td>D10</td>
<td></td>
<td>PROGRAM NUMBER OF PALLET A</td>
</tr>
<tr>
<td>D12</td>
<td></td>
<td>PROGRAM NUMBER OF PALLET B</td>
</tr>
<tr>
<td>D22</td>
<td>50</td>
<td>SPINDLE SPEED FOR DOOR INTERLOCK</td>
</tr>
</tbody>
</table>
# 0  ACOL  K0.5(M06C), K0.6(M05C), K1.2 (PSC) control is.
   0 : depending on K1.3(TOCL).
   1 : unvalid for any mode.

# 1  TUP.LK  Table up, X axis interlock.
   0 : valid.
   1 : unvalid.

# 2  ABS  MANUAL ABSOLUTE.
   0 : depend on hard-key.
   1 : depend on soft-key.

# 3  ZLK  Z AXIS LOCK.
   0 : depend on hard-key.
   1 : depend on soft-key.

# 4  AFL  AUXILIARY FUNCTION LOCK.
   0 : depend on hard-key.
   1 : depend on soft-key.

# 5  M06C  At the moment of tool changing, the coolant will
   0 : stop.
   1 : nonstop.

# 6  M05C  Coolant motor does not start until the spindle rotates.
   0 : yes.
   1 : beyond the limit.
<table>
<thead>
<tr>
<th></th>
<th>#7</th>
<th>#6</th>
<th>#5</th>
<th>#4</th>
<th>#3</th>
<th>#2</th>
<th>#1</th>
<th>#0</th>
</tr>
</thead>
<tbody>
<tr>
<td>K1</td>
<td>AL.L</td>
<td>ST.L</td>
<td>CALL</td>
<td>STL</td>
<td>TOCL</td>
<td>PSC</td>
<td>PSP</td>
<td>TAP.K</td>
</tr>
</tbody>
</table>

# 0  TAP.K  Air blow for tapping:
- 0 : invalid.
- 1 : valid.

# 1  PSP  While executing M01 & M00:
- 0 : the spindle will stop.
- 1 : the spindle will not stop.

# 2  PSC  While executing M01 & M00:
- 0 : coolant will stop.
- 1 : coolant will not stop.

# 3  TOCL  K0.5(M06C) , K0.6(M05C) , K1.2(PSC).
- 0 : valid at the modes of TAPE and MEN.
- 1 : valid for any mode.

# 4  STL  While executing M06 or T code, the cycle start lamp.
- 0 : flash.
- 1 : not flash.

# 5  CALL  Work light:
- 0 : valid.
- 1 : unvalid.

# 6  ST.L  START call light (green):
- 0 : valid.
- 1 : unvalid.

# 7  AL.L  ALARM call light (red):
- 0 : valid.
- 1 : unvalid.
### 10. MAINTENANCE AND ADJUSTMENT

<table>
<thead>
<tr>
<th></th>
<th>#7</th>
<th>#6</th>
<th>#5</th>
<th>#4</th>
<th>#3</th>
<th>#2</th>
<th>#1</th>
<th>#0</th>
</tr>
</thead>
<tbody>
<tr>
<td>K2</td>
<td></td>
<td>ZRN.AL</td>
<td></td>
<td>BIL</td>
<td>ZIL</td>
<td>YIL</td>
<td>XIL</td>
<td>B.ZRN</td>
</tr>
</tbody>
</table>

**#0  B.ZRN**  
Manual B axis zero return is.  
0 : unvalid.  
1 : valid.

**#1  XIL**  
X axis interlock.  
0 : valid.  
1 : unvalid.

**#2  YIL**  
Y axis interlock.  
0 : valid.  
1 : unvalid.

**#3  ZIL**  
Z axis interlock.  
0 : valid.  
1 : unvalid.

**#4  BIL**  
B axis interlock.  
0 : valid.  
1 : unvalid.

**#6  ZRN.AL**  
When X,Y,Z axes not zero return.  
0 : Cycle start unvalid.  
1 : Cycle start valid.
<table>
<thead>
<tr>
<th>#</th>
<th>#7</th>
<th>#6</th>
<th>#5</th>
<th>#4</th>
<th>#3</th>
<th>#2</th>
<th>#1</th>
<th>#0</th>
</tr>
</thead>
<tbody>
<tr>
<td>K3</td>
<td>T.JOG</td>
<td>T.HAN</td>
<td>AL.CAL</td>
<td>H.SP</td>
<td>HINT</td>
<td>HAN</td>
<td>SPC</td>
<td></td>
</tr>
</tbody>
</table>

#1 **SPC**  
Spindle cooling AL.  
0: valid.  
1: unvalid.

#2 **HAN**  
MANUAL PULSE GENERATOR.  
0: single manual pulse generator.  
1: multi manual pulse generator.

#3 **HINT**  
Handle interruption.  
0: unvalid.  
1: valid.

#4 **H.SP**  
Spindle C.W, CCW and orientation in manual mode.  
0: unvalid.  
1: valid.

#5 **AL.CAL**  
When alarm, sleep switch.  
0: valid.  
1: unvalid.

#6 **T.HAN**  
Teach in handle (PLAYBACK).  
0: unvalid.  
1: valid.

#7 **T.JOG**  
Teach in jog (PLAYBACK).  
0: unvalid.  
1: valid.
### 10. MAINTENANCE AND ADJUSTMENT

<table>
<thead>
<tr>
<th>#0</th>
<th>M30.K</th>
<th>Auto cycle start (K4.4 : 1).</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0 : cycle start once.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 : cycle start continually.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#1</th>
<th>ACSB</th>
<th>ATC and APC stop in the SINGLE BLOCK.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0 : not valid.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 : valid.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#2</th>
<th>PAT</th>
<th>Pallet up/down check.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0 : Pallet up.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 : Pallet down.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#3</th>
<th>BUD</th>
<th>B axis up/down check.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0 : B axis up.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 : B axis down.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#4</th>
<th>M30.C</th>
<th>After M30 , auto cycle start.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0 : not valid.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 : valid.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#5</th>
<th>M30.M</th>
<th>M30 call the program number in D10 , D12 is.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0 : valid.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 : not valid.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#6</th>
<th>WAIR</th>
<th>Table air blowing.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0 : Table does not blow the air until table down ( M59 ).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 : When table is up ( M58) the air start blowing.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#7</th>
<th>APCL</th>
<th>APC READY signal.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0 : Depend on the button in APC panel.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 : Always on.</td>
</tr>
<tr>
<td>#</td>
<td>Description</td>
<td>Setting 0</td>
</tr>
<tr>
<td>---</td>
<td>-------------</td>
<td>----------</td>
</tr>
<tr>
<td>0</td>
<td>LUB.AL1</td>
<td>Lubrication alarm display:</td>
</tr>
<tr>
<td>1</td>
<td>LUB.I</td>
<td>Lubrication oil:</td>
</tr>
<tr>
<td>2</td>
<td>PDN.C</td>
<td>Pallet down detect (X9.5) (MCH-800, it must set to 1):</td>
</tr>
<tr>
<td>3</td>
<td>PCP.C</td>
<td>Pallet up detect (X9.6).</td>
</tr>
<tr>
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<td>CP1, 2</td>
<td>CHIP CONVEYOR 1, 2.</td>
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<td>CP3</td>
<td>CHIP CONVEYOR 3.</td>
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<tr>
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<td>PUD.C</td>
<td>Pallet down air pressure check (X3.1).</td>
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<tr>
<td>7</td>
<td>APC</td>
<td>APC ready lamp is.</td>
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10. MAINTENANCE AND ADJUSTMENT

<table>
<thead>
<tr>
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<th>#4</th>
<th>#3</th>
<th>#2</th>
<th>#1</th>
<th>#0</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>XAIR</td>
<td></td>
<td>SAIR</td>
<td>TAIR</td>
<td>ZAIR</td>
<td>AIRZ</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

# 0   AIRZ  Z axis slideway auxiliary air switch.
     0 : off.
     1 : on (depend on k6.1).

# 1   ZAIR  Z axis slideway auxiliary air switch.
     0 : always ON, but OFF when Z axis is at the 1st or 2nd reference point.
     1 : when Z axis is moving it switch ON, when Z axis stop it switch OFF.

# 2   TAIR  Air blow when M06.
     0 : When exchange tools the spindle will not blow the air until the ATC arm's movement "BACKWARD" is in action.
     1 : When exchange tools the spindle will blow the air at the tool is pulled from the spindle.

# 3   SAIR  Air Blow when tool unclamp by manual.
     0 : The spindle will not blow the air when tool unclamp by manual.
     1 : The spindle will blow the air when tool unclamp by manual.

# 5   XAIR  X axis slideway auxiliary air.
     0 : always ON, but OFF when X axis is at the 1st or 2nd or 3rd reference point.
     1 : when X axis is moving it switch ON, when X axis stop it switch OFF.
<table>
<thead>
<tr>
<th>#7</th>
<th>#6</th>
<th>#5</th>
<th>#4</th>
<th>#3</th>
<th>#2</th>
<th>#1</th>
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<tr>
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<td>APC.D</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

# 5  APC.D  APC door.
0 : close.
1 : open.
### #0 DOOR.ILK
Operation door interlock is.
- 0: NO (Normal open).
- 1: NC (Normal close).

### #1 SPED
When door is opened the spindle speed:
- 0: 50 rpm.
- 1: depend on S command.

### #4 APC.ILK
APC door interlock signal is.
- 0: NO (Normal open).
- 1: NC (Normal close).

### #5 ATC.ILK
ATC door interlock signal is.
- 0: NO (Normal open).
- 1: NC (Normal close).
# 0  TUR.CL  TURRET CLAMP ABNORMAL ALARM DISPLAY.
0 : valid.
1 : unvalid.

# 1  TUR.UCL  TURRET UNCLAMP ABNORMAL ALARM DISPLAY.
0 : valid.
1 : unvalid.

# 2  TUR.ROT  TURRET ROTATE ABNORMAL ALARM DISPLAY.
0 : valid.
1 : unvalid.

# 3  MEL.SV  MELDAS SERVO MOTOR ALARM DISPLAY.
0 : unvalid.
1 : valid.

# 4  P.CUT  PALLET NOT DOWN, CANNOT CUT ALARM DISPLAY.
0 : valid.
1 : unvalid.
10. MAINTENANCE AND ADJUSTMENT

<table>
<thead>
<tr>
<th></th>
<th>#7</th>
<th>#6</th>
<th>#5</th>
<th>#4</th>
<th>#3</th>
<th>#2</th>
<th>#1</th>
<th>#0</th>
</tr>
</thead>
<tbody>
<tr>
<td>K10</td>
<td>ATC.S7</td>
<td>ATC.S6</td>
<td>ATC.S5</td>
<td>ATC.S4</td>
<td>ATC.S3</td>
<td>ATC.S2</td>
<td>ATC.S1</td>
<td></td>
</tr>
</tbody>
</table>

# 0 ATC.S1 ARM BACK & STANDBY POSITION.
  0: NO.
  1: YES.

# 1 ATC.S2 ARM BACK & TOWARD SPINDLE SIDE POSITION.
  0: NO.
  1: YES.

# 2 ATC.S3 ARM BACK & CATCH SPINDLE POSITION.
  0: NO.
  1: YES.

# 3 ATC.S4 ARM FORWARD & CATCH SPINDLE POSITION.
  0: NO.
  1: YES.

# 4 ATC.S5 ARM BACK & TOWARDS MG. SIDE POSITION.
  0: NO.
  1: YES.

# 5 ATC.S6 ARM FORWARD & TOWARDS MG. SIDE POSITION.
  0: NO.
  1: YES.

# 6 ATC.S7 ARM FORWARD & STANDBY POSITION.
  0: NO.
  1: YES.
# 0  APC.S1  SHUTTLE BACK & CENTER POSITION.
      0 : NO.
      1 : YES.

# 1  APC.S2  SHUTTLE BACK & RIGHT POSITION.
      0 : NO.
      1 : YES.

# 2  APC.S3  SHUTTLE BACK & LEFT POSITION.
      0 : NO.
      1 : YES.

# 3  APC.S4  SHUTTLE FORWARD & RIGHT POSITION.
      0 : NO.
      1 : YES.

# 4  APC.S5  SHUTTLE FORWARD & CENTER POSITION.
      0 : NO.
      1 : YES.

# 5  APC.S6  SHUTTLE FORWARD & LEFT POSITION.
      0 : NO.
      1 : YES.
<table>
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<th>#5</th>
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</tbody>
</table>

**# 1 SP_LOAD  SPINDLE OVERLOAD ALARM.**

0 : unvalid.

1 : valid.
10-11 SWITCH AND SOLENOID VALVE

POSITION DIAGRAM FOR SOLENOID

SOL 1
SOL 2

SOL 14
SOL 15
SOL 16

SOL 7
SOL 8
SOL 9
SOL 10
SOL 11
SOL 12
SOL 13

SOL 3
SOL 4

SOL 20
SOL 21
SOL 22
SOL 23
SOL 24

SOL 25
(Only MCH-800)

SOL 5
SOL 6
THE POSITIONS OF LIMIT SWITCH AND PROXIMITY SWITCH

[Diagram showing various limit switch positions labeled with numbers like LS 1, LS 2, LS 3, etc.]
# 10-11-1 SOLENOID VALVE LIST

<table>
<thead>
<tr>
<th>NO.</th>
<th>POSITION</th>
<th>VICKERS</th>
<th>NORTHERN</th>
<th>7-OCEAN</th>
<th>APPLICATION</th>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOL1</td>
<td>Spindle high and low speed</td>
<td>DG4V-3-2N</td>
<td>SWH-G92-D2</td>
<td>Directional solenoid valve</td>
<td>MT-02W</td>
<td>Y1,Y2</td>
</tr>
<tr>
<td>SOL2</td>
<td>Tool clamp / unclamp</td>
<td>DG4V-3-2A</td>
<td>SWH-G92-B2</td>
<td>Directional solenoid valve</td>
<td>Y3</td>
<td></td>
</tr>
<tr>
<td>SOL3</td>
<td>Index table up and down</td>
<td>DG4V-3-2N</td>
<td>SWH-G92-D2</td>
<td>Directional solenoid valve</td>
<td>MT-02W</td>
<td>Y22,Y23</td>
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<tr>
<td>SOL4</td>
<td>Table up and down</td>
<td>DG4V-3-2N</td>
<td>SWH-G02-D2</td>
<td>Directional solenoid valve</td>
<td>MT-02W</td>
<td>Y20,Y21</td>
</tr>
<tr>
<td>SOL5</td>
<td>Shuttle backward and forward</td>
<td>DG4V-3-2N</td>
<td>SWH-G02-D2</td>
<td>Directional solenoid valve</td>
<td>MT-02W</td>
<td>Y25,Y26</td>
</tr>
<tr>
<td>SOL6</td>
<td>Shuttle left and right</td>
<td>DG4V-3-7C</td>
<td>SWH-G02-7C</td>
<td>Directional solenoid valve</td>
<td>MT-02W</td>
<td>Y27,Y28</td>
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<tr>
<td>SOL7</td>
<td>Magazine orientation</td>
<td>DG4V-3-2A</td>
<td>SWH-G02-B2S</td>
<td>Directional solenoid valve</td>
<td>MT-02B</td>
<td>Y17</td>
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<td>SOL8</td>
<td>Magazine rotates C.W/ CCW</td>
<td>DG4V-3-6C</td>
<td>SWH-G02-C4</td>
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<td>MT-02W</td>
<td>Y15,Y16</td>
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<tr>
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<td>Arm move to the magazine</td>
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<td>SWH-G02-D2</td>
<td>Directional solenoid valve</td>
<td>MT-02W</td>
<td>Y11,Y12</td>
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<tr>
<td>SOL10</td>
<td>Arm move to the spindle</td>
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<td>SWH-G02-D2</td>
<td>Directional solenoid valve</td>
<td>MT-02W</td>
<td>Y9,Y10</td>
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<tr>
<td>SOL11</td>
<td>Arm backward and forward</td>
<td>DG4V-3-2N</td>
<td>SWH-G02-D2</td>
<td>Directional solenoid valve</td>
<td>MT-02W</td>
<td>Y7,Y8</td>
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<tr>
<td>SOL12</td>
<td>Arm moves left and right</td>
<td>DG4V-3-2N</td>
<td>SWH-G02-D2</td>
<td>Directional solenoid valve</td>
<td>MT-02W</td>
<td>Y5,Y6</td>
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<tr>
<td>SOL13</td>
<td>Arm [80°]</td>
<td>DG4V-3-2N</td>
<td>SWH-G02-D2</td>
<td>Directional solenoid valve</td>
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<tr>
<td>SOL14</td>
<td>ATC door</td>
<td>DG4V-3-2N</td>
<td>SWH-G02-D2</td>
<td>Flowrate regulating valve</td>
<td>MT-02W</td>
<td>Y20,Y21</td>
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<td>NO.</td>
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<td>NORTHERN</td>
<td>7-OCEAN</td>
<td>APPLICATION</td>
<td>NOTE</td>
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<tr>
<td>SOL15</td>
<td>APC door</td>
<td>DG4V-3-2N</td>
<td>SWH-G02-D2</td>
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<td>Flowrate regulating valve</td>
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<tr>
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<td>M-02W</td>
<td>MTC-02W</td>
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<td>Pressure regulating valve</td>
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<td></td>
<td></td>
<td>MPC-02A</td>
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<td>Counterbalance valve</td>
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</tr>
<tr>
<td>SOL16</td>
<td>Headstock counterbalance</td>
<td>(NACHI)GR-G03-A2</td>
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<tr>
<td>SOL20</td>
<td>Spindle air blow</td>
<td>21T2BV28-F</td>
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<td>Y4</td>
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<tr>
<td>SOL21</td>
<td>Z axis air blow</td>
<td>21T2BV28-F</td>
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<td>Y35</td>
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<tr>
<td>SOL22</td>
<td>Pallet air blow</td>
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<td>SOL23</td>
<td>Index table air blow</td>
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<td>SOL24</td>
<td>Pallet down pressure check</td>
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<td>Only MCH-800:</td>
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<td>SOL25</td>
<td>Pallet setting</td>
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## 10-11-2 LIMIT SWITCH AND PROXIMITY SWITCH LIST

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<th>YAMATAKE</th>
<th>BULLUFF</th>
<th>REMARK</th>
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<td>X axis stroke</td>
<td>ZCQ-2255</td>
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<td>LS2</td>
<td>Y axis stroke</td>
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<td>LDV-5202</td>
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<td>Z axis stroke</td>
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<td>ZCQ-2255</td>
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<tr>
<td>LS4</td>
<td>Interlock of electric cabinet</td>
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<td>2LS-J6</td>
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<tr>
<td>LS5</td>
<td>High speed</td>
<td>ZCQ-2255</td>
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<tr>
<td>LS6</td>
<td>Low speed</td>
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<tr>
<td>LS7</td>
<td>Tool clamp</td>
<td>ZCQ2155</td>
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<td>LS8</td>
<td>Tool unclasp</td>
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<td>LS9</td>
<td>Deceleration for X axis</td>
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<td>LS10</td>
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<td>BES516-325E3R NPN/NO 4mm</td>
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<tr>
<td>LS13</td>
<td>Table up</td>
<td>ZCQ-2255</td>
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<tr>
<td>LS15</td>
<td>Arm right</td>
<td>BES516-325E4-Y03 PNP/NO 2mm</td>
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<td>LS16</td>
<td>Arm left</td>
<td>BES516-325E4-Y03 PNP/NO 2mm</td>
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<td>LS17</td>
<td>Arm forward</td>
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<td>LS18</td>
<td>Arm backward</td>
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<td>LS19</td>
<td>Arm + 180˚</td>
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<td>LS20</td>
<td>Arm - 180˚</td>
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<td>LS21</td>
<td>Arm moves to the spindle</td>
<td>BES516-325E4-Y03 PNP/NO 2mm</td>
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<td>LS22</td>
<td>Arm returns to the normal position</td>
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<td>LS23</td>
<td>Arm moves to the magazine</td>
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<td>LS24</td>
<td>Counter</td>
<td>BES516-325E4-Y03 PNP/NO 2mm</td>
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<td>LS25</td>
<td>Tool detect</td>
<td>BES516-356E4-Y03 PNP/NO 4mm</td>
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<tr>
<td>NO.</td>
<td>POSITION</td>
<td>OMRON</td>
<td>YAMATAKE</td>
<td>BULLUFF</td>
<td>REMARK</td>
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<td>LS26</td>
<td>Magazine orientation</td>
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<td>BES516-325E4-Y03 PNP/NO</td>
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<td>LS27</td>
<td>APC door</td>
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<td>LS28</td>
<td>Pallet A detection</td>
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<td>BES516-325E4-Y03 PNP/NO</td>
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<td>LS29</td>
<td>Pallet B position</td>
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<td>LS30</td>
<td>Pallet B detection</td>
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<td>LS31</td>
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<td>BES516-325E4-Y03 PNP/NO</td>
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<td>LS32</td>
<td>Shuttle forward</td>
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<td>BES516-356E4-Y03 PNP/NO</td>
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<td>LS33</td>
<td>Shuttle backward</td>
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<td>LS35</td>
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<td>2mm</td>
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<td>LS36</td>
<td>Shuttle right</td>
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<td>BES516-325E4-Y03 PNP/NO</td>
<td>2mm</td>
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<td>LS37</td>
<td>APC door</td>
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<td>LS38</td>
<td>Automatic tool length measurement</td>
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<td>P-10F-B-B(METROL)</td>
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<td>LS39</td>
<td>Lubrication oil</td>
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<td>LS40</td>
<td>Spindle cooling</td>
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<td>LS41</td>
<td>Hydraulic pressure</td>
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<td>PS-70-10(NORTHMAN)</td>
<td>Switch pressure</td>
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<th>REMARK</th>
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<tr>
<td>LS42</td>
<td>Interlock for operating door</td>
<td>TITAN</td>
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<td>LS43</td>
<td>Interlock for rear door</td>
<td>CADET</td>
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<td>LS44</td>
<td>Interlock for magazine door</td>
<td>CADET</td>
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<td>LS45</td>
<td>Interlock for operating door (MCH-800)</td>
<td>TITAN</td>
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<td>LS47</td>
<td>Interlock for APC side operation door (left)</td>
<td>ENSIGN</td>
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<td>LS48</td>
<td>Interlock for APC side operation door (right)</td>
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<tr>
<td>LS49</td>
<td>Interlock for APC door</td>
<td>ENSIGN</td>
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</table>
Hydraulic diagram of table system and A.P.C system
10-13 DOOR INTERLOCK RELEASE

SAFETY CRITICAL COMPONENTS
Install two "safety interlock switches with guard locking" on the front door of the guard.

The safety switch can't release the pin from the interlock state until all stop conditions of moveable parts, as follows, yield.

1. Spindle stops completely.
2. Three axes stop completely.
3. Magazine stops completely.
The manual unlocking ports are provided as shown below. Either of the covering security screws can be removed by the special screwdriver bit supplied allowing a thin screwdriver blade to be inserted and pushed to unlock, the guard locking mechanism.

**IT IS IMPORTANT THAT THE SECURITY SCREW IS REPLACED AND FULLY TIGHTENED TO MAINTAIN THE IP67 PROTECTION RATING.**
Install a Guard master safety switch on each side door of the guard. When opening the side door, the pin jumps off and machine comes to stop. Until the side door is closed. The machine can be restarted.
Electricity-break safety switch in the electric box.

When opening the electric box, the safety switch jumps off so that the circuit becomes off.
A. OPEN/CLOSE LINEAR SCALE.................................................. A-1

B. FSSB START–UP PROCEDURE/MATERIALS
   B-1 OVERVIEW.............................................................................. B-1
   B-2 SLAVE...................................................................................... B-2
   B-3 AUTOMATIC SETTING............................................................ B-3
       B-3-1 GENERAL CONFIGURATION(SEMI-CLOSED LOOP)... B-6
       B-3-2 GENERAL CONFIGURATION(CLOSED LOOP).............. B-8

C. AUTOMATIC TOOL LENGTH MEASURE........................................ C-1

D. X, Z, Y AXIS ORIGIN ADJUSTING D-1

E. CALL A/B PALLET MACRO PROGRAM................................. E-1
OPEN/CLOSE LINEAR SCALE

1. Move to the middle position for table that you want to specify’s axis, and rapid mode switching to “L”.

2. The following table lists parameter related to the linear scale.

(1) ISB/ 3 digit after decimal point :

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<th>Pitch</th>
<th>10mm</th>
<th>12mm</th>
<th>16mm</th>
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<td>PRM.NO</td>
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<td>Open</td>
<td>Close</td>
<td>Open</td>
</tr>
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<td>LS176</td>
<td>LF191</td>
<td>LF192</td>
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<td>(DLZX)</td>
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<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000#0</td>
<td>LS176</td>
<td>LF191</td>
<td>LF192</td>
<td>LS176</td>
</tr>
<tr>
<td>(PLC)</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2023</td>
<td>8192</td>
<td>8192</td>
<td>819</td>
<td>8192</td>
</tr>
<tr>
<td>2024</td>
<td>12500</td>
<td>10000</td>
<td>10000</td>
<td>20000</td>
</tr>
<tr>
<td>2084</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2085</td>
<td>100</td>
<td>1</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>2185</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>1821</td>
<td>10000</td>
<td>10000</td>
<td>10000</td>
<td>10000</td>
</tr>
</tbody>
</table>
## (2) ISC/ 4 digit after decimal point:

<table>
<thead>
<tr>
<th>Pitch</th>
<th>10mm</th>
<th>12mm</th>
<th>16mm</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRM.NO</td>
<td>Close</td>
<td>Open</td>
<td>Close</td>
<td>Open</td>
</tr>
<tr>
<td>1815#1 (OPTX)</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1005#1 (DLZX)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2000#0 (PLC)</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2023</td>
<td>8192</td>
<td>8192</td>
<td>819</td>
<td>8192</td>
</tr>
<tr>
<td>2024</td>
<td>12500</td>
<td>10000</td>
<td>10000</td>
<td>20000</td>
</tr>
<tr>
<td>2084</td>
<td>1</td>
<td>10</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2085</td>
<td>10</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2185</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>1821</td>
<td>100000</td>
<td>10000</td>
<td>100000</td>
<td>100000</td>
</tr>
</tbody>
</table>

**Note:**
1. Detect unit 1 μ for “LS176”; detect unit 0.1 μ for “LF191”; detect unit 0.05 μ for “LF192”.

2. If it generates “AL.410 servo excess error : xx axis”, please setting PRM.2018#0 (The signal direction for the separate detector).

3. If it generates “AL.445 soft disconnection alarm”, and check “FSSB” if setting.
3. Turn off the power on again, then mode select switch change to “HANDLE”.

4. Turning the plus/minus direction slow to check speed if normal for specify axis just now.

5. If handle mode is normal, then test Jog→Rapid→Zero Return etc.

6. It is successfully after finish above action.

7. Finish, setting the PRM.1005#1(DLZX) to “1”, then to prevent coordinate shift.

NOTE: If it close linear scale, you must check your program coordinate if shift. (very important)
FSSB START-UP
PROCEDURE/MATERIALS

B-1 OVERVIEW

With a system that uses the FSSB, the parameters below need to be set for axis setting. (Set other parameters as usually done.)

- No. 1023
- No. 1905
- No. 1910 to 1919
- No. 1936, 1937

For setting of these parameters, three methods are available.

1. Automatic setting

   By entering data including the relationship between axes and amplifiers on the FSSB setting screen, a calculation for axis setting is made automatically, and parameter Nos. 1023, 1905, 1910 through 1919, 1936, and 1937 are automatically set.

2. Manual setting 2

   Enter desired values directly in all of parameter Nos. 1023, 1905, 1910 through 1919, 1936, and 1937.

   Before setting the parameters, fully understand the functions of the parameters.

3. Manual setting 1 (NOTE)

   Based on the setting of No. 1023, default axis setting is performed. Parameter Nos. 1905, 1910 through 1919, 1936, and 1937 need not be set. Automatic setting is not performed.

NOTE

With manual setting 1, usable functions are limited. So, when starting up the FSSB, use automatic setting or manual setting 2 whenever possible.
B-2 SLAVE

In a system using the FSSB, the CNC, servo amplifiers, and separate detector interface units are connected with each other via optical cables. These amplifiers and pulse modules are referred to as slaves. Assume that a 2–axis amplifier consists of two slaves, and a 3–axis amplifier consists of three slaves. Slave numbers (1, 2, 3, ..., 10) are assigned to the slaves in ascending order; a younger number is assigned to a slave that is closer to the CNC.

NOTE) M1/M2 : Separate detector interface unit 1st/2nd.
B-3 AUTOMATIC SETTING

When the following parameters are set, automatic setting can be performed using the FSSB setting screen:

- Bit 0 of No. 1902 = 0
- Bit 1 of No. 1902 = 0

For automatic setting on the FSSB setting screen, use the procedure below.

1. Set a servo axis number in No. 1023.

   Be sure to match an axis number set in No. 1023 with the total number of axes of the servo amplifiers connected via optical cables.

2. On the servo initialization screen, initialize the servo parameters.

3. Turn off then on the power to the CNC.

4. Press function key SYSTEM.

5. Pressing the continuous menu key several times displays [FSSB].

6. Pressing soft key [FSSB] switches the screen display to the amplifier setting screen (or the FSSB setting screen selected previously), and displays the following soft keys:

   ![Soft keys](image)

7. Press soft key [AMP].

8. On the amplifier setting screen, set a controlled axis number connected to each amplifier.

   The amplifier setting screen lists the slaves in ascending order of slave numbers from top to bottom. So, when setting controlled axis numbers, consider which amplifier axis is to be connected to which CNC axis, sequentially, starting with the amplifier axis closest to the NC. On this setting screen, 0 and duplicate numbers cannot be entered.
9. Press soft key [SETTING]. (This soft key appears when a value is entered.)

10. Press function key \( \text{SYSTEM} \).

11. Pressing the continuous menu key \( \text{\rightarrow} \) several times displays [FSSB].

12. Pressing soft key [FSSB] switches the screen display to the amplifier setting screen, and displays the following soft keys:

\[ \text{AMP} \text{ [ AXIS ] [ MAINT ] [ OPRT ] } \]

13. Press soft key [AXIS].

14. On the axis setting screen, set information on each axis.

15. The axis setting screen lists the CNC axes in ascending order of axis numbers from top to bottom.

When any of the following is to be performed for each axis, the setting of this screen is required:

- Use of a separate detector
- Exclusive use of a DSP (CPU for servo control) by one axis (for use of a current loop period of 125 µs or learning control, for example)
- Use of a CS axis controlled axis
- Use of tandem control
16. Press soft key [SETTING]. (This soft key appears when a value is entered.)

This operation starts an automatic calculation, and parameter Nos. 1023, 1905, 1910 through 1919, 1936, and 1937 are automatically set.

Bit 1 of parameter No. 1902 is set to 1 to indicate that each of these parameters has been set. When the power is turned off then back on, axis settings are made according to each parameter.

- **Notes on using the simple electronic gear box (EGB) function**

  When using the simple electronic gear box (EGB) function, perform EGB axis setting (parameter No. 7771) before automatic setting using the FSSB setting screen. Without EGB axis setting, correct values cannot be set by automatic setting using the FSSB setting screen.

<table>
<thead>
<tr>
<th>AXIS</th>
<th>NAME</th>
<th>AMP</th>
<th>M1</th>
<th>M2</th>
<th>IDSP</th>
<th>Cm</th>
<th>TNKM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>X</td>
<td>A1-L</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Y</td>
<td>A1-M</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>Z</td>
<td>A2-L</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>A</td>
<td>A3-L</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>B</td>
<td>A3-M</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>C</td>
<td>A4-L</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Step 1 Set the following with parameter No. 1023:

- X : 1
- Y : 2
- Z : 3
- A : 4

Step 2 Initialize the servo parameters for each axis.

Step 3 Turn on then off the power to the CNC.

Step 4 Enter the axis numbers on the amplifier setting screen.
Step 5 Press soft key [SETTING]. (This soft key appears when a value is entered.)

Step 6 Press function key [SYSTEM].

Step 7 Pressing the continuous menu key several times displays [FSSB].

Step 8 Pressing soft key [FSSB] switches the screen display to the amplifier setting screen, and displays the following soft keys:

[ AMP ] [ AXIS ] [ MAINT ] [ (OPRT) ]

Step 9 Press soft key [AXIS].

Step 10 Press soft key [(OPRT)] without entering any data, then press soft key [SETTING].

Step 11 Turn off then on the power to the CNC. This completes the setting.
Step 1 Set the following with parameter No. 1023:

X : 1
Y : 2
Z : 3
A : 4

Step 2 Initialize the servo parameters for each axis.

Step 3 Turn on then off the power to the CNC.

Step 4 Enter the axis numbers on the amplifier setting screen.
APPENDIX B. FSSB start-up procedure/materials

Step 5 Press soft key [SETTING]. (This soft key appears when a value is entered.)

Step 6 Press function key \(\text{SYSTEM}\). 

Step 7 Pressing the continuous menu key several times displays [FSSB].

Step 8 Pressing soft key [FSSB] switches the screen display to the amplifier setting screen, and displays the following soft keys:

\[
\text{[AMP]}[\text{AXIS}][\text{MAINT}][\hspace{3pt}][\hspace{3pt}][\text{(OPRT)}] 
\]

Step 9 Press soft key [AXIS].

Step 10 Set the separate detector on the axis setting screen. (Separate detector interface unit: M1/M2)
Step 11 Press soft key [SETTING]. (This soft key is displayed when a value is entered.)

Step 12 Set bit 1 of parameter No. 1815 to 1 for the Y–axis and A–axis.

Step 13 Turn off then on the power to the CNC. This completes the setting.

```
<table>
<thead>
<tr>
<th>AXIS</th>
<th>NAME</th>
<th>AMP</th>
<th>M1</th>
<th>M2</th>
<th>1DSP</th>
<th>Cs</th>
<th>TNDM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>X</td>
<td>A2-L</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Y</td>
<td>A1-L</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>Z</td>
<td>A3-M</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>A</td>
<td>A3-L</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
```

MDI  ***** *** ***  13:11:56
[ AMP ] [ AXIS ] [ MAINT ] [ ] [ (OPRT) ]
APPENDIX C. Automatic tool length measure

AUTOMATIC TOOL LENGTH MEASURE

1. The macro program (O9009) apply to FANUC control–0i/18i/21iMB、0iMC.

2. General wiring diagrams.

3. The “M26” command for tool length measure cover up, and “M27” command for tool length measure cover down.

   NOTE: If table dimension is 630X630mm, cover allow to up, after B axis rotate to “36” degree. (Because cover up interfere with table each other)

4. Test skip signal (X4.7) if normal, then procedure as follows:
   ① Executing “M26” command, then cover up.
   ② Executing [SYSTEM]→ [PMC]→ [PMCDGN]→ [STATUS]→ X4.7→ [SEARCH].
   ③ To touch the probe, then signal (X4.7) should be from “0” to “1”.
   ④ Executing G91 G31 G01 X-200 F100 in MDI mode, then touch the probe when X axis is moving.
   ⑤ The X axis should be stop (If without, please check signal (X4.7) and parameter No.6200#1).
5. Set machine coordinate (X,Y,Z) of Sensor (Probe) :

A. Machine coordinate of Sensor :

#510 : X axis machine coordinate of center of Sensor.

#511 : Y axis machine coordinate of center of Sensor

#512 : Z axis machine coordinate of center of Sensor

B. Method of setting macro #512 :

Put a tool which length is already know on the spindle.

Input M26 command of auto. tool length cover open, If machine type=MCH-800 define the coordinate values of stored stroke checks in the negative directions for Y axis in machine coordinate system (parameter 1321=-50000).

Manually move Z axis to Sensor. Detecting Sensor signal by DGN(0i/18i/21iMB、0iMC : X4.7) While tool approaches Sensor, move Z axis slowly until tool touches Sensor. (0i/18i/21iMB、0iMC : X4.7) is on when sensor is touched.

Example :

76543210
X4.7 □1111111
down
1
APPENDIX C. Automatic tool length measure

#512 : Z axis machine coordinate — tool length

Ex : Z axis coordinate : -324.158

Tool length : 230.45

Then #512 = -324.158 — 230.45 = -554.608

Note : (1) It’s not necessary to set #510,#511 and #512 every time,

Unless they are modified or cleared.

(2) When #510~#512 setting complete, Input M27

command of auto. tool length cover close.

6. Application :

Command :

G65 P9009  H__Z__( T__X__Y__ )

H : OFFSET NO. of tool length in program

Z : about tool length(Max. ±50mm)

T : tool number (It can be forgotten when tool number is spindle tool)

X,Y : X,Y axes bias of tool edge to center of face cutter

NOTE : (       ) can be forgotten when they are not used.
7. Flow chart:

G65 P9009 Hxx Zxx (Txx Xxx Yxx)

Break wire for sensor

YES ➔ ALARM(3003 SENSOR ERROR)

NO

H=Null or Z=Null

NO

Y - Z axis 2nd point return

Is there data in T?

NO

YES

Tool select finish, and tool change

Cover up (M26)

NOTE: If table dimension 630x630mm, B axis must rotate to 36 degree.

X - Y axis move to the position of sensor

According to about tool length (Zxx), and Z axis move to probe

Touch sensor

Is there output of signal from sensor

NO ➔ ALARM(3002 TOOL NOT FOUND)

YES

Calculator, and measure value write to the offset (Hxx)

Y - Z axis zero return

Cover close (M27)

End
THE ADJUSTMENTS OF THE STROKE AND THE PALLET CENTER FOR MCH-500/800

1. TARGET

To standardize the operations of setting the strokes and the pallet center locations for MCH 500/800.

2. SUITABLE RANGE

This operation standard is suitable for the adjustment of every axial stroke and the B axial turning center location of MCH 500/800.

3. TOOLS AND INSTRUMENTS IN USE

<table>
<thead>
<tr>
<th>ITEM</th>
<th>NAME</th>
<th>SPECIFICATION</th>
<th>ACCURACY</th>
<th>AMOUNT</th>
<th>REMARK</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Testing bar</td>
<td>300mm</td>
<td>Runout: below 3 µ</td>
<td>1</td>
<td>Standard length and diameter should be given.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cylindricity: below 3 µ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Dial gauge</td>
<td>0.001 scale</td>
<td></td>
<td>1</td>
<td>(Including magnetic base)</td>
</tr>
<tr>
<td>3</td>
<td>Height setter</td>
<td>HP-150</td>
<td>0.01mm</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

4. PROCEDURES OF CALIBRATING EVERY AXIAL STROKE CENTER LOCATION

(1) Parameter setting:

a. Machine zero (G53)

<table>
<thead>
<tr>
<th>NO</th>
<th>TYPE</th>
<th>MCH-500</th>
<th>MCH-800</th>
<th>REMARK</th>
</tr>
</thead>
<tbody>
<tr>
<td>0M</td>
<td>15M</td>
<td>18M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>800</td>
<td>(1240</td>
<td>X)</td>
<td>(1240</td>
<td>X)</td>
</tr>
<tr>
<td>801</td>
<td>(1240</td>
<td>Y)</td>
<td>(1240</td>
<td>Y)</td>
</tr>
<tr>
<td>802</td>
<td>(1240</td>
<td>Z)</td>
<td>(1240</td>
<td>Z)</td>
</tr>
</tbody>
</table>
b. Stroke range

<table>
<thead>
<tr>
<th>NO</th>
<th>TYPE</th>
<th>MCH-500</th>
<th>MCH-800</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0M</td>
<td>15M</td>
<td>18M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>700</td>
<td>5220 (X)</td>
<td>1320 (X)</td>
<td>380000</td>
<td>680000</td>
</tr>
<tr>
<td>701</td>
<td>5220 (Y)</td>
<td>1320 (Y)</td>
<td>735000</td>
<td>105500</td>
</tr>
<tr>
<td>702</td>
<td>5220 (Z)</td>
<td>1320 (Z)</td>
<td>785000</td>
<td>130500</td>
</tr>
<tr>
<td>704</td>
<td>5221 (X)</td>
<td>1321 (X)</td>
<td>-380000</td>
<td>-680000</td>
</tr>
<tr>
<td>705</td>
<td>5221 (Y)</td>
<td>1321 (Y)</td>
<td>50000</td>
<td>50000</td>
</tr>
<tr>
<td>706</td>
<td>5221 (Z)</td>
<td>1321 (Z)</td>
<td>180000</td>
<td>300000</td>
</tr>
</tbody>
</table>

Values inside ( ) are MCH-800's

(G28) X axis reference zero
X,Z axis machine zero
375 (675)
780 (1300)
Z axis reference
Y axis reference
730 (1050)
Y axis machine zero

Values inside ( ) are MCH-800's
(2) The adjustments of the stroke for X axis and the pallet turning center location.

a. Fit the testing bar to the spindle. The center line of the testing bar should run through the pallet center (as shown in Fig 1).

b. Perform the manual reference point return for the X axis, and then move the pallet to machine zero point by G53 X0.

c. Fix the dial gauge on the pallet. Let the probe of the dial gauge point towards the screw hole located on the pallet center and apply it against the round surface of the testing bar.

d. Move the Y axis up and down zero both the dial gauge and the relative coordinate value of Y axis, when the maximum value in readings of the dial gauge is measured.

e. Please elevate the Y axis, until the Y axis reach the height which the testing bar does not hit the dial gauge while the pallet rotating.

f. Input B180 under MDI mode to make the pallet rotate 180° (as shown in Fig 1).

g. Lower the Y axis to the position of the relative coordinate reference point. To obtain the difference in readings of the dial gauge, and divide it by 2.

Input the parameter values:

<table>
<thead>
<tr>
<th></th>
<th>0M</th>
<th>15M</th>
<th>18M</th>
</tr>
</thead>
<tbody>
<tr>
<td>508</td>
<td>1850 (X)</td>
<td>1850 (X)</td>
<td></td>
</tr>
</tbody>
</table>

h. Repeat steps b~g. Let the difference in reading be equivalent to zero while the pallet being on the positions of 0° and 180°.

Remark: The dog for the reference point return should be moved if the difference in readings is greater than 5mm while the pallet being on the positions of 0° and 180°.
(3) Adjusting the stroke for Z axis

a. It should be accomplished to find out the turning center of the B axis before adjusting the stroke for Z axis.(steps 2.b~2.g)

b. Perform the reference point returns for Z axis.

c. Input B90 under MDI mode to make the pallet rotate 90°.

d. Let the end surface of the testing bar touch the prabe of the dial gauge and its reading turn out to be zero by means of moving the Z axis (as shown in Fig 2).

e. Record the Z axis machine coordinate position and calculate its stroke.

For example, if the standard length of the testing bar is L=316.31, the standard diameter of the testing bar is φ:49.75

When the end surface of the testing bar touches the prabe of the dial gauge and its reading turn out to be zero, the machine coordinate position of the Z axis should be

\[ 316.31 - 49.75/2 = 291.435 \] (standard value)

If the recorded value of the machine coordinate position for Z axis does not equal to the standard value, please compensate it by means of revising the parameter values.

The parameter values are as follows :

<table>
<thead>
<tr>
<th>0M</th>
<th>15M</th>
<th>18M</th>
<th>REMARK</th>
</tr>
</thead>
<tbody>
<tr>
<td>510</td>
<td>1850 (Z)</td>
<td>1850 (Z)</td>
<td>Z axis reference point shift</td>
</tr>
</tbody>
</table>

[Figure 2]
APPENDIX D. X, Y, Z axis origin adjusting

THE ADJUSTMENTS OF THE STROKE AND THE PALLET CENTER FOR MCH-500/800

(4) Adjusting the Y axial stroke

a. Mount the height setter on the pallet (for the sake of promoting accuracy, the height setter should be calibrated before using).

b. Perform the reference point return for Y axis.

c. Let the end surface of the testing bar touch the probe of the height setter and the reading turns out to be zero by means of moving the Y axis (as shown in Fig 3).

d. Record the machine coordinate position of Y axis and calculate its stroke.

For example,

the standard diameter of the testing bar is $\phi$: 49.75mm

the standard height of the height setter is $H$: 150mm

When the end surface of the testing bar reaches the zero position of the height setter, the machine coordinate position of the Y axis should be

$$150 + \frac{49.75}{2} = 174.875$$

(standard value)

If the recorded value of the machine coordinate position of the Y axis does not equal to the standard value, please compensate it by means of revising the parameter values:

The parameter values are as follows:

<table>
<thead>
<tr>
<th>0M</th>
<th>15M</th>
<th>18M</th>
<th>REMARK</th>
</tr>
</thead>
<tbody>
<tr>
<td>509</td>
<td>1850(Y)</td>
<td>1850(Y)</td>
<td>Y axis reference point shift</td>
</tr>
</tbody>
</table>

Figure 3
5. SETTING APC EXCHANGE POSITIONS (2nd, 3rd REFERENCE POINTS)

1. Parameter:

<table>
<thead>
<tr>
<th>NO TYPE</th>
<th>MCH-500</th>
<th>MCH-800</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>0M</td>
<td>15M</td>
<td>18M</td>
<td></td>
</tr>
<tr>
<td>735</td>
<td>1241</td>
<td>1241</td>
<td>APC exchange position for pallet</td>
</tr>
<tr>
<td></td>
<td>(X)</td>
<td>(X)</td>
<td></td>
</tr>
<tr>
<td>780</td>
<td>1242</td>
<td>1242</td>
<td>APC exchange position for pallet</td>
</tr>
<tr>
<td></td>
<td>(X)</td>
<td>(X)</td>
<td></td>
</tr>
</tbody>
</table>

2. Setting parameter values:

   a. The setting procedure 4 should be accomplished before setting the exchange positions for pallets to fulfill automatic pallet change.

   b. Perform the manual reference point return for X axis and then move the pallet to 2nd, 3rd reference point by G30 command in MDI mode.

   c. Adjust the APC exchange position for pallet A to the proper position.(2nd reference point)

   d. Record the machine coordinate value of X axis.

      Input it to the position of the 2nd reference point for X axis.

   e. Adjust the APC exchange position for pallet B to the proper position.(3rd reference point)

   f. Record the machine coordinate value of X axis.

      Input it to the position of the 3rd reference point for X axis.

Remark: The coordinate values of the 2nd and 3rd reference points are positions relative to the machine zero point.
APPENDIX D.  X, Y, Z axis origin adjusting

THE ADJUSTMENTS OF THE STROKE AND THE PALLET CENTER FOR MCH-500/800

6. SETTING ATC TOOL EXCHANGE POSITIONS (2nd REFERANCE POINTS FOR Y AND Z AXES)

1. Parameter :

<table>
<thead>
<tr>
<th>NO</th>
<th>TYPE</th>
<th>MCH-500</th>
<th>MCH-800</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>736</td>
<td>1241 (Y)</td>
<td>1241 (Y)</td>
<td>ATC tool exchange position</td>
<td>Y axis 2nd reference point coordinate value</td>
</tr>
<tr>
<td>737</td>
<td>1242 (Z)</td>
<td>1242 (Z)</td>
<td>The same as above</td>
<td>Y axis 3rd reference point coordinate value</td>
</tr>
</tbody>
</table>

2. Setting parameter values :

a. The setting procedure 4 should be accomplished before setting the ATC ready positions for tools.

b. Perform the reference point return for Y and Z axes in advance by G30 command in MDI mode.

c. Adjust the tool exchange positions for tools to the proper positions.

d. Record the machine coordinate values of Y and Z axes. Input them respectively to the positions of Y and Z axis 2nd reference points.

Remark : The coordinate values of the 2nd reference points are the positions relative to the machine zero point.
CALL A/B PALLET MACRO PROGRAM

% O9004(CALL A PALLET M601)
#100=#4001
#101=#4003
IF[#1003EQ0]GOTO991
IF[#1004EQ0]GOTO992
IF[#1000EQ1]GOTO999
IF[#1001EQ1]GOTO120
IF[#1000+#1001]EQ0]GOTO130
GOTO999
N120G91G00G30Y0Z0
G28B0
M51
G30P3X0
M63
G30P2X0
M64
GOTO999
N130G91G00G30Y0Z0
G28B0
M51
G30P2X0
M56
M58
M64
GOTO999
N991#3000=2(A PALLET NOT POS)
N992#3000=3(B PALLET NOT POS)
N999G#100G#101
M99
%

NOTE: PRM.6074=601
% 
O9005(CALL B PALLET M602) 
#100=#4001 
#101=#4003 
IF[#1003EQ0]GOTO991 
IF[#1004EQ0]GOTO992 
IF[#1000EQ1]GOTO110 
IF[#1001EQ1]GOTO999 
IF[#1100+#1001EQ0]GOTO130 
GOTO999 
N110G91G00G30Y0Z0 
G28B0 
M51 
G30P2X0 
M61 
G30P3X0 
M62 
GOTO999 
N130G91G00G30Y0Z0 
G28B0 
M51 
G30P3X0 
M56 
M58 
M62 
GOTO999 
N991#3000=2(A PALLET NOT POS) 
N992#3000=3(B PALLET NOT POS) 
N999G#100G#101 
M99 
% 

NOTE: PRM.6075=602