Professional 3

Operation Manual

V Series (V33, V55)

No. 485A-9911(E)

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Chapter 1 Main Control Panel

V33, V55
Professional 3

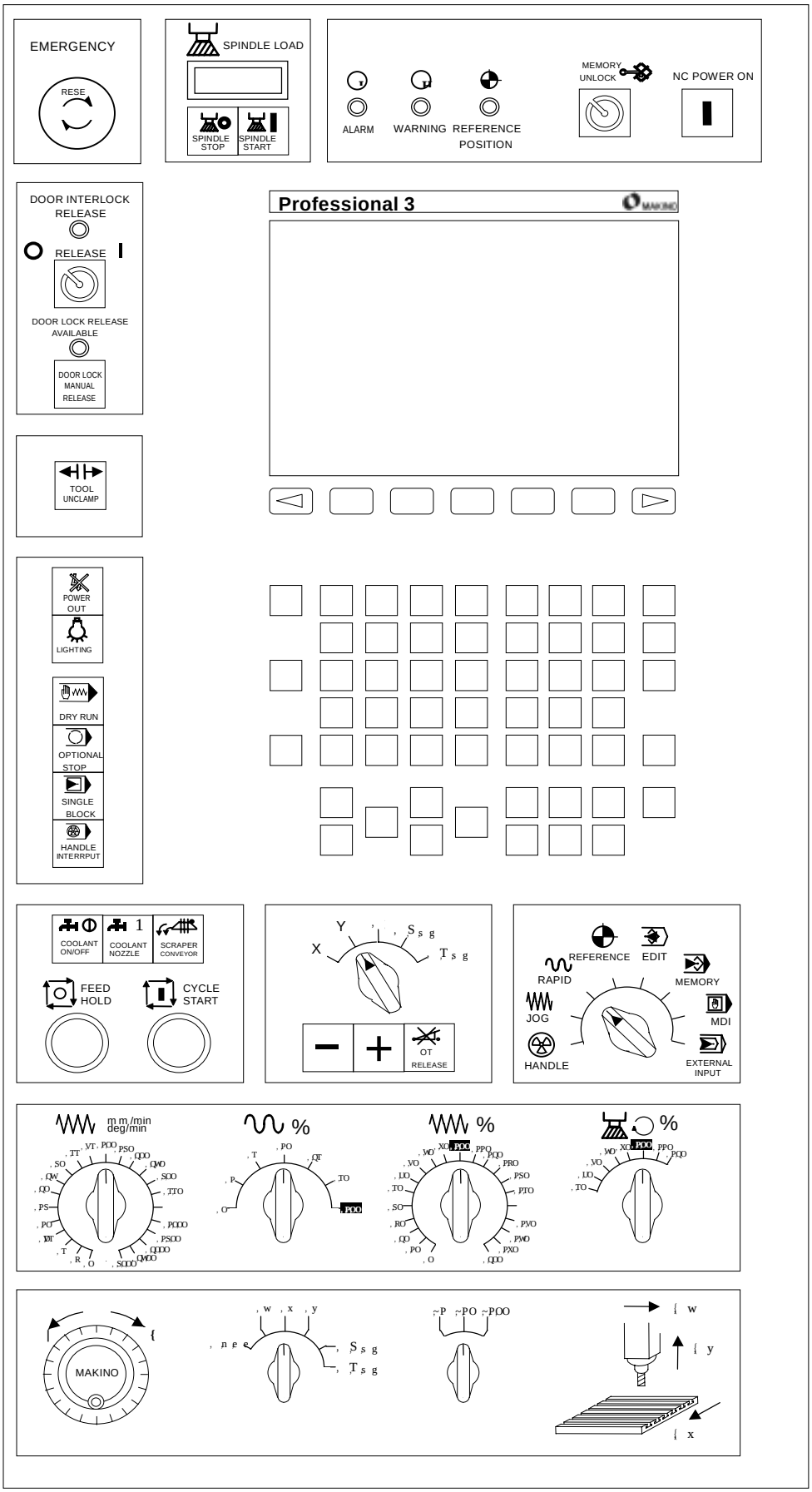
Chapter 1
Main Control Panel

Contents

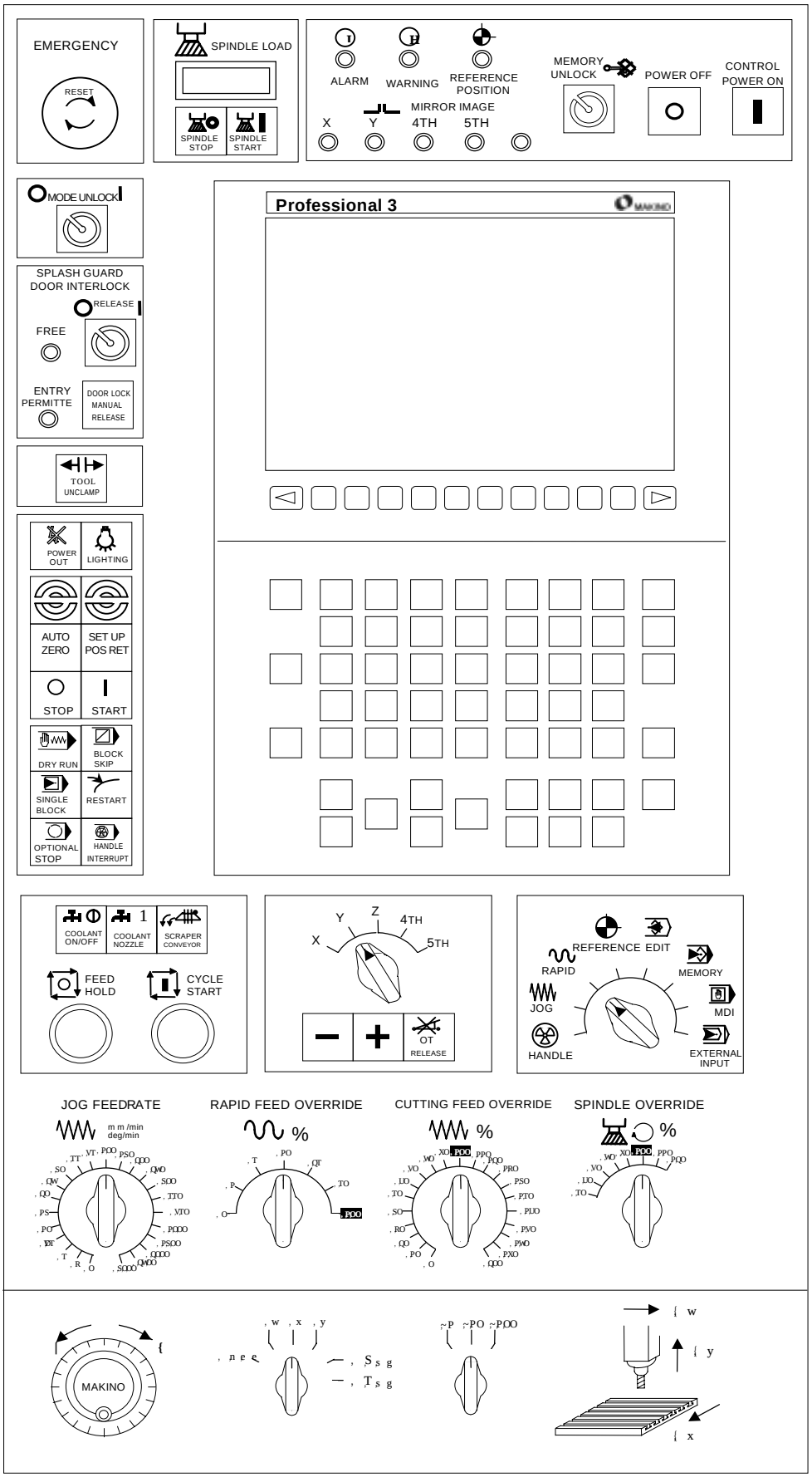
The Main control panel is used to perform the most basic machining center operations, and consists of switches and lamps.
The coolant, NC function and machine function related switches on this control panel are called flexible switches, and can be configured as desired according to the usage conditions of the machine.
Furthermore, functions and modes which are not allocated to the main control panel can be utilized on the PC Primary Operation screen.
There are the following main functions on the Main control panel:

- Manual operations
- NC program-related operations
- Spindle and other frequently used machine related operations
- Operations in event of malfunction
- Machine status display

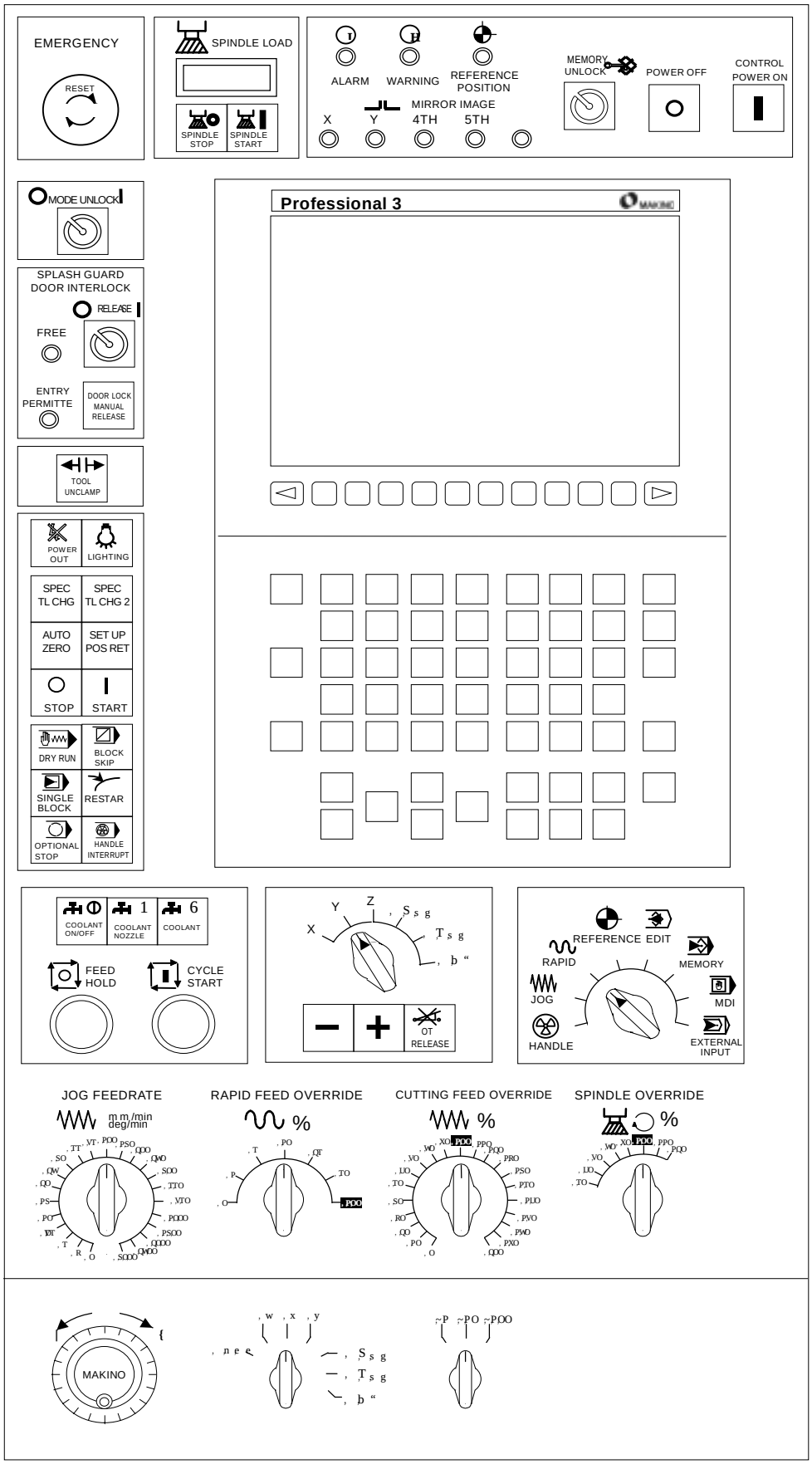
Furthermore, the control panels on the V55 with FS16MC, V55 with FS16i-MA and for the V33 differ. However, only one explanation is provided in this chapter for each operation for procedures which are the same unless otherwise specified.



V55 Main Control Panel (FS16MC)

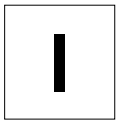


V55 Main Control Panel (FS16i-MA)



V33 Main Control Panel

1.1 Turning On Power

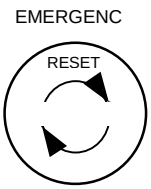


Press this button to turn On the NC power.
The following operations are performed:

1. The main circuit breaker in the machine controller is turned On.
2. Press the NC Power On button.

When turning the NC power Off, turn Off the main circuit breaker on the machine controller.

1.2 Emergency Stop



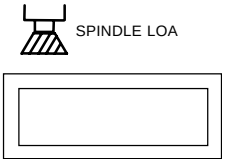
Emergency Stop Button
This button is used to stop the machine in the event of an emergency. All machine operations are stopped at this time.

This button is locked in place when it is pressed. It can be unlocked by turning it in the direction indicated by the arrows (clockwise). Press the NC Power On button again after resetting the emergency stop. The normal machine status is restored.

The following operations are performed when the emergency stop button is pressed:

1. All axis feed is immediately stopped.
2. The spindle is immediately stopped if it is rotating.
3. If the spindle tool is unclamped, it is clamped.
4. If the spindle is being oriented, the operation is cancelled.
5. If the ATC operation is being performed, it is stopped at an intermediate point.
6. The NC unit is reset.
7. If the pallet changer is operating, movement is stopped at an intermediate point.
8. The coolant supply is turned Off.

1.3 Spindle Related (Load Display, Start/Stop Buttons)



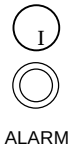
Spindle Load Display
This indicates the spindle load status.
1. 0 – Continuous rated load : Green
2. Continuous rating – 30 min. rating : Yellow
3. 30 min. rated load or more : Red

Spindle Start Switch
The spindle is started in the clockwise direction when this switch is pressed. However, it is operated in the opposite direction in the following case:

M04 (Spindle counterclockwise)
↓
Spindle is stopped with spindle stop switch
↓
Spindle is started with spindle start switch

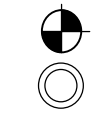
Spindle Stop Switch
The spindle is stopped with this switch.
This switch remains valid regardless of the operation mode.
When this switch is pressed during automatic operation, the feed hold status is activated for the axes.

1.4 Machine Status Display

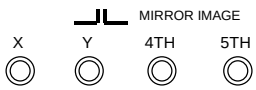


Alarm Display
This indicates a machine alarm.
It lights when a machine alarm is triggered, and goes out when it is reset.
The details of the alarm are displayed on the PC alarm screen.

Warning Display
It indicates a data entry error or other improper operation.
It lights when a warning is triggered, and goes out when it is reset.
The details of the warning are displayed on the PC alarm screen.

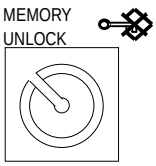


Machine Reference Position Display
It indicates the reference point return status.
It lights when all axes have been returned to the reference point by the G28 code or manual reference point return operation, and goes out when any of the feed axes is not at the reference point.



Mirror Image Display (V55 with FS16i-MA, V33)
This indicates the mirror image status for each axis. The lamp for the axis for which mirror image is active lights.

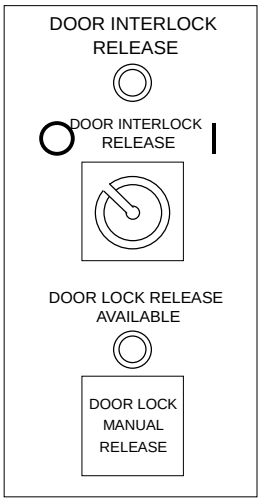
1.5 Memory Protect



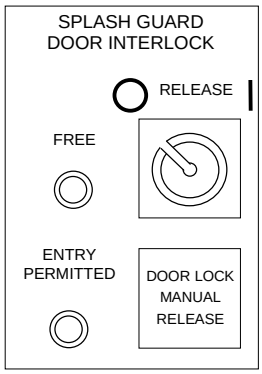
Memory Protect Unlock (Release) Key
Turning this key to the right enables the following operations:

1. Program entry and editing.
2. Registration into memory from an external input device.
3. Entry of tool offset values.
4. Entry of workpiece reference point offset value.
5. Entry of macro variables.
6. Presetting of absolute coordinate values.

1.6 Door Interlock



For V55 (FS16MC)



For V55 (FS16Mi-MA),V33

For V55 (FS16MC)

Door Interlock Release Switch
When this key is is turned to the right, the splash guard door interlock function is disabled.
The following operations can be performed while the splash guard door interlock function is disabled: (Basically, all operations can be performed.)

V55 (FS16Mi-MA), V33

1. Automatic operation
2. Starting of spindle
3. Coolant discharge
4. Starting of spiral chip conveyor
5. Automatic tool changes (M06, M98P9806)
6. Pallet changes (M60)

Make sure to take adequate safety precautions since all operations can be performed when the door interlock is released, even if the door is open.
Normally, this switch is turned to the left, the key is removed, and kept by the person responsible for safe operation.

Door Lock Release Button (option)
When the splash guard door is attached with a lock mechanism, the lock is released while this button is held down when the splash guard door release lamp is On, enabling the splash guard door to be opened.

Door Interlock Release Display

DOOR INTERLOCK RELEASE

V55 (FS16MC)

FREE

V55 (FS16Mi-MA), V33

This lamp lights while the door interlock release switch is turned to the right, releasing the interlock.

DOOR LOCK RELEASE AVAILABLE

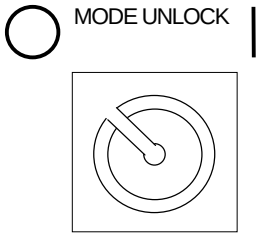
V55 (FS16MC)

ENTRY PERMITTED

V55 (FS16Mi-MA), V3

Door Interlock Release Display (Option)
When a splash guard door lock mechanism is provided, this lamp lights when the splash guard door can be unlocked by the door interlock release button.

1.7 Mode Unlock

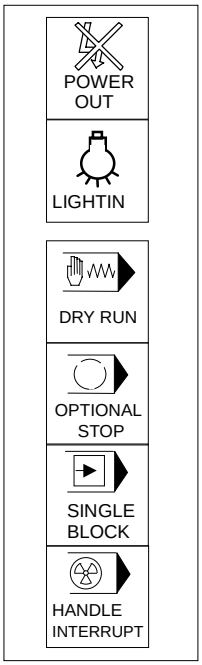


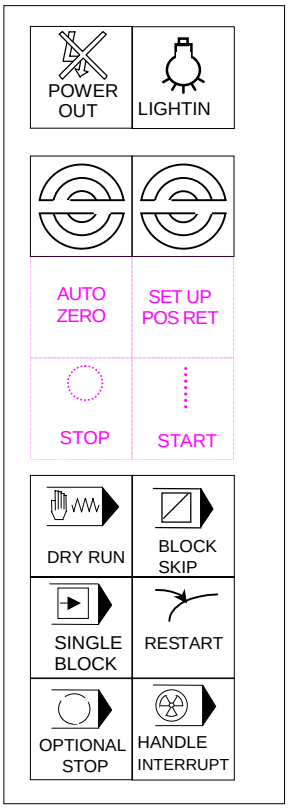
Mode Unlock (Option)
Turning this key switch to the right allows the operation mode to be changed. The operation mode cannot be changed when this key switch is in the left position. (Neither can the operation mode be changed when the operator door is open.)

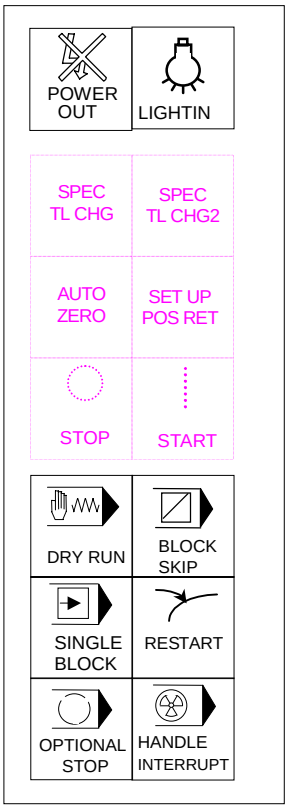
1.8 Spindle Tool Unclamp

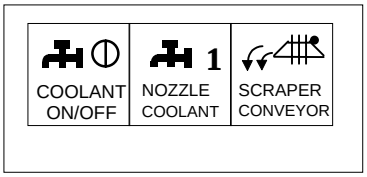
Spindle Tool Unclamp Button
The spindle tool is unclamped when this switch is pressed while in the manual mode. The spindle tool is clamped when this switch is pressed again. The lamp for this switch lights while the tool is unclamped. Furthermore, the spindle tool cannot be unclamped unless the splash guard is open.

1.9 NC, Machine Related Functions (Flexible Switches)

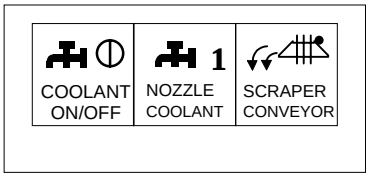




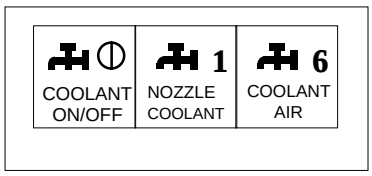




For V55 - FS16MC



For V55 - FS16iMA



For V33

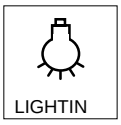
These are the NC and machine related function switches. They are valid regardless of the mode. Refer to the NC Unit Instruction Manual for details on the NC functions.

The lamp lights when a switch is pressed, and the corresponding function is turned On. The lamp goes out when the switch is pressed again, and the function is turned Off.

The standard configuration is shown above, but can be changed to a different function for each switch with the machine parameters since these are flexible switches. For example, the Dry Run switch can be changed to be the Block Skip switch. Refer to the Explanation of Machine Parameters for details.

The [AUTO ZERO], [SET UP POS RET], [SPEC TL CHG], [SPEC TL CHG2], [STOP] and [START] switches outlined in dotted lines above are explained in the Single Touch Function section.

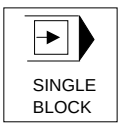
Power Out
This switch turns the automatic power off mode On and Off.
When this mode is On, the power can be automatically turned off upon completion of automatic operation.
When this mode is turned On during automatic operation, power is turned Off by the reading of an M02 or M30 code in the program. Power is also turned Off when the emergency stop status or an alarm is triggered.



Light Switch
The light is turned On and Off with this switch. It can also be turned On with the M736 command, and Off with the M737 command.

Dry Run
This switch turns the dry run mode On and Off.
When this mode is turned On, the feed rate selected with the manual feedrate override switch is used in place of the cutting feedrate specified in the program.

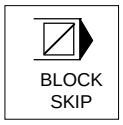
Optional Stop
This switch turns the optional stop mode On and Off.
When this mode is turned On, operation can be stopped with the M01 code in programs. The M01 code causes the cycle start lamp to start blinking. Operation can be continued by pressing the cycle start switch.



Single Block
This switch turns the single block mode On and Off.
When this mode is On, the program is executed one block at a time.

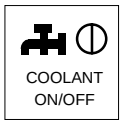
Handle Interrupt (Option)
This switch turns the handle interrupt mode On and Off.
When this mode is On, handle operation can be performed, even while automatic operation is taking place. Normally, the blind cover is mounted over this switch.

Block Skip 1 (Accessed from PC Primary Screen for V55 [FS16MC])
This switch turns the block skip 1 mode On and Off.



When this mode is turned On, blocks with a "/" (slash) in the program are ignored.

Program Restart
(Accessed from PC Primary Screen for V55 [FS16MC])
This switch turns the program restart mode On and Off.
This mode is turned On when the program restart function is used. When machining has been interrupted at an intermediate point due to a broken tool or other cause, the sequence number for the block from which you wish to restart machining is specified, and operation is restarted from that block.
Refer to the NC Unit Instruction Manual for the operation procedure.



Coolant On/Off
This switch is used to turn the coolant mode On and Off.
When this mode is turned On, all coolant being discharged at that time is turned Off. Pressing the switch again restores the previous status.

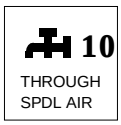
Nozzle Coolant
This switch turns the nozzle coolant mode On and Off.
The mode can also be turned On with the M8 command.

Scraper Conveyor
This switch turns the scraper conveyor On and Off.
It can also be turned On with the M741 command, and Off with the M740 command.

Air Blow (Option)
This switch turns the air blow function On and Off.
It can also be turned On with the M7 command.

The following functions can be turned On and Off on the PC primary screen.
Since these are flexible switch functions, these switches can be interchanged with the switches described on the previous pages.

Through-Spindle Coolant (Option)
This switch turns the through-spindle coolant function On and Off. The function is turned off when the next tool change command is sent, even if this switch is on, and operation is not restored after the command. This function can also be turned On with the M26 command.

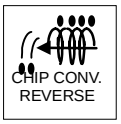


Through-Spindle Air (Option)
This switch turns the through-spindle air function On and Off. The function is turned off when the next tool change command is sent, even if this switch is on, and operation is not restored after the command. This function can also be turned On with the M77 command.

Through-Tool Coolant (Option)
This switch turns the through-tool coolant function On and Off. The function is turned off when the next tool change command is sent, even if this switch is on, and operation is not restored after the command. This function can also be turned On with the M96 command.

Through-Tool Air (Option)
This switch turns the through-tool air function On and Off. The function is turned off when the next tool change command is sent, even if this switch is on, and operation is not restored after the command. This function can also be turned On with the M28 command.

Ceiling Shower Coolant (Option)
This switch turns the ceiling shower coolant function On and Off. This function can also be turned On with the M97 command.



Chip Conveyor Reverse (Option)
When this switch is turned On, the scraper conveyor is operated in the reverse direction. Refer to the Scraper Conveyor section for details.

Mist Collector (Option)
This switch turns the mist collector function On and Off.
It can also be turned On with the M711 command, and Off with the M710 command.

Oil Skimmer (Option)
This switch turns the oil skimmer function On and Off.
It can also be turned On with the M743 command, and Off with the M742 command.

High-Pressure Nozzle Coolant (Option)
This switch turns the high-pressure nozzle coolant function On and Off.

Through-Spindle Mist (Option)
This switch turns the through-spindle mist function On and Off.
It can also be turned On with the M398 command. However, it can only be turned Off with the flexible switch, or from the primary operation screen.

Mist Blow (Option)
This switch turns the mist blow function On and Off.
It can also be turned On with the M399 command. However, it can only be turned Off with the flexible switch, or from the primary operation screen.

Vacuum (Dust Collector) (Option)
This switch turns the vacuum (dust collector) On and Off.
The vacuum cannot be turned On when the wet machining mode is On.

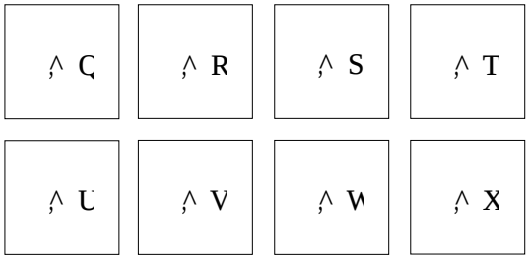
Machine Lock
This switch turns the machine lock mode On and Off.
When this mode is turned On, the position display will change during automatic and manual operation, but no axis movement will be performed. However, M, S and T functions are still executed at this time.
This function is used to check programs.

When this switch is turned On during axis movement, axis feed will decelerate and stop, but the position display will continue to change.
Conversely, when this switch is turned Off during execution of a movement command in the machine lock status, the axis starts to move and accelerates to the specified feed rate.

Z Axis Ignore
This switch turns the Z axis ignore mode On and Off.
It is used to apply machine lock to only the Z axis.
In other words, when this mode is turned On, movement for axes other than the Z axis is performed, but Z axis movement commands are ignored (no movement is performed), but the position display continues to change.
This function is used to check programs.

Auxiliary Function Lock
This switch turns the auxiliary function mode On and Off.
When this mode is turned On, the M, S and T auxiliary functions are not executed.
However, the following auxiliary functions **are executed:**
M00, M01, M02, M30, M98, M99

Manual Absolute
This switch turns the manual absolute mode On and Off.
When this mode is turned On, the absolute coordinate system is maintained, even when axes are manually moved. When you wish to shift the coordinate system by an amount equal to the movement in the manual operation mode, turn Off this function.
Normally, the manual absolute function is always left On, and cannot be turned Off.



Block Skip 2 Block – Block Skip 9 (Option)
These switches are used to turn block skip mode 2 to 9 On and Off.
When the respective mode is turned On, blocks with /2 to /9 at the beginning in the program are ignored.

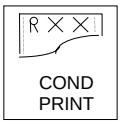
Playback (Option)
This switch turns the playback mode On and Off.
This mode is turned On when the playback function is performed.
The playback function registers the machine positions obtained in the manual operation mode as program positions in the memory, enabling a program to be created.

F1 Digit Feed (Option)
This switch turns the F1 digit feed mode On and Off.
When the feedrate is specified by a 1 digit F code (F1 to F9), the feedrate set in the NC unit corresponding to that F1 digit command is activated. If this mode is turned On at this time, the feedrate specified with the F1 digit command can be increased and decreased using the handle control panel (manual pulse generator).
The feedrate is increased 2 millimeters/minute per handle graduation on the handle control panel (when handle is rotated in clockwise direction), and decreased at this rate per graduation (when handle is rotated in counterclockwise direction).
However, the upper limit for F1 digit command feed is clamped at the maximum cutting feed rate.
The current feed rate is cancelled when a new F1 digit code is specified.

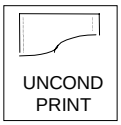
Operator Call Lamp
This switch turns the operator call lamp function On and Off.
When this function is turned On, the operator call lamp is turned On upon completion of automatic operation, informing the operator.
When this switch is turned On during automatic operation, the operator call lamp is turned On when an M02 or M30 code is read in the program, or when an alarm or warning is triggered.

Operator Call Lamp Off
This switch is used when the operator call function is On (active).
In the event the operator call lamp is turned On, it can be turned Off by turning this function On.
This function is void when the warning lamp is not lit.

Spare Tool Select
This switch turns the SpareTool Select function On and Off.
Refer to the Automatic Tool Monitoring Function for details.



Conditional Printout (Option)
This switch is used for data printout with the automatic measuring function. When this function is turned On, the conditional printout mode is activated. At this time, printout is performed when the Rxxx argument is specified in the call format for the automatic workpiece measurement function or automatic tool length measurement function. Refer to the Automatic Measuring Function Operation Manual for details.



Unconditional Printout (Option)
This switch is used for data printout with the automatic measuring function. When this function is turned On, the unconditional printout mode is activated. At this time, printout is performed, regardless of whether or not the Rxxx argument is specified in the call format for the automatic workpiece measurement function or automatic tool length measurement function. Refer to the Automatic Measuring Function Operation Manual for details.

Air Cut Mode
This switch turns the air cut mode On and Off.
The following functions are active while the air cut mode is On:

- Spindle can be rotated, even without tool in spindle.
- Tool changes can be performed without tool in spindle.

Make sure to turn Off the air cut mode upon completion of use.

Random Mode Switch
The random mode is activated by turning this switch On.
This switch is turned On to perform random operation (option).
Refer to section 4. Pallet Changer in the Main Options chapter for details.

Random Start Switch
Random operation (option) is started when this switch is turned On. This switch is valid while the random mode is active.
Refer to section 4. Pallet Changer in the Main Options chapter for details.

Automatic Change (Discharge) Switch
The automatic workpiece change (discharge) function is activated when this switch is turned On.
The automatic workpiece change function automatically discharges the pallet when an alarm is triggered by the automatic tool monitoring function, and loads the next pallet (if there is a ready one), enabling machining to be continued. However, this function is not valid unless the random mode has been selected. Furthermore, automatic change can be prohibited when performing back boring or tapping with the M52 command.

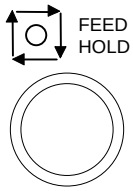
System Mode Switch
The system mode is activated when this switch is turned On.
It is used with a Makino Module MMC system.
This switch is turned on to perform system operation (Operation of machine by commands from an upper-level computer, Option).

Wet Cut Mode Switch (Option)
This switch is used to turn the wet cut mode On and Off.
When the wet cut mode is turned On while the vacuum is On, the vacuum is turned Off.

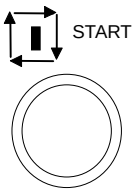
Operator Door Open/Close Switch (Option)
This switch is used to open and close the operator door.

Pallet Unclamp Switch (Option for V55 - 5XA)
This switch is used to clamp and unclamp the pallet.

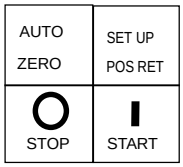
1.10 Starting/Stopping NC Programs



Feed Hold Switch
Pressing this switch stops the NC program.
This activates the feed hold status for the axes, but the M, S and T function operations are continued, stopping upon completion.
The red lamp lights while operation is stopped. Pressing the cycle start switch again turns Off the red lamp.



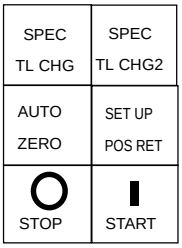
Cycle Start Switch
When this switch is released after it is pressed, the NC program is started.
The green lamp lights while the NC program is running.
This switch is valid during the M.D.I., memory and external input modes.



V55¥FS16i-MA

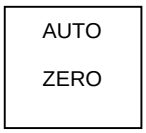
1.11 One-Touch Functions

The One-Touch related function switches are described in this section. They are valid regardless of the operation mode. The standard configuration is shown to the left.
The One-Touch functions enable multiple operations to be performed by selecting the function and starting it.



V33

There are no One-Touch functions on the V55 (FS16MC) main control panel. These functions are accessed from the PC primary screen page.



Auto Zero Return Switch
This function automatically returns all axes to their zero (reference) point. The following operations are performed:

1. The spindle and coolant are stopped.
2. The Z axis is positioned at the retracted position set in the machine parameters at the rapid feed rate, effecting reference point return.
3. The X and Y axes are positioned at the retracted position set in the machine parameters at the rapid feed rate, effecting reference point return.
4. The 4th axis is positioned at the retracted position set in the machine parameters at the rapid feed rate, effecting reference point return.
5. The 5th axis is positioned at the retracted position set in the machine parameters at the rapid feed rate, effecting reference point return.

The retracted position for reference point return is an absolute position in the machine coordinates, and is set with the following machine parameters: (The standard values shown are set when the machine is shipped, and normally do not need to be changed.)

V55 Settings		
Axis	Parameter	Standard Pos.
X Axis	No. 254	–100 (mm)
Y Axis	No. 255	–100 (mm)
Z Axis	No. 256	–100 (mm)
4th Axis	No. 257	–20 (°)
5th Axis	No. 258	–20 (°)

V33 Settings		
Axis	Parameter	Standard Pos.
X Axis	No. 254	–100 (mm)
Y Axis	No. 255	–100 (mm)
Z Axis	No. 256	–100 (mm)
4th Axis	–	–
5th Axis	–	–

1. This operation cannot be performed for the ATC magazine axis (PMC axis).
2. Restoring of spindle/coolant operation and return to original position are not performed.
3. Operations 4. and 5. above are only performed for a machine with 4th / 5th axes.

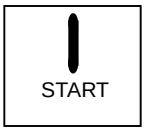
Set Up Position Return Switch
This function automatically moves the X and Y axes to the set up position set in the machine parameters after positioning of the Z axis to the reference point.

The following operations are performed:
1. The spindle and coolant supply are stopped.
2. The Z axis is returned to its reference point at the rapid feedrate.
3. The X and Y axes are positioned at the machine coordinate values set in the machine parameters at the rapid feedrate.

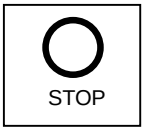
The set up position is set with the following machine parameters:

Axis	Machine Parameter
X	No. 252
Y	No. 253

1. Restoring of spindle/coolant operation and return to the position before performing this function are not performed.
2. Refer to the Explanation of Machine Parameters chapter regarding setting of the machine parameters.



One-Touch Function Start Switch
The selected One-Touch function is started when this switch is pressed.



One-Touch Function Stop Switch
The selected One-Touch function is stopped when this switch is pressed. This switch is valid while the One-Touch function is being performed.

The following One-Touch functions can be turned On and Off on the PC primary screen. Since these are flexible switch functions, these switches can be allocated to the main control panel. Refer to the Explanation of Machine Parameters chapter for the flexible switch functions.

AUTO
TL CHG

Auto Tool Change Switch
This function automatically exchanges the tool indexed to the automatic tool change position in the tool magazine with the spindle tool. The following operations are performed:

1. The spindle and coolant supply are stopped.
2. The X and Z axes are moved, automatically exchanging the tool indexed to the automatic tool change position with the spindle tool.

1. Restoring of spindle/coolant operation and return to the position before performing this function are not performed.
2. This function cannot be used with the V55 15-tool and 25-tool ATC magazines.

SPEC
TL CH

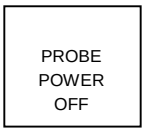
Specified Tool Change Switch (Specified Tool 1 – 4)
This function automatically exchanges the tool specified in the machine parameters with the spindle tool. The operation is almost the same as the Txxxx;M6; command. The following operations are performed:

1. The spindle and coolant supply are stopped.
2. The X and Z axes are moved, automatically exchanging the tool specified in the machine parameters with the spindle tool.

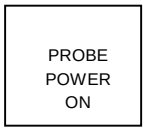
A maximum of four tools can be specified. The tool numbers are set with the following machine parameters:

Specified Tool	Machine Parameter
1	No. 260
2	No. 261
3	No. 262
4	No. 263

1. Restoring of spindle/coolant operation and return to original position are not performed.
2. Refer to the Explanation of Machine Parameters chapter regarding setting of the machine parameters.



Probe Power Off Switch (Option)
This function turns Off the automatic workpiece measuring probe power. It is valid when the automatic workpiece measuring option is provided.



Probe Power On Switch (Option)
This function turns On the automatic workpiece measuring probe power. It is valid when the automatic workpiece measuring option is provided.

1.11.1 One-Touch Function Operations

1.11.1.1 Operations for V55/FS16i-MA and V33 Machines

1. To select a One-Touch function, the desired switch is pressed on the main control panel or on the function page of the PC primary screen. The selected function lamp lights at this time. In addition, the auxiliary function lock and single block functions are turned off.
   When the wrong function is pressed, press the desired function switch afterwords. The last function pressed is the one that is selected.

2. Press the One-Touch Function Start switch to start the selected function. The One-Touch Function Start switch lights while operation is being performed.
   Press the One-Touch Function Stop switch to stop operation at an intermediate point. This activates the feed hold status. The One-Touch Function Start switch goes out while operation is stopped, and the One-Touch Function Stop switch lights.
   Press the One-Touch Function Start switch again to restart operation.

3. The selected One-Touch function is cancelled upon completion of operation, and the built-in lamp goes out. The operation mode (main mode), auxiliary function lock and single block status are restored to their previous condition at this time.

1.11.1.2 Operations for V55/FS16MC Machines

1. Select the function page on the PC primary screen.

2. Move the cursor to the One-Touch function to be executed with the cursor keys. When there are 21 or more functions or modes, select the desired page with the page keys.

3. Press the [ON] soft key.
   The function selection On/Off mark lights at this time. (Display changes from ❍ to ●.) At the same time, the auxiliary function lock and single block functions are turned Off.
   When the wrong function is pressed, press the desired function switch afterwords. The last function pressed is the one that is selected.

   To cancel the selected One-Touch function, press the [OFF] soft key.

4. Press the [ONE TH START] soft key on the PC primary screen.
   The selected one-touch function is started when this soft key is pressed. The [ONE TH START] soft key is highlighted in yellow while operation is taking place.

   Press the [ONE TH STOP] soft key to stop operation at an intermediate point. This applies the feed hold status.

   When operation is stopped, the [ONE TH START] soft key is displayed in white, and the [ONE TH STOP] soft key is highlighted in yellow.

   To restart operation, press the [ONE TH START] soft key

5. Upon completion of the operation, the selected one-touch function is cancelled, and the On/Off mark changes back to the off status. (Display changes from ● to ❍.) The [ONE TH START] key is displayed in white at this time.
   The auxiliary function lock and single block status are restored to their previous condition at this time.

1.11.2 Notes on Using One-Touch Functions

1. Since the one-touch functions perform axis movement, make sure to check for any interference with the workpiece before executing a one-touch function.

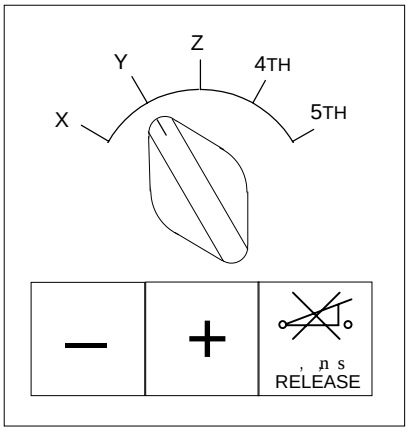
2. When a one-touch function is selected, the auxiliary function lock and single block functions are turned off. However, upon completion of the operation or when the operation is interrupted by resetting of the NC or another cause, these functions are restored to their previous status.

3. The one-touch functions cannot be used during automatic operation, when the machine lock or Z axis ignore status is active, nor during manual axis feed.
   When the one-touch function start switch or [ONE TH START] soft key is pressed at this time, a machine warning is triggered, but the one-touch function will not be performed.

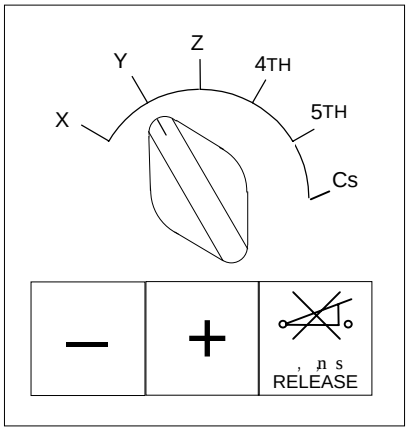
4. The machine lock, Z axis ignore (neglect), auxiliary function lock and single block On/Off operations cannot be performed (are void) while a one-touch function is being performed.

5. In the event a one-touch function is stopped by an emergency stop or resetting of the NC, operation cannot be continued.

1.12 Jog, OT Release Switches



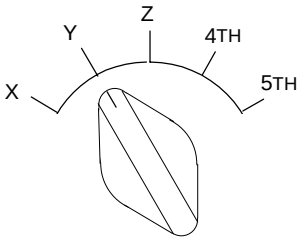
For V55



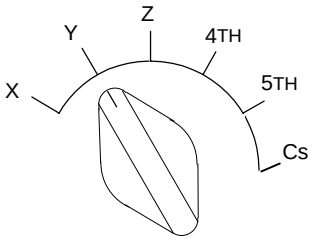
For V33

These switches are used to select the axis and direction of movement for the jog, rapid feed and reference point return modes. The feedrate is selected with the manual feed or rapid feed rate rotary switch.

Feed Axis Select Switch

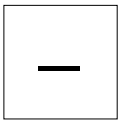


For V55

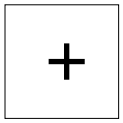


For V33

This switch is used to select the axis to be moved in the manual mode.



Minus Direction Feed Switch
The axis selected with the feed axis select switch is moved in the minus direction while this switch is is held down.



Plus Direction Feed Switch
The axis selected with the feed axis select switch is moved in the minus direction while this switch is held down.

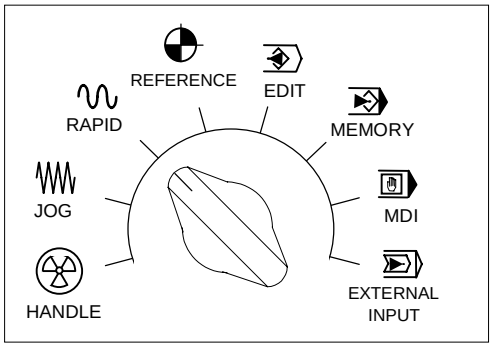
OT Release Switch
This switch is used for the following purposes:

1. When the emergency stop status is triggered by a feed axis overtravel (OT2), the emergency stop status is cancelled while this switch is held down.
   Move the axis in the opposite direction while holding down this switch to move it back within its stroke.

2. The interlock status is activated for all feed axes when the ATC or another operation is stopped at an intermediate point. The OT Release switch is used to cancel the interlock in order to restore operation.
   The interlock is cancelled while this switch is held down.

3. This switch is also used to cancel interlocks when performing maintenance.

1.13 Operation Mode Select Switch



This switch selects the operation mode.


HANDLE

Handle Mode
This mode is selected when moving axes with the handle control panel (manual pulse generator).
When this mode is activated, the axis to be moved is selected with the rotary switch on the handle control panel, and the axis is moved by rotating the handle on the handle control panel.


JOG

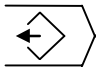
Jog Feed Mode
This mode is selected to move an axis in the jog feed mode.
When this mode is activated, the axis to be moved is selected, and is moved with the [+] or [–] switch.


RAPID

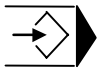
Rapid Feed Mode
This mode is selected to move an axis in the rapid feed mode.
When this mode is activated, the axis to be moved is selected, and is moved with the [+] or [–] switch.


REFERENCE

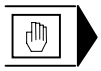
Jog Feed Mode
This mode is selected to perform reference point return in the manual mode.
When this mode is activated, the axis to be returned to its reference point is selected, and is returned with the [+] or [–] switch.


EDIT

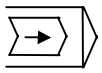
Edit Mode
This mode is selected when registering NC programs from an external input unit, or when editing a program registered in the NC memory.


MEMORY

Memory Mode
This mode is selected to perform memory operation (using a registered program).
Automatic operation is started by searching for the registered program and pressing the cycle start switch.


MDI

M.D. I. (Manual Data Input) Mode
This mode is selected to enter axis movement commands and M, S and T function commands.
It enables the generation and execution of programs with the same format as registered programs.

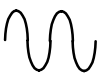

EXTERNAL INPUT

External Input Mode
This mode is selected to perform DNC operation.

The following modes are all called **Manual Modes**:

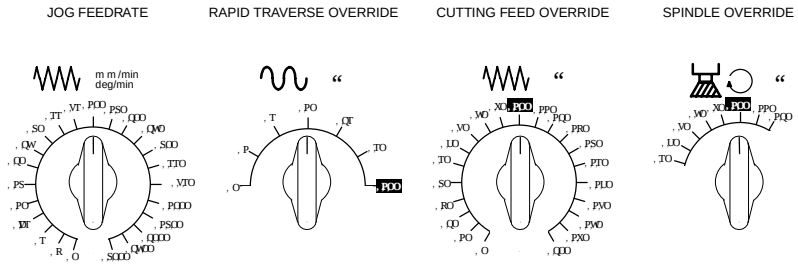
Handle Mode (), Jog Feed Mode (),

HANDLE JOG

Rapid Feed Mode (), Ref. Point Return Mode ()

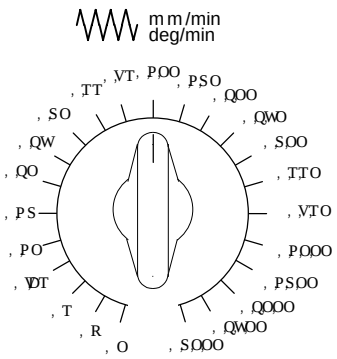
RAPID REFERENCE

1.14 Override Switches



These switches are used to select the jog axis feedrate and override settings for rapid feed, cutting feed and the spindle.

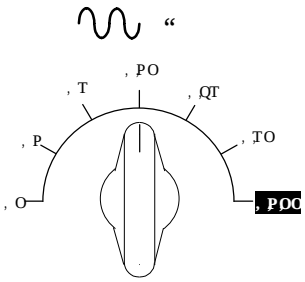
JOG FEEDRATE



Jog (Manual) Feedrate Switch
The feedrate for the following modes is specified with this rotary switch:

1. Jog mode
2. When dry run is On during automatic operation

RAPID TRAVERSE OVERRIDE

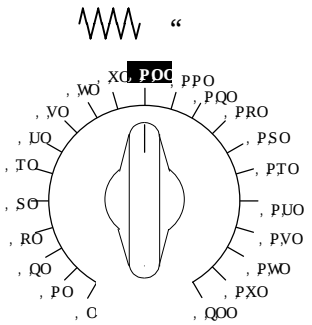


Rapid Traverse Override Switch
The rapid traverse override rate is specified for the following modes with this rotary switch:

1. Rapid traverse mode
2. Reference point return mode

For a machine with 4th or 5th axes, the reference point return rate is clamped at 8% of the maximum rate after power is turned On until reference point return has been completed for all axes.
The feedrate is clamped at 15% of the maximum during automatic measuring operation.

CUTTING FEED OVERRIDE

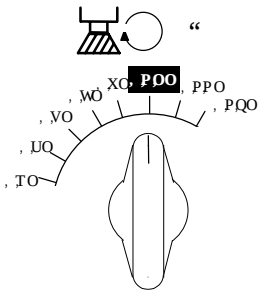


Cutting Feed Override Switch

This switch applies an override to the cutting feed specified during automatic operation.

1. When dry run is selected, this switch is deactivated, and the jog feedrate rotary switch is activated.
2. The feedrate is fixed at 100% during the G84 tapping cycle and while M49 override cancel is active.

SPINDLE OVERRIDE

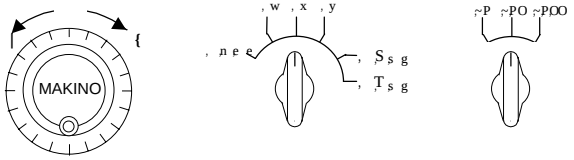


Spindle Speed Override Switch

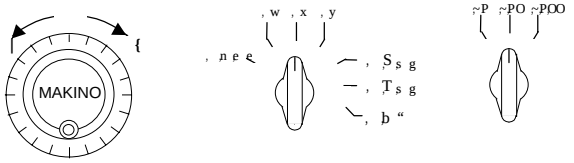
This switch applies an override to the specified spindle rotation speed. However, the spindle will not be rotated at a speed lower than the minimum rotation speed, or higher than the maximum rotation speed for the machine.

1. This switch is deactivated when the M59 spindle override cancel mode is On. The M58 spindle override valid status is activated when power is turned On.
2. The feedrate is fixed at 100% during the G84 tapping cycle.

1.15 Jog (Manual) Handle

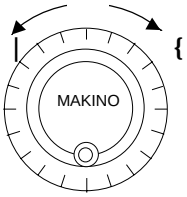


For V55



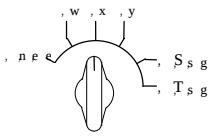
For V33

This handle is used to perform the jog handle feed and handle interrupt operations.



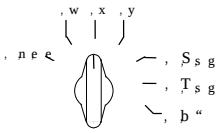
Jog Handle
This control is used to move the feed axis for jog handle feed.
When jog handle interrupt is selected, it is used to increase or decrease the movement distance during automatic operation.

When jog handle feed is performed, the axis is moved in the minus direction when the handle is rotated in the minus (counterclockwise) direction, and in the plus direction when it is rotated in the plus (clockwise) direction. When jog handle interrupt is performed, movement in the minus direction is added when the handle is rotated in the minus (counterclockwise) direction, and movement in the plus direction is added when it is rotated in the plus (clockwise) direction.

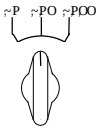


For V55

Jog Handle Axis Select Switch
This switch is used to select the axis for which jog handle feed or jog handle interrupt is performed. Select OFF when the jog handle is not being used.

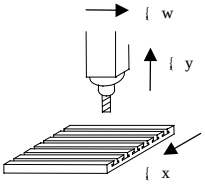


For V33



Jog Handle Multiplication Factor Select Switch
This switch is used to select the multiplication factor for jog handle feed or jog handle interrupt.

1.16 Feed Direction Display



Feed Direction Display
This indicates the movement direction for the respective axes.

Chapter 2 PC Screens

(Type 8.4 Color LCD/MDI Panel)

V55

Professional 3

Chapter 2
PC Screens

Contents

A variety of switches and buttons appear in the explanation of the PC screens (Type 8.4 Color LCD/MDI Panel).

The following conventions are used for the soft keys, NC keys and control panel buttons in this chapter.

Example

Soft Keys 

→ JOG @SINGLE n

NC Ke 

→ INPUT

Control Panel 

→ LIGHTING v

2.1 LCD Control Panel

2.1.1 LCD Control Panel

A type 8.4 color LCD/MDI panel is used for this machine. Hereinafter, it will be called the LCD control panel. The [CUSTOM] NC key on the LCD control panel is used to display the PC screens.

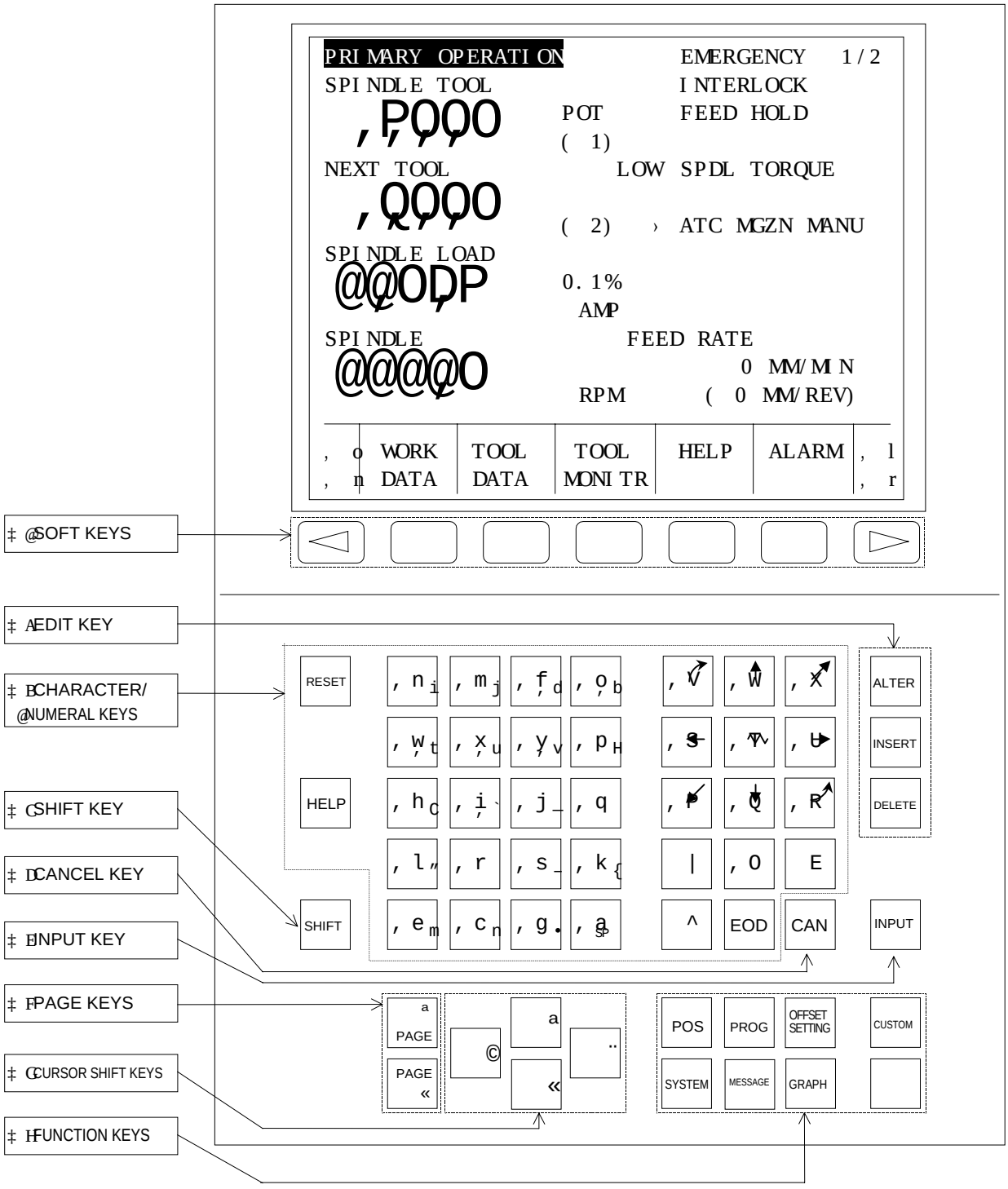
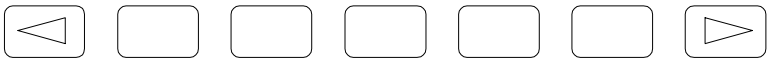


FIGURE 2-1 LCD CONTROL PANEL

2.1.2 Keyboard Explanation

The basic operation procedures are the same as those described in the FANUC Series 16 / FANUC Series 16i Instruction Manual.
The keys used for the Professional 3 are described in this section.

1. Soft Keys

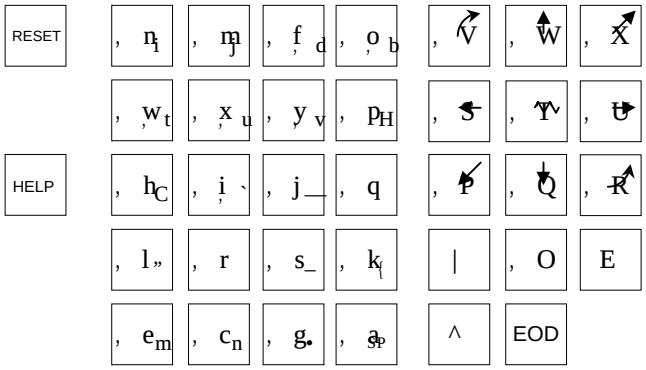


A variety of functions are allocated to these keys, depending upon the function. The function which is currently allocated is displayed at the bottom of the LCD display as a menu.

2. Edit Keys

The [DELETE] NC key is used to delete all data displayed on the input line. However, its function differs on some screens.

3. Character/Number Keys



These keys are used to enter letters and numbers.

4. Shift Key

Two characters are inscribed on some keys. The shift key is used to enter the character inscribed on the lower right.

5. Cancel Key 

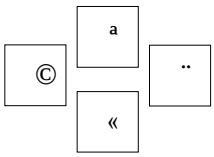
This key is used to delete one character from the input line.
(Refer to section 2.1.4.3, Entering and Setting Data, for details on the input line.)

6. Input Key 

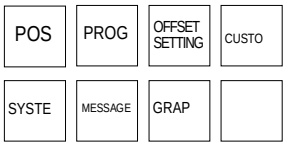
This key is used to enter the data displayed on the input line.
(Refer to section 2.1.4.3, Entering and Setting Data, for details on the input line.)

7. Page Keys 

These keys are used to change between screen pages.

8. Cursor Keys 

These keys are used to move the cursor

9. Function Keys 

The [CUSTOM] key is used to change from the NC screen to the PC screen. It is also used to change back from the PC screen to the NC screen.

2.1.3 PC Screens

1. Primary Operation Screen
   A. Machine status display
   B. Screen selection
   C. Turning functions/modes On and Off

2. Work Data Screen (option)
   A. Setting and display of work data

3. Tool Data Screen
   A. Setting and display of tool data

4. Tool Monitor Screen
   A. Spindle tool status display
   B. Display and turning On and Off auto tool monitor function
   C. Auto tool monitor function alarm display

5. Help Screen
   A. Display of machine side software version
   B. Display of M code content

6. Alarm Screen
   A. Display of alarm details
   B. Display example
   C. Display of alarm record

7. Diagnose (I/O Data) Screen
   A. Display of DI/DO signal status

8. Maintenance Screen
   A. Machine status display
   B. Status display and maintenance operations for ATC, P/C, ATC magazine and auto tool/workpiece measurement.

9. Parameter Screen
   A. Setting and display of parameters

10. Regular Maintenance Screen
    A. Display and completion of regulation inspection items
    B. Display of daily inspection items
    C. Display example

2.1.4 Screen Operations

2.1.4.1 Changing Between Screens

Normally, the NC screen is displayed when power is turned On. However, when the power is turned On on a day specified for regular maintenance (weekly, monthly, six-month, yearly), the inspection items are displayed on the PC Regular Maintenance Screen.

1. Changing from NC Screen to PC Screen (other than regular maintenance)

   A. Press the [CUSTOM] NC key.
   The PC screen is displayed.

   B. The primary operation screen is displayed when you change to the PC screen immediately after power is turned On. In other cases, the PC screen displayed before changing to the NC screen appears again.

2. For Regular Maintenance

   A. Perform the inspections displayed on the screen.

   B. Press the [FINISH] key upon completion of the inspections.
   This completes the inspection procedure, and automatically sets the next inspection date.

   C. On a day when there are multiple regular inspections, the next group of inspection items is displayed.

   D. To change to another screen after all inspections have been completed, first press the [P O] soft key to display the primary operation screen. Refer to the primary operation screen for the screen selection procedure.

The inspection procedure is not completed until the [FINISH] soft key is pressed after completion of the actual inspection.
This screen is displayed again when power is turned On.
Refer to section 2.11 Regular Maintenance Screen for details.

2.1.4.2 Changing Between Pages

There are two keys which are used to change between pages:

ª @PAG	Displays previous page. The last page is displayed when pressed on the first page.
« @PAG	Displays next page. The first page is displayed when pressed on the last page.

2.1.4.3 Entering and Setting Data

Data entry and setting can be performed when the [INPUT OUTPUT] soft key is displayed.

A. Press the [INPUT OUTPUT] soft key to select the input mode. When the input mode is activated, [INPUT =] appears on the menu at the bottom left portion of the screen, the cursor is displayed, and [INPUT] is highlighted.

B. Use the cursor keys to align the cursor with the data.

C. Enter the data with the character/number keys. The entered data appears on the input line.

D. Use the following keys to correct the data when a mistake is made:

CAN	Deletes one character from input line.
DELETE	Deletes all data from input line.

E. Press the NC INPUT key after confirming that all data displayed on the input line is correct.

F. An error message is displayed when the data on the input line is not within the prescribed scope. Correct the data using the procedures in steps C and D above.

2.2 Primary Operation Screen

The primary operation screen is displayed when the PC screen is first selected, or when the [P O] soft key is pressed on any of the PC screens.

There are the following three functions on the primary operation screen:
1. Machine status display
2. Screen selection
3. Turning functions or modes On and Off

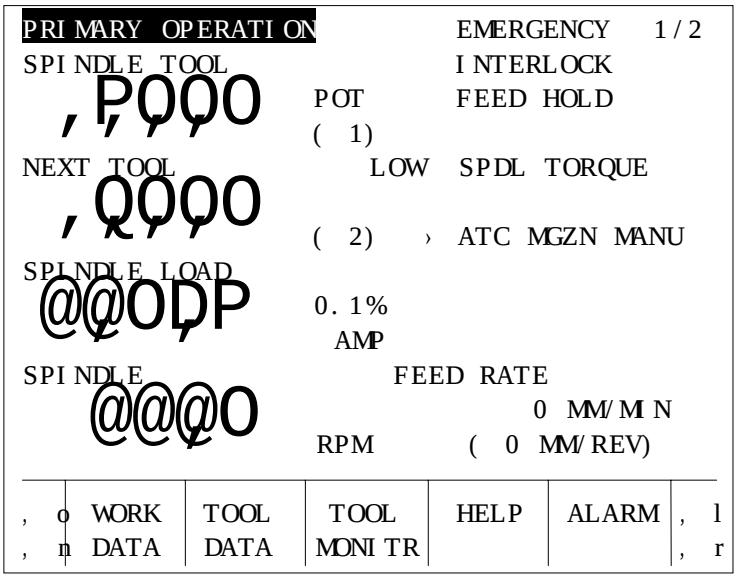


FIGURE 2-2 PRIMARY OPERATION SCREEN (INITIAL STATUS)

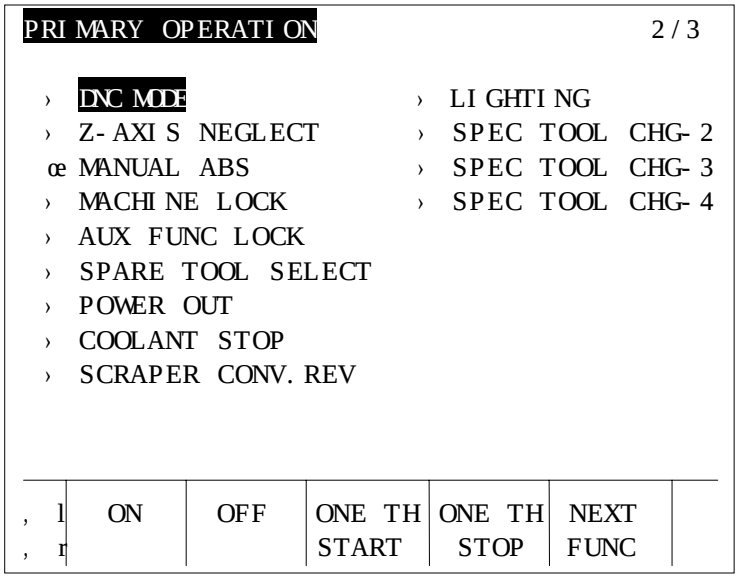


FIGURE 2-3 PRIMARY OPERATION SCREEN (FUNCTION PAGE)

2.2.1 Display Content

1. Spindle Tool
   This indicates the tool number that is clamped in the spindle.
   When the spindle tool has been returned to the ATC magazine by the T0 command, and the spindle is empty, nothing is displayed.
   The number in parentheses indicates the pot number

2. Next Tool
   This indicates the tool number which is indexed to the ATC position. Nothing is displayed when no tool has been indexed to the ATC position. The number in parentheses indicates the pot number.

3. Spindle Load
   This indicates the spindle motor load as a current value. The color changes depending upon the amount of current.
   White : Within continuous rating
   Yellow : Within 30 minute rating
   Red : Above 30 minute rating
   Unit : AMP (amperes)

   The value at the right indicates the load factor.

4. Spindle
   This indicates the spindle rotation speed, including any change effected by spindle override.
   Unit : RPM

5. Feed Rate
   This indicates the actual machine feed rate.
   Unit : mm/min or inch/min (depending upon specifications)

6. Feed Rate per Revolution
   This indicates the feed rate per spindle revolution.
   Unit : mm/min or inch/min (depending upon specifications)

7. Machine Status Display
   A. Emergency
      This is displayed in red when the machine is in the emergency stop status. It changes to white when the emergency stop status is reset.

   B. Interlock
      This is displayed in yellow when the machine is stopped by an axis interlock. It changes to white when the axis interlock is reset.

C. Feed Hold
This is displayed in yellow when the machine is stopped by the feed hold status. It changes to white when the feed hold status is reset.

D. Spindle Torque
The selected spindle output torque range is displayed.
There are the following types of output torque range/rpm:

14000min^{-1} Spindle
High : 15 — 3500 min^{-1}
Low : 3501 — 14000 min^{-1}

20000min^{-1} Spindle
High : 20 — 4000 min^{-1}
Low : 4001 — 20000 min^{-1}

30000min^{-1} Spindle
High : 30 — 8000 min^{-1}
Low : 8001 — 30000 min^{-1}

E. ATC Arm Standby
This is displayed for a 40-tool or 80-tool ATC.
"●" (green) appears when the ATC arm is in the standby status.

F. ATC Magazine Manual
"●" (pink) appears when the manual mode has been activated for the ATC magazine by the manual intervention button on the ATC control panel. Tool indexing by T commands is suspended until the manual mode is cancelled. "●" blinks when the manual intervention button on the ATC control panel is pressed during ATC magazine operation.

G. 2nd Reference Point
The axis name and this item appear when 2nd reference point is completed for each axis.

H. PC Arm Standby
This is displayed for a machine with a pallet changer. "●" (green) appears when the PC arm is in the standby status.

I. PC Manual
This is displayed for a machine with a pallet changer
"●" (pink) appears when the manual mode has been activated for the pallet changer by the manual intervention button on the APC control panel. Pallet changing by the M60 command is suspended until the manual mode is cancelled. "●" blinks when the manual intervention button on the APC control panel is pressed during pallet changer operation.

8. Function or Mode
   Functions and modes which have not been allocated to the main control panel can be turned On and Off on the function page of the primary operation screen.

   The following colors are used for the respective functions/modes:

NC Functions	: Yellow
Machine Functions	: Blue
One-Touch Functions	: White
Changing Machining Mode, etc.	: Green

   Refer to the "Main Control Panel" for details on the functions and one-touch functions.

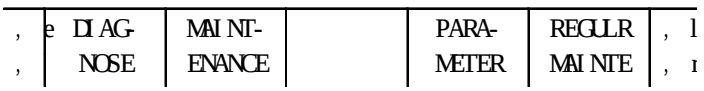
2.2.2 Soft Keys

1. Types of Soft Keys

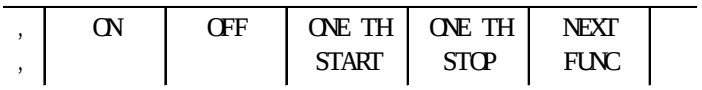
   A. Initial Status

   B. When [MS] Soft Key is Pressed Once

   C. When [FC] Soft Key is Pressed

2. Soft Key Description

[MS]	Used for screen selection. The function page cannot be selected.
[FC]	Selects function page menu. Screen selection cannot be performed.
[WORK DATA]	Selects the work data screen (option).
[TOOL DATA]	Selects the tool data screen.

[TOOL MONITR]	Selects the tool monitor screen.
[HELP]	Selects the help screen.
[ALARM]	Selects the alarm screen.
[DIAG- NOSE]	Selects the diagnose screen.
[MAINT- ENANCE]	Selects the maintenance screen.
[PARA- METER]	Selects the parameter screen.
[REGULR MAINTE]	Selects the regular maintenance screen.
[ON]	Used to turn On a function or mode.
[OFF]	Used to turn Off a function or mode.
[ONE TH START]	Used to start a one-touch function.
[ONE TH STOP]	Used to temporarily stop a one-touch function.

2.2.3 Screen Operations

2.2.3.1 Screen Selection

1. Press the soft key for the desired screen.

2. If the desired screen is not displayed on the menu, press the [MS] soft key to select the other menu.

2.2.3.2 Turning Functions/Modes On and Off

1. Press the [FC] soft key, or use the page keys to select the function page.

2. Move the cursor to the item to be turned On or Off with the cursor keys. The desired page is selected with the page keys when there are 21 or more functions or modes.

3. Press the [ON] soft key to turn On a function or mode, and press the [OFF] key to turn it Off.

4. "●" (pink) is displayed when a function or mode is On, and "O" is displayed when it is Off.

2.3 Work Data Screen (option)

The work data screen is displayed when the [WORK DATA] soft key is pressed on the primary operation screen.

There are work data setting and display functions on the work data screen. Work data used for random operation of the pallet changer (option) is displayed.

There are two different pages: a Machining data display page, on which the program number, block skip, work coordinate shift value and work-piece name are displayed; and a Machining time display page, on which the machining start time, finish time, machining time and automatic run (operation) time are displayed.

Refer to Pallet Changer in the Main Options chapter for random operation.

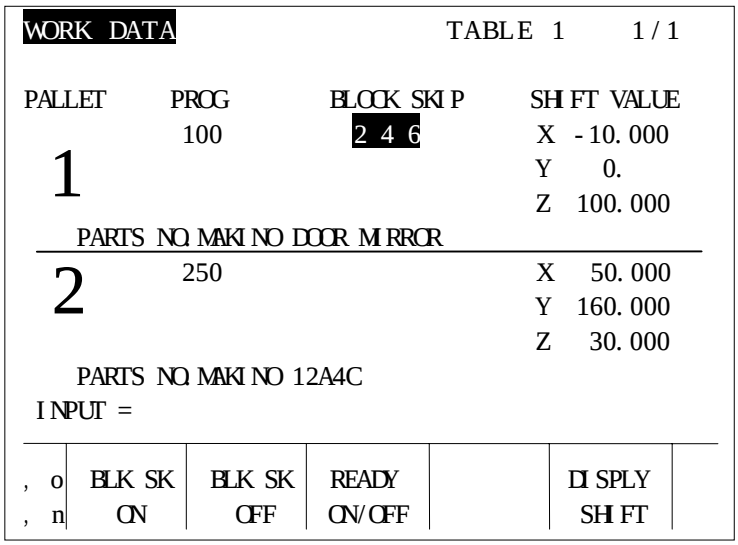


FIGURE 2-4 WORK DATA SCREEN (MACHINING DATA DISPLAY PAGE)

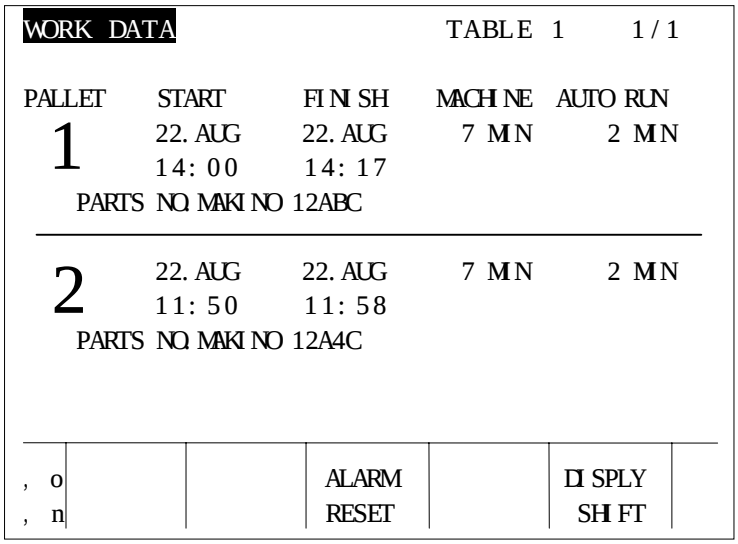


FIGURE 2-5 WORK DATA SCREEN (MACHINING TIME DISPLAY PAGE)

2.3.1 Display Content

One block of work data is displayed in the area of the screen separated by the horizontal line. The work data is displayed for each pallet, with one screen containing the data for two pallets.

1. Table
   The pallet number on the machine table is displayed.

2. Pallet
   The work data pallet number is displayed as a large number.

3. Program (PROG)
   The machining program number is displayed. When random operation is performed, this program number is search for and started.

4. Block Skip
   The On/Off status of the block skip function is displayed. The numbers for block skip 2 – 9 that appear on the screen are On, and the block skip numbers that do not appear are Off.
   Block skip 2 – 9 are set to this status when random operation is started. The block skip numbers are respectively displayed in their own fixed location.

5. Coordinate Shift Value
   The workpiece reference point shift values for the X, Y and Z axes are displayed. The workpiece offset values set by G54 to G59 can be shifted by the values set by this item. These settings are transferred to

the NC workpiece reference point shift values when random operation is started.

6. Machining Start
   The date/time that the machining program was started in the random operation mode are displayed. The machining start date/time are set by the M479 code in the standard operation mode. If the start time has not been set, "-" is displayed.

7. Machining Finish
   The date/time that the random operation mode ended are displayed. The machining finish date/time are set by the M478 code in the standard operation mode. If machining has not finished, "-" is displayed.

8. Auto Run
   The time that the spindle was rotating, from when machining was started until it finished, is displayed. Unit: Minutes

9. Machining Time
   The time from when machining was started until it finished (Machining Finish – Machining Start) is displayed. Unit: Minutes

10. Workpiece Name
    The workpiece name is displayed. This name is not used for operation of the machine. Use this space for reference purposes.

11. Status
    The following information is displayed next to the Z axis coordinate shift value:

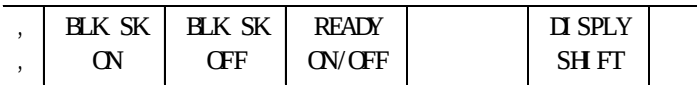
    A. Ready Status
       "READY" is displayed in green if the ready status is On.

    B. Alarm Status
       If a tool monitor alarm occurs during machining and the workpiece is discharged by the automatic workpiece unload function, the program number, sequence number, tool number and a description of the alarm are displayed in red.

2.3.2 Soft Keys

1. Types of Soft Keys

A. Machining Data Display Page



B. Machining Time Display Page

2. Soft Key Description

[BLK SK ON] This key is displayed when the cursor is on a block skip number. It is used to turn the block skip setting On.

[BLK SK OFF] This key is displayed when the cursor is on a block skip number. It is used to turn the block skip setting Off.

[READY ON/OFF] This key is displayed on the machining data display page. It is used to turn the ready status for the pallet on the machine table On or Off.

[ALARM RESET] This key is displayed on the machining time display page. It is used to reset a tool monitor alarm which occurred during machining.

[DISPLY SHIFT] This key is displayed at all times. It is used to change between the machining data display page and the machining time display page.

2.3.3 Screen Operations, Data Setting Procedure

Data for items other than pallets can be changed on the work data screen. Refer to section 2.1.4 Screen Operations for the basic operation procedure.

2.3.3.1 Programs

Keys Used : Number keys

Setting Range : 1 – 7999

Operation Procedure

1. Move the cursor to the program number.
2. Enter the program number which has been registered in the NC memory.

2.3.3.2 Block Skip

Keys Used : Number keys

Setting Range : 2, 3, 4, 5, 6, 7, 8, 9

Operation Procedure

1. Move the cursor to block skip.
2. Enter the block skip number to be turned On or Off on the input line.
3. Press the [BLK SK ON] soft key to turn the function On.
   Press the [BLK SK OFF] soft key to turn the function Off.
4. The data which was turned On is displayed on the screen, and the data which was turned Off disappears from the screen.

2.3.3.3 Coordinate Shift Value

Keys Used : Number keys, minus key, decimal point key

Setting Range : –99999.999 — 99999.999 (for mm)
–9999.9999 — 9999.9999 (for inches)

Operation Procedure

Move the cursor to the coordinate shift value, and enter the desired number.

2.3.3.4 Machining Start/Machining Finish

Keys Used : Number keys

Setting Range : Months 1 – 12, Days 1 – 31
Hours 0 – 23, Minutes 0 – 59

Operation Procedure

Move the cursor to month, day, hour and minute sequentially, and enter the appropriate value for each item. This data is normally set automatically, and does not need to be entered.

2.3.3.5 Machining Time, Automatic Operation

Keys Used : Number keys

Setting Range : 0 – 999999 (min)

Operation Procedure

Move the cursor to machining time and automatic operation sequentially, and enter the appropriate value for each item. This data is normally set automatically, and does not need to be entered.

2.3.3.6 Workpiece Name

Keys Used : All keys (except for cancel key)

Setting Range : Max. 20 characters

Operation Procedure

Move the cursor to the workpiece name area, and enter the desired name.

The following NC keys can be used to change the workpiece name:

ALTER	If the workpiece name has already been registered, the data after the cursor position is overwritten. I the workpiece name has not been registered, this key has the same function as the INPUT key.
INSER	If the workpiece name has already been registered, data is entered after the cursor position. If the workpiece name has not been registered, this key has the same function as the INPUT key.
DELETE	This key deletes one character from the workpiece name. It has the same function as the cancel key during normal input. It only functions when there is data on the input line.

2.3.3.7 Alarm Reset

Operation Procedure

1. Move the cursor to the pallet for which the alarm is to be reset.
2. Press the [ALARM RESET] soft key. The alarm disappears, and is reset.

2.3.3.8 Ready On/Off

Operation Procedure

1. Move the cursor to the pallet number for which the ready status is to be turned On or Off. When the [READY ON/OFF] soft key is pressed while the ready status is On, it is turned off and disappears from the screen.

2. When the [READY ON/OFF] soft key is pressed while the ready status is Off, it is turned On and appears on the screen.

The ready status can only be turned On and Off for the pallet on the machine table.

2.3.3.9 Changing Display Data

The display can be changed back and forth between machining data display and machining time display by pressing the [DISPLY SHIFT] soft key.

2.3.3.10 Overwriting Pallet Number on Machine Table

The procedure in this section is used to enter or change the data for the pallet on the machine table in the event this becomes necessary due to the stopping of APC operation at an intermediate point because of an emergency stop, alarm or other cause.

1. Activate the maintenance mode on the maintenance screen.
   Procedure to Select Maintenance Mode
   A. Select the maintenance screen. (Refer to section 2.2.3.1, Screen Selection.)
   B. Display the machine status display page.
   C. Press the [MODE SELECT] soft key to activate the maintenance mode.

2. Return to the primary operation screen with the maintenance mode active, and select the work data screen. (Refer to section 2.9, Maintenance Screen, for details.)

3. Move the cursor to the right of "TABLE".

The pallet number on the machine table cannot be overwritten unless the maintenance mode is activated.

4. Enter the appropriate data (0 – 2). (0 indicates there is no pallet on the table.)

5. The data is set according to the machine table pallet number entered in step 4.

6. Select the maintenance screen again.

7. Press the [MODE SELECT] soft key to cancel the maintenance mode. This completes the setting procedure.

2.4 Tool Data (Detail) Screen

The tool data (detail) screen is displayed when the [TOOL DATA] soft key is pressed on the primary operation screen. The tool detail screen has tool data setting and display functions.

There are three different tool detail screens, with the items listed below displayed. All items correspond to the pot number.

1. Pot
2. Tool (PTN)
3. Kind
4. Type (FTN)
5. Life
6. Remaining life
7. Tool length (H value)
8. Tool diameter (D value)
9. Status
10. ITN
11. SL value
12. AC value
13. Through-spindle coolant suction time (option)

The number of pots and pages displayed differs depending upon the ATC magazine tool capacity, but the content and data setting procedure are the same.

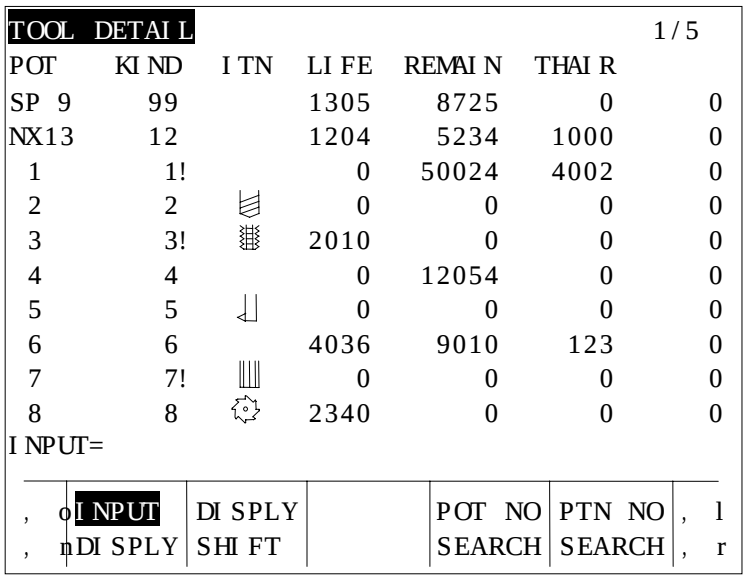


FIGURE 2-6 TOOL DETAIL SCREEN NO. 1

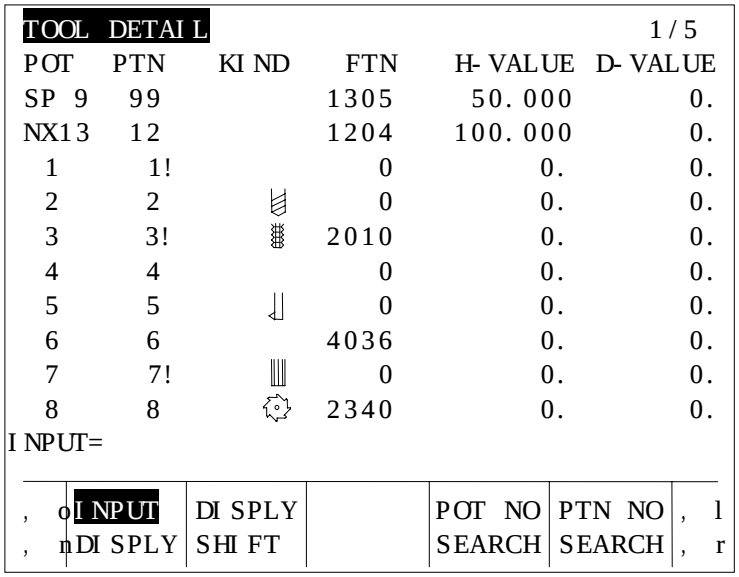


FIGURE 2-7 TOOL DETAIL SCREEN NO. 2

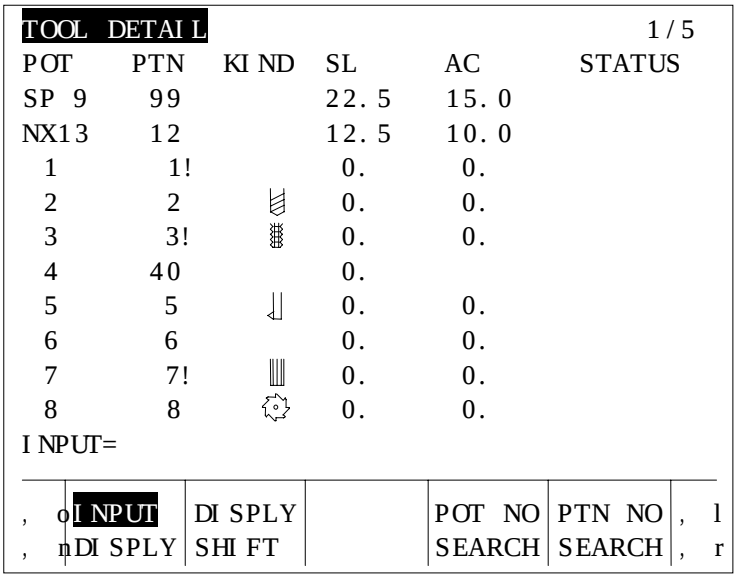


FIGURE 2-8 TOOL DETAIL SCREEN NO. 3

2.4.1 Display Content

The spindle tool is displayed in green, the next tool in yellow, and other tools are displayed in white.

1. Pot
   The pot number is displayed.
   The data for eight tools in addition to the spindle tool and next tool is displayed on one page. The data for more tools than the ATC magazine tool capacity will be displayed, but only the data equal to the tool magazine capacity can be used for operation of the machine.
   Use the pot number data which exceeds the tool magazine capacity for memorandum purposes.

2. Tool (PTN)
   The tool number used by the T command in the program is displayed.
   Unit : None
   Setting Range : 0 – 9999

3. Kind
   A diagram indicating the kind of tool is displayed.
   The correspondence between setting and diagram are shown in the table below
   Unit : None
   Setting Range : 0 – 9

TABLE 2-1 KIND OF TOOL SETTINGS

Setti	@ O	@ P	@ Q	@ R	@ S	@ T	@ U	@ V	@ W	@ X
Diagram										
Name	Space	Drill	Ball End Mill	End Mill	Boring Bar	Spring Tool	Spring Tool	Tapper	Reamer	Face Mill

4. Type (FTN)
   The type of tool (Functional Tool Number) is displayed. As long as this data is the same, tools are recognized to be the same type, even if the tool number differs. This data is registered when using the spare tool change function.
   Unit : None
   Setting Range : 0 – 9999

5. Life
   The tool life is displayed. Time, distance or machining quantity can be selected for tool life. This data is valid when the TL mode (tool life management) is selected on the tool monitor screen. (Refer to section 2.5, Tool Monitor Screen.)
   Unit : Time
   Distance (m or inch) (according to specifications)
   Machining quantity

Setting Range : 0 – 99999

6. Remaining Life (or Cumulative Value)
   The tool life is displayed. Time, distance or machining quantity can be selected for tool life. This data is valid when the TL mode (tool life management) is selected on the tool monitor screen. (Refer to section 2.5, Tool Monitor Screen.)
   Unit : Time
   Distance (m or inch) (according to specifications)
   Machining quantity
   Setting Range : 0 – 99999

7. Tool Length (H Value)
   The tool length offset value is displayed. This data can be transferred to the NC tool offset memory by the M56 command.
   Unit : mm or inch (according to specifications)
   Setting Range : –999.999 — 999.999 (mm)
   –99.9999 — 99.9999 (inches)

8. Tool Diameter (D Value)
   The tool diameter offset value is displayed. This data can be transferred to the NC tool offset memory by the M56 command.
   Unit : mm or inch (according to specifications)
   Setting Range : –999.999 — 999.999 (mm)
   –99.9999 — 99.9999 (inches)

9. Status
   A two-letter code is displayed in red when a tool alarm occurs. A tool alarm differs from a machine alarm. When a tool alarm occurs while the tool monitor function is being used, an alarm is displayed for the respective tool number. There are the following types of tool alarms:

   TL : Tool life alarm
   SL : SL monitor alarm
   AC : AC monitor alarm
   BT : Broken tool alarm
   B2 : Long detection by broken tool check

   A maximum of three alarms are displayed. When more than 3 alarms occur at the same time, only three appear on the screen. Refer to section 2.7, Alarm Screen, for details on alarms.

10. ITN (Individual Tool Number)
    When a unique tool number is needed other than the tool number used in programs, this data is registered. This item is used for a system where the same tool numbers are used for other machines and programs, but not when the machine is operated independently.
    Unit : None
    Setting Range : 0 – 9999

11. SL Value
The spindle load value for the SL monitor is displayed.
Unit : A
Setting Range : 0 – 999.9

12. AC Value
The spindle load value for the AC monitor is displayed.
Unit : A
Setting Range : 0 – 999.9

13. THAIR
The time that cleaning air is discharged after using through-spindle coolant, or the coolant suction time is displayed.
This item is displayed when the through-spindle coolant option is provided.
Unit : 1 sec
Setting Range : 0 – 99 (0 – 99 sec.)

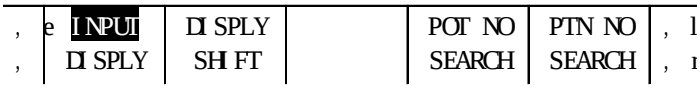
14. ATC Arm Rotation Speed Data for Each Tool (option)
A "!" is displayed to the right of the tool number when the ATC arm is operated at the low speed.
This item is blank when the arm is rotated at the normal speed.

2.4.2 Soft Keys

1. Types of Soft Keys

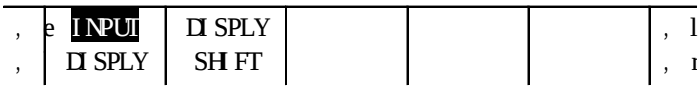
A. Display Mode (cursor not displayed)

B. Input Mode, Pot No./Tool No. Search Status



C. "Status" Displayed in Input Mode

D. Other Than "Status" Displayed in Input Mode



2. Soft Key Description

- INPUT DISPL : Used to change between the display mode and input mode. The highlighted mode is the mode which is currently selected.

- DISPLY SHIFT : Used to change between tool data display items
(Pot No., PTN and Kind are always displayed.

- PTN NO SEARCH : Used to search for a tool (PTN) number. The search operation can be performed by entering the tool number and pressing this soft key.

- POT NO SEARCH : Used to search for a pot number. The search operation can be performed by entering the pot number and pressing this soft key.

- ALARM RESET : Displayed when the input mode is active. It is used to reset the tool alarm displayed under “Status”.
(TL, SL, AC, BT, B2 alarms)

- MS : Displayed when the input mode is active. This key is used to change between the po No., search/tool No., search menu, and th other menu.

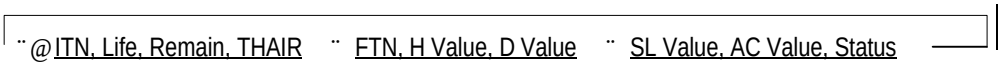
2.4.3 Screen Operations, Data Setting Procedure

All data on the tool detail screen can be overwritten.

2.4.3.1 Display Shift

There are 12 display items for each tool. These appear on three different screens.

The display items change as follows each time the [DISPLY SHIFT] soft key is pressed (Pot No., PTN and Kind are always displayed):



2.4.3.2 Resetting Alarms

This procedure enables TL, SL, AC, BT and B2 alarms displayed in red under Status to be reset.

Operation Procedure

1. Activate the input mode. The [ALARM RESET] soft key is displayed.

2. Move the cursor to Status.

3. Press the [ALARM RESET] soft key.

Only tool alarms can be reset with this alarm reset key. These differ from machine alarms.
A machine alarm is triggered when a tool alarm occurs, and the alarm lamp on the main control panel lights. This machine alarm cannot be reset by resetting the tool alarm on the tool detail screen.

Restart operation after resetting the machine alarm by pressing the [ALARM RESET] soft key on the PC alarm screen. (Refer to section 2.7, Alarm Screen, for details.)

2.4.3.3 Searching for Tool/Pot Numbers

1. Enter the tool or pot number you wish to search for.

2. The page with the entered number is displayed when the [PTN NO SEARCH] or [POT NO SEARCH] soft key is pressed.
   When the input mode is active, the cursor moves to the same item as before the search was performed.

2.4.3.4 Overwriting Spindle Tool, Next Tool Data

In the event the spindle tool or next tool is lost, or needs to be changed when ATC operation stops at an intermediate point due to an emergency stop, alarm or other cause, the procedure in this section is used.

1. Activate the maintenance mode on the maintenance screen.
   Procedure to Select Maintenance Mode
   A. Select the maintenance screen. (Refer to section 2.2.3.1, Screen Selection.)
   B. Display the machine status display page.
   C. Press the [MODE SELECT] soft key to activate the maintenance mode.

2. Return to the primary operation screen with the maintenance mode active, and select the tool detail screen. (Refer to section 2.9, Maintenance Screen, for details.)

3. Activate the input mode.

4. Move the cursor to the spindle tool or next tool pot number.

The spindle tool/next tool number cannot be overwritten unless the maintenance mode is activated.

5. Enter the data.

6. The tool data is automatically set according to the spindle tool/next tool pot number entered in step 5. The spindle tool data is displayed in green, and the next tool data is displayed in yellow.

7. Select the maintenance screen again.

8. Press the [MODE SELECT] soft key to cancel the maintenance mode. This completes the setting procedure.

2.4.3.5 ATC Arm Rotation Speed Setting for Each Tool (option)

This function allows the ATC arm rotation speed to be set to the "Normal mode" or "Slow mode."

1. Align the cursor to the right of the tool number on the tool detail screen.

2. Enter "0" at the normal mode. (Nothing appears to the right of the tool number.) Enter "1" at the slow mode. ("!" appears to the right of the tool number.)

When the slow speed has been specified for the spindle tool or next tool, the ATC arm is rotated at the slow speed.

2.5 Tool Monitor Screen

The tool monitor screen is displayed when the [TOOL MONITR] soft key is pressed on the primary operation screen.

There are the following three functions on the tool monitor screen:
1. Spindle tool status display
2. Display and turning auto tool monitor function On and Off
3. Display of auto tool monitor function alarms

There are two different tool monitor screen pages; a Setting page on which the spindle tool load current/tool life display and monitor mode settings are made, and a Load page on which the load current values for the spindle and feed axes are displayed.
Refer to the Auto Tool Monitor Function chapter for details on the tool monitor function.

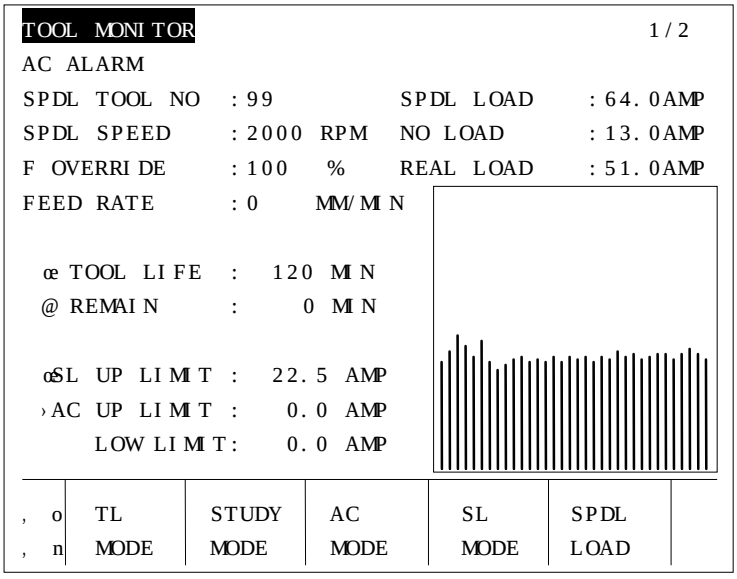


FIGURE 2-9 TOOL MONITOR SCREEN, SETTING PAGE

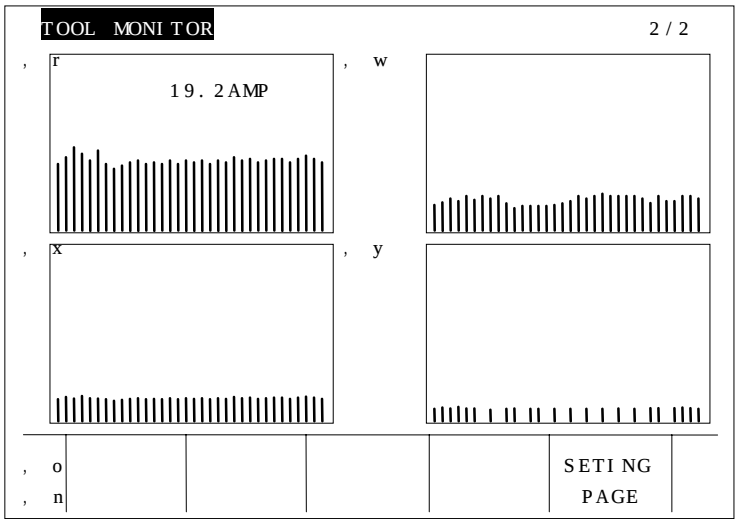


FIGURE 2-10 TOOL MONITOR SCREEN, LOAD PAGE

2.5.1 Display Content

1. Spindle Tool Number
   The number of the tool clamped in the spindle is displayed.
   When the spindle tool has been returned to the ATC magazine by the T0 command (spindle is empty), nothing is displayed.

2. Spindle Speed
   The actual spindle speed is displayed, taking into consideration any spindle override.
   Unit : RPM

3. Feed Override
   The feed override value is displayed.
   Unit : %

4. Actual Feed Rate
   The actual feed rate is displayed, taking into consideration any feed override.
   Unit : mm/min or inch/min (depending upon specifications)

5. Spindle Load
   There are three types of spindle load displays. The [SPDL LOAD] soft key is used to change between these.
   Unit : AMP

   A. Current Spindle Load Current Display
      The current spindle load value is displayed.
      The color changes depending upon the amount of current.
      The value in parentheses indicates the spindle motor load fac-

tor.
White : Within continuous rating
Yellow : Within 30 minute rating
Red : Above 30 minute rating

B. Current Spindle Load Current, No Load Current, Real Load Current
The current spindle load current, no load current and real (actual) load current are displayed.
SPDL LOAD: Spindle load current value
NO LOAD : Load current value when spindle is under no load
REAL LOAD: Actual load current due to cutting
(Real load current = Load current – No load current)

C. Spindle Load/Real Load Current When Tool Monitor Alarm Occurred
When a tool monitor alarm has occurred, the spindle load current and actual load current when the alarm was triggered are displayed in red. This screen is only displayed when a tool monitor alarm occurs (appears automatically).
SPDL LOAD: Spindle load current value
REAL LOAD: Actual load current due to cutting
(Real load current = Load current – No load current)

6. Tool Life
The tool life is displayed.
Time, distance or machining quantity can be selected for tool life.
"●" (pink) is displayed when the TL (tool life management) mode is On, and "O" is displayed when it is Off.
Unit : Time
Distance (m or inch) (according to specifications)
Machining quantity
Setting Range : 0 – 99999

7. Remaining Life (Cumulative value)
The remaining tool life is displayed.
When cumulative value display has been selected, the tool usage time is displayed.
Unit : Time
Distance (m or inch) (according to specifications)
Machining quantity
Setting Range : 0 – 99999

8. SL Upper Limit Value
The SL mode On/Off status and SL monitor upper value are displayed.
"●" (pink) is displayed when the TL (tool life management) mode is On, and "O" is displayed when it is Off.
When the load current exceeds this upper limit, an SL monitor alarm is triggered.
Unit : AMP

9. AC Upper Limit Value

The AC mode On/Off status and AC monitor upper value are displayed. "●" (pink) is displayed when the AC mode is On, and "O" is displayed when it is Off.
When the load current exceeds this upper limit, feed override is reduced. An AC monitor alarm is triggered when the feed override rate drops to 40% or below.
Unit : AMP

10. AC Lower Limit Value
The AC monitor upper value is displayed (AC setting x 0.875 + No load current). Feed override is applied when the load current drops below the lower limit value.
Unit : AMP

11. tudy Coefficient Setting

The study mode On/Off status, SL/AC coefficients and settings are displayed. "●" (pink) is displayed when the study mode is On, and "O" is displayed when it is Off. Refer to the AutoTool Monitor Function chapter for details on the study mode.

Unit : AMP

The SL/AC monitor and study mode are displayed in almost the same location on the screen. When the study mode is turned On, the display changes from the SL/AC monitor to study display.
The AC coefficient indicates the multiplication factor for the AC monitor value, and the SL coefficient indicates the multiplication factor for the SL monitor value.
The AC/SL setting values are displayed on the monitor while the study mode is active.
The displayed settings are calculated as follows: AC coefficient x Real load current, SL coefficient x Real load current.

12. Spindle Load Current Bar Graph

A bar graph of the current spindle load value is displayed in the box indicated by "S". One bar graph line indicates an approximate interval of 0.1 second. The bar graph color changes depending upon the size of the load current.

Blue : Until load current stabilizes when spindle is started
White : Within continuous rating
Yellow : Within 30 minute rating
Red : Above 30 minute rating

Triangular marks are provided to the left of the bar graph as a guideline to the size of the load current.

Yellow : Continuous rating value
Red :30 minute rating value

When the SL mode is On, the SL monitor load current (upper limit) is displayed as a red line. When the AC mode is On, the AC monitor load current (upper limit and low limit) are displayed as blue lines.

13. Feed Axis Load Current Bar Graphs

The load current for the respective feed axes (X, Y, Z, B, A axes) is displayed as a bar graph. One bar graph line indicates an approximate interval of 0.1 seconds. The bar graph color is always green, even when the load current exceeds the continuous rating.

A triangular mark is provided to the left of the bar graph as a guideline to the size of the load current.

Yellow : Continuous rating value

14. Display When Tool Monitor Alarm Occurs (Load, Real Load, Bar Graph)
    A. When AC/SL Alarm Occurs
       When an AC or SL alarm occurs, the spindle load current and actual (real) load current due to cutting are displayed in red. Furthermore, the following information is displayed on the spindle load current bar graph:
       - AC alarm
       - SL alarm

    B. When TL/BTS Alarm Occurs
       When a TL or BTS alarm occurs, the following information is displayed on the spindle load current bar graph:
       - Tool life alarm
       - Broken tool alarm (for machines with a broken tool sensor)
       - Broken tool OT alarm (for machines with a broken tool sensor)

When a tool monitor alarm occurs, the details of the alarm are recorded for each tool. Refer to "Status" on the tool detail screen.

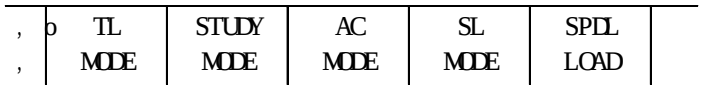
15. Alarm History (Load, Bar Graph)
    The spindle load current for the last AC or SL alarm that occurred is displayed on the load page.
    The load current at the time the alarm occurred is displayed in the bar graph for each axis. The following information is also displayed on the bar graph:
    - AC alarm history
    - SL alarm history

    Nothing is displayed if an AC or SL alarm has not occurred.

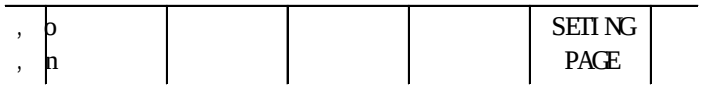
2.5.2 Soft Keys

1. Types of Soft Keys

A. Setting Page



B. Load Page



2. Soft Key Description

[TL MODE]	Turns tool life management function On and Off.
[STUDY MODE]	Turns study function On and Off.
[AC MODE]	Turns AC monitor function On and Off.
[SL MODE]	Turns SL monitor function On and Off.
[SPDL LOAD]	When this key is pressed, the display changes back and forth between display of spindle load current only and display of load current, no load current and real load current.
[SETTING PAGE]	Pressing this key changes between the load page and setting page. The page keys on the LCD control panel can also be used to change between pages.

2.5.3 Screen Operations

2.5.3.1 Changing Between Axis Bar Graph Displays

The page keys on the LCD control panel are used to change from the setting page to the load page, and from the load page to the setting page ([Setting Page] soft key can also be used).

2.5.3.2 Turning Tool Monitor On and Off

The operation procedure is the same for the TL, study, AC and SL functions.

Operation Procedure

1. The respective tool monitor mode is turned On or Off when the [TL MODE], [STUDY MODE], [AC MODE], or [SL MODE] soft key is pressed.

2. "●" (pink) is displayed when the mode is On, and "O" is displayed when it is Off.

1. Study Mode
   When the study mode is turned On while the AC mode or SL mode is On, the A mode or SL mode is turned Off.
   This mode cannot be turned On when the dry run mode is On. Likewise, the study mode cannot be turned On when the dry run mode is On.
2. AC, SL Modes
   When the AC mode or SL mode is turned On while the study mode is On, the study mode is turned Off.
   The AC mode/SL mode cannot be turned On while the dry run mode is On, and the dry run mode cannot be turned On while the AC mode or SL mode is On.

2.5.3.3 AC, SL Alarm History Display Procedure

The display changes as follows each time the page key is pressed:

→ Setting Page → Load Page → History

2.6 Help Screen

The help screen is displayed when the [HELP] soft key is pressed on the primary operation screen.

There are two functions on the help screen:
1. Display of machine side ROM version
2. Display of M code list

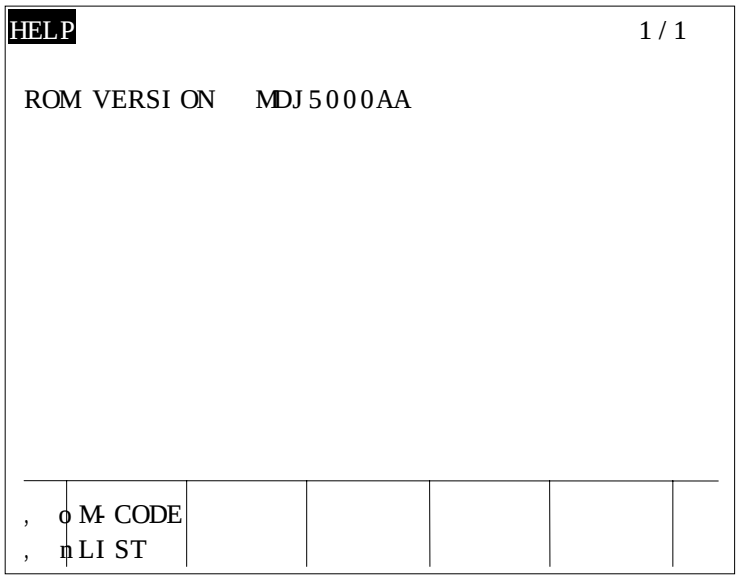


FIGURE 2-11 HELP SCREEN, MENU PAGE

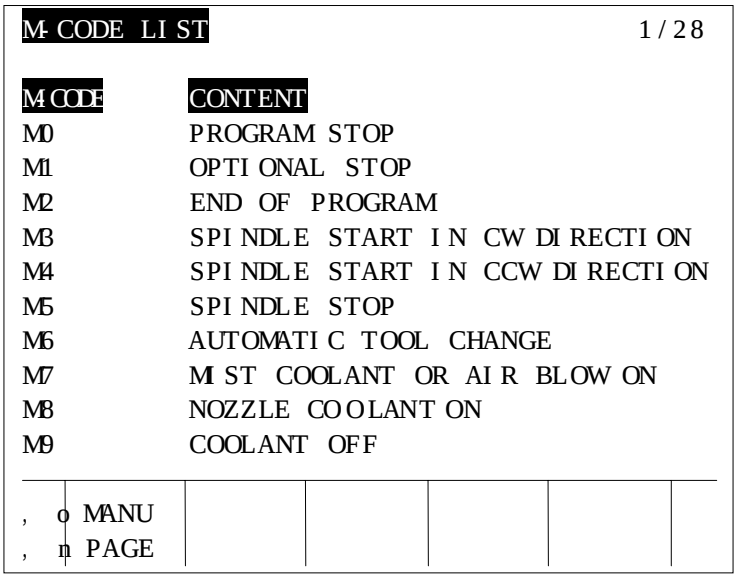
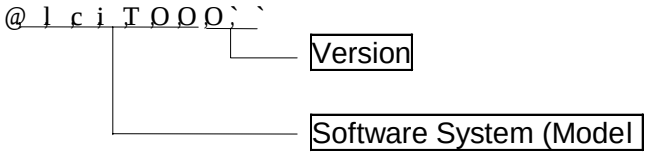


FIGURE 2-12 HELP SCREEN, M CODE LIST PAGE

2.6.1 Display Content

1. ROM Version
   The machine side software system and version are displayed.
   The system indicates the machine model, and the version indicates the revision history. Please check this screen when informing Makino of the software system and version in the event of a problem.
   "MDJ5000" shown below is the model (V55 in this case), and "AA" indicates the version.

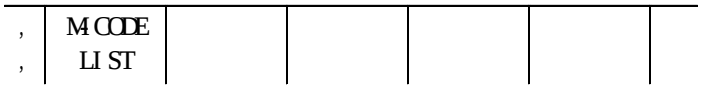


2. List of M Codes
   The M codes and their respective functions are displayed.

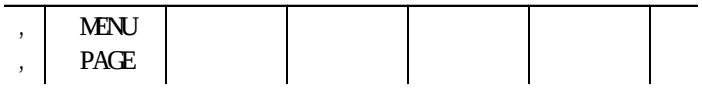
2.6.2 Soft Keys

1. Types of Soft Keys

   A. Menu Page



   B. M Code List Page



2. Soft Key Description

[M-CODE LIST]	Displayed on the menu page. Changes screen to the M code list page.
[MENU PAGE]	Displayed on the M code list page. Changes screen to the menu page.

2.6.3 Screen Operations

2.6.3.1 Changing Between Menu Page and M Code List Page

1. Menu Page → M Code List Page

   The M code list page is displayed when the [M-CODE LIST] soft key is pressed on the menu page.

2. M Code List Page → Menu Page

   The menu page is displayed when the [MENU PAGE] soft key is pressed on the M code list page.

2.6.3.2 M Code List Page Operations

Change between screens on the M code list page with the page keys.

2.7 Alarm Screen

The alarm screen is displayed when the [ALARM] soft key is pressed on the primary operation screen.

There are three functions on the help screen:
1. Display of alarm details
2. Display example
3. Display of alarm record

The machine diagram on the machine alarm screen differs depending on the ATC magazine capacity, but the messages which appear are the same.

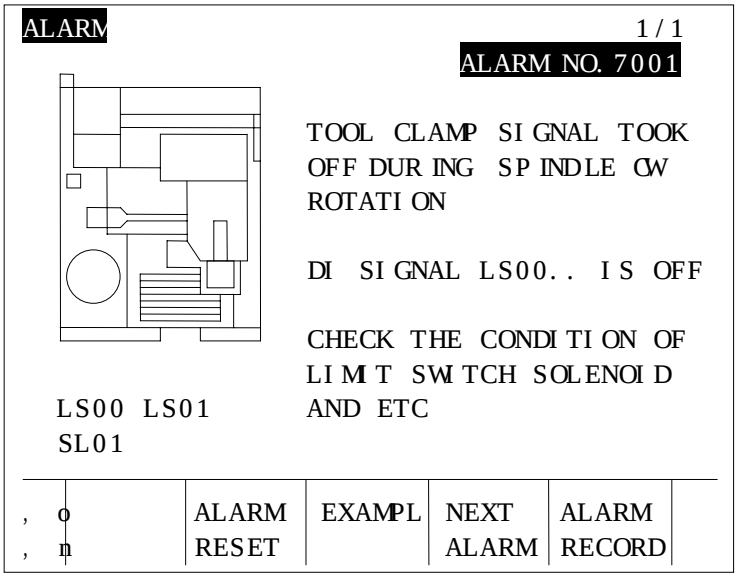


FIGURE 2-13 ALARM SCREEN (15-/25- OOL ATC)

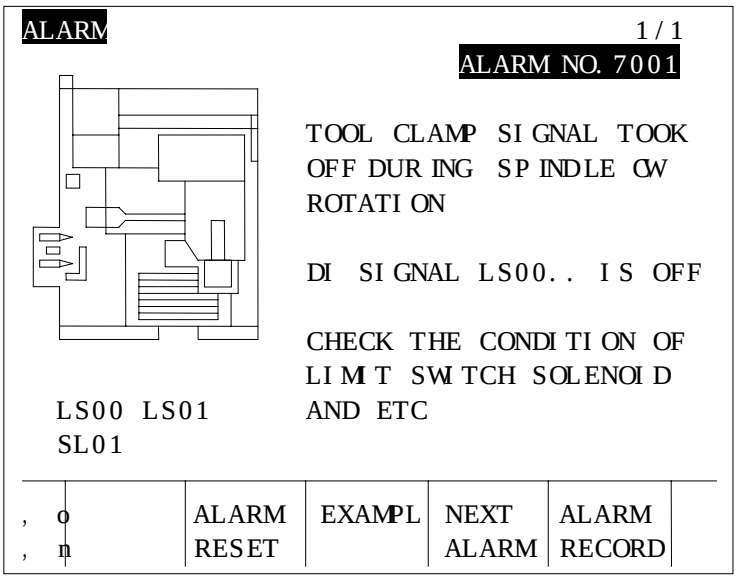


FIGURE 2-14 ALARM SCREEN (40-TOOL ATC)

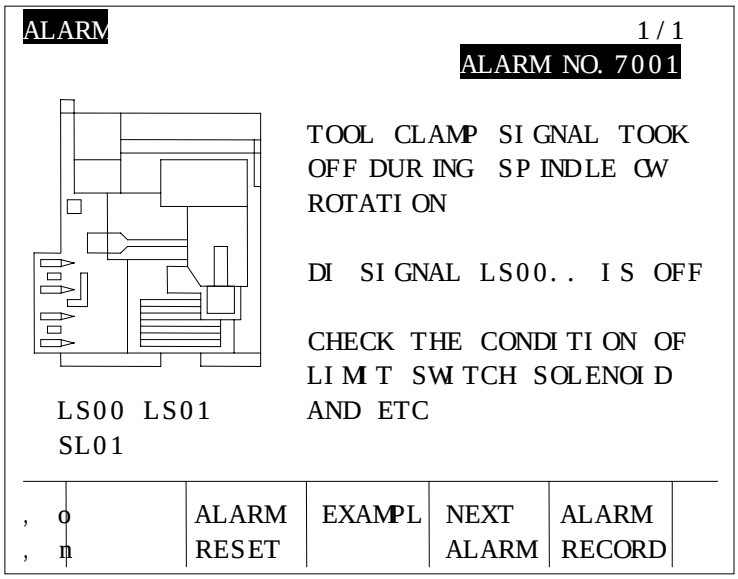


FIGURE 2-15 ALARM SCREEN (80-TOOL ATC)

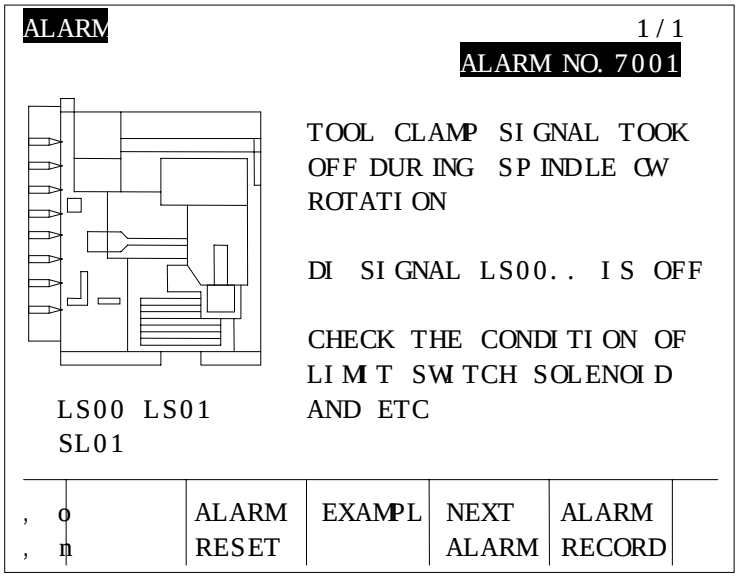


FIGURE 2-16 ALARM SCREEN (MATRIX ATC MAGAZINE)

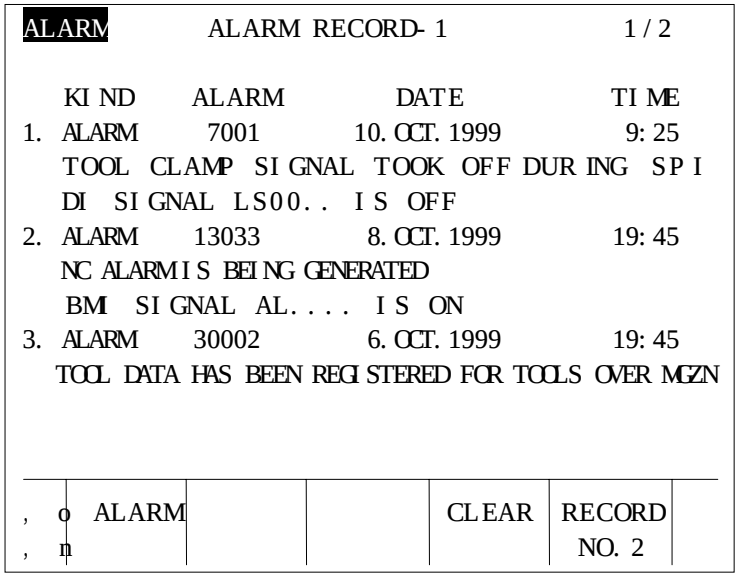


FIGURE 2-17 ALARM SCREEN, RECORD PAGE 1

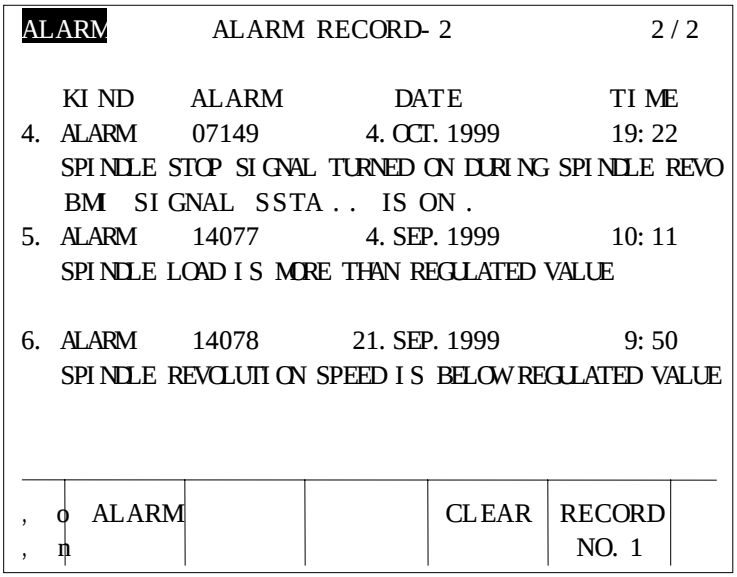


FIGURE 2-18 ALARM SCREEN, RECORD PAGE 2

2.7.1 Display Content

1. Machine Diagram and Device Position Display
   The location of the limit switch, solenoid or other device which triggered the alarm is shown on a diagram of the machine, looking from the top.
   Nothing is displayed when no alarm has occurred.

2. Alarm Related Signal Display
   The name of the limit switch (LS), solenoid (SOL) or other device which triggered the alarm is displayed. This corresponds with the diagram explained in item 1.
   Nothing is displayed when no alarm has occurred.

3. Alarm No.
   This indicates the alarm number.
   Nothing is displayed when no alarm has occurred.

4. Next Alarm
   This is displayed when multiple alarms have occurred.

5. Alarm Description
   The cause of the alarm and status are displayed.
   Nothing is displayed when no alarm has occurred.

6. Signal Name
   The name of the signal which caused the alarm and status are displayed.
   Nothing is displayed when no alarm has occurred.

7. Restore Procedure
   The procedure to restore operation is displayed.
   Nothing is displayed when no alarm has occurred.

8. Example Display
   An example of an alarm can be displayed.

9. Alarm Record
   The alarms that have occurred to date are displayed, starting with the most recent alarm. The last 100 alarms are displayed in alarm record 1, and the last 20 alarms are stored in alarm record 2.
   This information is retained when power is turned off.

10. Alarm No.
    This corresponds to the alarm No. on the alarm screen (item 3.).

11. Kind
    This indicates whether it is an alarm or warning. This corresponds to

the alarm/warning lamp display on the main control panel.

12. Date
    This indicates the date that the alarm occurred.

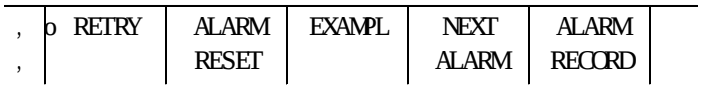
13. Time
    This indicates the time that the alarm occurred.

14. Description
    A description of the alarm is provided. This corresponds to the description in item 5.

2.7.2 Soft Keys

1. Types of Soft Keys

   A. Alarm Screen



   B. Alarm Record Screen

2. Soft Key Description

[RETRY]	Displayed when operation can be continued after the machine has been stopped by an alarm.Operation is restarted when this soft key is pressed.
[ALARM RESET]	Used to reset the alarm. Press this key after eliminating the cause of the alarm. The alarm will not be reset if the cause is not eliminated.
[EXAMPL]	Pressing this soft key displays an example of an alarm. EXAMPL appears at the top of the screen at this time.
[NEXT ALARM]	When multiple alarms have occurred,this key displayds the next alarm.
[ALARM RECORD]	Displays alarm record screen.
[ALARM]	Displays alarm screen.

2.7.3 Screen Operations

2.7.3.1 Changing Between Screens

1. Alarm Screen → Record Screen

   The alarm record screen is displayed when the [ALARM RECORD] soft key is pressed.

2. Record Screen → Alarm Screen

   The alarm screen is displayed when the [ALARM] soft key is pressed.

2.7.3.2 Alarm Screen Operations

1. Example
   An example of an alarm is displayed when the [EXAMPL] soft key is pressed.

2. Retry
   This soft key is displayed when operation can be continued after the machine has been stopped by an alarm.

   Operation is restarted when the [RETRY] soft key is pressed.
   To cancel the operation, press the [ALARM RESET] soft key.

3. Next Alarm
   When multiple alarms have occurred, another alarm is displayed by pressing the [NEXT ALARM] soft key.

2.8 Diagnose (I/O Data) Screen

The diagnose (I/O data) screen is displayed when the [DIAG- NOSE] soft key is pressed on the primary operation screen. This screen has DI/DO signal status display functions.

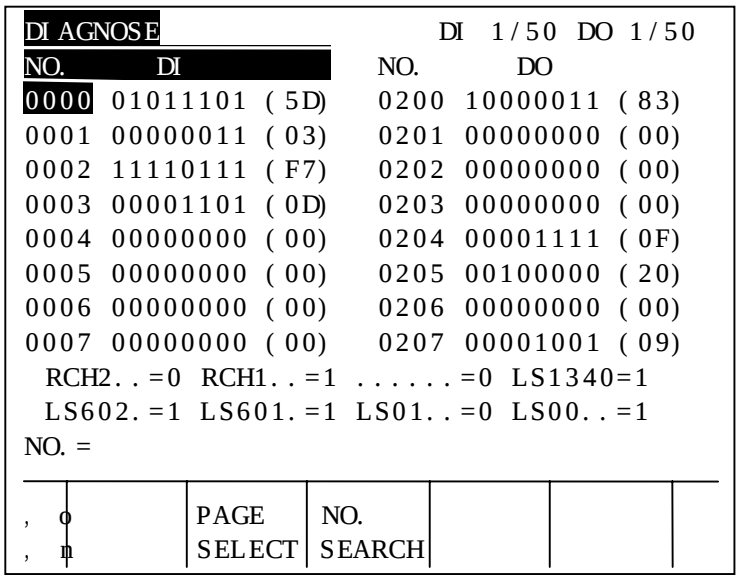


FIGURE 2-19 DIAGNOSE (I/O DATA) SCREEN

2.8.1 Display Content

1. Page (DI/DO)
   There are 50 DI and 50 DO pages. The respective page number is displayed at the top right of the screen.

2. NO.
   This indicates the diagnose number. The DI (input) signals are shown on the left side of the screen, and the DO (output) signals are shown on the right side. Each signal consists of 8 digits.

Diagnose No.		Description
000 – 095	:	Machine input signals (On/Off status of limit switches, thermal switches, etc.)
096 – 107	:	Main control panel input signals (On/Off status of switches)
200 – 295	:	Machine output signals (On/Off status of solenoids, motors, etc.)
296 – 303	:	Main control panel output signals (On/Off status of lamps)
500 – 799	:	Input signals from NC to machine side
800 – 991	:	Output signals from machine side to NC

1. Refer to the Machine I/O Table chapter for the names and meaning of diagnose No. 000 – 303.
2. Refer to "Interface Between CNC and PMC" in the "FS16M/FS16i Connection Manual" for signal Nos. 500 – 901. Diagnose No. 500 corresponds to the F000 address, and diagnose No. 800 corresponds to the G000 address.

3. Input/Output
   The status of each diagnose No. signal is displayed using 8 bits. The far right digit is the 0 bit. The value in parentheses ( ) indicates the 8 bit data as a hexadecimal number.

4. Signal Name
   The signal name and On/Off status of the diagnose No. signal bit where the cursor is located are displayed.
   "1" indicates the signal is On, and "0" indicates it is Off.

```
   Bit 7  @    Bit 6  @    Bit 5  @  Bit 4
  @  «    @@     «           «          «
RCH2..=0  @RCH1..=1  @.....=0  @LS1340=0

   Bit 3  @  Bit 2  @     Bit 1  @    Bit 0
  @  «    @@    «  @@@      «           «
LS602.=1   LS601.=0   LS01..=1  LS00..=1
```

5. NO=
   This is displayed when searching for a diagnose No.

2.8.2 Soft Keys

1. Types of Soft Keys

,	o	PAGE SELECT	NO. SEARCH			
,						

2. Soft Key Description

[PAGE SELECT]	Used to change between the input (DI) side and output (DO) side pages.
[NO. SEARCH]	Pressed to search for a diagnose No.

2.8.3 Screen Operations

2.8.3.1 Changing Between Screens

1. The [PAGE SELECT] soft key is used to change between the input (DI) and output (DO) side pages.

2. The selected page is highlighted in green.

3. Change between screen pages (1 – 50) using the page keys on the MDI keyboard.

2.8.3.2 Cursor Movement

The cursor is moved with the cursor keys.
The signal name display changes as the cursor is moved.

2.8.3.3 Diagnose No. Search Procedure

1. Enter the diagnose No.
   The entered data appears to the right of [NO=].

2. Press the [NO. SEARCH] soft key.

3. The selected cursor moves to the entered diagnose number. The signal name display changes at this time.

The highest diagnose No. is 991. If a number higher than this is entered, the cursor moves to diagnose No. 991.

2.9 Maintenance Screen

The maintenance screen is displayed when the [MAINT- ENANCE] soft key is pressed on the primary operation screen.

There are three functions on the maintenance screen:
1. Display of machine status
2. Selection of maintenance screens
3. Turning maintenance mode On and Off

When the machine is stopped, the status and cause (emergency stop, interlock, feed hold, servo Off) are displayed on the maintenance screen. The various maintenance screens are used to restore the machine to its normal operating condition (perform maintenance).

2.9.1 Machine Status Display Page

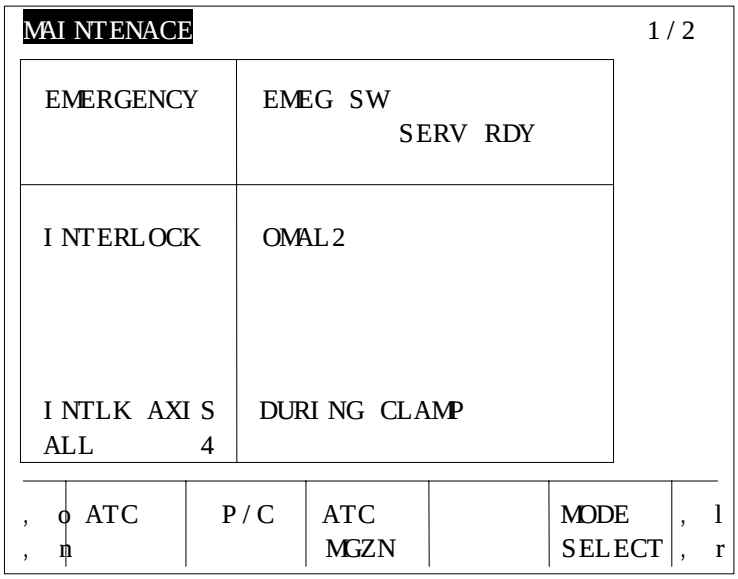


FIGURE 2-20 MAINTENANCE SCREEN, MACHINE STATUS DISPLAY PAGE NO. 1

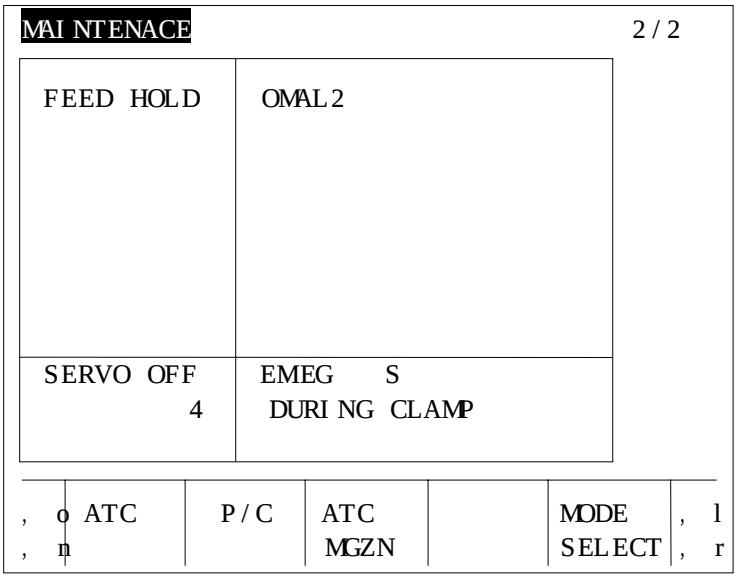


FIGURE 2-21 MAINTENANCE SCREEN, MACHINE STATUS DISPLAY PAGE NO. 2

2.9.1.1 Machine Status Display Page Content

When an emergency stop, interlock or feed hold is triggered, or when the servo goes Off, the status and cause are displayed on the machine status display page.

1. Emergency Stop
   When the machine has been stopped by an emergency stop, the cause is displayed in red. The message changes to white when the emergency stop status is reset.

2. Interlock
   When the machine is stopped by an axis interlock, the cause of the axis interlock is displayed in yellow
   The message changes to white when the axis interlock is released.

3. Interlock Axis
   The name of the axis stopped by the interlock is displayed.

4. Feed Hold
   When the machine is stopped by a feed hold, the cause of the feed hold is displayed in yellow. The message changes to white when the feed hold status is cancelled.

5. Servo Off
   The cause of the servo going Off is displayed in green. This changes to white when the servo Off status is cancelled.

6. Maintenance Mode

This is displayed when the maintenance mode is selected.

2.9.1.2 Machine Status Display Page Soft Keys

1. Types of Soft Keys

   A. Initial Status

   B. When [M S] Soft Key is Pressed

2. Soft Key Description

[ATC]	Selects ATC maintenance screen.
[P/C]	Selects P/C maintenance screen (option).
[ATC MGZN]	Selects ATC magazine maintenance screen.
[MEASUR SYSTEM]	Selects Marposs maintenance screen (option).
[MODE SELECT]	Used to change between the normal mode and the maintenance mode.
[M S]	Displayed when the machine is provided with a measuring system (option). Used to change menus.

2.9.1.3 Mode Operation

This operation is performed to change between the normal mode and the maintenance mode.

1. Press the [MODE SELECT] soft key to turn the maintenance mode On and Off.
   When the maintenance mode is selected, "MAINTENANCE MODE" appears at the top of the screen. The maintenance mode is turned On in order to restore the machine to its normal operating condition after the machine was stopped during ATC or ATC magazine operation.

2.9.2 ATC Maintenance Screen

The ATC maintenance screen is displayed when the [ATC] soft key is pressed on the machine status display page.

There are two types of screens depending on the ATC capacity: a 15-/25-Tool ATC Screen, and a 40-/80-Tool/Matrix ATC Screen.

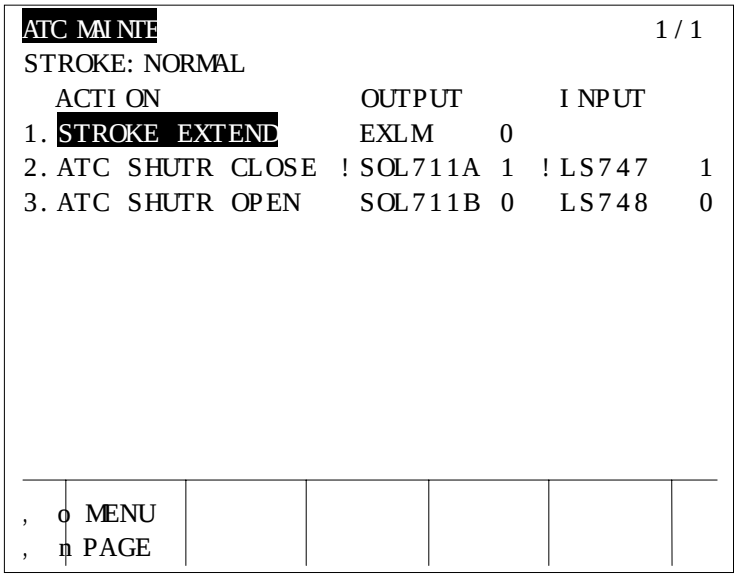


FIGURE 2-22 15-/25- TOOL ATC MAINTENANCE SCREEN

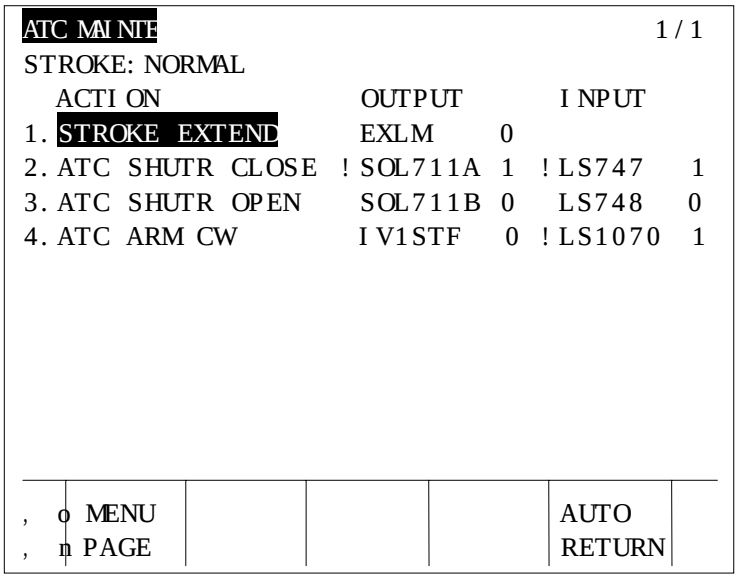


FIGURE 2-23 40-/80- TOOL/MATRIX TYPE ATC MAINTENANCE SCREEN

2.9.2.1 ATC Maintenance Screen Display Content

1. Stroke Status
   The X axis stroke limit status is displayed.

Display		Status
Normal	:	Stroke limit set within machining range
Extended	:	Stroke limit extended to allow ATC/tool length measuring operation

Normally, the X axis stroke is limited to the machining area, and a stroke limit alarm is triggered in the event a command exceeding this range is sent, preventing movement from being performed.
However, the stroke limit can temporarily be extended to move the X axis outside its stroke when performing an ATC or tool length measuring operation. The stroke limit is returned to its original setting upon completion of the operation.

2. Operation
   The respective ATC operation is displayed.
   A. Stroke extension
   B. Shutter close
   C. Shutter open
   D. ATC arm clockwise (only for 40-/80-tool or matrix type ATC)

3. Solenoids
   The solenoid On/Off status is displayed.
   "1" is displayed when the solenoid is On, and "0" when it is Off. "!" is displayed in green to the left of the solenoid name when it is in the standby status.

4. Limit Switches
   The limit switch On/Off status is displayed.
   "1" is displayed when the limit switch is On, and "0" when it is Off. "!" is displayed in green to the left of the limit switch name when it is in the standby status.

5. Maintenance Mode
   This is displayed when the maintenance mode is selected.

6. Single Mode
   This is displayed when the single mode is selected while the maintenance mode is active.

7. Jog Mode
   This is displayed when the jog mode is selected while the maintenance mode is active.

2.9.2.2 ATC Maintenance Screen Soft Keys

1. Types of Soft Keys

A. Normal Status

,	MENU				AUTO	
,	PAGE				RETURN	

B. Maintenance Mode

,	MENU	JOG		SOL	SOL	
,	PAGE	SINGLE		ON	OFF	

2. Soft Key Description

[MENU PAGE]	Selects machine status display page.
[JOG SINGLE]	Displayed when the maintenance mode is active. Used to change between the single mode and jog mode. The current mode is highlighted.
[SOL ON]	Displayed when the maintenance mode is active. Turns On the solenoid selected by the cursor.
[SOL OFF]	Displayed when the maintenance mode is active. Turns Off the solenoid selected by the cursor.
[AUTO RETURN]	Pressing this key when the machine has been stopped by an emergency stop or alarm during ATC operation automatically returns the ATC arm to the standby position.

2.9.2.3 ATC Maintenance Screen Operations

There are some cases where the spindle tool and next tool pot (tool) numbers differ from the actual tool numbers after completion of the maintenance operation. In this event, this data is changed on the tool detail screen. Refer to section 2.4.3.4, Overwriting Spindle Tool/Next Tool.

Manual Operation of Solenoids

1. @Select the maintenance mode on the machine status display page.

2. @Select the ATC maintenance screen.

3. @Select the item to be started by the maintenance operation with the cursor keys.

4. @Select the operation mode with the [JO SINGLE] soft key.
   The selected mode appears at the top of the screen.
   - EJOG Mode — Movement is performed while the [SOL ON] soft key is held down, and stops when it is released.
   - ESingle Mode — Operation is performed to the final point once the [SOL ON] soft key is pressed.

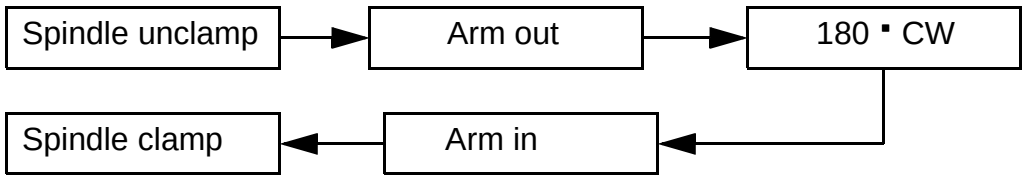
5. @Press the [SOL ON] or [SOL OFF] soft key.
   @@This enables the solenoid to be turned On or Off.
   @@When one solenoid is turned On, the opposite solenoid is automatically turned Off.
   The solenoid is only excited while the [SOL ON] soft key is pressed during the Jog mode.

An error message is displayed at the bottom of the screen when operation cannot be performed for the selected item.

ATC Automatic Restore Operation

The ATC arm is automatically returned to the standby position by pressing the [AUTO RETURN] soft key when the machine is stopped by an emergency stop or alarm during ATC operation, and the ATC arm is not at the standby status.
The maintenance mode does not need to be activated at this time.

Operation is restored according to the procedure described below, although this differs depending upon the status of the stopped ATC arm.



1. The automatic restore operation is performed even if the spindle is not at the orientation position, and the X/Z axes are not at their 2nd reference point. Therefore, make sure to pay special attention to the actual status of the spindle and the location of the X and Z axes.
2. The spindle tool number is not registered by the automatic restore operation. Make sure to compare the actual tool status with the registered tool data after the automatic restore operation is performed. Correct the data on the tool detail screen if any discrepancies are found. (Refer to section 2.4, Tool Detail Screen.)
3. The automatic restore operation can still be performed after the power has been turned off.
4. A machine alarm is triggered if the limit switch status prevents the automatic restore operation from being performed, indicating which signal is abnormal. In this case, restore operation manually, referring to the details of the alarm.
5. When ATC operation has been interrupted by an alarm, reset the alarm before performing the automatic restore operation. This operation cannot be performed until the alarm is reset.

2.9.3 P/C Maintenance Screen (Option)

The P/C maintenance screen is displayed when the [P/C] soft key is pressed on the machine status display page.

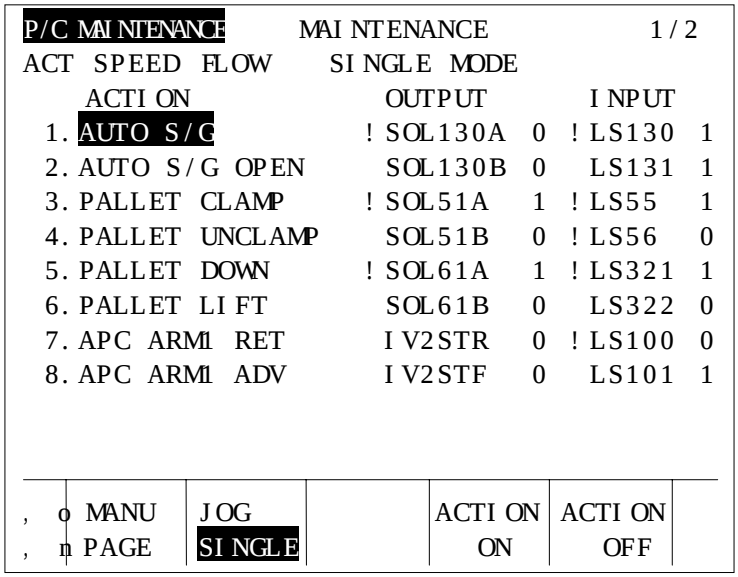


FIGURE 2-24 P/C MAINTENANCE SCREEN 1

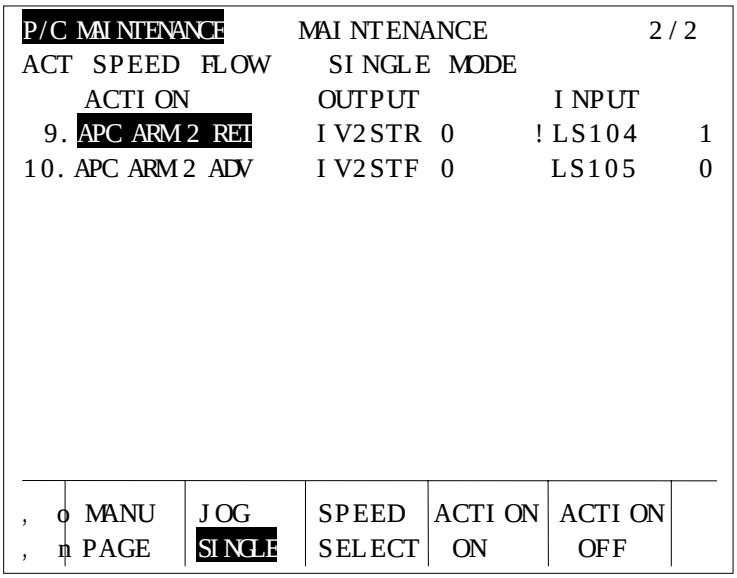


FIGURE 2-25 P/C MAINTENANCE SCREEN 2

2.9.3.1 P/C Maintenance Screen Display Content

1. Output
   The solenoid On/Off status is displayed.
   "1" indicates the solenoid is On, and "0" indicates it is Off.
   "!" is displayed in green to the left of the solenoid name when it is in the standby status.

2. Input
   The limit switch On/Off status is displayed.
   "1" indicates the limit switch is On, and "0" indicates it is Off.
   "!" is displayed in green to the left of the limit switch name when it is in the standby status.

3. Maintenance Mode
   "MAINTENANCE" is displayed at the top of the screen when the maintenance mode is selected. The maintenance mode is used to restore the machine to its normal operating status after it has been stopped during P/C operation.

4. Single Mode
   "SINGLE" is displayed when the single mode is selected while the maintenance mode is active.

5. Jog Mode
   "JOG" is displayed when the jog mode is selected while the maintenance mode is active.

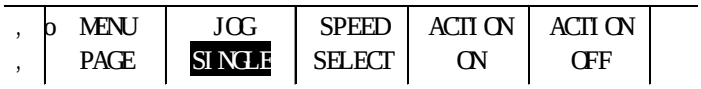
6. Operation (ACT) Speed
   This indicates the speed at which the machine is operated: Medium or Low.

2.9.3.2 P/C Maintenance Screen Soft Keys

1. Types of Soft Keys

A. Normal Status

B. Maintenance Mode



2. Soft Key Description

[MENU PAGE]	Selects machine status display page.
[JOG SINGLE]	Displayed when the maintenance mode is active. Used to change between the single mode and jog mode. The current mode is highlighted.
[SPEED SELECT]	Displayed when the maintenance mode is active. The operation speed is changed between medium and low speed each time this key is pressed. Low is the normal speed.
[ACTION ON]	Displayed when the maintenance mode is active. Turns the solenoid selected by the cursor On.
[ACTION OFF]	Displayed when the maintenance mode is active. Turns the solenoid selected by the cursor Off.

2.9.3.3 P/C Maintenance Screen Operations

Manual Operation of Solenoids

1. @Select the maintenance mode on the machine status display page.

2. @Select the P/C maintenance screen.

3. @Select the item to be started by the maintenance operation with the cursor keys.

4. @Select the operation mode with the [JOG SINGLE] soft key.
   The selected mode appears at the top of the screen.
   - EJOG Mode — Movement is performed whil the [ACTION ON] soft key is held down, and stops when it is released.
   - ESingle Mode — Operation is performed to the final point once the [ACTION ON] soft key is pressed.

5. @Press the [ACTION ON] or [ACTION OFF] soft key.
   @@This enables the solenoid to be turned On or Off.
   @@When one solenoid is turned On, the opposite solenoid is automatically turned Off.

   The solenoid is only excited while the [ACTION ON] soft key i pressed during the Jog mode.

1. Once the pallet clamp/unclamp solenoid (SOL51) on the P/C maintenance screen is turned On, it is not stopped until the [ACTION ON] soft key for the opposite item is pressed.
2. An error message is displayed at the bottom of the screen when the operation for a selected item cannot be performed.

2.9.4 ATC Magazine Maintenance Screen

2.9.4.1 ATC Magazine Maintenance Screen (Solenoids)

The ATC magazine maintenance screen (solenoids) is displayed when the [ª @PAG] or [« PAG] NC key is pressed after pressing the [ATC MGZN] soft key on the machine status display page.

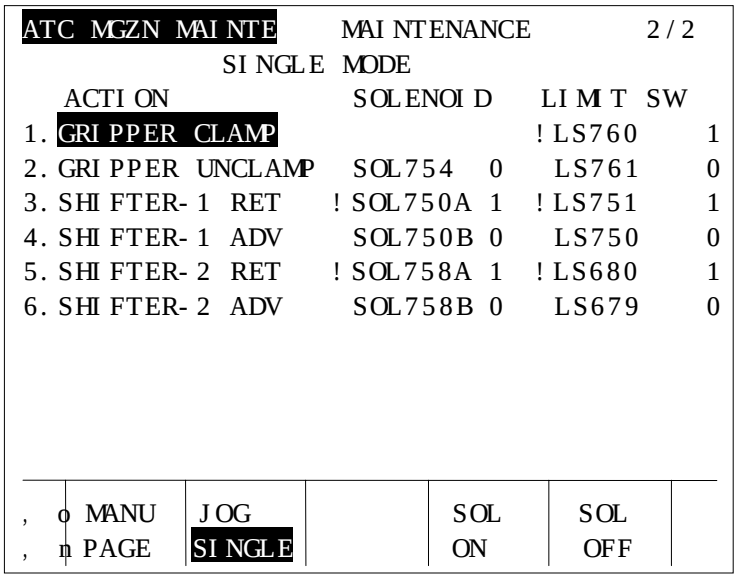


FIGURE 2-26 40- OOL ATC MAGAZINE MAINTENANCE SCREEN (SOLENOIDS)

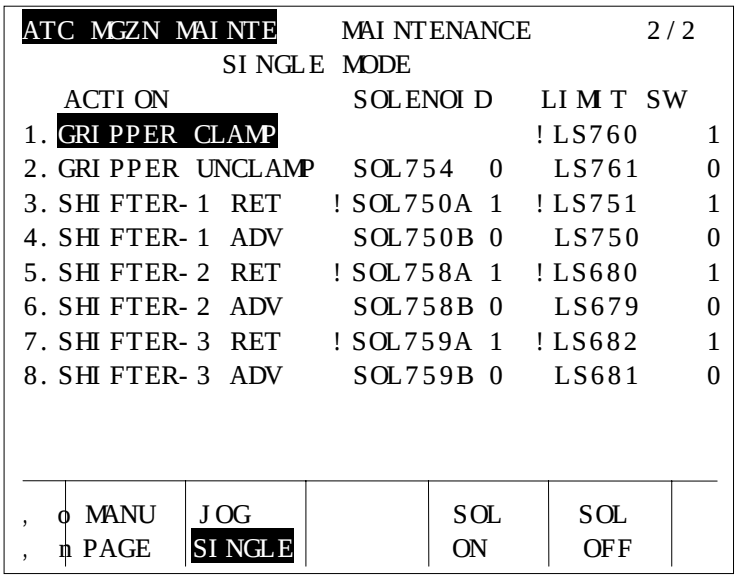


FIGURE 2-27 80- OOL ATC MAGAZINE MAINTENANCE SCREEN (SOLENOIDS)

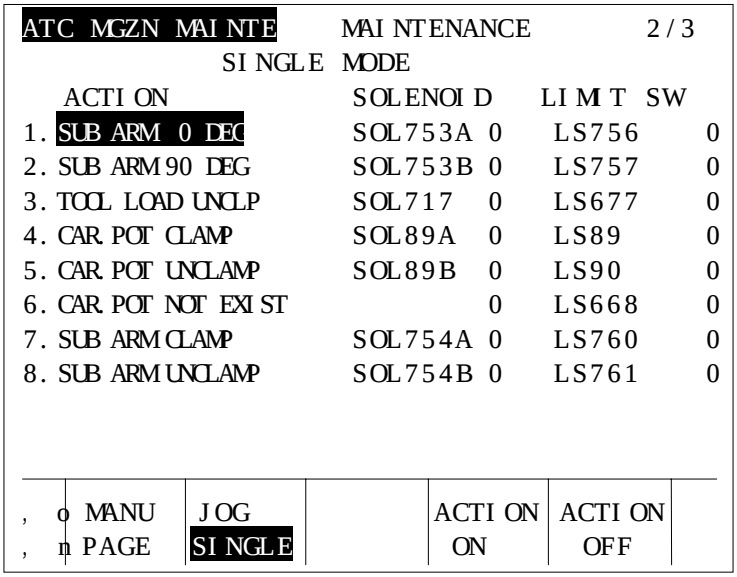


FIGURE 2-28 MATRIX TYPE ATC MAGAZINE MAINTENANCE SCREEN 1 (SOLENOIDS)

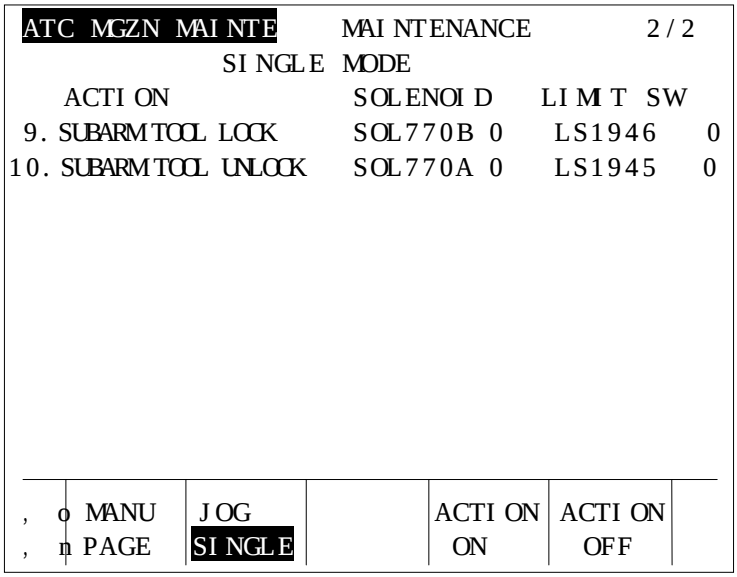


FIGURE 2-29 MATRIX TYPE ATC MAGAZINE MAINTENANCE SCREEN 2 (SOLENOIDS)

1. Solenoid
   The solenoid On/Off status is displayed.
   "1" indicates the solenoid is On, and "0" indicates it is Off.

2. Limit Switch
   The limit switch On/Off status is displayed.
   "1" indicates the limit switch is On, and "0" indicates it is Off.

3. Maintenance Mode
   "MAINTENANCE" is displayed at the top of the screen when the maintenance mode is selected. The maintenance mode is used to restore

the machine to its normal operating status after it has been stopped during ATC magazine operation.

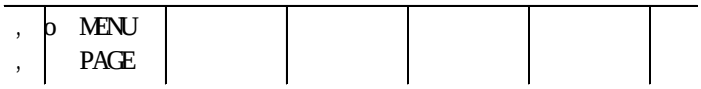
4. Single Mode
   "SINGLE" is displayed when the single mode is selected while the maintenance mode is active.

5. Jog Mode
   "JOG" is displayed when the jog mode is selected while the maintenance mode is active.

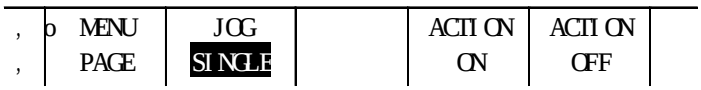
ATC Magazine Maintenance Screen Soft Keys (Solenoids)

1. Types of Soft Keys

   A. Normal Status



   B. Maintenance Mode



2. Soft Key Description

[MENU PAGE] ¥¥¥¥ Selects machine status display page.

[JOG SINGLE] ¥¥¥ Displayed when the maintenance mode is active. Used to change between the single mode and jog mode. The current mode is highlighted.

[ACTION ON] ¥¥¥¥ Displayed when the maintenance mode is active. Turns the solenoid selected by the cursor On.

[ACTION OFF] ¥¥¥¥ Displayed when the maintenance mode is active. Turns the solenoid selected by the cursor Off.

ATC Magazine Maintenance Screen Operations (Solenoids)

Manual Operation of Solenoids

1. @Select the maintenance mode on the machine status display page.

2. @Select the ATC maintenance screen (solenoids).

3. @Select the item to be started by the maintenance operation with the cursor keys.

4. @Select the operation mode with the [JO SINGLE] soft key.
   The selected mode appears at the top of the screen.
   - EJOG Mode — Movement is performed while the [ACTION ON] soft key is held down, and stops when it is released.
   - ESingle Mode — Operation is performed to the final point once the [ACTION ON] soft key is pressed.

2.9.4.2 ATC Magazine Maintenance Screen (Servos)

The ATC magazine maintenance screen (servos) is displayed when the [ATC MGZN] soft key is pressed on the machine status display page.

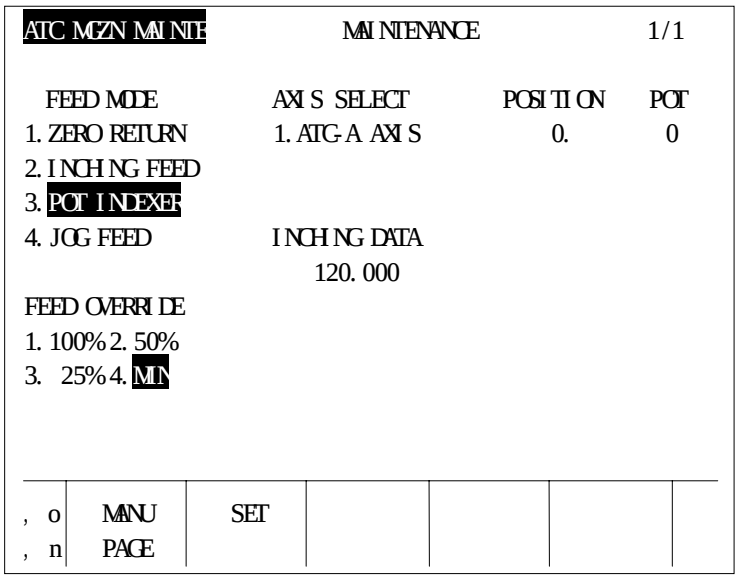


FIGURE 2-30 15-/25- OOL TYPE ATC MAINTENANCE SCREEN (SERVOS)

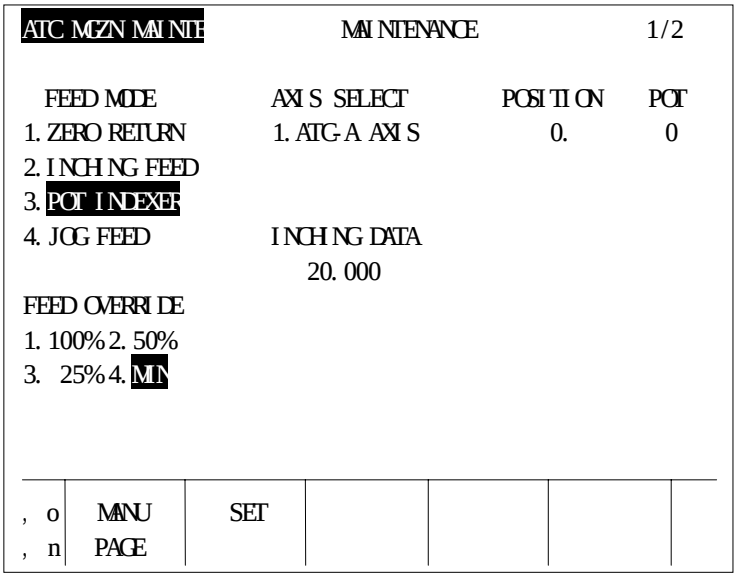


FIGURE 2-31 40- OOL TYPE ATC MAINTENANCE SCREEN (SERVOS)

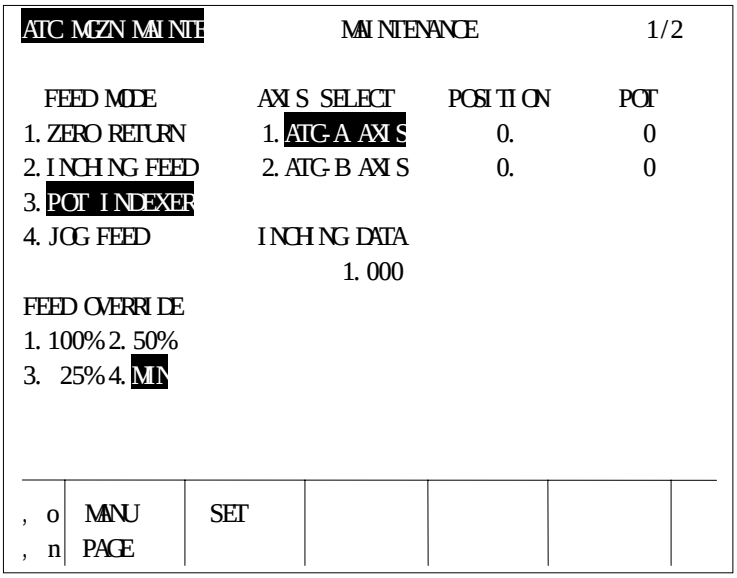


FIGURE 2-32 80- OOL TYPE ATC MAINTENANCE SCREEN (SERVOS)

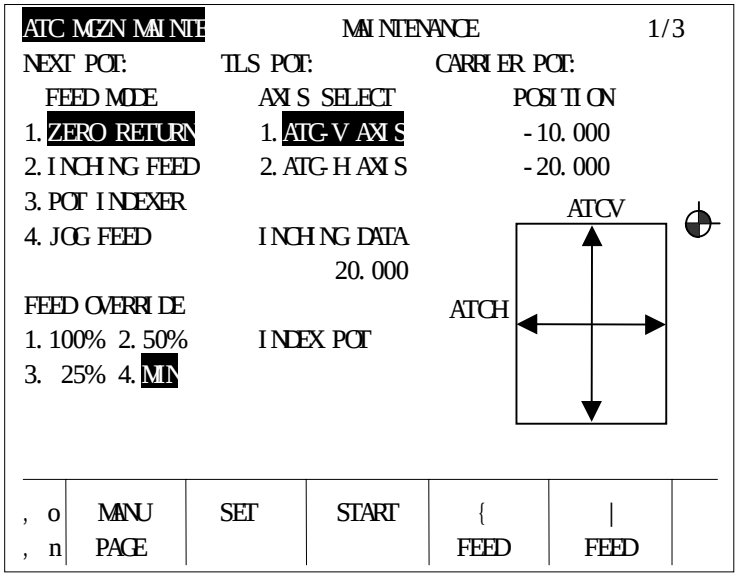


FIGURE 2-33 MATRIX TYPE ATC MAINTENANCE SCREEN (SERVOS)

ATC Mag. Maintenance Screen (Servos) Content

A number of locations are highlighted on the screen as follows:

Highlighted in white : Cursor
Highlighted in blue : Selected items

When the cursor is positioned on a selected item, it is highlighted in white.

1. Feed Mode
   The feed mode in which the ATC magazine is operated is displayed. The selected mode (reference [zero] point return, inching feed, pot indexing or jog feed) is highlighted in blue.

2. Feed Override
   This indicates the speed at which the magazine is operated. This is a percentage of the speed during automatic operation, considered to be 100%. The selected speed is highlighted in blue.

3. Feed Axis Select
   This indicates the ATC magazine axis.
   The selected axis is highlighted in blue.
   There is only one ATC magazine axis on 15-/25-tool and 40-tool ATC magazines.
   There are two axes on an 80-tool ATC magazine, an A axis and a B axis.
   Likewise, there are two axes on a matrix type ATC magazine, a V axis and an H axis.

4. Position (Coordinate Value)
   This indicates the coordinate value of each ATC magazine axis. "0" is the reference point.

5. Inching Data
   This indicates the movement distance in the inching feed mode.
   Setting Range : 0 – 99999.999 (° or mm)

6. Next Pot, TLS Pot, Carrier Pot

   A. NEXT POT : Indicates next tool pot number.

   B. TLS POT : Indicates tool number indexed to tool loading station.

   C. CARRIER POT : Indicates pot number in carrier pot.

The data for item A. to C. above can be overwritten in the maintenance mode.
Overwriting Pot Numbers
When a pot is moved using the maintenance or other operation, make sure that the actual machine status corresponds with the MPC5 internal memory (which is retained). The internal MPC5 memory data is displayed by "NEXT POT", TLS POT" and "CARRIER POT" on the maintenance screen. When necessary, align the cursor with the item you wish to change, and overwrite the pot number using the procedure described below:

1. Move the cursor to "NEXT POT", TLS POT" or "CARRIER POT."

2. Enter the pot number which corresponds to the actual pot number on the machine, and press the [INPUT] key. Any pot number from "0" to the highest pot number can be entered. Entering "0" indicates there is no pot. When "0" is entered, nothing is displayed.

7. Index Pot (Only displayed for matrix type magazine)
   This indicates the position to be indexed by the carrier pot.

ATC Magazine Maintenance Screen (Servos) Soft Keys

1. Types of Soft Keys

   A. Initial Status

   B. Maintenance Mode (15-/25-/40-/80-Tool ATC)

   C. Maintenance Mode (Matrix Type ATC)

2. Soft Key Description

[MENU PAGE]	Selects machine status display page.
[SET]	Sets feed mode or feed override.
[START]	Displayed when pot indexing is selected as feed mode while maintenance mode is active. This key is pressed to start pot indexing.
[+ FEED]	Displayed when maintenance mode is active. Used to move ATC magazine axes in jog mode or inching mode.
[– FEED]	Displayed when maintenance mode is active. Used to move ATC magazine axes in jog mode or inching mode.

ATC Mag. Maintenance Screen (Servos) Operations (15-/25-/40-/80-Tool ATC Magazines)

ATC Magazine Reference Point Return

1. Activate maintenance mode on machine status display page.
2. Align the cursor with Zero (reference point) Return, and press the [SET] soft key.

This mode cannot be selected during ATC magazine operation.

3. Align the cursor with a feed override value between MIN and 100% (MIN and 50% for 15/25-tool ATC), and press the [SET] soft key.
4. Press the [CW] key on the ATC control panel to perform zero point return after confirming the magazine position. The magazine is rotated while the [CW] key on the ATC control panel is held down, and automatically stops upon completion of zero (reference) point return.

An error message is displayed at the bottom of the screen when the ATC magazine cannot be operated.

ATC Magazine Inching Feed

In this mode, the magazine is rotated an amount equal to the inching setting.

1. Activate maintenance mode on machine status display page.
2. Align the cursor with Inching Feed, and press the [SET] soft key.

This mode cannot be selected during ATC magazine operation.

3. Align the cursor with a feed override value between MIN and 100%, and press the [SET] soft key.
4. Align the cursor with the inching setting.
5. Enter the movement distance in degrees (°).

6. To move the magazine in the clockwise direction, press the [CW] key on the ATC control panel after confirming the magazine position, and to move the magazine in the counterclockwise direction, press the [CCW] key . Once either key is pressed, the magazine is rotated the set inching distance, and automatically stops at this distance.

An error message is displayed at the bottom of the screen when the ATC magazine cannot be operated.

ATC Magazine Pot Indexing

When the [CW] or [CCW] key on the ATC control panel is pressed (and released), movement stops at the nearest pot position. This is the same as the manual intervention operation.

1. Activate maintenance mode on machine status display page.
2. Align the cursor with Pot Indexer, and press the [SET] soft key.

This mode cannot be selected during ATC magazine operation.

3. Align the cursor with a feed override value between MIN and 100%, and press the [SET] soft key.
4. The magazine is rotated when the [CW] or [CCW] key on the ATC control panel is pressed. Movement stops at the nearest indexing position when the key is released.

An error message is displayed at the bottom of the screen when the ATC magazine cannot be operated.

ATC Magazine Jog Feed

The magazine is rotated while the [CW] or [CCW] key on the ATC control panel is held down.

1. Activate maintenance mode on machine status display page.
2. Align the cursor with Jog Feed, and press the [SET] soft key.

This mode cannot be selected during ATC magazine operation.

3. Align the cursor with a feed override value between MIN and 100%, and press the [SET] soft key.

4. To move the magazine in the clockwise direction, press the [CW] key on the ATC control panel after confirming the magazine position, and to move the magazine in the counterclockwise direction, press the [CCW] key . The magazine is rotated while either key is held down, and stops when it is released.

An error message is displayed at the bottom of the screen when the ATC magazine cannot be operated.

ATC Mag. Maintenance Screen (Servos) Operations (Matrix Type ATC Magazine)

There are the following feed modes:

1. Zero Return — Performs zero (reference) point return.
2. Inching Feed — Moves magazine amount equal to inching setting (mm).
3. Pot Indexer — Performs axis movement to set indexing pot.
4. Inching Feed — Movement is performed while the [+ FEED] or [– FEED] soft key is held down.

ATC Magazine Reference Point Return

1. Activate maintenance mode on machine status display page.

2. Align the cursor with Zero (reference point) Return, and press the [SET] soft key.

This mode cannot be selected during ATC magazine operation.

3. Align the cursor with a feed override value between MIN and 100%, and press the [SET] soft key.

4. Align the cursor with the axis you wish to return to the zero point, and press the [SET] soft key.

5. Press the [+ FEED] soft key to perform zero point return from the – direction after confirming the carrier position. The magazine is rotated while the soft key is held down, and automatically stops upon completion of zero (reference) point return.

An error message is displayed at the bottom of the screen when the ATC magazine cannot be operated.

ATC Magazine Inching Feed

1. Activate maintenance mode on machine status display page.
2. Align the cursor with Inching Feed, and press the [SET] soft key.

This mode cannot be selected during ATC magazine operation.

3. Align the cursor with a feed override value between MIN and 100%, and press the [SET] soft key.
4. Align the cursor with the axis you wish to move, and press the [SET] soft key.
5. Align the cursor with the inching setting (input line appears).
6. Enter the movement distance in millimeters (mm).
7. After confirming the carrier position, press the [+ FEED] soft key to move in the + direction, and press the [– FEED] to move in the – direction. Once either key is pressed, the magazine is moved the set inching distance, and automatically stops at this distance.

An error message is displayed at the bottom of the screen when the ATC magazine cannot be operated.

ATC Magazine Pot Indexing

1. Activate maintenance mode on machine status display page.

2. Align the cursor with Pot Indexer, and press the [SET] soft key.

This mode cannot be selected during ATC magazine operation.

3. Align the cursor with a feed override value between MIN and 100%, and press the [SET] soft key.

4. Align the cursor with the axis you wish to move and press the [SET] soft key.

5. Align the cursor with Pot Indexer (input line appears).

6. Enter the position to which the axis is to be moved.
   One of the following values should be entered:
   - 1 – 999 : Positioning is performed at the entered pot for the AV axis. Positioning is performed at the route for the entered pot for the AH axis.
   - A : Positioning is performed at the change position with the ATC sub arm.
   - D : Positioning is performed on route 1 for the AH axis.
   - T : Positioning is performed on the TLS route for the T.L.S. Ah axis.

Positioning is performed on the TLS for the AV axis.
T.L.S.:Tool Loading Station

7. When the [SET] soft key is pressed after confirming the cartridge axis position, axis movement is performed to the set indexing pot position. An error message appears at the bottom of the screen when ATC magazine operation cannot be performed.

ATC Magazine Jog Feed

1. Activate maintenance mode on machine status display page.
2. Align the cursor with Jog Feed, and press the [SET] soft key.

This mode cannot be selected during ATC magazine operation.

3. Align the cursor with a feed override value between MIN and 100%, and press the [SET] soft key.
4. Align the cursor with the axis you wish to move, and press the [SET] soft key.
5. After confirming the carrier pot position, press the [+ FEED] soft key to move in the + direction, and press the [– FEED] to move in the – direction.

   Movement is performed while the soft key is held down, and stops when it is released.

An error message is displayed at the bottom of the screen when the ATC magazine cannot be operated.

2.9.5 Measuring System Maintenance Screen (Option)

The Marposs maintenance screen is displayed when the [MEASUR SYSTEM] soft key is pressed on the machine status display page.

The probe battery and communication status with the measuring system is displayed on this page. This screen only has a display function. No operations can be performed.

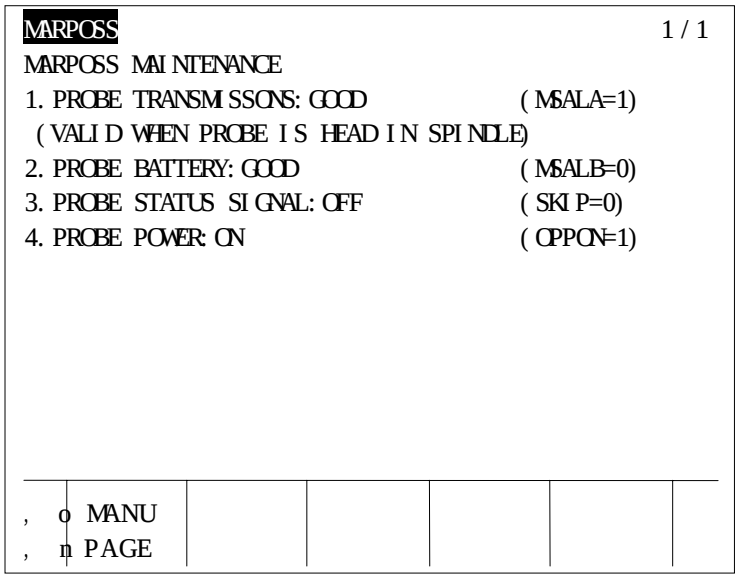


FIGURE 2-34 MARPOSS MAINTENANCE SCREEN

2.9.5.1 Measuring System Maintenance Screen Content

1. Probe and Receptor Status
   This indicates whether or not the communication status between the probe and receptor is good. This is only valid when the probe is installed in the spindle and the measuring mode is activated.

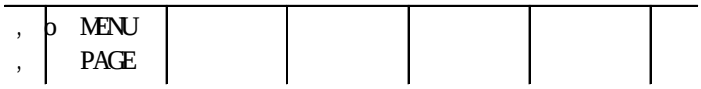
2. Probe Battery Status
   This indicates the status of the probe battery.

3. Skip Signal Status
   This indicates the On/Off status of the skip signal. It is only valid when measuring is being performed.

4. Probe Power Status (only displayed on Marposs maintenance screen)
   This indicates the On/Off status of probe power

2.9.5.2 Measuring System Maintenance Screen Soft Keys

1. Types of Soft Keys



2. Soft Key Description

[MENU PAGE] Selects machine status display page.

2.10 Machine Parameter Screen

The machine parameter screen is displayed when the [PARA- METER] soft key is pressed on the primary operation screen. The machine parameter screen has parameter display and setting functions.
Refer to the Explanation of Machine Parameters chapter for the changing of machine parameter settings.

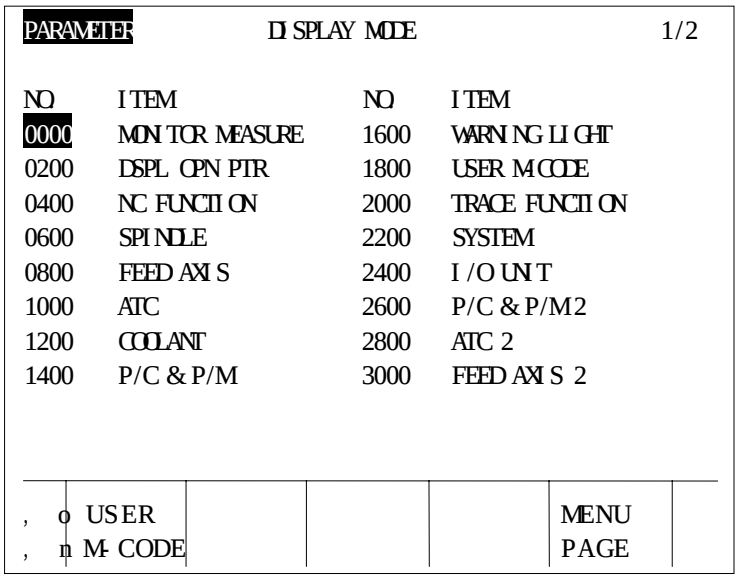


FIGURE 2-35 MACHINE PARAMETER SCREEN (ITEM SELECTION PAGE)

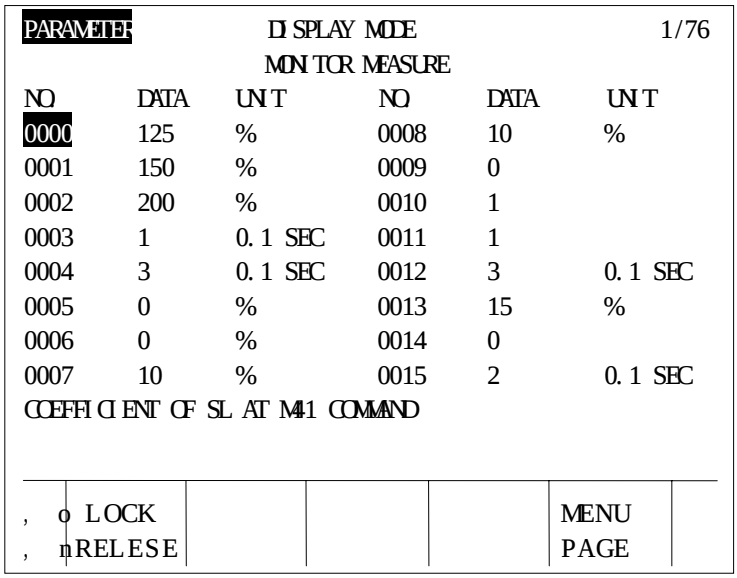


FIGURE 2-36 MACHINE PARAMETER SCREEN (CONTENT DISPLAY PAGE)

2.10.1 Parameter Screen Content

1. Display Mode
   This is displayed in the display mode. The cursor appears at this time.

2. No.
   This indicates the parameter number

3. Item
   This indicates the parameter item.

4. Input Mode
   This is displayed when the lock is released on the content display page. Parameters can be set in the input mode.

5. Data
   This indicates the parameter value.

6. Unit
   This indicates the unit for each parameter.

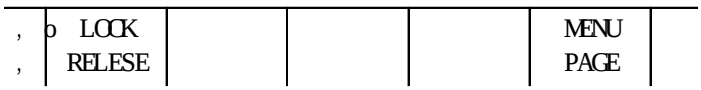
7. Message
   A description of the parameter is displayed.

2.10.2 Parameter Screen Soft Keys

1. Types of Soft Keys

   A. Item Display Page (Initial Status)

   B. Content Display Page (Display Mode)



   C. Content Display Page (Input Mode)

2. Soft Key Description

[MENU PAGE]	Changes screen from item select page to content display page, and from content display page to item select page.
[LOCK RELESE]	Allows password to be entered in order to release lock. This key is highlighted in yellow when it is pressed.
[USER M-CODE]	Changes to user M-code screen (option).

2.10.3 Parameter Screen Operations

2.10.3.1 Changing from Item Select to Content Display Page

1. Move the cursor to the item to be displayed with the cursor keys.
2. Press the [MENU PAGE] soft key or page keys to change pages.

The cursor moves to the lowest parameter number for the selected item, and that content page is displayed.

2.10.3.2 Changing from Content Display to Item Select Page

Press the [MENU PAGE] soft key to change from the content display page to the item select page.

2.10.4 User M Code Screen (Option)

The user M code screen is displayed when the [USER M-CODE] soft key is pressed on the menu page. The user M code screen enables standard Makino M code to be replaced with unique user M codes, and display of the current settings.

There are two user M code screens, with 10 codes displayed on each screen, for a total of 20.

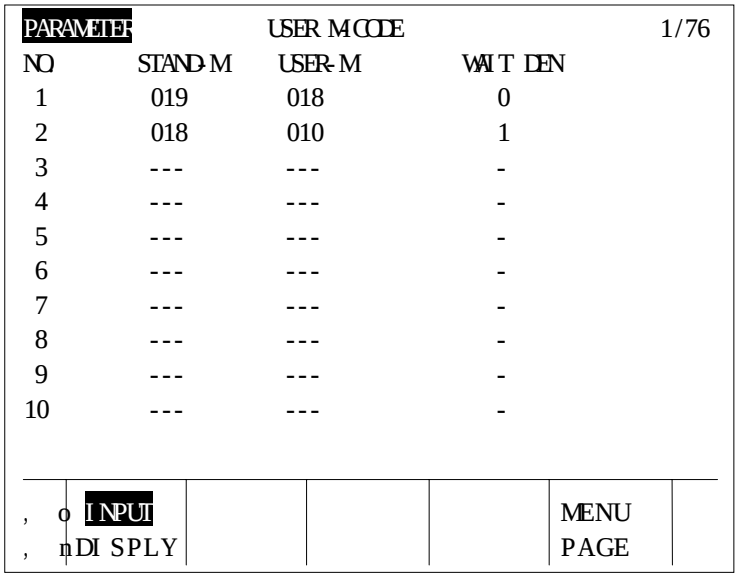


FIGURE 2-37 USER M CODE SCREEN

2.10.4.1 User M Code Screen Content

1. NO.
   A total of 20 user M codes can be registered. The standard M code, user M code and whether or not the system waits for completion of axis movement are set for each code.

2. Standard M Code
   The standard M code is displayed.

3. User M Code
   The unique user M code is set.

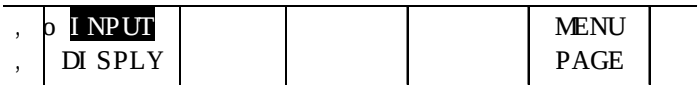
4. Wait DEN
   When an axis movement command is sent in the same block as the unique user M code, this setting specifies whether or not the system waits for completion of axis movement before executing the M code.
   Setting Content
   1 : M code is executed after completion of axis movement
   0 : M code is executed without waiting for completion of axis

movement

2.10.4.2 User M Code Screen Soft Keys

1. Types of Soft Keys

A. Initial Status



B. Input Mode

2. Soft Key Description

[MENU PAGE]	Used to change from user M code screen to item display page.
[INPUT DISPLY]	Changes between input mode and display mode. This soft key is pressed in order to enter data.
[DATA CANCEL]	Clears all user M code data set on the screen.
[INIT SET]	Enables user M code to be set for each user.

2.10.4.3 User M Code Screen Operations

User M Code Settings

The procedure to change the setting so that the function of standard M code M▲▲ is used as user M code M❑❑ is described in this section.

1. Press the [INPUT DISPLY] soft key to select the input mode.
2. Align the cursor with the desired standard M code ith the cursor keys.
3. Use the MDI keyboard to enter the ▲▲ digit for the selected M▲▲ code.
4. Move the cursor to the user M code on the same line as the standard M code set in step 3.
5. Enter the ❑❑ digit for the user M❑❑ code.
6. Move the cursor to the Wait DEN setting on the same line.
7. Enter “0” if the user M code is to be executed at the same time when there is axis movement in the same block, and enter “1” if the system should wait for completion of axis movement before executing the M code.

Changing from User M Code to Item Select Page

Press the [MENU PAGE] soft key to change from the user M code screen to the item select page.

2.11 Regular Maintenance Screen

The regular maintenance screen is displayed when the [REGULR MAINT] soft key is pressed on the primary operation screen.

There are two functions on the regular maintenance screen:
1. Display and completion of regular maintenance inspection items
2. Display example

There are three types of regular maintenance: Weekly, Six month and Yearly. The next inspection date is automatically calculated from the date/ time set by parameter No. 266, and the inspection items are displayed on the regular inspection day when the machine power is turned On.

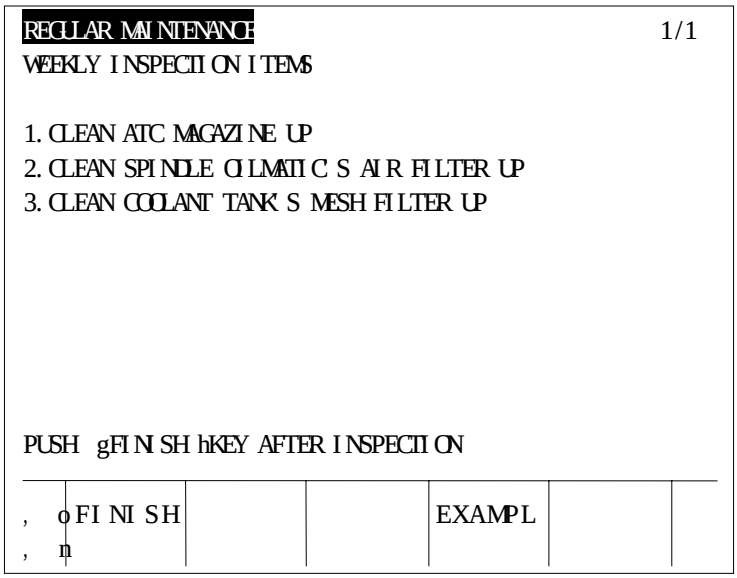


FIGURE 2-38 REGULAR MAINTENANCE SCREEN (WEEKLY)

2.11.1 Display Content

1. "IT IS NOT INSPECTION TIME YET"
   Displayed when this screen is displayed on a day other than a regular maintenance day.

2. Weekly, Six Month, Yearly Inspection Items
   Indicates the type of inspection items.

3. Display
   The inspection items are displayed.

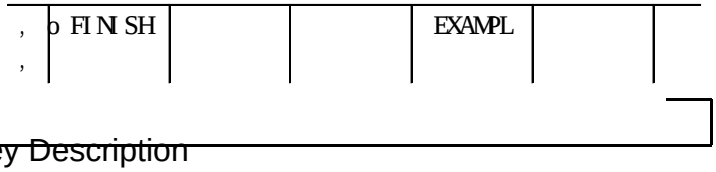
4. PUSH "FINISH" KEY AFTER INSPECTION
   Instruction to operator upon completion of inspection.

5. EXAMPLE

A display example can be displayed.

2.11.2 Soft Keys

1. Types of Soft Keys



2. Soft Key Description

[FINISH]	Used when the inspection is completed. (Appears on inspection day, and when example is displayed.)
[EXAMPL]	Inspection item examples are sequentially displayed when this key is pressed. (Allows display on a day which is not an inspection day.)

2.11.3 Screen Operations

2.11.3.1 Weekly, Six Month, Yearly Inspection Days

Inspection instructions are displayed on the weekly, six month and yearly inspection days when the power is turned On.

1. When this screen is displayed when power is turned On, perform the inspection according to the instructions on the screen.

2. Make sure to press the [FINISH] soft key when the inspection is completed. This notifies the system the inspection has been finished.

3. The next set of inspection items is displayed on a day when multiple inspections are to be performed.

4. To change to another screen after all inspections have been completed, press the [P O] soft key to select the primary operation screen. Refer to the primary operation screen for the screen selection procedure.

The system does not consider the inspection to have been completed if the [FINISH] soft key is not pressed upon completion of the inspection.
In this case, the inspection screen will be displayed when the power is turned On again.

2.11.3.2 Display Example

This function allows an example of the inspection screen to be displayed on a day which is not an inspection day

Examples are displayed in the following sequence when the [DISPLY] soft key is pressed:

→ Original screen → Weekly → Six month → Yearly

Chapter 3 PC Screens

(Type 10.4 Color LCD/MDI Panel)

V33, V55

Professional 3

Chapter 3
PC Screens

Contents

A variety of switches and buttons appear in the explanation of the PC screens (Type 10.4 Color LCD/MDI Panel).

The following conventions are used for the soft keys, NC keys and control panel buttons in this chapter.

Example

Soft Keys 

→ JOG @SINGLE n

NC Ke 

→ INPUT

Control Panel 

→ LIGHTING v

3.1 LCD Control Panel

3.1.1 LCD Control Panel

Type 10.4 color LCD/MDI panel is used for this machine. Hereinafter, it will be called the LCD control panel. The [CUSTOM] NC key on the LCD control panel is used to display the PC screens.

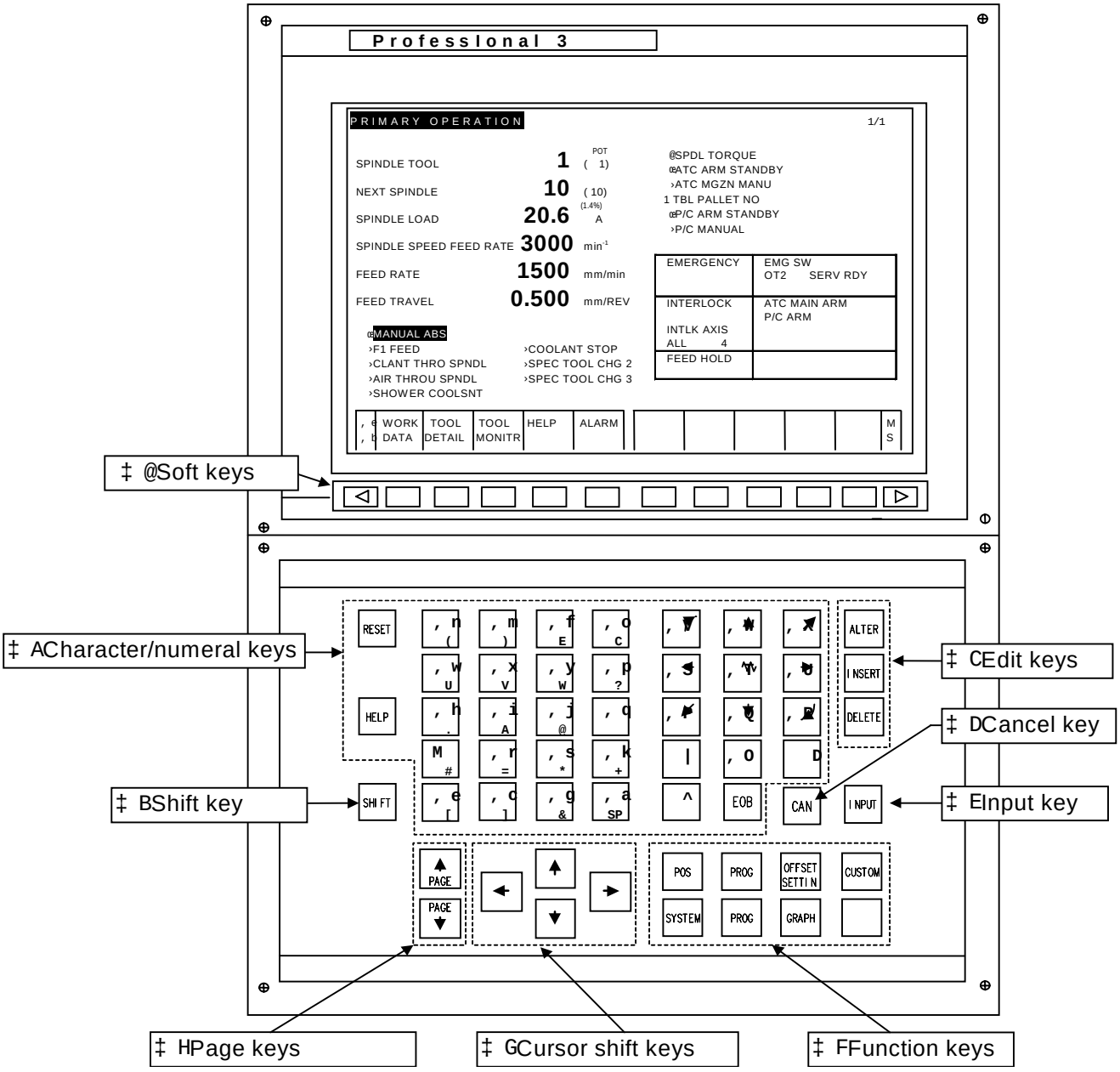


FIGURE 3-1 LCD CONTROL PANEL

* The V55 screen is shown above.

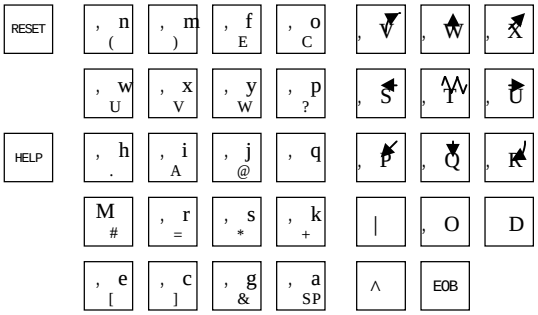
3.1.2 Keyboard Explanation

The basic operation procedures are the same as those described in the FANUC Series 16 / FANUC Series 16i Instruction Manual.
The keys used for the Professional 3 are described in this section.

1. Soft Keys

A variety of functions are allocated to these keys, depending upon the function. The function which is currently allocated is displayed at the bottom of the LCD display as a menu.

2. Character/Number Keys



These keys are used to enter letters and numbers.

3. Shift Key 

Two characters are inscribed on some keys. The shift key is used to enter the character inscribed on the lower right.

4. Edit Keys 

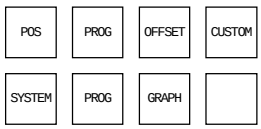
   The [DELETE] NC key is used to delete all data displayed on the input line. However, its functions differ on some screens.
   The edit keys other than the Delete key are only used on the work data screen. Refer to section 3.3, Work Data Screen, for details.

5. Cancel Key 

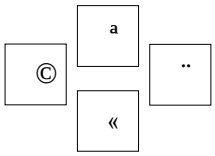
   This key is used to delete one character from the input line.
   (Refer to section 3.1.4.3, Entering and Setting Data, for details on the input line.)

6. Input Key 

   This key is used to enter the data displayed on the input line.
   (Refer to section 3.1.4.3, Entering and Setting Data, for details on the input line.)

7. Function Keys 

   The [CUSTOM] key is used to change from the NC screen to the PC screen. It is also used to change back from the PC screen to the NC screen.

8. Cursor Keys 

These keys are used to move the cursor.

9. Page Keys 

These keys are used to change between screen pages.

3.1.3 PC Screens

PC screens will be called screens hereinafter. There are ten types of screens, including the optional functions.

1. Primary Operation Screen
   A. Machine status display
   B. Screen selection
   C. Turning functions/modes On and Of

2. Work Data Screen
   A. Setting and display of work data

3. Tool Data (Detail) Screen
   A. Setting and display of tool data

4. Tool Monitor Screen
   A. Spindle tool status display
   B. Display and turning On and Off auto tool monitor function
   C. Auto tool monitor function alarm display

5. Help Screen
   A. Display of machine side software version
   B. Display of M code content

6. Alarm Screen
   A. Display of alarm details
   B. Display example
   C. Display of alarm record

7. Diagnose (I/O Data) Screen
   A. Display of DI/DO signal status

8. Maintenance Screen
   A. Machine status display
   B. Status display and maintenance operations for ATC, P/C, ATC magazine and auto tool/workpiece measurement.

9. Parameter Screen
   A. Setting and display of parameters

10. Regular Maintenance Screen
    A. Display and completion of regulation inspection items
    B. Display of daily inspection items
    C. Display example

3.1.4 Screen Operations

3.1.4.1 Changing Between Screens

Normally, the NC screen is displayed when power is turned On. However, when the power is turned On on a day specified for regular maintenance (weekly, monthly, six-month, yearly), the inspection items are displayed on the PC Regular Maintenance Screen.

1. Changing from NC Screen to PC Screen (other than regular maintenance)

   A. Press the [CUSTOM] NC key.

   B. The PC screen is displayed.
      The primary operation screen is displayed when you change to the PC screen immediately after power is turned On. In other cases, the PC screen displayed before changing to the NC screen appears again.

2. For Regular Maintenance

   A. Perform the inspections displayed on the screen.

   B. Press the [FINISH] key upon completion of the inspections.
   This completes the inspection procedure, and automatically sets the next inspection date.

   C. On a day when there are multiple regular inspections, the next group of inspection items is displayed.

   D. To change to another screen after all inspections have been completed, first press the [P O] soft key to display the primary operation screen. Refer to the primary operation screen for the screen selection procedure.

The inspection procedure is not completed until the [FINISH] soft key is pressed after completion of the actual inspection.
This screen is displayed again when power is turned On.
Refer to the Regular Maintenance Screen for details.

3.1.4.2 Changing Between Pages

There are two keys which are used to change between pages:

[ª @PAG]	Displays previous page. The last page is displayed when pressed on the first page.
[« @PAG]	Displays next page. The first page is displayed when pressed on the last page.

3.1.4.3 Entering and Setting Data

Data entry and setting can be performed when the [INPUT OUTPUT] soft key is displayed.

A. Press the [INPUT OUTPUT] soft key to select the input mode. When the input mode is activated, [INPUT] is highlighted, [INPUT =] appears on the menu at the bottom left portion of t screen, and the cursor is displayed. [INPUT =] is called the input line.

B. Use the cursor keys to align the cursor with the data.

C. Enter the data with the character/number keys. The entered dat appears on the input line.

D. Use the following keys to correct the data when a mistake is made:

CAN	Deletes one character from input line.
DELETE	Deletes all data from input line.

E. Press the NC INPUT key after confirming that all data displayed on the input line is correct.

F. An error message is displayed when the data on the input line is not within the prescribed scope. Correct the data using the procedures in steps C and D above.

3.2 Primary Operation Screen

The primary operation screen is displayed when the PC screen is first selected, or when the [P O] soft key is pressed on any of the PC screens.

There are the following three functions on the primary operation screen:
1. Machine status display
2. Screen selection
3. Turning functions or modes On and Off

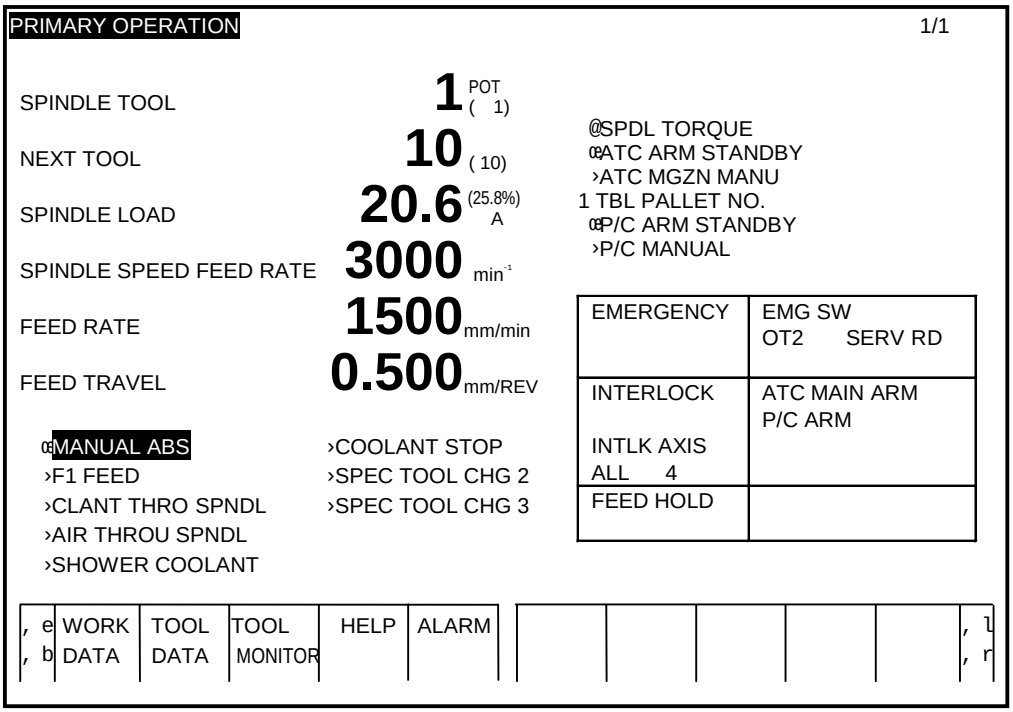


FIGURE 3-2 PRIMARY OPERATION SCREEN (INITIAL STATUS)

3.2.1 Display Content

1. Spindle Tool
   This indicates the tool number that is clamped in the spindle.
   When the spindle tool has been returned to the ATC magazine by the T0 command, and the spindle is empty, nothing is displayed.
   The number in parentheses indicates the pot number

2. Next Tool
   This indicates the tool number which is indexed to the ATC position. Nothing is displayed when no tool has been indexed to the ATC position. The number in parentheses indicates the pot number.

3. Spindle Load
   This indicates the spindle motor load as a current value. The color changes depending upon the amount of current.
   White : Within continuous rating
   Yellow : Within 30 minute rating
   Red : Above 30 minute rating
   Unit : A (amperes)

   The value at the right indicates the load factor.

4. Spindle Speed Feed Rate
   This indicates the spindle rotation speed, including any change effected by spindle override.
   Unit : min^{-1}

5. Feed Rate
   This indicates the actual machine feed rate.
   Unit : mm/min or inch/min (depending upon specifications)

6. Feed Rate per Revolution
   This indicates the feed rate per spindle revolution.
   Unit : mm/min or inch/min (depending upon specifications)

7. Machine Status Display
   A. Emergency
      This is displayed in red when the machine is in the emergency stop status. It changes to white when the emergency stop status is reset.

   B. Interlock
      This is displayed in yellow when the machine is stopped by an axis interlock. It changes to white when the axis interlock is reset.

   C. Interlock Axis
      The name of the axis which is stopped by the interlock status is displayed.

   D. Feed Hold
      This is displayed in yellow when the machine is stopped by the feed hold status. It changes to white when the feed hold status is reset.

   E. Spindle Torque
      The selected spindle output torque range is displayed.
      The relationship between display and output torque is as follows:
      Standard : High-speed windings
      High : Low-speed windings

   F. ATC Arm Standby
      "●" (green) appears when the ATC arm is in the standby status.

   G. ATC Magazine Manual
      "●" (pink) appears when the manual mode has been activated for the ATC magazine by the manual intervention button on the ATC control panel. Tool indexing by T commands is suspended until the manual mode is cancelled. "●" blinks when the manual intervention button on the ATC control panel is pressed during ATC magazine operation.

   H. Table Pallet No.
      This indicates the pallet number on the machine table.

   I. PC Arm Standby
      "●" (green) appears when the PC arm is in the standby status.

J. PC Manual
"●" (pink) appears when the manual mode has been activated for the pallet changer by the manual intervention button on the PC control panel. Pallet changing is suspended until the manual mode is cancelled. "●" blinks when the manual intervention button on the PC control panel is pressed during pallet changer operation.

K. 2nd Reference Point
The axis name and this item appear when 2nd reference point is completed for each axis.

8. Function or Mode
Functions and modes which have not been allocated to the main control panel can be turned On and Off on the function page of the primary operation screen.

The following colors are used for the respective functions/modes:

NC Mode	: White
NC Functions	: Yellow
Machine Functions	: Blue
One-Touch Functions	: White
GI	: Green

Refer to the "Main Control Panel" for details of each function.

3.2.2 Soft Keys

1. Types of Soft Keys

A. Initial Status

, e , b	WORK DATA	TOOL DATA	TOOL MONITR	HELP	ALARM						, l , r

B. When [MS] Soft Key is Pressed Once

, e , b	DIAG- NOSE	MAINT- ENANCE		PARA- METER	REGULR MAINTE						, l , r

C. When [FC] Soft Key is Pressed

, l , r	ON	OFF			NEXT FUNC	ONE TH START	ONE TH STOP				

2. Soft Key Description

[MS]	Used for screen selection. The function page cannot be selected.
[FC]	Selects function page menu. Screen selection cannot be performed.
[WORK DATA]	Selects the work data screen (option).
[TOOL DATA]	Selects the tool data screen.
[TOOL MONITR]	Selects the tool monitor screen.
[HELP]	Selects the help screen.
[ALARM]	Selects the alarm screen.
[DIAG- NOSE]	Selects the diagnose screen.
[MAINT- ENANCE]	Selects the maintenance screen.
[PARA- METER]	Selects the parameter screen.

[REGULR MAINTE]	Selects the regular maintenance screen.
[ON]	Used to turn On a function or mode.
[OFF]	Used to turn Off a function or mode.
[NEXT FUNC]	Changes function display.
[ONE TH START]	Used to start a one-touch function.
[ONE TH STOP]	Used to temporarily stop a one-touch function.

3.2.3 Screen Operations

3.2.3.1 Screen Selection

1. Press the soft key for the desired screen.
2. If the desired screen is not displayed on the menu, press the [MS] soft key to select the other menu.

3.2.3.2 Turning Functions/Modes On and Off

1. Press the [FC] soft key to select the function page menu.
2. Move the cursor to the item to be turned On or Off with the cursor keys. The desired page is selected with the page keys when there are 13 or more functions or modes.
3. Press the [ON] soft key to turn On a function or mode, and press the [OFF] key to turn it Off.
4. "●" (pink) is displayed when a function or mode is On, and "❍" is displayed when it is Off.

3.3 Work Data Screen (V55: Option)

The work data screen is displayed when the [WORK DATA] soft key is pressed on the primary operation screen.
There are work data setting and display functions on the work data screen. Work data used for random operation.
Refer to Pallet Changer in the Main Options chapter for random operation.

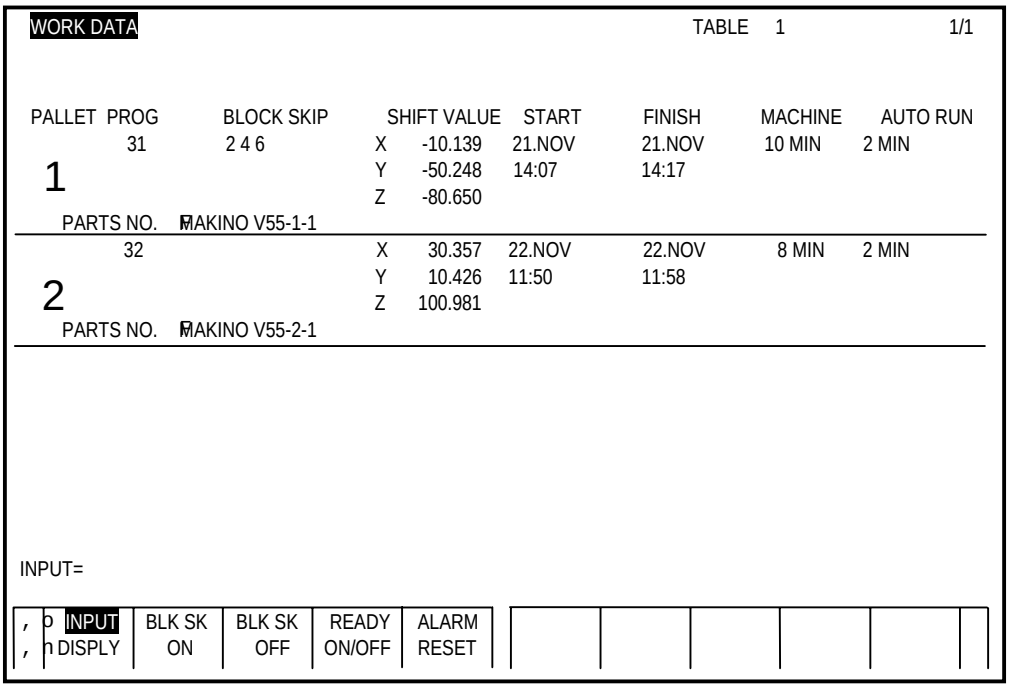


FIGURE 3-3 WORK DATA SCREEN

3.3.1 Display Content

One block of work data is displayed in the area of the screen separated by the horizontal line. The work data is displayed for each pallet, with one screen containing the data for two pallets.

1. Table
   The pallet number on the machine table is displayed.

2. Pallet
   The work data pallet number is displayed as a large number

3. Program (PROG)
   The machining program number is displayed. When random operation is performed, this program number is search for and started.

4. Block Skip
   The On/Off status of the block skip function is displayed. The numbers for block skip 2 – 9 that appear on the screen are On, and the block skip numbers that do not appear are Off.
   Block skip 2 – 9 are set to this status when random operation is started. The block skip numbers are respectively displayed in their own fixed location.

5. Coordinate Shift Value
   The workpiece reference point shift values for the X, Y and Z axes are displayed. The workpiece offset values set by G54 to G59 can be shifted by the values set by this item. These settings are transferred to the NC workpiece reference point shift values when random operation is started.
   Unit: mm or inch (depending upon specifications)

6. Machining Start
   The date/time that the machining program was started in the random operation mode is displayed. The machining start date/time are set by the M479 code in the standard operation mode. If the start time has not been set, "–" is displayed.

7. Machining Finish
   The date/time that the random operation mode ended is displayed. The machining finish date/time are set by the M478 code in the standard operation mode. If machining has not finished, "–" is displayed.

8. Machining Time
   The time from when machining was started until it finished (Machining Finish – Machining Start) is displayed.
   Unit: Minutes

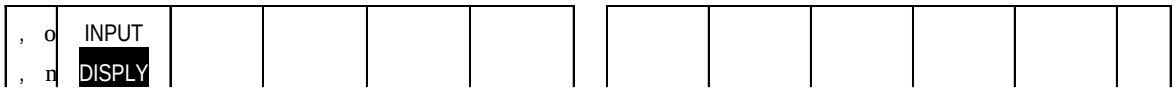
9. Auto Run
   The time that the spindle was rotating, from when machining was started until it finished, is displayed.
   Unit: Minutes

10. Workpiece Name
    The workpiece name is displayed. This name is not used for operation of the machine. Use this space for reference purposes.

11. Status
    The following information is displayed next to the Z axis coordinate shift value:
    A. Ready Status
       "READY" is displayed in green if the ready status is On.
    B. Alarm Status
       If a tool monitor alarm occurs during machining and the workpiece is discharged by the automatic workpiece unload function, the program number, sequence number, tool number and a description of the alarm are displayed in red.

3.3.2 Soft Keys

1. Types of Soft Keys
   A. Machining Data Display Page



   B. Machining Time Display Page

2. Soft Key Description

[INPUT DISPLY] Used to change between the display mode and input mode. The highlighted mode is the mode which is currently selected.

[ALARM RESET] This key is displayed in the input mode. It is used to reset a tool monitor alarm which occurred during machining.

[READY ON/OFF] This key is displayed in the input mode. It is used to turn the ready status for the pallet on the machine table On or Off.

[BLK SK ON] This key is displayed when the cursor is on a block skip number. It is used to turn the block skip setting On.

[BLK SK OFF] This key is displayed when the cursor is on a block skip number. It is used to turn the block skip setting Off.

3.3.3 Screen Operations, Data Setting Procedure

Data for items other than pallets, faces, table and the stocker can be changed on the work data screen. Refer to section 3.1.4 Screen Operations for the basic operation procedure.

3.3.3.1 Programs

Keys Used : Number keys

Setting Range : 1 – 7999

Operation Procedure

1. Activate the input mode.
2. Move the cursor to the program number
3. Enter the program number which has been registered in the NC memory.

3.3.3.2 Block Skip (Option)

Keys Used : Number keys

Setting Range : 2, 3, 4, 5, 6, 7, 8, 9

Operation Procedure

1. Activate the input mode.
2. Move the cursor to block skip.
3. Enter the block skip number to be turned On or Off on the input line.
4. Press the [BLK SK ON] soft key to turn the function On.
   Press the [BLK SK OFF] soft key to turn the function Off.
5. The data which was turned On is displayed on the screen, and the data which was turned Off disappears from the screen.

3.3.3.3 Coordinate Shift Value

Keys Used : Number keys, minus key, decimal point key

Setting Range : –99999.999 — 99999.999 (for mm)
–9999.9999 — 9999.9999 (for inches)

Operation Procedure

1. Activate the input mode.

2. Move the cursor to the coordinate shift value, and enter the desired number.

3.3.3.4 Machining Start/Machining Finish

Keys Used : Number keys

Setting Range : Months 1 – 12, Days 1 – 31
Hours 0 – 23, Minutes 0 – 59

Operation Procedure

1. Activate the input mode.

2. Move the cursor to month, day, hour and minute sequentially, and enter the appropriate value for each item. This data is normally set automatically, and does not need to be entered.

3.3.3.5 Machining Time, Automatic Operation

Keys Used : Number keys

Setting Range : 0 – 999999 (min)

Operation Procedure

1. Activate the input mode.

2. Move the cursor to machining time and automatic operation sequentially, and enter the appropriate value for each item. This data is normally set automatically and does not need to be entered.

3.3.3.6 Workpiece Name

Keys Used : All keys (except for cancel key)

Setting Range : Max. 20 characters

Operation Procedure

1. Activate the input mode.

2. Move the cursor to the workpiece name area and enter the desired name.
   The following NC keys can be used to change the workpiece name:

ALTER	If the workpiece name has already been registered, the data after the cursor position is overwritten. I the workpiece name has not been registered, this key has the same function as the INPUT NC key.
INSER	If the workpiece name has already bee registered, data is entered after the cursor position. If the workpiece name has not been registered, this key has the same function as the INPUT NC key.
DELETE	This key deletes one character from the workpiece name. It has the same function as the cancel key during normal input. It only functions when there is data on the input line.

3.3.3.7 Alarm Reset

Operation Procedure

1. Activate the input mode.

2. Move the cursor to the pallet for which the alarm is to be reset.

3. Press the [ALARM RESET] soft key. The alarm disappears and is reset.

3.3.3.8 Ready On/Off

Operation Procedure

1. Activate the input mode.

2. Move the cursor to the pallet number for which the ready status is to be turned On or Off.

   When the [READY ON/OFF] soft key is pressed while the ready status is On, it is turned off and disappears from the screen.

   When the [READY ON/OFF] soft key is pressed while the ready status is Off, it is turned On and appears on the screen.

The ready status can only be turned On and Off for the pallet on the machine table.
The APC control panel is used to turn the status On and Off for the pallet on the stocker.

3.3.3.9 Overwriting Pallet Number on Machine Table

The procedure in this section is used to enter or change the data for the pallet on the machine table in the event this becomes necessary due to the stopping of APC operation at an intermediate point because of an emergency stop, alarm or other cause.

1. Activate the maintenance mode on the maintenance screen.
   Procedure to Select Maintenance Mode
   A. Select the maintenance screen. (Refer to section 3.2.3.1, Screen Selection.)
   B. Display the machine status display page.
   C. Press the [MODE SELECT] soft key to activate the maintenance mode.

2. Return to the primary operation screen with the maintenance mode active, and select the work data screen. (Refer to section 3.9, Maintenance Screen, for details.)

3. Move the cursor to the right of "TABLE."

The pallet number on the machine table cannot be overwritten unless the maintenance mode is activated.

4. Enter the appropriate data (0 – 2). (0 indicates there is no pallet on the table.)

5. The data is set according to the machine table pallet number entered in step 4.

6. Select the maintenance screen again.

7. Press the [MODE SELECT] soft key to cancel the maintenance mode. This completes the setting procedure.

3.4 Tool Data (Detail) Screen

The tool data (detail) screen is displayed when the [TOOL DATA] soft key is pressed on the primary operation screen. The tool detail screen has tool data setting and display functions.

The items listed below are displayed on the tool detail screen. All items correspond to the pot number:

1. Pot
2. Tool (PTN)
3. Kind
4. Type (FTN)
5. Life
6. Remaining life
7. Tool length (H value)
8. Tool diameter (D value)
9. Status
10. THAIR (Through-spindle coolant suction time)
11. ITN
12. SL value
13. AC value

The number of pots and pages displayed differs depending upon the ATC magazine tool capacity, but the content and data setting procedure are the same.

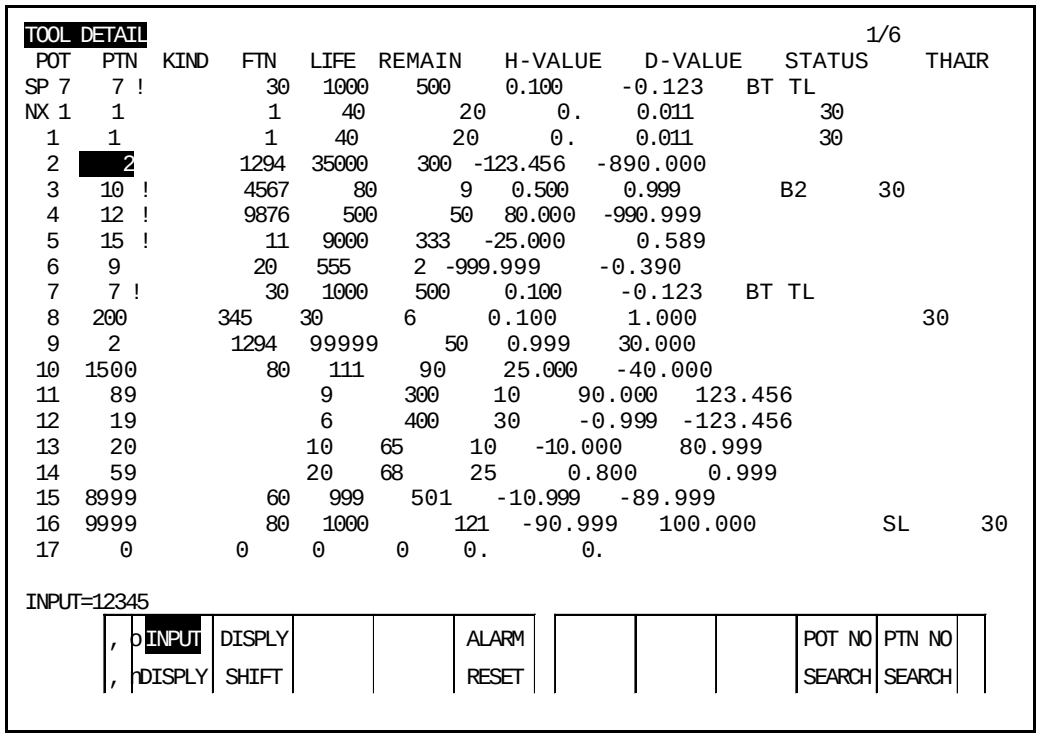


FIGURE 3-4 TOOL DETAIL SCREEN NO. 1

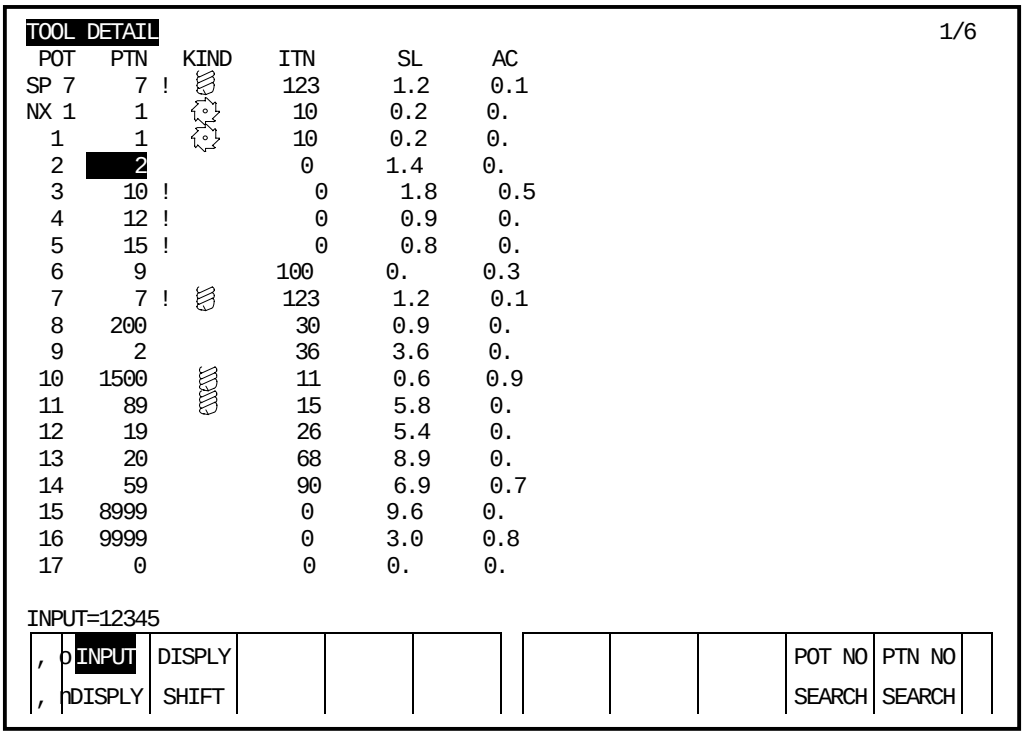


FIGURE 3-5 TOOL DETAIL SCREEN NO. 2

3.4.1 Display Content

The spindle tool is displayed in green, the next tool in yellow, and other tools are displayed in white.

1. Pot
   The pot number is displayed.
   The data for 17 tools in addition to the spindle tool and next tool is displayed on one page. The data for more tools than the ATC magazine tool capacity will be displayed, but only the data equal to the tool magazine capacity can be used for operation of the machine.
   Use the pot number data which exceeds the tool magazine capacity for memorandum purposes.

2. Tool (PTN)
   The tool number used by the T command in the program is displayed.

   Unit : None
   Setting Range : 0 – 9999

3. Kind
   A diagram indicating the kind of tool is displayed.
   The correspondence between setting and diagram are shown in the table below

   Unit : None
   Setting Range : 0 – 9

TABLE 3-1 KIND OF TOOL SETTINGS

Setti	@ O	@ P	@ Q	@ R	@ S	@ T	@ U	@ V	@ W	@ X
Diagram										
Name	Space	Drill	Ball End Mill	End Mill	Boring Bar	Spring Tool	Spring Tool	Tapper	Reamer	Face Mill

4. Type (FTN)
   The type of tool (Functional Tool Number) is displayed. As long as this data is the same, tools are recognized to be the same type, even if the tool number differs. This data is registered when using the spare tool change function.

   Unit : None
   Setting Range : 0 – 9999

5. Life
   The tool life is displayed.
   Time, distance or machining quantity can be selected for tool life. This data is valid when the TL mode (tool life management) is selected on the tool monitor screen. (Refer to section 3.5, ToolMonitor Screen.)

   Unit : Time
   Distance (m or inch) (according to specifications)
   Machining quantity
   Setting Range : 0 – 99999

6. Remaining Life (or Cumulative Value)
   The tool life is displayed. The same unit is used as for item 5.
   When cumulative value display is selected, the tool usage time is displayed.
   Time, distance or machining quantity can be selected for tool life. This data is valid when the TL mode (tool life management) is selected on the tool monitor screen. (Refer to section 3.5, ToolMonitor Screen.)

   Unit : Time
   Distance (m or inch) (according to specifications)
   Machining quantity
   Setting Range : 0 – 99999

7. Tool Length (H Value)
   The tool length offset value is displayed. This data can be transferred to the NC tool offset memory by the M56 command.

   Unit : mm or inch (according to specifications)
   Setting Range : –999.999 — 999.999 (mm)
   –99.9999 — 99.9999 (inches)

8. Tool Diameter (D Value)
   The tool diameter offset value is displayed. This data can be transferred to the NC tool offset memory by the M56 command.

   Unit : mm or inch (according to specifications)
   Setting Range : –999.999 — 999.999 (mm)
   –99.9999 — 99.9999 (inches)

9. Status
   A two-letter code is displayed in red when a tool alarm occurs.
   A tool alarm differs from a machine alarm. When a tool alarm occurs while the tool monitor function is being used, an alarm is displayed for the respective tool number.
   There are the following five types of tool alarms:

   TL : Tool life alarm
   SL : SL monitor alarm
   AC : AC monitor alarm
   BT : Broken tool alarm
   B2 : Long detection by broken tool check

   A maximum of three alarms are displayed. When more than 3 alarms occur at the same time, only three appear on the screen. Refer to section 3.7, Alarm Screen, for details on alarms.

10. THAIR (Through spindle Air) (Option)
    The suction time after the through spindle coolant is stopped is displayed.
    Suction time is the time that coolant inside the tool is removed after spindle-through coolant supply is stopped.

    Unit : 1 sec
    Setting Range : 0 – 99

This data is not used when through spindle coolant is not being discharged through the spindle.
The suction time is 3 seconds, even when a setting between 0 and 2 is made.
A setting of between 3 and 10 should be used, since a setting of higher than 10 seconds will not increase suction performance.

11. ITN (IndividualTool Number)
    When a unique tool number is needed other than the tool number used in programs, this data is registered. This item is used for a system where the same tool numbers are used for other machines and programs, but not when the machine is operated independently.

    Setting Range : 0 – 9999

12. SL (Spindle Load) Value
    The spindle load value for the SL monitor is displayed.

    Unit : A
    Setting Range : 0 – 999.9

13. AC (Adaptive Control) Value
    The spindle load value for the AC monitor is displayed.

    Unit : A
    Setting Range : 0 – 999.9

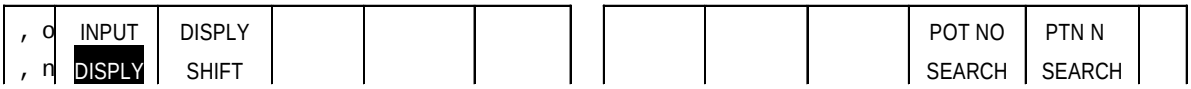
14. ATC Arm Rotation Speed Data for Each Tool (option)
    A "!" is displayed to the right of the tool number when the ATC arm is operated at low speed.
    This item is blank when the arm is rotated at normal speed.

The ATC arm is only operated at normal speed when low speed has not been specified for the spindle tool or next tool.

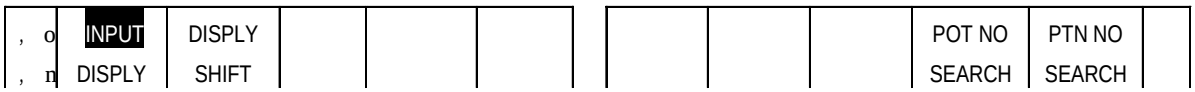
3.4.2 Soft Keys

1. Types of Soft Keys
2.

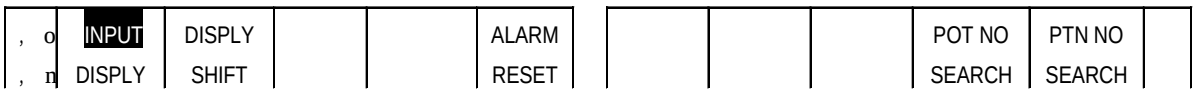
A. Display Mode (cursor not displayed)



B. Input Mode, Pot No./Tool No. Search Status



C. "Status" Displayed in Input Mode



3. Soft Key Description

- INPUT DISPLY: Used to change between the display mode and input mode. The highlighted mode is the mode which is currently selected.
- DISPLY SHIFT: Used to change between tool data display items
  (Pot No., PTN and Kind are always displayed.)
- PTN NO SEARCH: Used to search for a tool (PTN) number.
  The search operation can be performed by entering the tool number and pressing this soft key.
- POT NO SEARCH: Used to search for a pot number.
  The search operation can be performed by entering the pot number and pressing this soft key.
- ALARM RESET: Displayed when the input mode is active. It is used to reset the tool alarm displayed under “Status.”
  (TL, SL, AC, BT, B2 alarms)
- P O: Used to change to the primary operation screen.

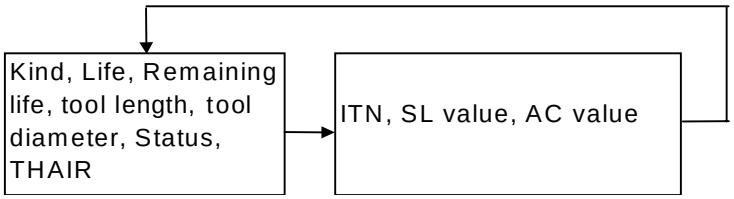
3.4.3 Screen Operations, Data Setting Procedure

All data on the tool detail screen can be overwritten.

3.4.3.1 Display Shift

Operation Procedure
The display is changed when the [DISPLY SHIFT] soft key is pressed.

The display items change as follows
(Pot number, PTN and Kind are always displayed):



3.4.3.2 Resetting Alarms

This procedure enables TL, SL, AC, BT and B2 alarms displayed in red under Status to be reset.

Operation Procedure

1. Activate the input mode. The [ALARM RESET] soft key is displayed.

2. Move the cursor to Status.

3. Press the [ALARM RESET] soft key.

Only tool alarms can be reset with this alarm reset key. These differ from machine alarms.
A machine alarm is triggered when a tool alarm occurs, and the alarm lamp on the main control panel lights. This machine alarm cannot be reset by resetting the tool alarm on the tool detail screen.

Restart operation after resetting the machine alarm by pressing the [ALARM RESET] soft key on the PC alarm screen. (Refer to section 3.7, Alarm Screen, for details.)

3.4.3.3 Searching for Tool/Pot Numbers

1. Enter the tool or pot number you wish to search for using the LCD control panel.

2. The page with the entered number is displayed when the [PTN NO SEARCH] or [POT NO SEARCH] soft key is pressed.

3.4.3.4 Overwriting Spindle Tool, Next Tool Data

In the event the spindle tool or next tool is lost, or needs to be changed when ATC operation stops at an emergency stop, alarm or other cause, like an incomplete end, the procedure in this section is used.

1. Activate the maintenance mode on the maintenance screen.
   Procedure to Select Maintenance Mode
   A. Select the maintenance screen. (Refer to section 3.2.3.1, Screen Selection.)
   B. Display the machine status display page.
   C. Press the [MODE SELECT] soft key to activate the maintenance mode.

2. Return to the primary operation screen with the maintenance mode active, and select the tool detail screen. (Refer to section 3.9, Maintenance Screen, for details.)

3. Activate the input mode.

4. Move the cursor to item to be set.

The spindle tool/next tool number cannot be overwritten unless the maintenance mode is activated.

5. Enter the data.

6. The tool data is automatically set according to the spindle tool/next tool pot number entered in step 5. The spindle tool data is displayed in green, and the next tool data is displayed in yellow.

7. Select the maintenance screen again.

8. Press the [MODE SELECT] soft key to cancel the maintenance mode. This completes the setting procedure.

3.4.3.5 ATC Arm Rotation Speed Setting for Each Tool (V55: Option)

This function allows the ATC arm rotation speed to be set to the "Normal mode" or "Slow mode."

1. Align the cursor to the right of the tool number on the tool detail screen.

2. Enter "0" to specify the normal mode. (Nothing appears to the right of the tool number.)
   Enter "1" to specify the slow mode. ("!" appears to the right of the tool number.)

When the slow speed has been specified for the spindle tool or next tool, the ATC arm is rotated at slow speed.

3.5 Tool Monitor Screen

The tool monitor screen is displayed when the [TOOL MONITR] soft key is pressed on the primary operation screen.

There are the following three functions on the tool monitor screen:
1. Spindle tool status display
2. Display and turning auto tool monitor function On and Off
3. Display of auto tool monitor function alarms

Refer to the Auto Tool Monitor Function chapter for details on the tool monitor function.

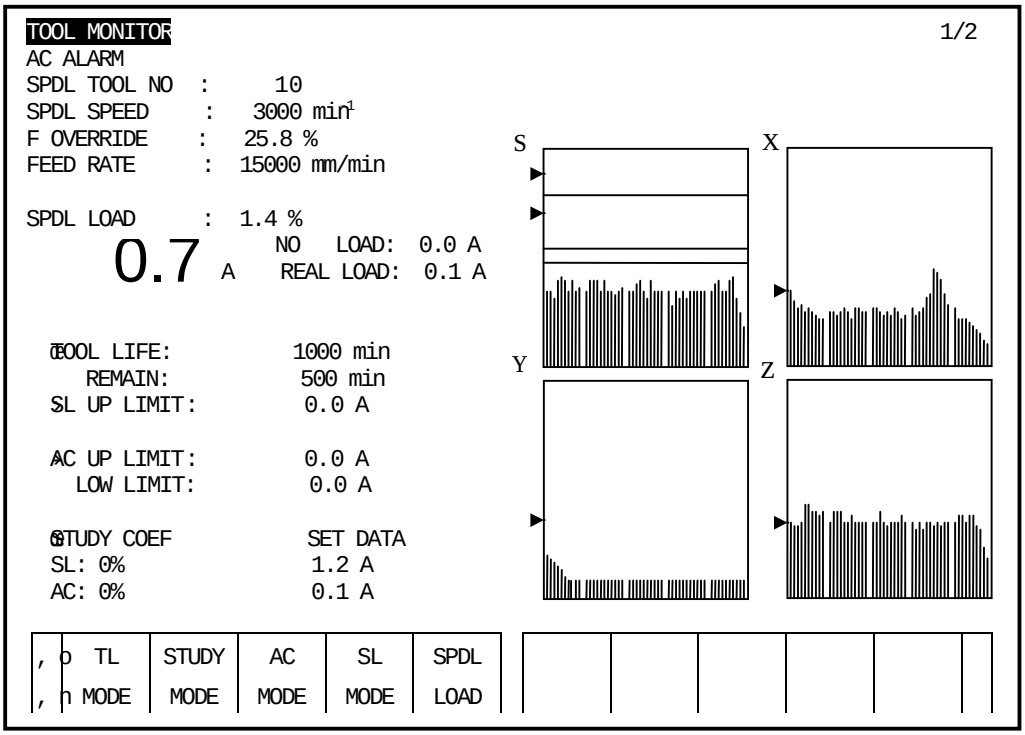


FIGURE 3-6 TOOL MONITOR SCREEN

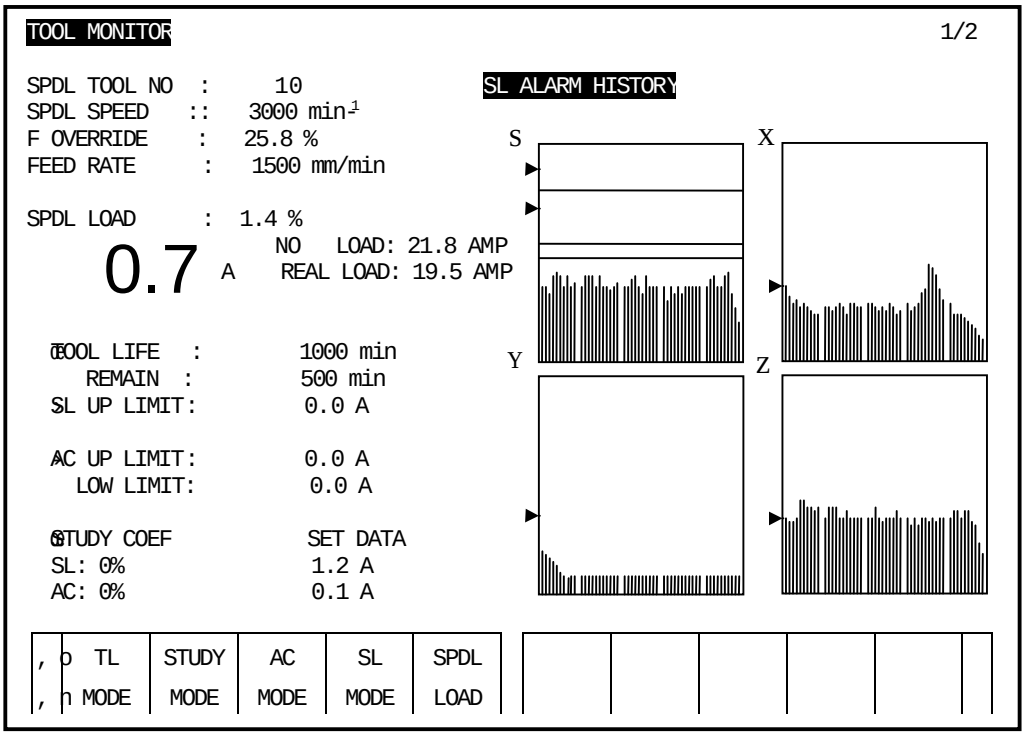


FIGURE 3-7 TOOL MONITOR SCREEN, ALARM HISTORY DISPLAY

3.5.1 Display Content

1. Spindle Tool Number
   The number of the tool clamped in the spindle is displayed.
   When the spindle tool has been returned to the ATC magazine by the T0 command (spindle is empty), nothing is displayed.

2. Spindle Speed
   The actual spindle speed is displayed, taking into consideration any spindle override.

   Unit : min^{-1}

3. Feed Override
   The feed override value is displayed.

   Unit : %

4. Actual Feed Rate
   The actual feed rate is displayed, taking into consideration any feed override.

   Unit : mm/min or inch/min (depending upon specifications)

5. Spindle Load
   The spindle motor load current is displayed. The color changes depending upon the amount of current.
   The value in parentheses indicates the spindle motor load factor.
   White : Within continuous rating
   Yellow : Within 30 minute rating
   Red : Above 30 minute rating

   Unit : A

6. No Load
   The current when the spindle is under no load is displayed.

   Unit : A

7. Real Load
   The actual load current due to cutting (Real load current = Load current – No load current) is displayed.

   Unit : A

8. Tool Life
   The tool life is displayed.
   Time, distance or machining quantity can be selected for tool life.
   "●" (pink) is displayed when the TL (tool life management) mode is On, and "❍" is displayed when it is Off.

   Unit : Time
   Distance (m or inch) (according to specifications)
   Machining quantity
   Setting Range : 0 – 99999

9. Remaining Life (or Cumulative value)
   The remaining tool life is displayed.
   When cumulative value display has been selected, the tool usage time is displayed.
   As for item 8., time, distance or machining quantity can be selected for tool life.

   Unit : Time
   Distance (m or inch) (according to specifications)
   Machining quantity
   Setting Range : 0 – 99999

10. SL Upper Limit Value
   The SL mode On/Off status and SL monitor upper value are displayed. "●" (pink) is displayed when the TL (tool life management) mode is On, and "❍" is displayed when it is Off.
   When the load current exceeds this upper limit, an SL monitor alarm is triggered.

   Unit : A

11. AC Upper Limit Value
   The AC mode On/Off status and AC monitor upper value are displayed. "●" (pink) is displayed when the AC mode is On, and "O" is displayed when it is Off.
   When the load current exceeds this upper limit, feed override is reduced. An AC monitor alarm is triggered when the feed override rate drops to 40% or below.

   Unit : A

12. AC Lower Limit Value
   The AC monitor upper value is displayed (AC setting x 0.875 + No load current). Feed override is applied when the load current drops below the lower limit value.

   Unit : A

13. Study Coefficient Setting
    The study mode On/Off status, SL/AC coefficients and settings are displayed. "●" (pink) is displayed when the study mode is On, and "O" is displayed when it is Off. Refer to the AutoTool Monitor Function chapter for details on the study mode.

14. Spindle Load Current Bar Graph
    A bar graph of the current spindle load value is displayed in the box indicated by "S".
    One bar graph line indicates an approximate interval of 0.1 second.
    The bar graph color changes depending upon the size of the load current.
    Blue : Until load current stabilizes when spindle is started
    White : Within continuous rating
    Yellow : Within 30 minute rating
    Red : Above 30 minute rating

    Triangular marks are provided to the left of the bar graph as a guideline to the size of the load current.
    Yellow : Continuous rating value
    Red :30 minute rating value

    When the SL mode is On, the SL monitor load current (upper limit) is displayed as a red line. When the AC mode is On, the AC monitor load current (upper limit and lower limit) are displayed as blue lines.

15. Feed Axis Load Current Bar Graphs
    The load current for the respective feed axes (X, Y, Zand additional axes) is displayed as a bar graph. One bar graph line indicates an approximate interval of 0.1 seconds. The bar graph color is always green, even when the load current exceeds the continuous rating.

16. Display When Tool Monitor Alarm Occurs (Load, Real Load, Bar Graph)

    A. When AC/SL Alarm Occurs
       When an AC or SL alarm occurs, the spindle load current and actual (real) load current due to cutting are displayed in red. Furthermore, the following information is displayed on the spindle load current bar graph:

       - AC alarm
       - SL alarm

B. When TL/BTS Alarm Occurs
When a TL or BTS alarm occurs, the following information is displayed on the spindle load current bar graph:

- Tool life alarm
- Broken tool alarm (for machines with a broken tool sensor)
- Broken tool OT alarm (for machines with a broken tool sensor)

When a tool monitor alarm occurs, the details of the alarm are recorded for each tool. Refer to "Status" on the tool detail screen.

17. Alarm History (Load, Real Load, Bar Graph)
The spindle load current and real load current due to cutting for the last AC or SL alarm that occurred are displayed in red. The load current at the time the alarm occurred is displayed in the bar graph for each axis. The following information is also displayed on the bar graph:

- AC alarm history
- SL alarm history

Nothing is displayed if an AC or SL alarm has not occurred.

3.5.2 Soft Keys

1. Types of Soft Keys

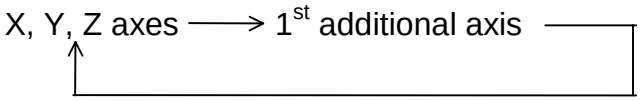
2. Soft Key Description

[TL MODE]	Turns tool life management function On and Off.
[STUDY MODE]	Turns study function On and Off.
[AC MODE]	Turns AC monitor function On and Off.
[SL MODE]	Turns SL monitor function On and Off.
[ALARM LOAD]	When this key is pressed, the display changes to display of spindle load status when the last AC or SL alarm occurred. Pressing the key again returns the screen to the normal display. This key will not function if an AC or SL alarm has not occurred.

3.5.3 Screen Operations

3.5.3.1 Changing Between Axis Bar Graph Displays

The page keys are used to change the bar graph display as follows when an additional axis is provided:



The spindle load current is displayed all the time.

3.5.3.2 Turning Tool Monitor On and Off

The operation procedure is the same for the TL, study, AC and SL functions.

Operation Procedure

1. The respective tool monitor mode is turned On or Off when the [TL MODE], [STUDY MODE], [AC MODE], or [SL MODE] soft key is pressed.

2. "●" (pink) is displayed when the mode is On, and "O" is displayed when it is Off.

1. Study Mode
   When the study mode is turned On while the AC mode or SL mode is On, the A mode or SL mode is turned Off.
   This mode cannot be turned On when the dry run mode is On. Likewise, the study mode cannot be turned On when the dry run mode is On.
2. AC, SL Modes
   When the AC mode or SL mode is turned On while the study mode is On, the study mode is turned Off.
   The AC mode/SL mode cannot be turned On while the dry run mode is On, and the dry run mode cannot be turned On while the AC mode or SL mode is On.

3.5.3.3 AC, SL Alarm History Display Procedure

1. A record of the load when the AC or SL alarm occurred is displayed when the [ALARM LOAD] soft key is pressed. However, nothing will be displayed if no AC or SL alarm has occurred.

2. The normal screen is displayed when the [ALARM LOAD] soft key is pressed again.

3.6 Help Screen

The help screen is displayed when the [HELP] soft key is pressed on the primary operation screen.

There are two functions on the help screen:
1. Display of machine side ROM version
2. Display of M code list

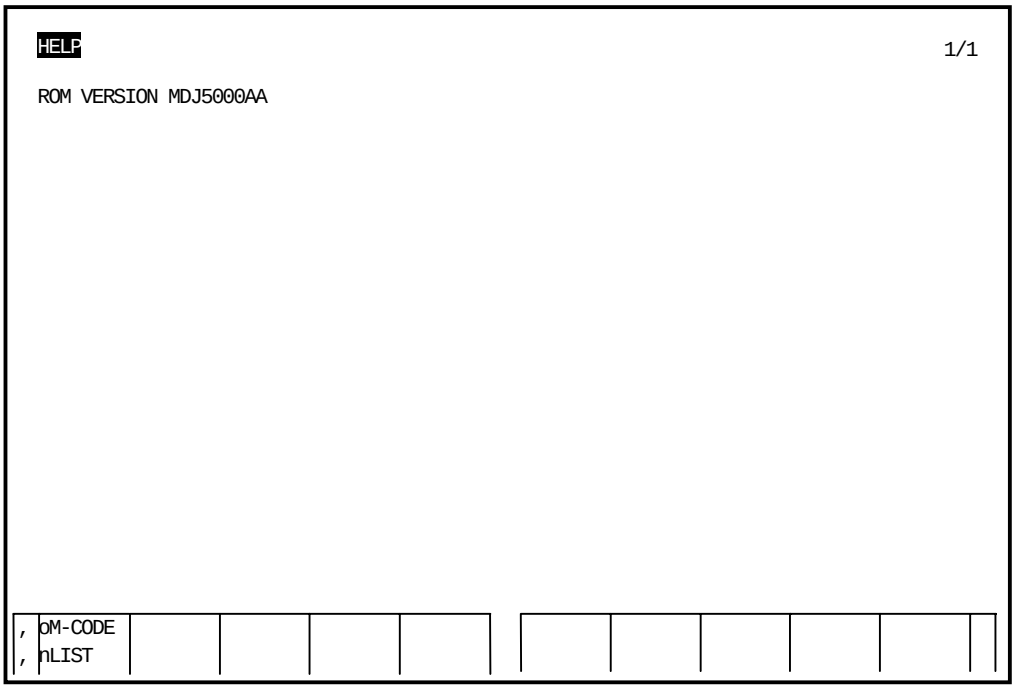


FIGURE 3-8 HELP SCREEN, MENU PAGE

* The V55 screen is shown above.

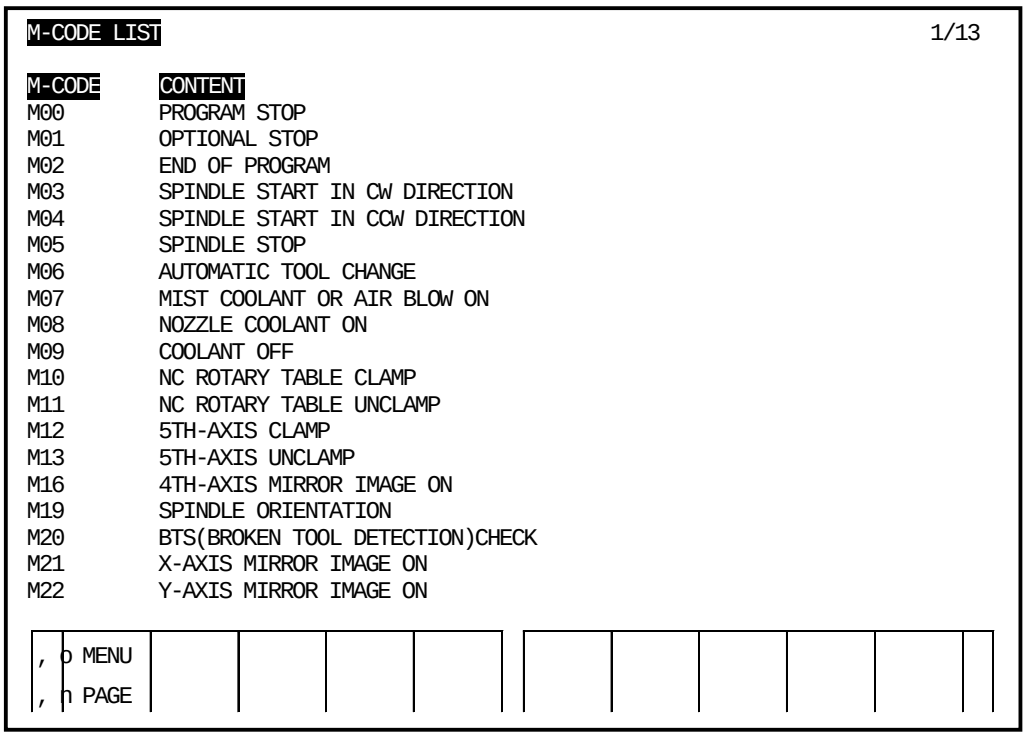


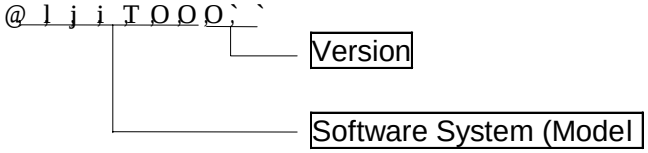
FIGURE 3-9 HELP SCREEN, M CODE LIST PAGE

3.6.1 Display Content

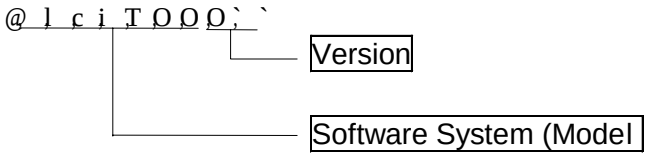
1. ROM Version
   The machine side software system and version are displayed.
   The system indicates the machine model, and the version indicates the revision history. Please check this screen when informing Makino of the software system and version in the event of a problem.

   The name of the software differs for a machine with a FANUC Series 16M and one with a FANUC Series 16i.
   The name of the software also also differs for a V33 and V55 system.

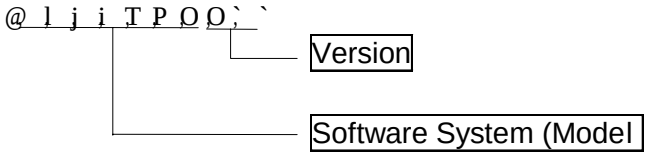
   V55: Machine with FANUC Series 16i
   "MKJ5000" shown below is the model (V55 with FANUC Series 16i in this case), and "AA" indicates the version.



   V55: Machine with FANUC Series 16M
   "MDJ5000" shown below is the model (V55 with FANUC Series 16M in this case), and "AA" indicates the version.



   V33
   "MKJ5100" shown below is the model (V33 with FANUC Series 16i in this case), and "AA" indicates the version.

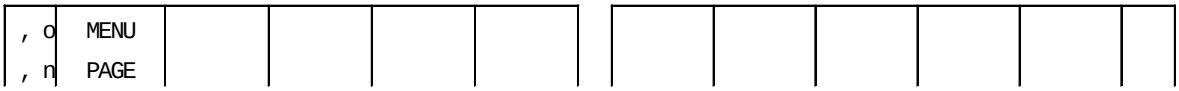


2. List of M Codes
   The M codes and their respective functions are displayed.

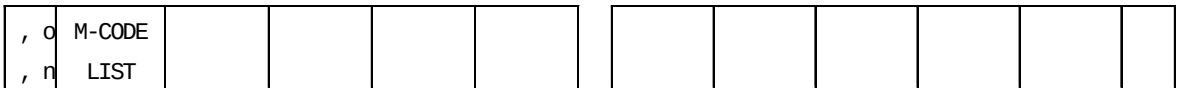
3.6.2 Soft Keys

1. Types of Soft Keys

   A. Menu Page



   B. M Code List Page



2. Soft Key Description

[M-CODE LIST]	Displayed on the menu page. Changes screen to the M code list page.
[MENU PAGE]	Displayed on the M code list page. Changes screen to the menu page.

3.6.3 Screen Operations

3.6.3.1 Changing Between Menu Page and M Code List Page

1. Menu Page → M Code List Page
   The M code list page is displayed when the [M-CODE LIST] soft key is pressed on the menu page.

2. M Code List Page → Menu Page
   The menu page is displayed when the [MENU PAGE] soft key is pressed on the M code list page.

3.6.3.2 M Code List Page Operations

Change between screens on the M code list page with the page keys.

3.7 Alarm Screen

The alarm screen is displayed when the [ALARM] soft key is pressed on the primary operation screen.

There are three functions on the help screen:
1. Display of alarm details
2. Display example
3. Display of alarm record

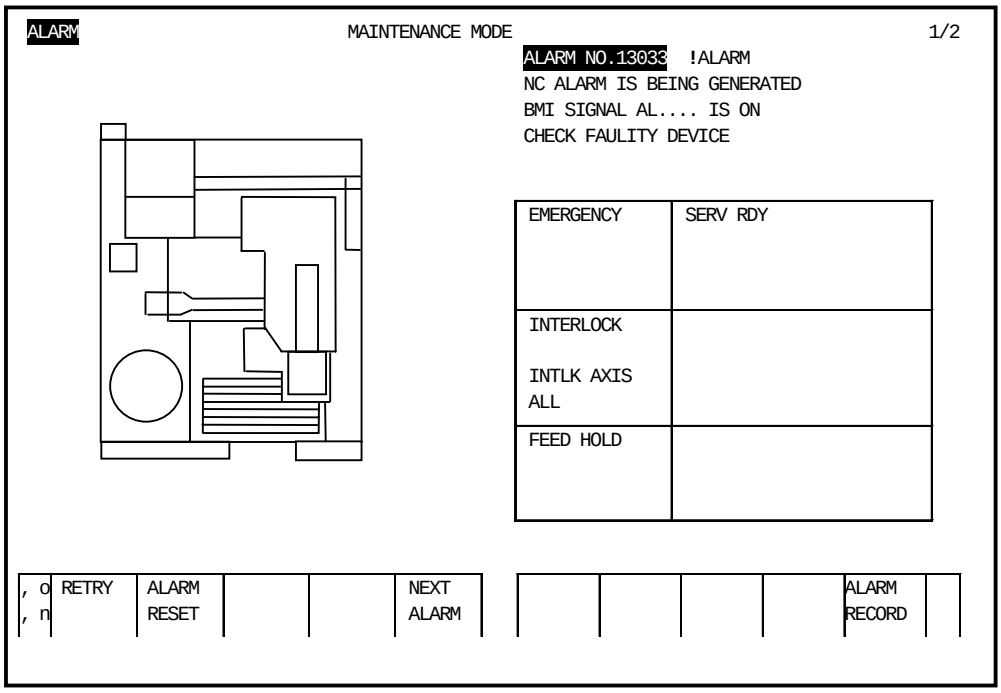


FIGURE 3-10 ALARM SCREEN (V55: 15-/25- OOL ATC)

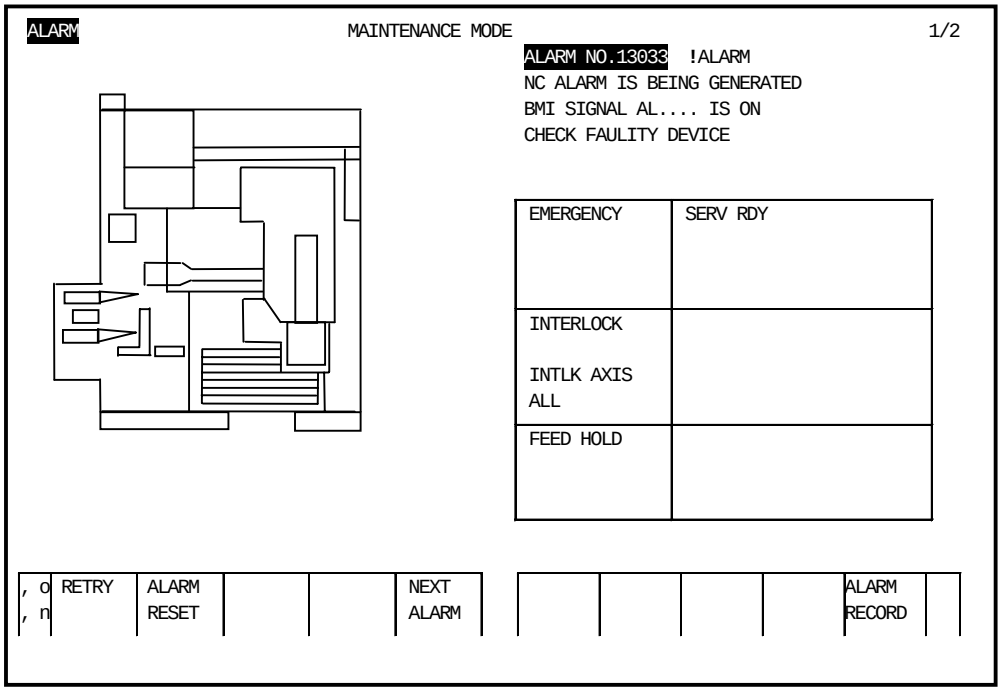


FIGURE 3-11 ALARM SCREEN (V55: 40- OOL ATC)

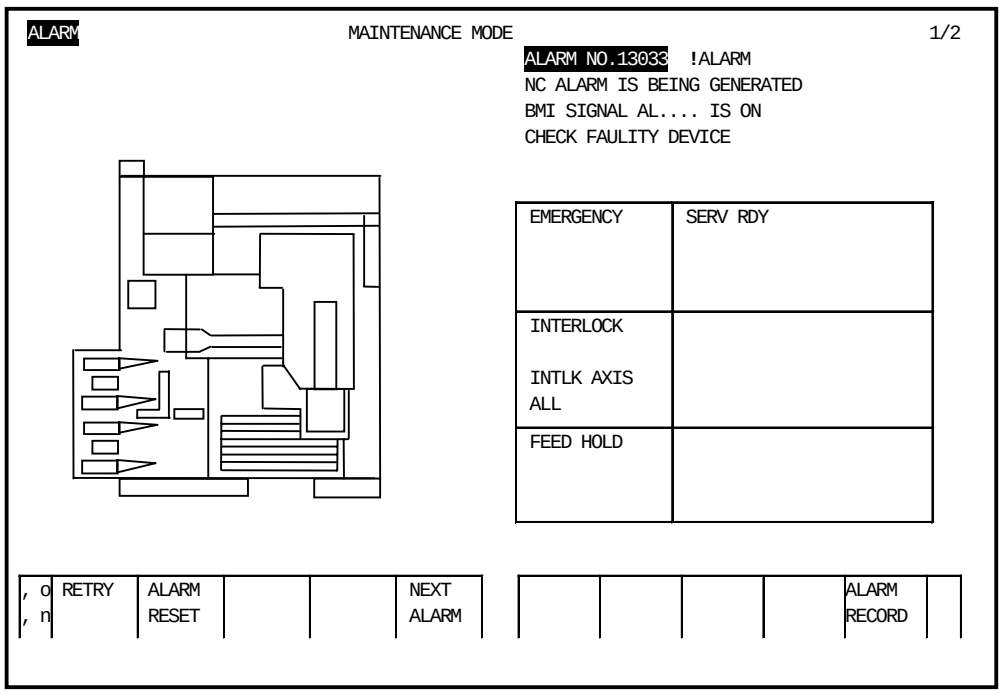


FIGURE 3-12 ALARM SCREEN (V55: 80- OOL ATC)

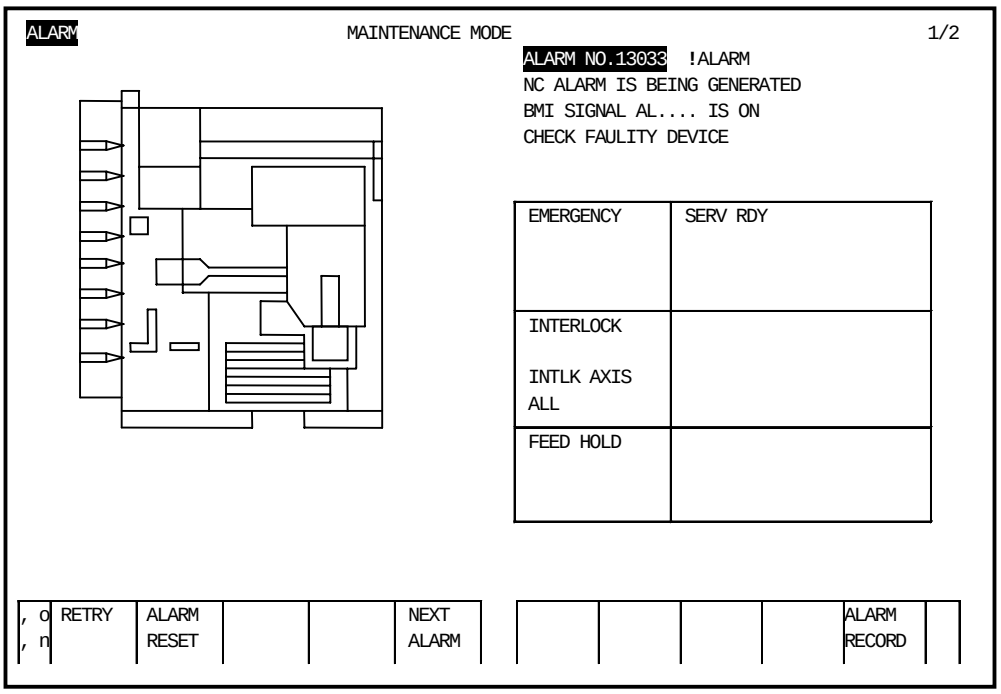


FIGURE 3-13 ALARM SCREEN (V55: MATRIX ATC MAGAZINE)

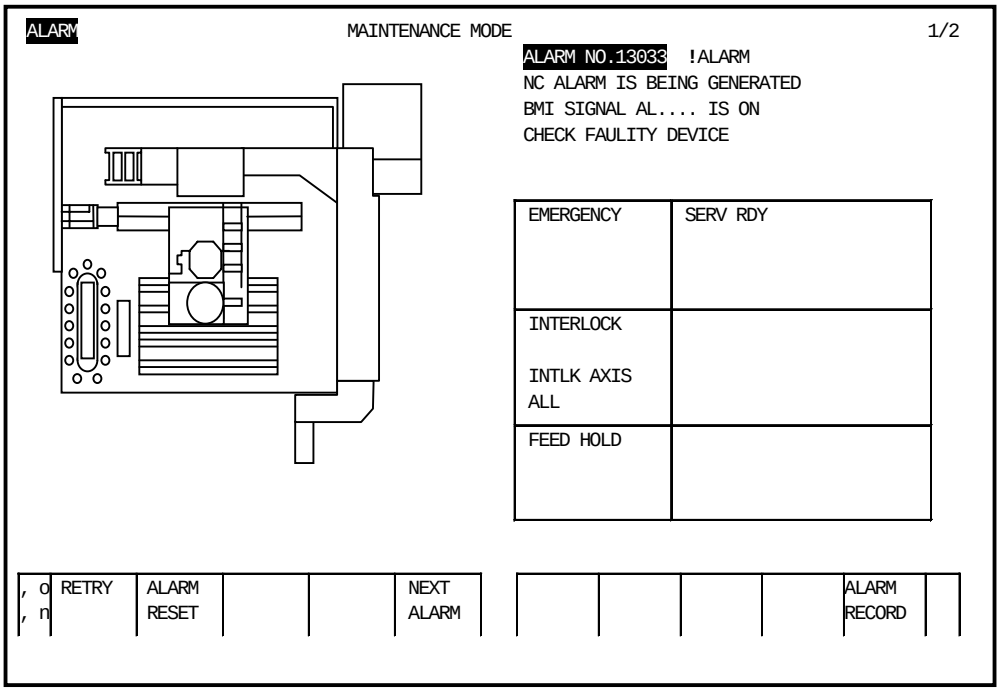


FIGURE 3-14 ALARM SCREEN (V33: 15- OOL ATC MAGAZINE)

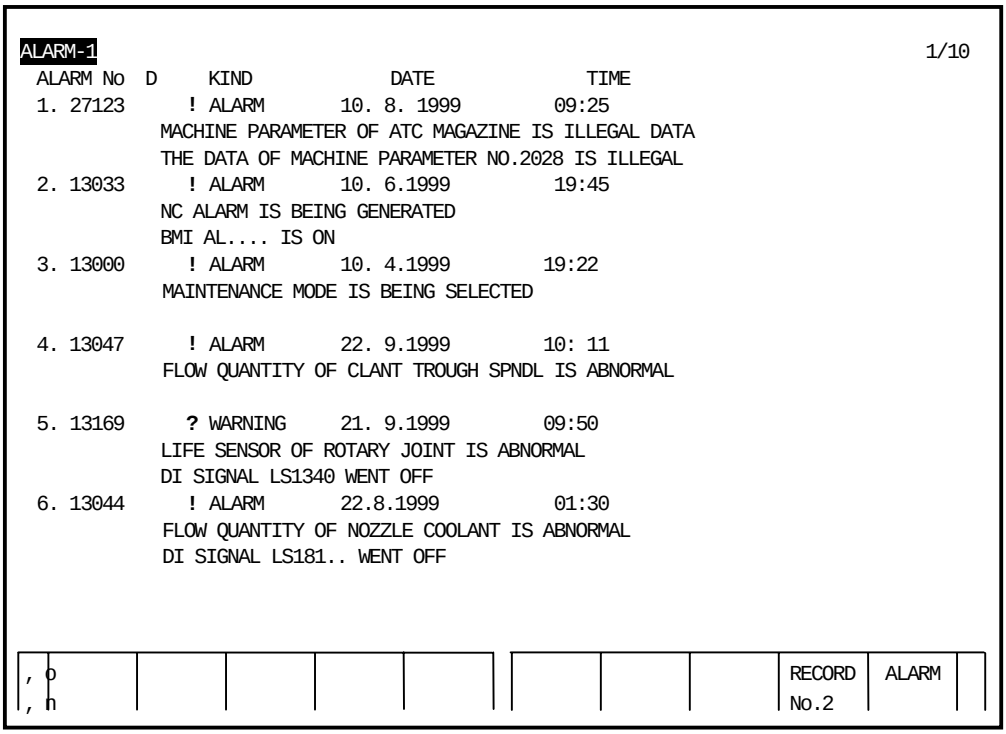


FIGURE 3-15 ALARM SCREEN, RECORD PAGE

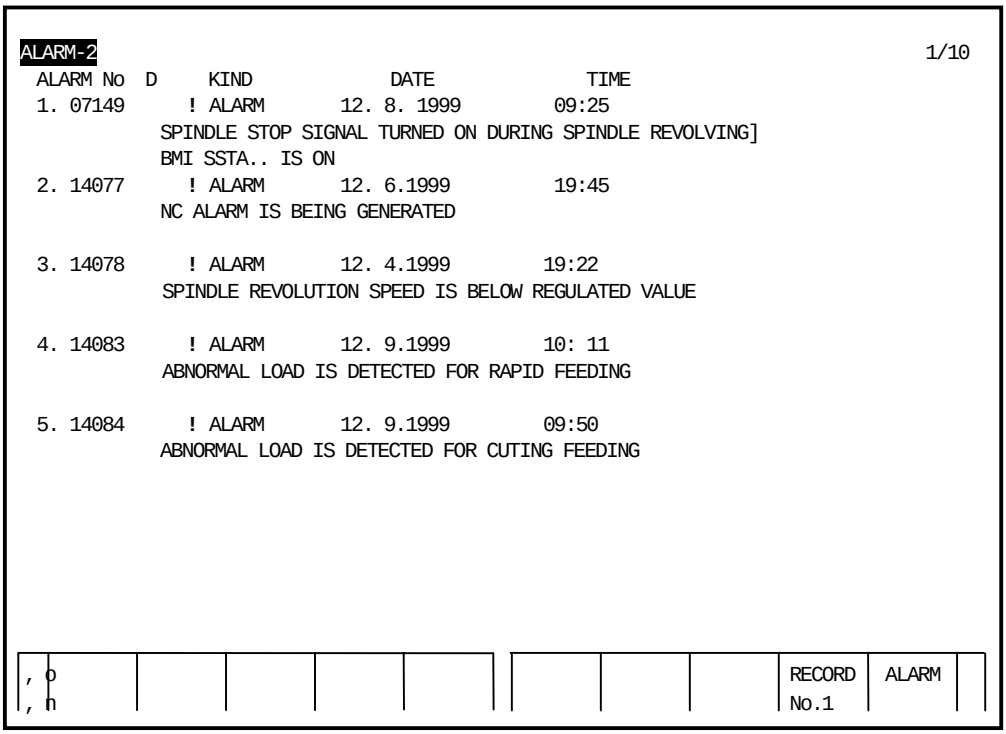


FIGURE 3-16 ALARM SCREEN, RECORD PAGE-2

3.7.1 Display Content

1. Machine Status Display
   A. Emergency
      The cause of the emergency stop is displayed in red when the machine has been stopped by the emergency stop status. The item is displayed in white when the emergency stop status is reset.

   B. Interlock
      The cause of the axis interlock is displayed in yellow when the machine has been stopped by an axis interlock. The item is displayed in white when the axis interlock is reset.

   C. Interlock Axis
      The name of the axis which stopped operation is displayed.

   D. Feed Hold
      The cause of the feed hold is displayed in yellow when the machine has been stopped by the feed hold status. The item is displayed in white when the feed hold is reset.

2. Machine Diagram and Device Position Display
   The location of the limit switch, solenoid or other device which triggered the alarm is shown on a diagram of the machine, looking from the top.
   Nothing is displayed when no alarm has occurred.

3. Alarm Related Signal Display
   The name of the limit switch (LS), solenoid (SOL) or other device which triggered the alarm is displayed. This corresponds with the diagram explained in item 2.
   Nothing is displayed when no alarm has occurred.

4. Alarm No.
   This indicates the alarm number
   Alarms are displayed in red, and warnings are displayed in yellow
   Nothing is displayed when no alarm has occurred.

5. ! Alarm, ? Warning
   ! indicates an alarm, and ? indicates a warning.
   ! Alarms are displayed in red, and ? Warnings are displayed in yellow.
   This alarm/warning display corresponds with the alarm and warning lamps on the main control panel.
   Nothing is displayed when no alarm has occurred.

6. Next Alarm
   This is displayed when multiple alarms have occurred.

7. Alarm Description
   The cause of the alarm and status are displayed.
   Nothing is displayed when no alarm has occurred.

8. Signal Name
   The name of the signal which caused the alarm and status are displayed.
   Nothing is displayed when no alarm has occurred.

9. Restore Procedure
   The procedure to restore operation is displayed.
   Nothing is displayed when no alarm has occurred.

10. Example Display
    An example of an alarm can be displayed.

11. Alarm Record
    The alarms that have occurred to date are displayed, starting with the most recent alarm. The last 100 alarms are displayed in alarm record 1, and the last 20 alarms are stored in alarm record 2.
    This information is retained when power is turned off.

12. Alarm No.
    This corresponds to the alarm No. on the alarm screen (item 4.).

13. Kind
    ! indicates an alarm, and ? indicates a warning. This corresponds to the alarm/warning lamp display on the main control panel.
    This is the same as for item 5., ! Alarm, ? Warning.

14. Date
    This indicates the date that the alarm occurred.

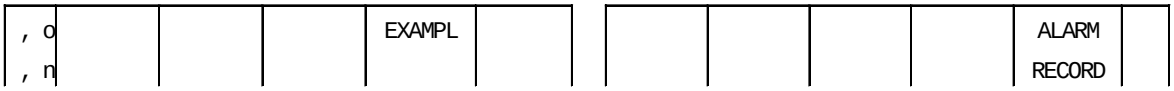
15. Time
    This indicates the time that the alarm occurred.

16. Description
    A description of the alarm is provided. This corresponds to the description in item 7.

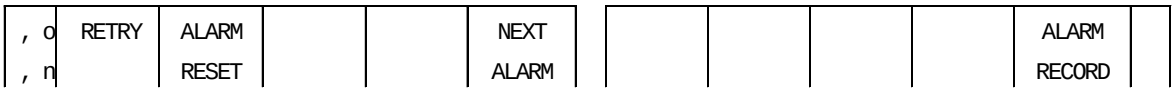
3.7.2 Soft Keys

1. Types of Soft Keys

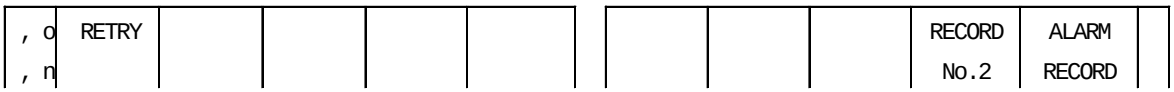
A. Alarm Screen



B. Alarm Record Screen



C. Alarm Record Screen



2. Soft Key Description

[EXAMPL]	Displays an example of an alarm display.
[ALARM RECORD]	Displays the alarm record screen.
[RETRY]	Displayed when operation can be continued when machine has been stopped by an alarm. Operation is restarted when this soft key is pressed.
[ALARM RESET]	Resets the alarm. Press this key after eliminating the problem. The alarm will not be reset unless the problem is eliminated.
[NEXT ALARM]	Press this key to display the next alarm when multiple alarms have occurred.
[ALARM]	Displays the alarm screen.
[RECORD NO. 2]	Displays alarm record 2.

3.7.3 Screen Operations

3.7.3.1 Changing Between Screens

1. Alarm Screen → Record Screen
   The alarm record screen is displayed when the [ALARM RECORD] soft key is pressed.

2. Record Screen → Alarm Screen
   The alarm screen is displayed when the [ALARM] soft key is pressed.

3.7.3.2 Alarm Screen Operations

1. Example
   An example of an alarm is displayed when the [EXAMPL] soft key is pressed.

2. Retry
   This soft key is displayed when operation can be continued after the machine has been stopped by an alarm.
   Operation is restarted when the [RETRY] soft key is pressed.
   To cancel the operation, press the [ALARM RESET] soft key.

3. Next Alarm
   When multiple alarms have occurred, the next alarm is displayed by pressing the [NEXT ALARM] soft key.

3.8 Diagnose (I/O Data) Screen

The diagnose (I/O data) screen is displayed when the [DIAG- NOSE] soft key is pressed on the primary operation screen. This screen has DI/DO signal status display functions.

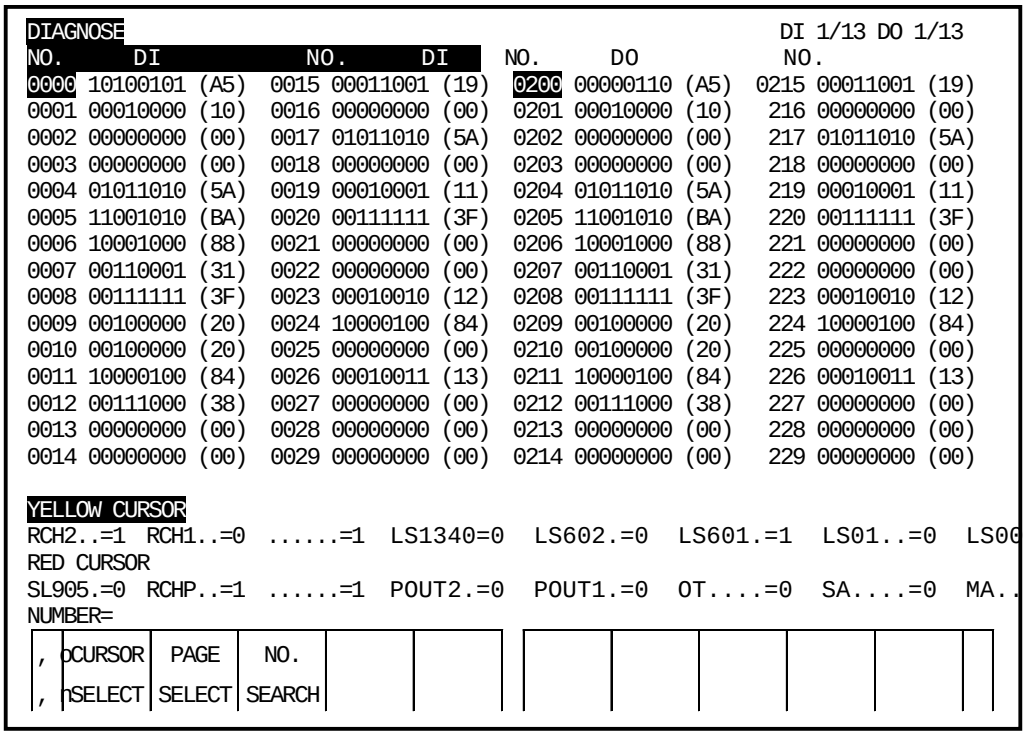


FIGURE 3-17 DIAGNOSE (I/O DATA) SCREEN

3.8.1 Display Content

1. Page (DI/DO)
   There are 13 DI and 13 DO pages. The respective page number is displayed at the top right of the screen.

2. NO.
   This indicates the diagnose number. Thirty DI (input) signals are shown on the left side of the screen (2 columns of 15 each), and 30 DO (output) signals are shown on the right side (2 columns of 15 each).

Diagnose No.		Description
000 – 095	:	Machine input signals (On/Off status of limit switches, thermal switches, etc.)
096 – 107	:	Main control panel input signals (On/Off status of switches)
200 – 295	:	Machine output signals (On/Off status of solenoids, motors, etc.)
296 – 303	:	Main control panel output signals (On/Off status of lamps)
500 – 799	:	Input signals from NC to machine side
800 – 991	:	Output signals from machine side to NC

1. Refer to the Machine I/OTable chapter for the names and meaning of diagnose No. 000 – 303.
2. Refer to "Interface Between CNC and PMC" in the FS16M/FS16i Connection Manual for signal Nos. 500 – 991. Diagnose No. 500 corresponds to the F000 address, and diagnose No. 800 corresponds to the G000 address.

3. Input/Output
   The status of each diagnose No. signal is displayed using 8 bits. The far right digit is the 0 bit. The value in parentheses ( ) indicates the 8 bit data as a hexadecimal number.

4. Red/Yellow Cursors
   A red and a yellow cursor are displayed on the screen. They can be moved as desired. When both cursors overlap, they are displayed in red.

5. Signal Name
   The signal name and On/Off status of the diagnose No. signal bit where the cursor is located are displayed.
   "1" indicates the signal is On, and "0" indicates it is Off.

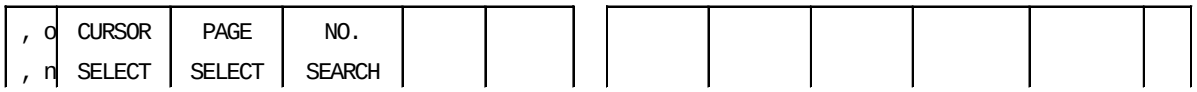
```
   Bit 7  @    Bit 6  @    Bit 5  @  Bit 4
  @  «     @@     «           «          «
RCH2..=0  @RCH1..=1  @.....=0  @LS1340=0

   Bit 3  @  Bit 2  @     Bit 1  @    Bit 0
  @  «     @@    «  @@@      «           «
LS602.=1   LS601.=0   LS01..=1  LS00..=1
```

6. NO=
   This is displayed when searching for a diagnose No.

3.8.2 Soft Keys

1. Types of Soft Keys



2. Soft Key Description

[CURSOR SELECT]	Used to select the red or yellow cursor so that it can be moved.
[PAGE SELECT]	Used to change between the input (DI) side and output (DO) side pages.
[NO. SEARCH]	Pressed to search for a diagnose No.

3.8.3 Screen Operations

3.8.3.1 Changing Between Screens

1. The [PAGE SELECT] soft key is used to change between the input (DI) and output (DO) side pages.

2. The selected page is highlighted in green.

3. Change between screen pages (1 – 13) using the [↓ PAGE] and [↑ PAGE] NC keys.

3.8.3.2 Cursor Movement

The two cursors cannot be moved at the same time. First select the desired cursor before moving it.

1. The cursor to be moved is selected with the [CURSOR SELECT] soft key. At the bottom of the screen, "YELLOW CURSOR" or "RED CURSOR" is highlighted.

2. The selected cursor (red or yellow) is moved with the cursor keys. The signal name changes as the cursor is moved.

3.8.3.3 Diagnose No. Search Procedure

1. Enter the diagnose No.
   The entered data appears to the right of [NUMBER=].

2. Press the [NO. SEARCH] soft key.

3. The selected cursor moves to the entered diagnose number. The signal name display changes at this time.

When a number higher than the highest existing diagnosis number is entered, the cursor moves to the last diagnose No.

3.9 Maintenance Screen

The maintenance screen is displayed when the [MAINT- ENANCE] soft key is pressed on the primary operation screen.

There are three functions on the maintenance screen:
1. Display of machine status
2. Selection of maintenance screens
3. Turning maintenance mode On and Off

When the machine is stopped, the status and cause (emergency stop, interlock, feed hold, servo Off) are displayed on the maintenance screen. The various maintenance screens are used to restore the machine to its normal operating condition (perform maintenance).

3.9.1 Machine Status Display Page

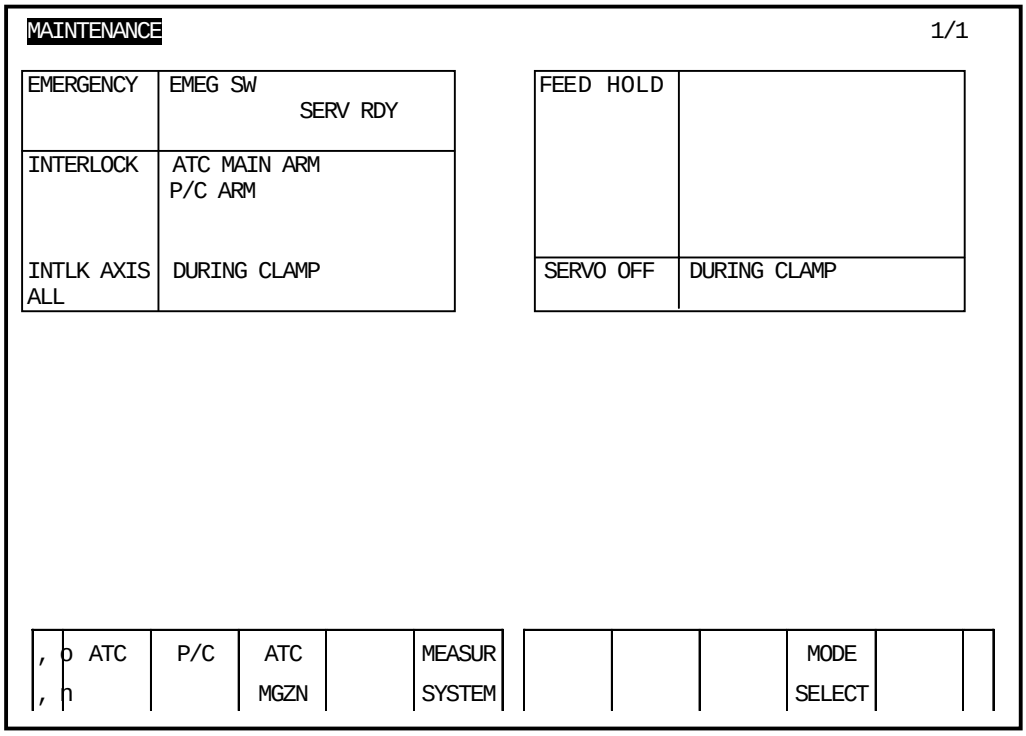


FIGURE 3-18 MAINTENANCE SCREEN, MACHINE STATUS DISPLAY PAGE

* V55 screen is shown above.

3.9.1.1 Machine Status Display Page Content

When an emergency stop, interlock or feed hold is triggered, or when the servo goes Off, the status and cause are displayed on the machine status display page.

1. Emergency Stop
   When the machine has been stopped by an emergency stop, the cause is displayed in red. The message changes to white when the emergency stop status is reset.

2. Interlock
   When the machine is stopped by an axis interlock, the cause of the axis interlock is displayed in yellow
   The message changes to white when the axis interlock is released.

3. Interlock Axis
   The name of the axis stopped by the interlock is displayed.

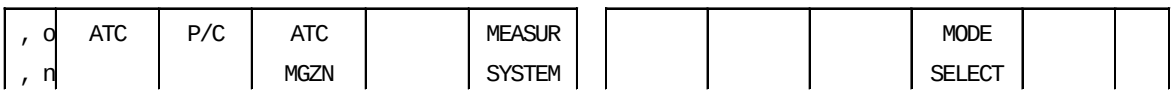
4. Feed Hold
   When the machine is stopped by a feed hold, the cause of the feed hold is displayed in yellow. The message changes to white when the feed hold status is cancelled.

5. Servo Off
   The cause of the servo going Off is displayed in green. This changes to white when the servo Off status is cancelled.

6. Maintenance Mode
   This is displayed when the maintenance mode is selected.

3.9.1.2 Machine Status Display Page Soft Keys

1. Types of Soft Keys



2. Soft Key Description

[ATC]	Selects ATC maintenance screen.
[P/C]	Selects P/C maintenance screen (option).
[ATC MGZN]	Selects ATC magazine maintenance screen.
[MEASUR SYSTEM]	Selects Marposs maintenance screen (option).
[MODE SELECT]	Used to change between the normal mode and the maintenance mode.

3.9.1.3 Mode Operation

This operation is performed to change between the normal mode and the maintenance mode.

1. Press the [MODE SELECT] soft key to turn the maintenance mode On and Off.

   When the maintenance mode is selected, "MAINTENANCE MODE" appears at the top of the screen. The maintenance mode is turned On in order to restore the machine to its normal operating condition after the machine was stopped during ATC, P/C or ATC magazine operation.

3.9.2 ATC Maintenance Screen

The ATC maintenance screen is displayed when the [ATC] soft key is pressed on the machine status display page.

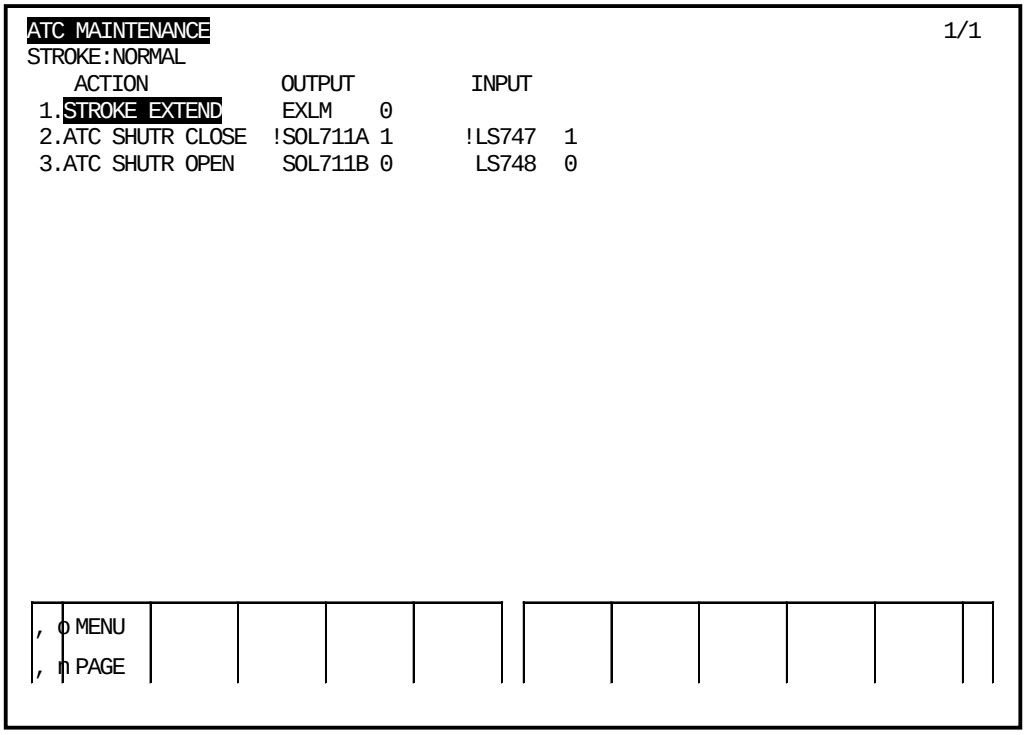


FIGURE 3-19 V55: 15-/25- OOL ATC MAINTENANCE SCREEN

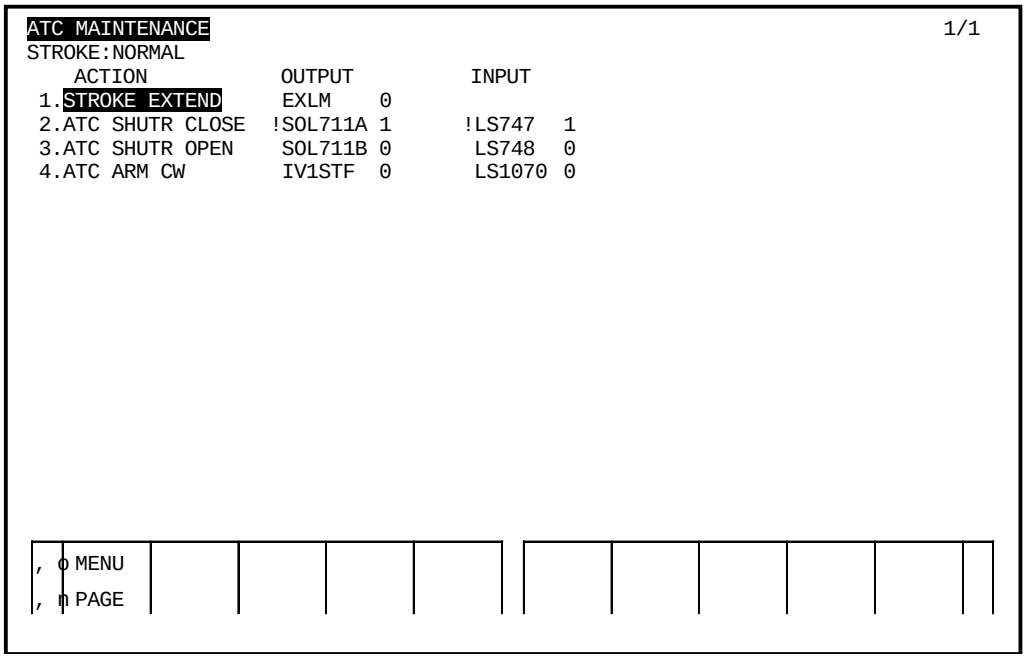


FIGURE 3-20 V55: 40-/80- OOL/MATRIX TYPE ATC MAINTENANCE SCREEN

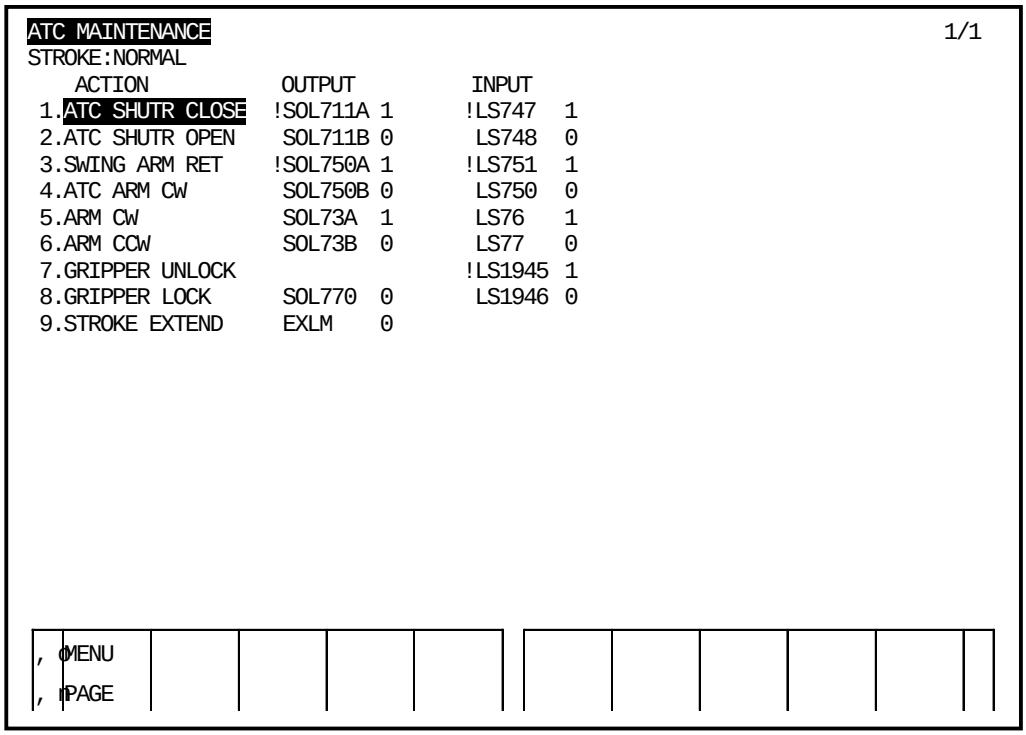


FIGURE 3-21 V33: 15-TOOL ATC MAINTENANCE SCREEN

3.9.2.1 ATC Maintenance Screen Display Content (Solenoids)

1. Stroke Status
   The X axis stroke limit status is displayed.

Display		Status
Normal	:	Stroke limit set within machining range
Extended	:	Stroke limit extended to allow ATC/tool length measuring operation

Normally, the X axis stroke is limited to the machining area, and a stroke limit alarm is triggered in the event a command exceeding this range is sent, preventing movement from being performed.
However, the stroke limit can temporarily be extended to move the X axis outside its stroke when performing an ATC or tool length measuring operation. The stroke limit is returned to its original setting upon completion of the operation.

2. Operation
   The respective ATC operation is displayed.

   V55
   A. STROKE EXTEND
   B. ATC SHUTR CLOSE
   C. ATC SHUTR OPEN
   D. ATC ARM CW (only for 40-/80-tool or matrix type ATC)

   V33: 15-Tool Type
   A. ATC SHUTR CLOSE
   B. ATC SHUTR OPEN
   C. SWING ARM RET
   D. SWING ARM ADV
   E. ARM CW
   F. ARM CCW
   G. GRIPPER UNLOCK
   H. GRIPPER LOCK
   I. STROKE EXTEND

3. Output
   The output On/Off status is displayed.
   "1" is displayed when it is On, and "0" when it is Off.
   "!" is displayed in green to the left of the solenoid name when it is in the standby status.

4. Input
   The input On/Off status is displayed.
   "1" is displayed when it is On, and "0" when it is Off.

"!" is displayed in green to the left of the limit switch name when it is in the standby status.

5. Maintenance Mode
   This is displayed when the maintenance mode is selected. The maintenance mode is used to restore the machine to the normal operation status after the machine is stopped during ATC operation.

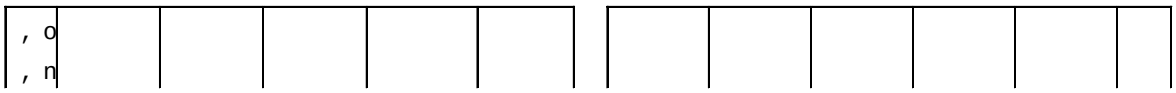
6. Single Mode
   This is displayed when the single mode is selected while the maintenance mode is active.

7. Jog Mode
   This is displayed when the jog mode is selected while the maintenance mode is active.

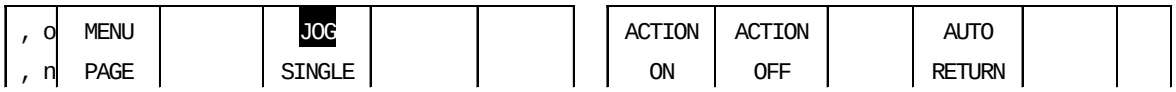
3.9.2.2 ATC Maintenance Screen Soft Keys

1. Types of Soft Keys

A. Normal Status (for Solenoids)



B. Maintenance Mode (for Solenoids)



2. Soft Key Description

[MENU PAGE] ¥¥¥¥ Selects machine status display page.

[JOG SINGLE] ¥¥¥ Displayed when the maintenance mode i active. Used to change between the singl mode and jog mode. The current mode is highlighted.

[ACTION ON] ¥¥¥¥¥ Displayed when the maintenance mode i active. Turns On the operation selected by the cursor.

[ACTION OFF] ¥¥¥¥ Displayed when the maintenance mode i active. Turns Off the operation selected by the cursor.

[AUTO RETURN] ¥¥ Pressing this key when the machine has been stopped by an emergency stop or alarm durin ATC operation automatically returns the ATC arm to the standby position (only for V55)

3.9.2.3 ATC Maintenance Screen Operations

There are some cases where the spindle tool and next tool pot (tool) numbers differ from the actual tool numbers after completion of the maintenance operation. In this event, this data is changed on the tool detail screen. Refer to section 3.4.3.4, Overwriting Spindle Tool/Next Tool.

Manual Operation of Solenoids

1. @Select the maintenance mode on the machine status display page.

2. @Select the ATC maintenance screen.

3. @Select the item to be started by the maintenance operation with the cursor keys.

4. @Select the operation mode with the [JO SINGLE] soft key.
   The selected mode appears at the top of the screen.
   - EJOG Mode — Movement is performed while the [ACTION ON] soft key is held down, and stops when it is released.
   - ESingle Mode — Operation is performed to the final point once the [ACTION ON] soft key is pressed.

5. @Press the [ACTION ON] or [ACTION OFF] soft key.
   @@This enables the solenoid to be turned On or Off.
   @@When one solenoid is turned On, the opposite solenoid is automatically turned Off.
   The solenoid is only excited while the [ACTION ON] soft key is pressed during the Jog mode.

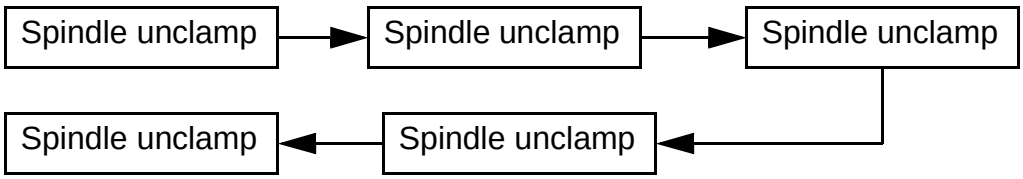
Operation is not performed unless all of the necessary conditions are satisfied.
An error message is displayed at the bottom of the screen when operation cannot be performed for the selected item.

Pressing the [OT RELEASE] button on the main control panel to turn the respective interlock Off enables operations to be performed. However, make sure to excercise extra caution at this time as it can be very dangerous.

ATC Automatic Restore Operation (V55 only)

The ATC arm is automatically returned to the standby position by pressing the [AUTO RETURN] soft key when the machine is stopped by an emergency stop or alarm during ATC operation, and the ATC arm is not at the standby status.
The maintenance mode does not need to be activated at this time.

Operation is restored according to the procedure described below, although this differs depending upon the status of the stopped ATC arm:



1. The automatic restore operation is performed even if the spindle is not at the orientation position, and the X/Z axes are not at their 2nd reference point. Therefore, make sure to pay special attention to the actual status of the spindle and the location of the X and Z axes.
2. The spindle tool number is not registered by the automatic restore operation. Make sure to compare the actual tool status with the registered tool data after the automatic restore operation is performed. Correct the data on the tool detail screen if any discrepancies are found. (Refer to section 3.4, Tool Detail Screen.)
3. The automatic restore operation can still be performed after the power has been turned off.
4. A machine alarm is triggered if the limit switch status prevents the automatic restore operation from being performed, indicating which signal is abnormal. In this case, restore operation manually, referring to the details of the alarm.
5. When ATC operation has been interrupted by an alarm, reset the alarm before performing the automatic restore operation. This operation cannot be performed until the alarm is reset.

3.9.3 P/C Maintenance Screen (Option)

The P/C maintenance screen is displayed when the [P/C] soft key is pressed on the machine status display page.

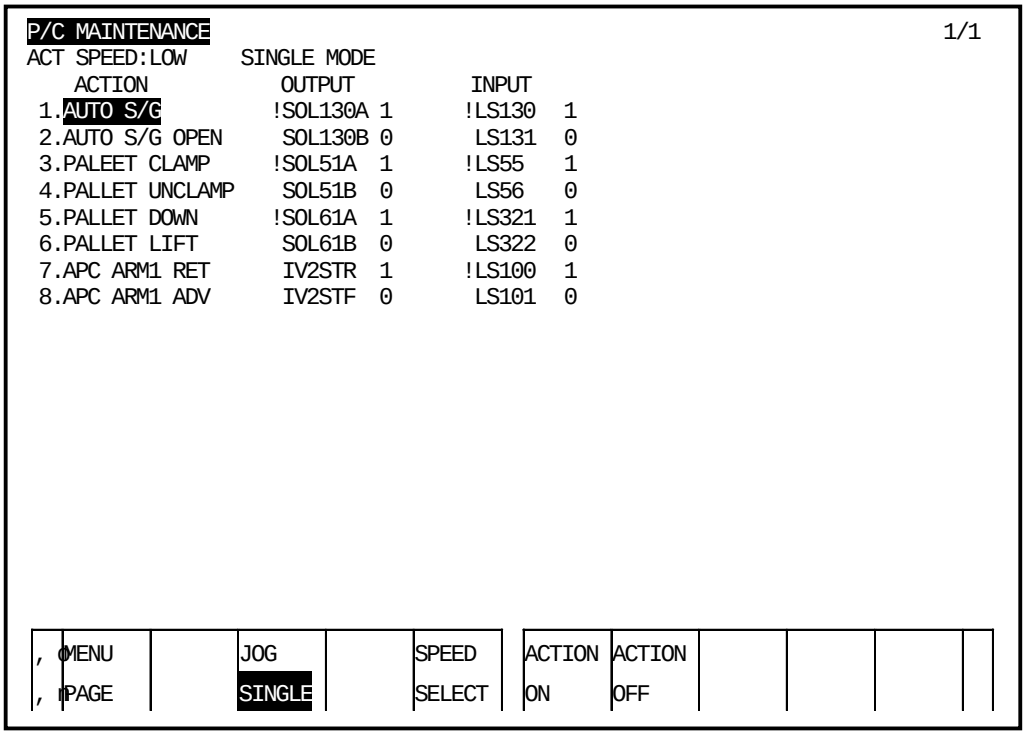


FIGURE 3-22 V55: P/C MAINTENANCE SCREEN

3.9.3.1 P/C Maintenance Screen Display Content (Solenoids)

1. Output
   The output On/Off status is displayed.
   "1" indicates it is On, and "0" indicates it is Off.
   "!" is displayed in green to the left of the output name when it is in the standby status.

2. Input
   The input On/Off status is displayed.
   "1" indicates it is On, and "0" indicates it is Off.
   "!" is displayed in green to the left of the input name when it is in the standby status.

3. Maintenance Mode
   "MAINTENANCE MODE" is displayed at the top of the screen when the maintenance mode is selected. The maintenance mode is used to restore the machine to its normal operating status after it has been stopped during P/C operation.

4. Single Mode
   "SINGLE" is displayed when the single mode is selected while the maintenance mode is active.

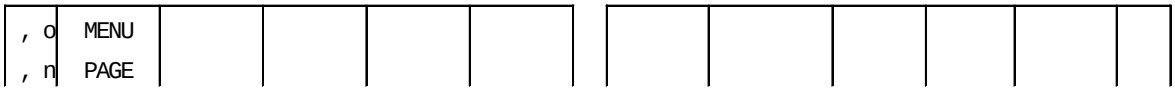
5. Jog Mode
   "JOG" is displayed when the jog mode is selected while the maintenance mode is active.

6. Operation (ACT) Speed
   This indicates the speed at which the machine is operated: Medium or Low.

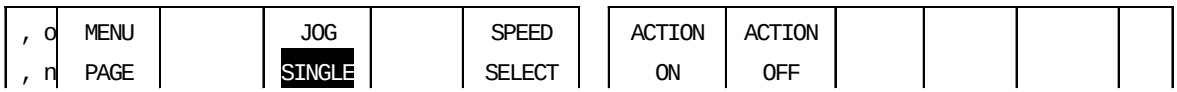
3.9.3.2 P/C Maintenance Screen Soft Keys

1. Types of Soft Keys

A. Normal Status



B. Maintenance Mode



2. Soft Key Description

[MENU PAGE]	Selects machine status display page.
[JOG SINGLE]	Displayed when the maintenance mode is active. Used to change between the single mode and jog mode. The current mode is highlighted.
[SPEED SELECT]	Displayed when the maintenance mode is active. The operation speed is changed between medium and low speed each time this key is pressed. Low is the normal speed.
[ACTION ON]	Displayed when the maintenance mode is active. Turns the solenoid selected by the cursor On.
[ACTION OFF]	Displayed when the maintenance mode is active. Turns the solenoid selected by the cursor Off.

3.9.3.3 P/C Maintenance Screen Operations

Manual Operation of Solenoids

1. @Select the maintenance mode on the machine status display page.

2. @Select the P/C maintenance screen.

3. @Select the item to be started by the maintenance operation with the cursor keys.

4. @Select the operation mode with the [JOG SINGLE] soft key.
   The selected mode appears at the top of the screen.
   - EJOG Mode — Movement is performed whil the [ACTION ON] soft key is held down, and stops when it is released.
   - ESingle Mode — Operation is performed to the final point once the [ACTION ON] soft key is pressed.

5. @Press the [ACTION ON] or [ACTION OFF] soft key.
   @@This enables the solenoid to be turned On or Off.
   @@When one solenoid is turned On, the opposite solenoid is automatically turned Off.

   When in the Jog mode, the solenoid is only excited while the [ACTION ON] soft key is held down.

When the following solenoids are turned On, operation is not stopped until the [SOL ON] soft key for the opposite item is pressed:

- Pallet clamping Û Unclamping (SOL51)
- Table clamping Û Unclamping (SOL51)
  (Clamp & Down) (Unclamp & Lift)

Operation is not performed unless all of the necessary conditions are satisfied.
An error message is displayed at the bottom of the screen when operation cannot be performed for the selected item.

Pressing the [OT RELEASE] button on the main control panel to turn the respective interlock Off enables operations to be performed. However, make sure to excercise extra caution at this time as it can be very dangerous.

3.9.4 ATC Magazine Maintenance Screen

3.9.4.1 ATC Magazine Maintenance Screen (Solenoids)

The ATC magazine maintenance screen (solenoids) is displayed when the [ª PAG] or [« PAG] NC key is pressed after pressing the [ATC MGZN] soft key on the machine status display page.

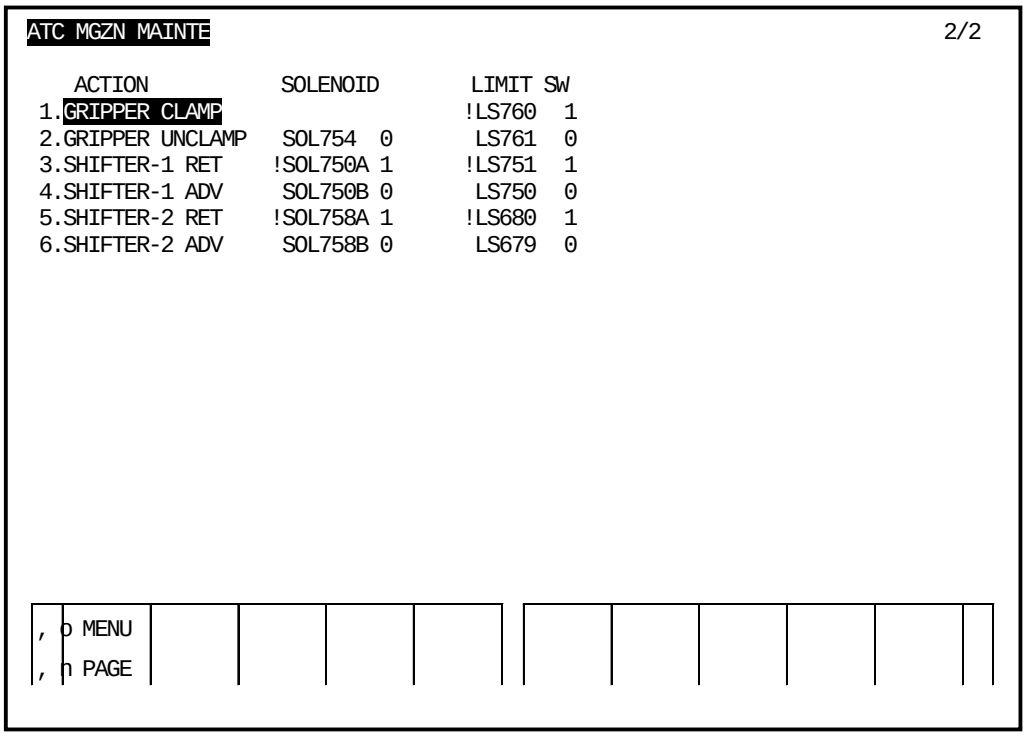


FIGURE 3-23 V55: 40-TOOL ATC MAGAZINE MAINTENANCE SCREEN (SOLENOIDS)

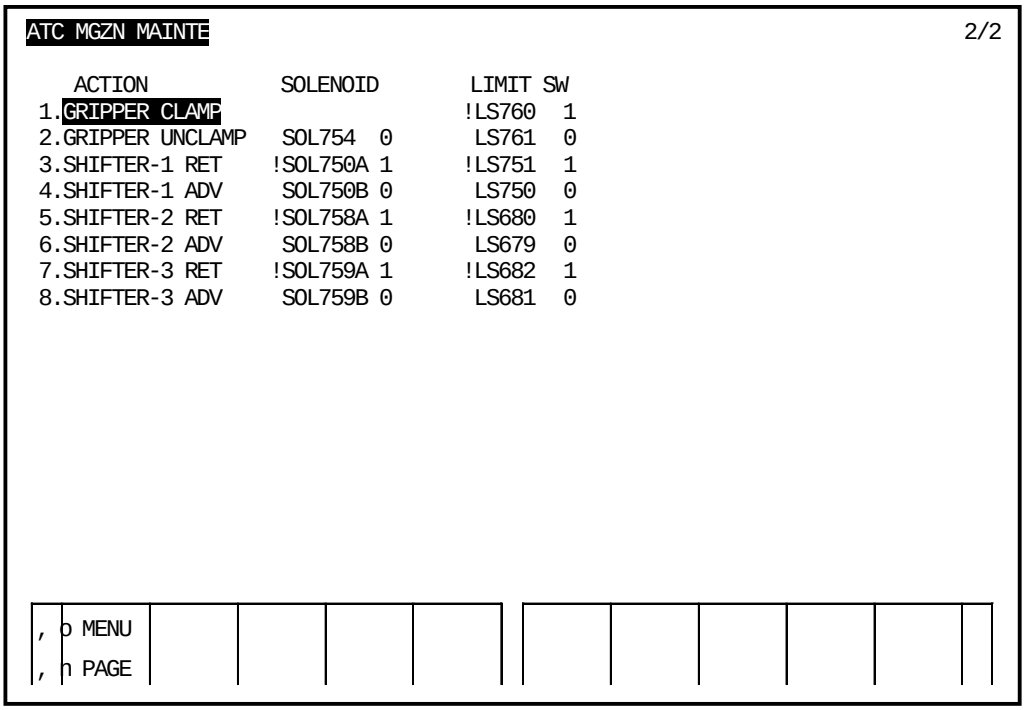


FIGURE 3-24 V55: 80-TOOL ATC MAGAZINE MAINTENANCE SCREEN (SOLENOIDS)

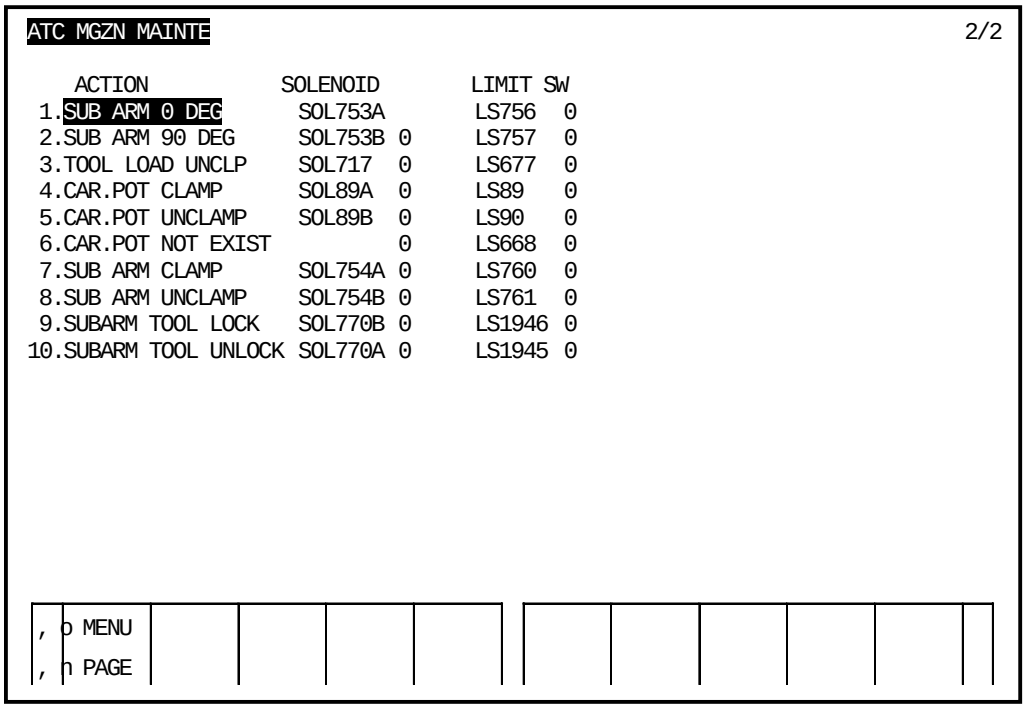


FIGURE 3-25 V55: MATRIX TYPE ATC MAGAZINE MAINTENANCE SCREEN (SOLENOIDS)

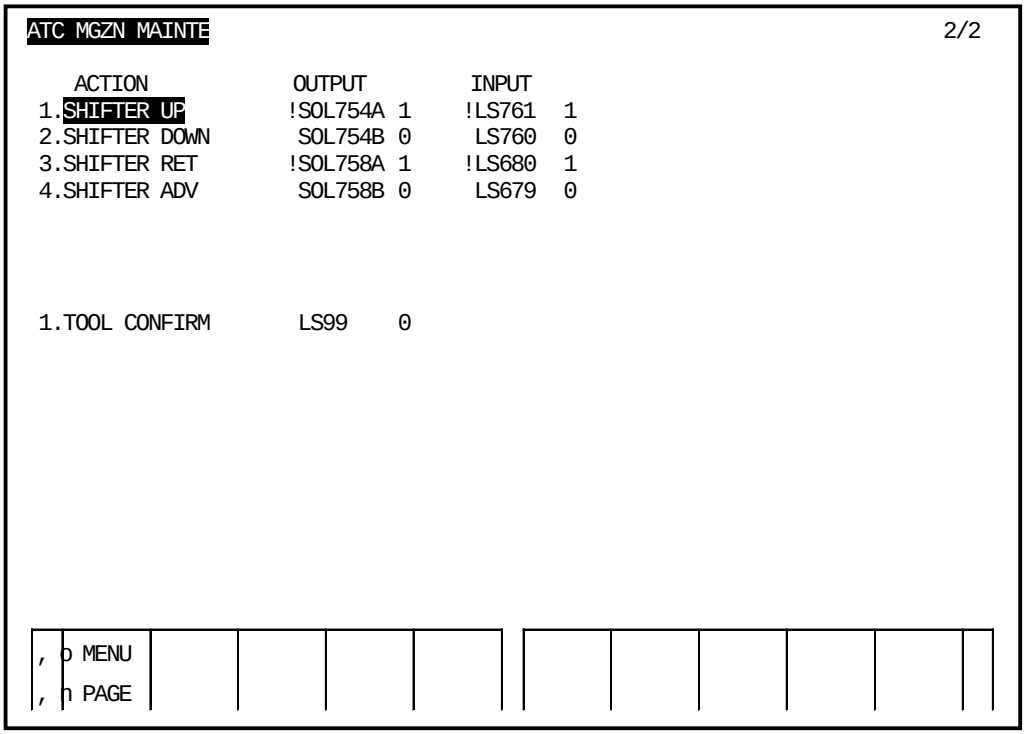


FIGURE 3-26 V33: 15-TOOL ATC MAGAZINE MAINTENANCE SCREEN (SOLENOIDS)

1. Action
   The respective ATC magazine related action is displayed.

   V55: 40-Tool ATC
   A. GRIPPER CLAMP
   B. GRIPPER UNCLAMP
   C. SHIFTER-1 RET
   D. SHIFTER-1 ADV
   E. SHIFTER-2 RET
   F. SHIFTER-2 ADV

   V55: 80-Tool ATC
   A. GRIPPER CLAMP
   B. GRIPPER UNCLAMP
   C. SHIFTER-1 RET
   D. SHIFTER-1 ADV
   E. SHIFTER-2 RET
   F. SHIFTER-2 ADV
   G. SHIFTER-3 RET
   H. SHIFTER-3 ADV

   V55: Matrix Type ATC
   A. SUB ARM 0 DEG
   B. SUB ARM 90 DEG
   C. TOOL LOAD UNCLP
   D. CAR. POT UNCLAMP
   E. CAR. POT CLAMP
   F. CAR. POT NOT EXIST
   G. SUB ARM CLAMP
   H. SUB ARM UNCLAMP
   I. SUBARM TOOL CLAMP
   J. SUBARM TOOL UNCLAMP

   V33: 15-Tool ATC
   A. SHIFTER UP
   B. SHIFTER DOWN
   C. SHIFTER RET
   D. SHIFTER ADV
   E. TOOL CONFIRM

2. Solenoid
   The solenoid On/Off status is displayed.
   "1" indicates the solenoid is On, and "0" indicates it is Off.
   "!" is displayed in green to the left of the solenoid name when it is in the standby status.

3. Limit Switch
   The limit switch On/Off status is displayed.
   "1" indicates the limit switch is On, and "0" indicates it is Off.
   "!" is displayed in green to the left of the limit switch name when it is in the standby status.

4. Output
   The output On/Off status is displayed.
   "1" indicates it is On, and "0" indicates it is Off.
   "!" is displayed in green to the left of the output name when it is in the standby status.

5. Input
   The input On/Off status is displayed.
   "1" indicates it is On, and "0" indicates it is Off.
   "!" is displayed in green to the left of the input name when it is in the standby status.

6. Maintenance Mode
   "MAINTENANCE MODE" is displayed at the top of the screen when the maintenance mode is selected. The maintenance mode is used to restore the machine to its normal operating status after it has been stopped during ATC magazine operation.

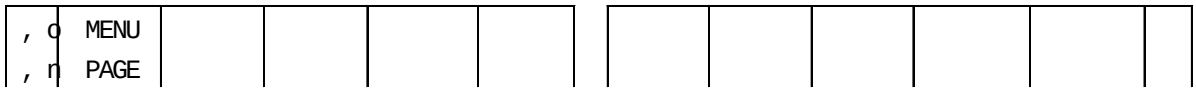
7. Single Mode
   "SINGLE" is displayed when the single mode is selected while the maintenance mode is active.

8. Jog Mode
   "JOG" is displayed when the jog mode is selected while the maintenance mode is active.

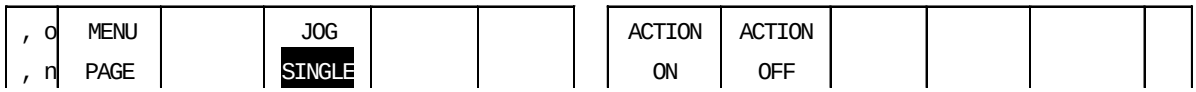
ATC Maintenance Screen Soft Keys

1. Types of Soft Keys

A. Standard Mode (for Solenoids)



B. Maintenance Mode (for Solenoids)



2. Soft Key Description

[MENU PAGE] ¥¥¥¥ Selects machine status display page.

[JOG SINGLE] ¥¥¥ Displayed when the maintenance mode is active. Used to change between the single mode and jog mode. The current mode is highlighted.

[ACTION ON] ¥¥¥¥ Displayed when the maintenance mode is active. Turns the actuator (solenoid) selected by the cursor On.

[ACTION OFF] ¥¥¥¥ Displayed when the maintenance mode is active. Turns the actuator (solenoid) selected by the cursor Off.

ATC Maintenance Screen Operations (Solenoids)

There are some cases where the spindle tool and next tool pot (tool) numbers differ from the actual tool numbers after completion of the maintenance operation. In this event, this data is changed on the tool detail screen. Refer to section 3.4.3.4, Overwriting Spindle Tool/Next Tool.

Manual Operation of Solenoids

1. @Select the maintenance mode on the machine status display page.

2. @Select the ATC magazine maintenance screen (solenoids).

3. @Select the item to be started by the maintenance operation with the cursor keys.

4. @Select the operation mode with the [JOG SINGLE] soft key.
   The selected mode appears at the top of the screen.
   - EJOG Mode — Movement is performed while the [ACTION ON] soft key is held down, and stops when it is released.
   - ESingle Mode — Operation is performed to the final point once the [ACTION ON] soft key is pressed.

5. @Select manual intervention for the ATC magazine.

6. @Press the [ACTION ON] or [ACTION OFF] soft key.
   @@This enables the solenoid to be turned On or Off.
   @@When one solenoid is turned On, the opposite solenoid is automatically turned Off.

   When in the Jog mode, the solenoid is only excited while the [ACTION ON] soft key is held down.

Operation is not performed unless all of the necessary conditions are satisfied.
An error message is displayed at the bottom of the screen when operation cannot be performed for the selected item.

Pressing the [OT RELEASE] button on the main control panel to turn the respective interlock Off enables operations to be performed. However, make sure to excercise extra caution at this time as it can be very dangerous.

3.9.4.2 ATC Magazine Maintenance Screen (Servos)

The ATC magazine maintenance screen (servos) is displayed when the [ATC MGZN] soft key is pressed on the machine status display page.

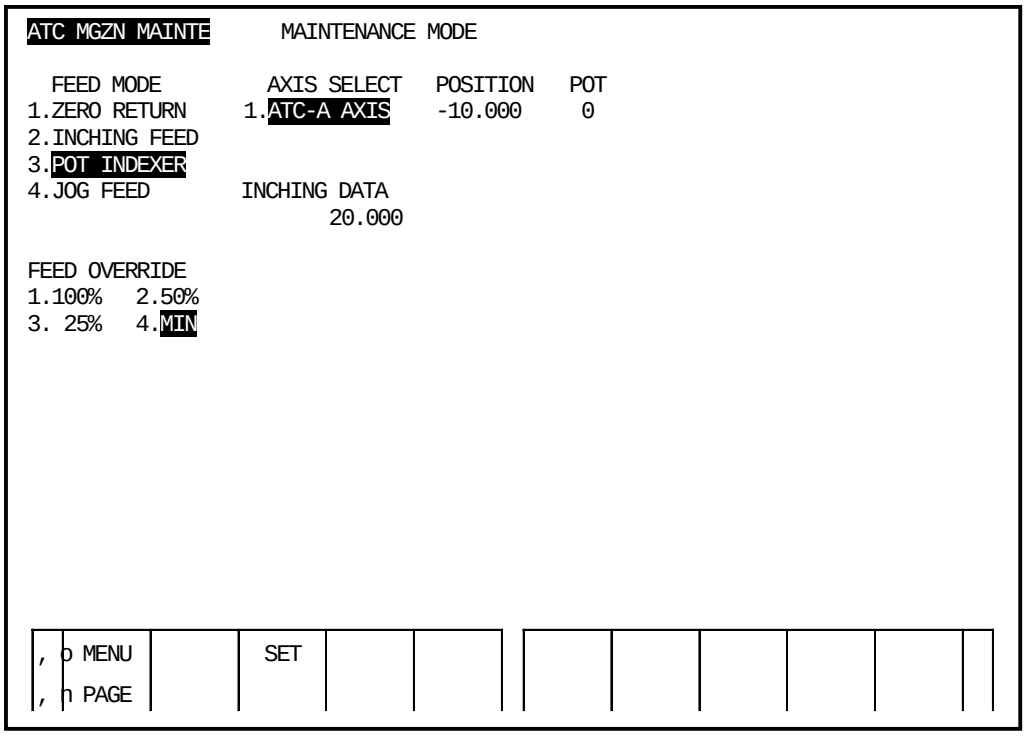


FIGURE 3-27 V55: 15-/25- OOL TYPE ATC MAINTENANCE SCREEN (SERVOS)

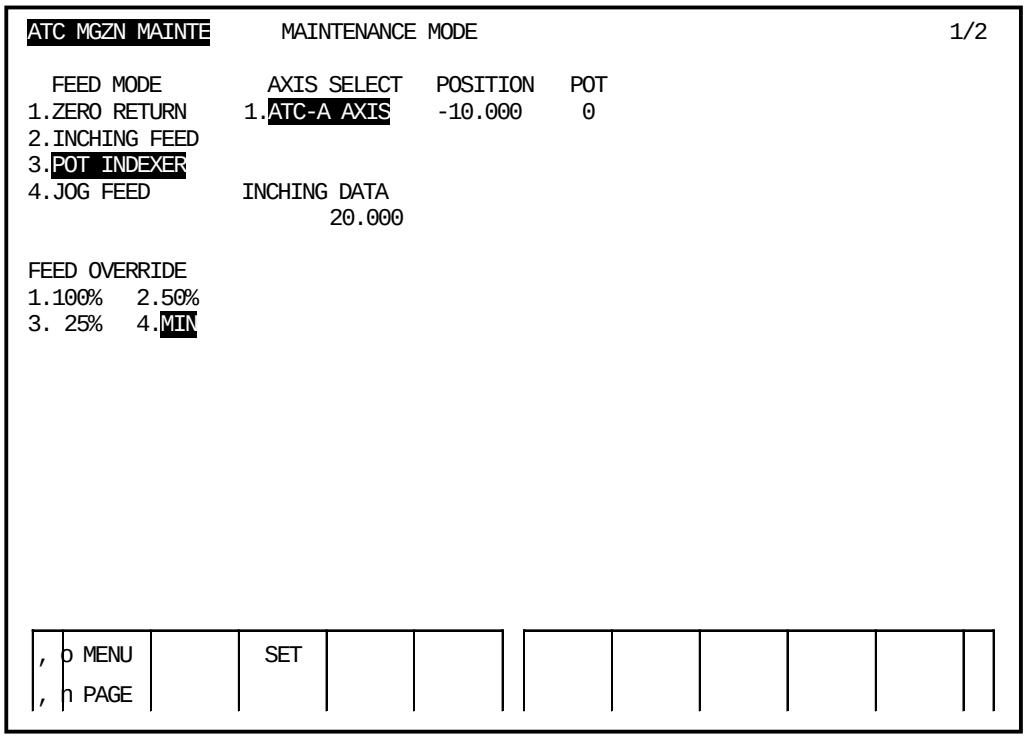


FIGURE 3-28 40- OOL TYPE ATC MAINTENANCE SCREEN (SERVOS)

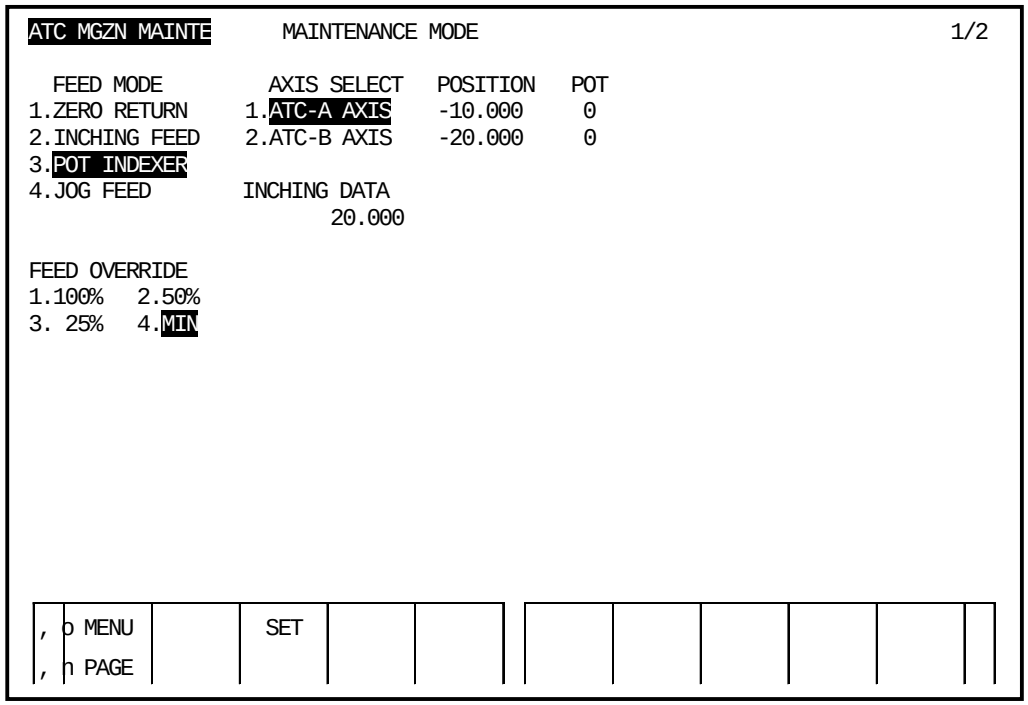


FIGURE 3-29 V55: 80-TOOL TYPE ATC MAINTENANCE SCREEN (SERVOS)

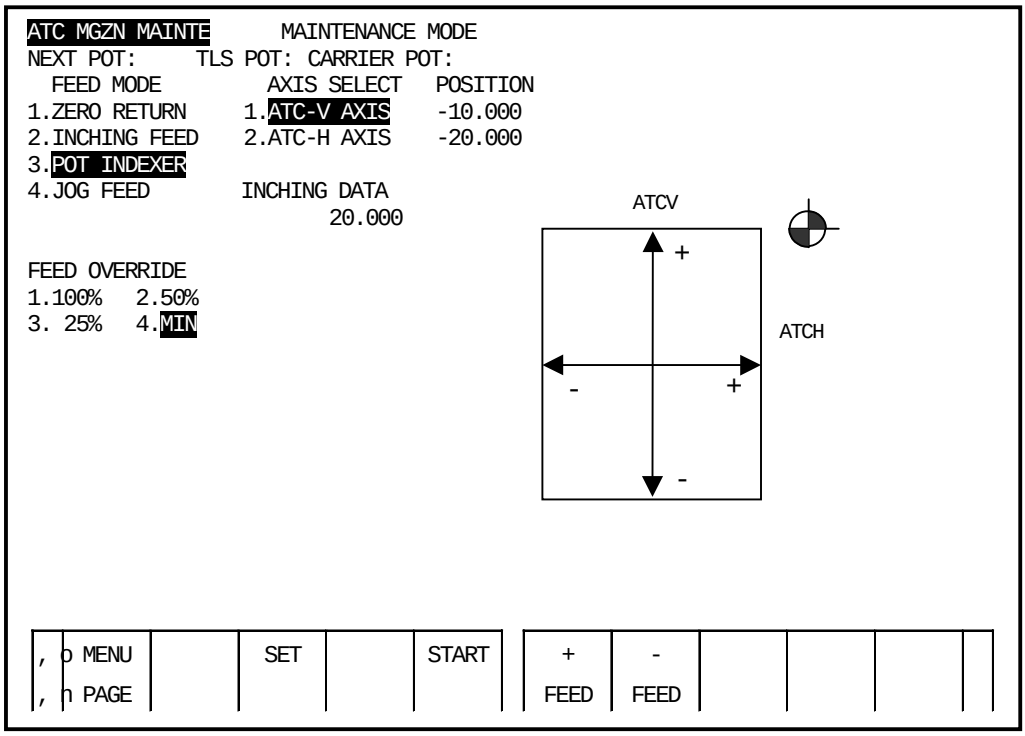


FIGURE 3-30 V55: MATRIX TYPE ATC MAINTENANCE SCREEN (SERVOS)

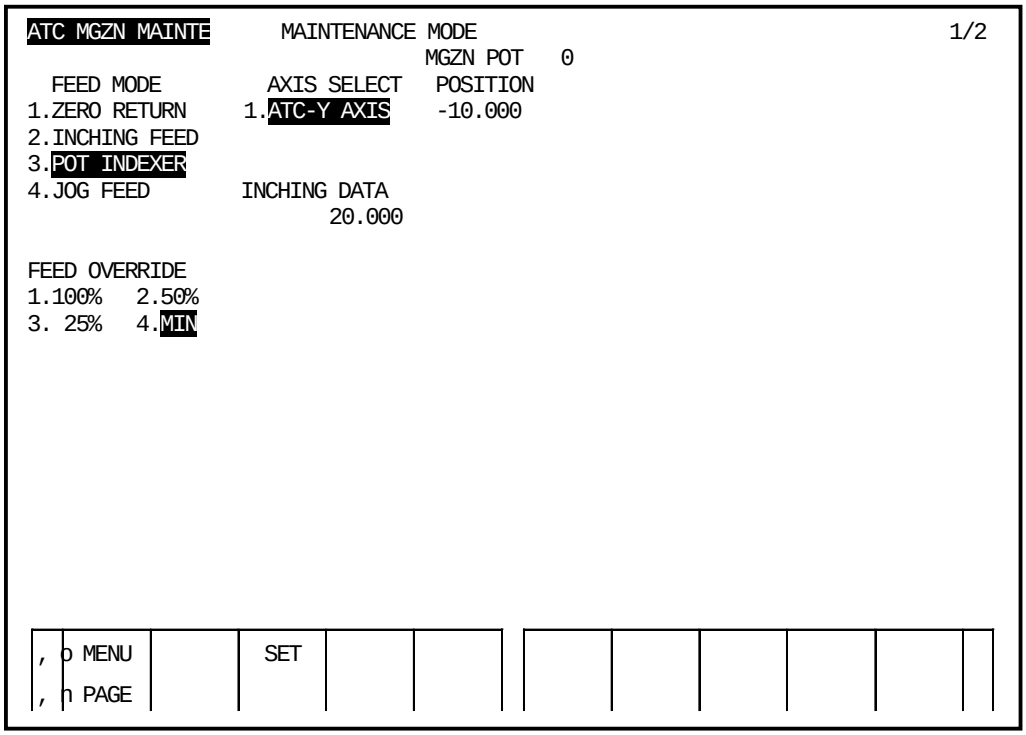


FIGURE 3-31 V33: 15-TOOL TYPE ATC MAINTENANCE SCREEN (SERVOS)

ATC Mag. Maintenance Screen (Servos) Content

A number of locations are highlighted on the screen as follows:

Highlighted in white : Cursor
Highlighted in blue : Selected items

When the cursor is positioned on a selected item, it is highlighted in white.

1. Feed Mode
   The feed mode in which the ATC magazine is operated is displayed. The selected mode (reference [zero] point return, inching feed, pot indexing or jog feed) is highlighted in blue.

2. Feed Override
   This indicates the speed at which the magazine is operated. This is a percentage of the speed during automatic operation, considered to be 100%. The selected speed is highlighted in blue.

3. Feed Axis Select
   This indicates the ATC magazine axis.
   The selected axis is highlighted in blue.

4. Position (Coordinate Value)
   This indicates the coordinate value of each ATC magazine axis. "0" is the reference point.

5. Inching Data
   This indicates the movement distance in the inching feed mode.
   Setting Range : 0 – 99999.999 (mm or °)

6. Magazine Pot
   This indicates the pot on the magazine indexed to the change position with the sub arm.

7. Next Pot, TLS Pot, Carrier Pot

   A. NEXT POT : Indicates next tool pot number.

   B. TLS POT : Indicates tool number indexed to tool loading station.

   C. CARRIER POT : Indicates pot number in carrier pot.

The data for items A. to C. above can be overwritten in the maintenance mode.
Overwriting Pot Numbers
When a pot is moved using the maintenance or other operation, make sure that the actual machine status corresponds with the MPC5 internal memory (which is retained). The internal MPC5 memory data is displayed by "NEXT POT", TLS POT", "CARRIER POT" and "SUB ARM POT" on the maintenance screen. When necessary, align the cursor with the item you wish to change, and overwrite the pot number using the procedure described below:

1. Move the cursor to "NEXT POT", TLS POT" or "CARRIER POT".

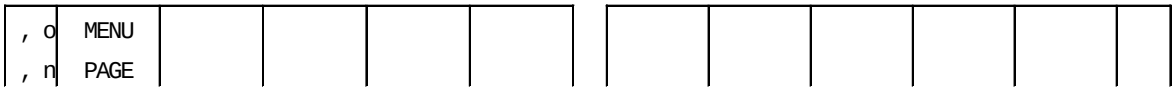
2. Enter the pot number which corresponds to the actual pot number on the machine, and press the [INPUT] key. Any pot number from "0" to the highest pot number can be entered. Entering "0" indicates there is no pot. When "0" is entered, nothing is displayed.

8. Index Pot (Only displayed for matrix type magazine)
   This indicates the position to be indexed by the sub arm or carrier pot.

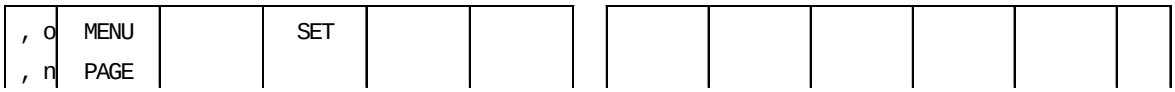
ATC Magazine Maintenance Screen (Servos) Soft Keys

1. Types of Soft Keys

A. Initial Status



B. Maintenance Mode (V55: 15-/25-/40-/80-Tool ATC, V33: 15-Tool ATC)



C. Maintenance Mode (V55: Matrix Type ATC)

2. Soft Key Description

[MENU PAGE]	Selects machine status display page.
[SET]	Sets feed mode or feed override.
[START]	Displayed when pot indexing is selected as feed mode while maintenance mode is active. This key is pressed to start pot indexing.
[+ FEED]	Displayed when maintenance mode is active. Used to move ATC magazine axes in jog mode.
[– FEED]	Displayed when maintenance mode is active. Used to move ATC magazine axes in jog mode.

ATC Mag. Maintenance Screen (Servos) Operations (V55: 15-/25-/40-/80-Tool ATC, V33: 15-Tool ATC)

There are the following feed modes:

1. ZERO RETURN — Performs zero (reference point) return.
2. INCHING FEED — Movement is performed by an amount equal to the entered value.
3. POT INDEXER — The axis is moved (indexed) to the entered pot.
4. INCHING FEED — Movement is performed while the [CW] or [CCW] button on the ATC control panel is held down.

ATC Magazine Reference Point Return

1. Activate maintenance mode on machine status display page.

2. Align the cursor with Zero (reference point) Return, and press the [SET] soft key.

This mode cannot be selected during ATC magazine operation.

3. Align the cursor with a feed override value between MIN and 100% (MIN and 50% for 15/25-tool ATC on V55), and press the [SET] soft key.

4. Press the [CW] key on the ATC control panel to perform zero point return after confirming the magazine position. The magazine is rotated while the [CW] key on the ATC control panel is held down, and automatically stops upon completion of zero (reference) point return.

An error message is displayed at the bottom of the screen when the ATC magazine cannot be operated.

ATC Magazine Inching Feed

In this mode, the magazine is rotated by an amount equal to the inching setting.

1. Activate maintenance mode on machine status display page.
2. Align the cursor with Inching Feed, and press the [SET] soft key.

This mode cannot be selected during ATC magazine operation.

3. Align the cursor with a feed override value between MIN and 100%, and press the [SET] soft key.
4. Align the cursor with the inching setting.
5. Enter the movement distance in degrees (°) (input line appears).
6. To move the magazine in the clockwise direction, press the [CW] key on the ATC control panel after confirming the magazine position, and to move the magazine in the counterclockwise direction, press the [CCW] key . Once either key is pressed, the magazine is rotated the set inching distance, and automatically stops at this distance.

An error message is displayed at the bottom of the screen when the ATC magazine cannot be operated.

ATC Magazine Pot Indexing

When the [CW] or [CCW] key on the ATC control panel is pressed (and released), movement stops at the nearest pot. This is the same as the manual intervention operation.

1. Activate maintenance mode on machine status display page.

2. Align the cursor with Pot Indexer, and press the [SET] soft key.

This mode cannot be selected during ATC magazine operation.

3. Align the cursor with a feed override value between MIN and 100%, and press the [SET] soft key.

4. The magazine is rotated when the [CW] or [CCW] key on the ATC control panel is pressed. Movement stops at the nearest indexing position when the key is released.

An error message is displayed at the bottom of the screen when the ATC magazine cannot be operated.

ATC Magazine Jog Feed

The magazine is rotated while the [CW] or [CCW] key on the ATC control panel is held down.

1. Activate maintenance mode on machine status display page.

2. Align the cursor with Jog Feed, and press the [SET] soft key.

This mode cannot be selected during ATC magazine operation.

3. Align the cursor with a feed override value between MIN and 100%, and press the [SET] soft key.

4. To move the magazine in the clockwise direction, press the [CW] key on the ATC control panel after confirming the magazine position, and to move the magazine in the counterclockwise direction, press the [CCW] key . The magazine is rotated while either key is held down, and stops when it is released.

An error message is displayed at the bottom of the screen when the ATC magazine cannot be operated.

ATC Mag. Maintenance Screen (Servos) Operations (V55: Matrix Type ATC Magazine)

There are the following feed modes:

1. Zero Return — Performs zero (reference) point return.
2. Inching Feed — Moves magazine by an amount equal to inching setting (mm).
3. Pot Indexer — Performs axis movement to set indexing pot.
4. Inching Feed — Movement is performed while the [+ FEED] or [– FEED] soft key is held down.

ATC Magazine Reference Point Return

1. Activate maintenance mode on machine status display page.

2. Align the cursor with Zero (reference point) Return, and press the [SET] soft key.

This mode cannot be selected during ATC magazine operation.

3. Align the cursor with a feed override value between MIN and 100%, and press the [SET] soft key.

4. Align the cursor with the axis you wish to return to the zero point, and press the [SET] soft key.

5. Press the [+ FEED] soft key to perform zero point return from the – direction after confirming the carrier position.

An error message is displayed at the bottom of the screen when the ATC magazine cannot be operated.

ATC Magazine Inching Feed

The magazine is moved by an amount equal to the entered inching value.

1. Activate maintenance mode on machine status display page.
2. Align the cursor with Inching Feed, and press the [SET] soft key.

This mode cannot be selected during ATC magazine operation.

3. Align the cursor with a feed override value between MIN and 100%, and press the [SET] soft key.
4. Align the cursor with the axis you wish to move, and press the [SET] soft key.
5. Align the cursor with the inching setting (input line appears).
6. Enter the movement distance in millimeters (mm).
7. After confirming the carrier position, press the [+ FEED] soft key to move in the + direction, and press the [– FEED] to move in the – direction. Once either key is pressed, the magazine is moved the set inching distance, and automatically stops at this distance.

An error message is displayed at the bottom of the screen when the ATC magazine cannot be operated.

ATC Magazine Pot Indexing

1. Activate maintenance mode on machine status display page.

2. Align the cursor with Pot Indexer, and press the [SET] soft key.

This mode cannot be selected during ATC magazine operation.

3. Align the cursor with a feed override value between MIN and 100%, and press the [SET] soft key. This selects the feed override value for the operation.

4. Align the cursor with the axis you wish to move and press the [SET] soft key.

5. Align the cursor with Pot Indexer (input line appears).

6. Enter the position to which the axis is to be moved.
   One of the following values should be entered:
   1 – Max. : Positioning is performed at the entered pot for the AV axis.
   Rack No. Positioning is performed at the route for the entered pot for the AH axis.
   A : Positioning is performed at the change position with the ATC sub arm.
   D : Positioning is performed on route 1 for the AH axis.
   T : T.L.S. positioning is performed.
   Positioning is performed at the TLS route for the AH axis.
   Positioning is performed at the TLS position for the AV axis.

T.L.S.: Tool Loading Station

7. When the [START] soft key is pressed, axis movement is performed to the set indexing pot position.

An error message is displayed at the bottom of the screen when the ATC magazine cannot be operated.

ATC Magazine Jog Feed

1. Activate maintenance mode on machine status display page.
2. Align the cursor with Jog Feed, and press the [SET] soft key.

This mode cannot be selected during ATC magazine operation.

3. Align the cursor with a feed override value between MIN and 100%, and press the [SET] soft key.
4. Align the cursor with the axis you wish to move, and press the [SET] soft key.
5. After confirming the carrier pot position, press the [+ FEED] soft key to move in the + direction, and press the [– FEED] to move in the – direction.

   Movement is performed while the soft key is held down, and stops when it is released.

An error message is displayed at the bottom of the screen when the ATC magazine cannot be operated.

3.9.5 Measuring System Maintenance Screen (Option)

The Marposs maintenance screen is displayed when the [MEASUR SYSTEM] soft key is pressed on the machine status display page.

The probe battery and communication status with the measuring system is displayed on this page. This screen only has a display function. No operations can be performed.

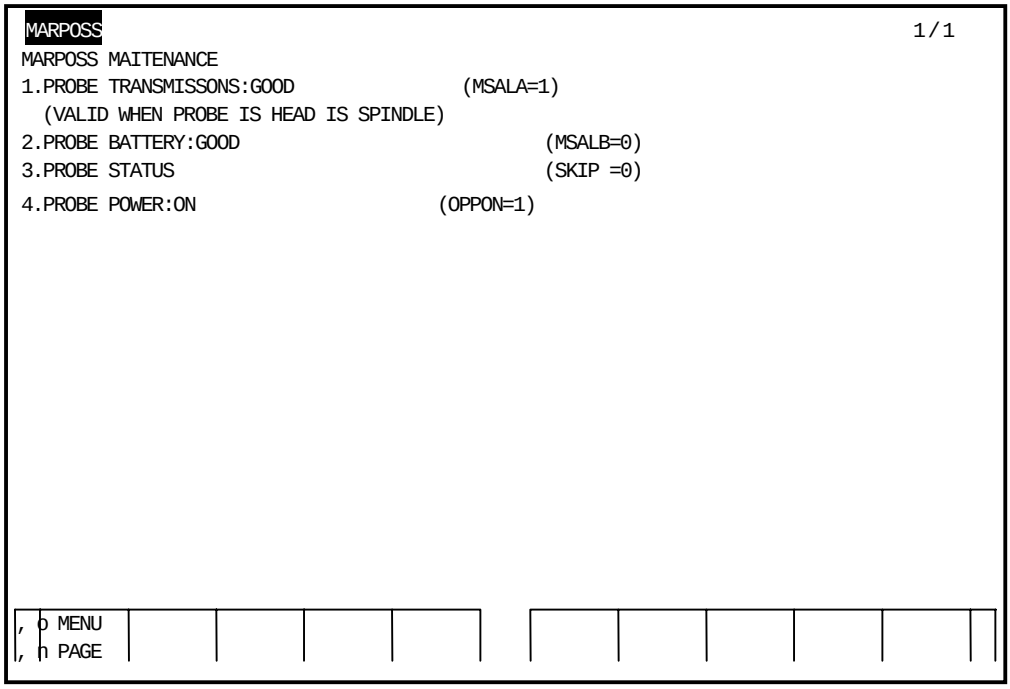


FIGURE 3-32 MARPOSS MAINTENANCE SCREEN

3.9.5.1 Measuring System Maintenance Screen Content

1. Probe and Receptor Status
   This indicates whether or not the communication status between the probe and receptor is good. This is only valid when the probe is installed in the spindle and the measuring mode is activated.

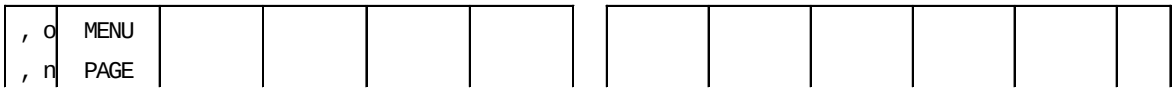
2. Probe Battery Status
   This indicates the status of the probe battery.

3. Skip Signal Status
   This indicates the On/Off status of the skip signal. It is only valid when measuring is being performed.

4. Probe Power Status
   This indicates the On/Off status of probe power

3.9.5.2 Measuring System Maintenance Screen Soft Keys

1. Types of Soft Keys



2. Soft Key Description

   [MENU PAGE] Selects machine status display page.

3.10 Machine Parameter Screen

The machine parameter screen is displayed when the [PARA- METER] soft key is pressed on the primary operation screen. The machine parameter screen has parameter display and setting functions.
Refer to the Explanation of Machine Parameters chapter for the changing of machine parameter settings.

```
PARAMETER              DISPLAY MODE                                   1/1

NO.    ITEM                                   NO.    ITEM
0000   MONITOR MEASURE                        3600   COOLANT 1
0200   DSPL OPN PTR                           3800   SPINDLE 3
0400   NC FUNCTION
0600   SPINDLE
0800   FEED AXIS
1000   ATC
1200   COOLANT
1400   P/C & P/M
1600   WARNING LIGHT
1800   USER M-CODE
2000   TRACE FUNCTION
2200   SYSTEM
2400   I/O UNIT
2600   P/C & P/M 2
2800   ATC 2
3000   FEED AXIS 2
3200   SPINDLE 2(1)
3400   SPINDLE 2(2)
```

FIGURE 3-33 MACHINE PARAMETER SCREEN (ITEM SELECTION PAGE)

```
PARAMETER              DISPLAY MODE                                   1/1
                       MONITOR MEASURE
 NO.       DATA  UNIT     CONTENTS
0000         80  %        COFFICIENT OF SL AT M41 COMMAND
0001        150  %        COFFICIENT OF SL AT M42 COMMAND
0002        200  %        COFFICIENT OF SL AT M43/M50 COMMAND
0003          1  0.1S     TIME INTERVAL OF SL MONITOR
0004          3  0.1S     TIME INTERVAL OF AC MONITOR
0005          0  %        POWER TO INCREASE AC MONITOR FEEDRATE
0006          0  %        POWER TO DECREASE AC MONITOR FEEDRATE
0007         10  %        AMOUNT TO INCREASE AC MONITOR FEEDRATE
0008         10  %        AMOUNT TO DECREASE AC MONITOR FEEDRATE
0009          0  %        TOOL LIFE(SELECTION 0-3)
0010          1           TOOL LIFE COUNT(0:ADD/1:REMAIN)
0011          1           TOOL LIFE ALARM(0:DON'T MAKE/1:MAKE)
0012          3  0.1S     SPNDL LOAD STABILITY LOAD STABILITY CHECK
0013          5  %        RATE OF SPINDLE LAOD STABILITY CHECK
0014          3           BROKEN TOOL SENSOR TYPE
0015          2  0.1S     SPINDLE LOAD SAMPLING TIME INTERVAL
0016          0  %        TOOL LIFE WARNING PARCENT
0025          0           RAKURAKU CHECKER TYPE

| , o |   |   |   | LOCK   |   |   |   |   | MENU |
| , n |   |   |   | RELESE |   |   |   |   | PAGE |
```

FIGURE 3-34 MACHINE PARAMETER SCREEN (CONTENT DISPLAY PAGE)

3.10.1 Parameter Screen Content

1. Display Mode
   This is displayed in the display mode. The cursor appears at this time.

2. No.
   This indicates the parameter number.

3. Item
   This indicates the parameter item.

4. Input Mode
   This is displayed when the lock is released on the content display page. Parameters can be set in the input mode.

5. Data
   This indicates the parameter value.

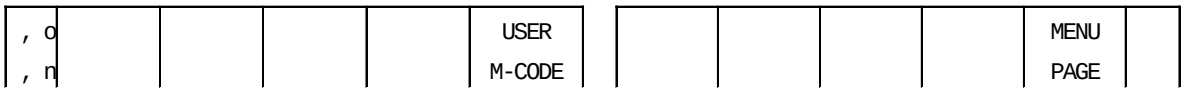
6. Unit
   This indicates the unit for each parameter

7. Message
   A description of the parameter is displayed.

3.10.2 Parameter Screen Soft Keys

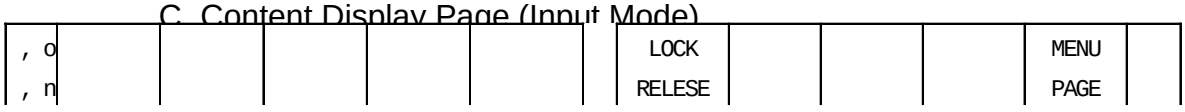
1. Types of Soft Keys

   A. Item Display Page (Initial Status)



   B. Content Display Page (Display Mode)

   C. Content Display Page (Input Mode)



2. Soft Key Description

[MENU PAGE]	Changes screen from item select page to content display page, and from content display page to item select page.
[LOCK RELESE]	Allows password to be entered in order to release lock. This key is highlighted in yellow when it is pressed.
[USER M-CODE]	Changes to user M-code screen (option).

3.10.3 Parameter Screen Operations

3.10.3.1 Changing from Item Select to Content Display Page

1. Move the cursor to the item to be displayed with the cursor keys.
2. Press the [MENU PAGE] soft key or page keys to change pages.

The cursor moves to the lowest parameter number for the selected item, and that content page is displayed.

3.10.3.2 Changing from Content Display to Item Select Page

Press the [MENU PAGE] soft key to change from the content display page to the item select page.

3.10.4 User M Code Screen (Option)

The user M code screen is displayed when the [USER M-CODE] soft key is pressed on the menu page. The user M code screen enables standard Makino M code to be replaced with unique user M codes, and display of the current settings.

There are two user M code screens, with 10 codes displayed on each screen, for a total of 20.

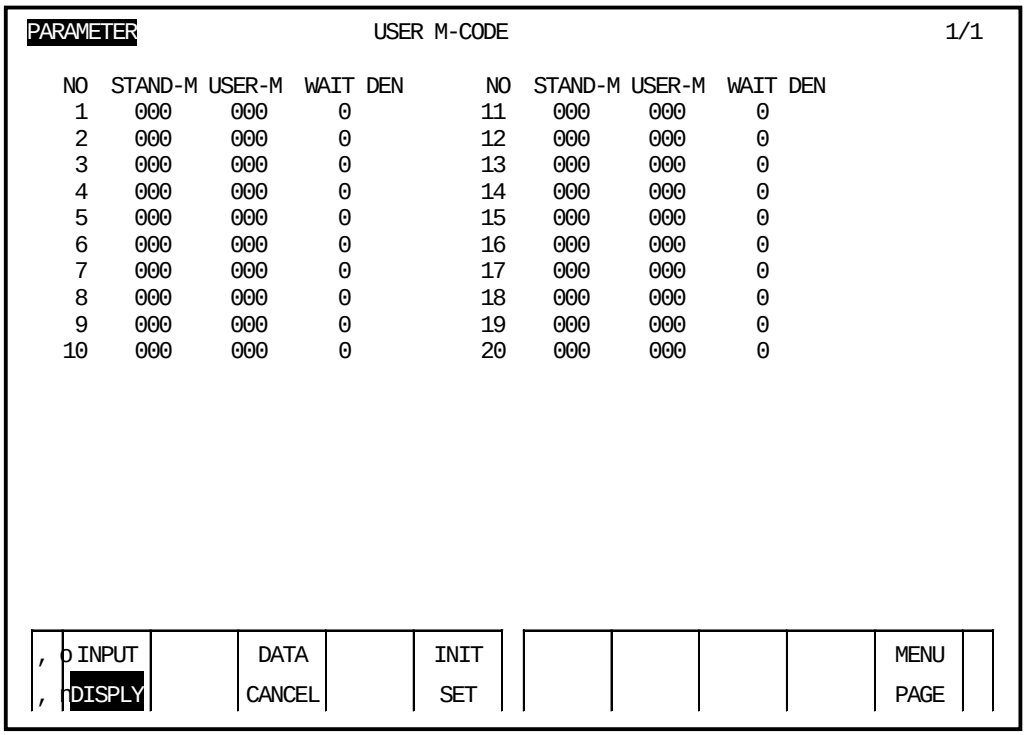


FIGURE 3-35 USER M CODE SCREEN

3.10.4.1 User M Code Screen Content

1. NO.
   A total of 20 user M codes can be registered. The standard M code, user M code and whether or not the system waits for completion of axis movement are set for each code.

2. Standard M Code
   The standard Makino M code is displayed.

3. User M Code
   The unique user M code is set.

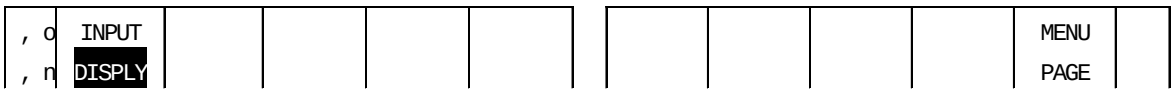
4. Wait DEN
   When an axis movement command is sent in the same block as the unique user M code, this setting specifies whether or not the system waits for completion of axis movement before executing the M code.

Setting		Content
1	:	M code is executed after completion of axis movement
0	:	M code is executed without waiting for completion of axis movement

3.10.4.2 User M Code Screen Soft Keys

1. Types of Soft Keys

A. Initial Status



B. Input Mode

2. Soft Key Description

[MENU PAGE]	Used to change from user M code screen to item display page.
[INPUT DISPLY]	Changes between input mode and display mode. This soft key is pressed in order to enter data.
[DATA CANCEL]	Clears all user M code data set on the screen.
[INIT SET]	Enables user M code to be set for each user.

3.10.4.3 User M Code Screen Operations

User M Code Settings

The procedure to change the setting so that the function of standard M code M▲▲ is used as user M code M❑❑ is described in this section.

1. Press the [INPUT DISPLY] soft key to select the input mode.
2. Align the cursor with the desired standard M code ith the cursor keys.
3. Use the MDI keyboard to enter the ▲▲ digit for the selected M ▲▲ code.
4. Move the cursor to the user M code on the same line as the standard M code set in step 3.
5. Enter the ❑❑ digit for the user M❑❑ code.
6. Move the cursor to the Wait DEN setting on the same line.
7. Enter “0” if the user M code is to be executed at the same time when there is axis movement in the same block, and enter “1” if the system should wait for completion of axis movement before executing the M code.

Changing from User M Code to Item Select Page

Press the [MENU PAGE] soft key to change from the user M code screen to the item select page.

3.11 Regular Maintenance Screen

The regular maintenance screen is displayed when the [REGULR MAINT] soft key is pressed on the primary operation screen.

There are two functions on the regular maintenance screen:
1. Display and completion of regular maintenance inspection items
2. Display example

There are three types of regular maintenance: Weekly, Six month and Yearly. The next inspection date is automatically calculated from the date/ time set by parameter No. 266, and the inspection items are displayed on the regular inspection day when the machine power is turned On.

Refer to the Explanation of Machine Parameters chapter for parameter No. 266.

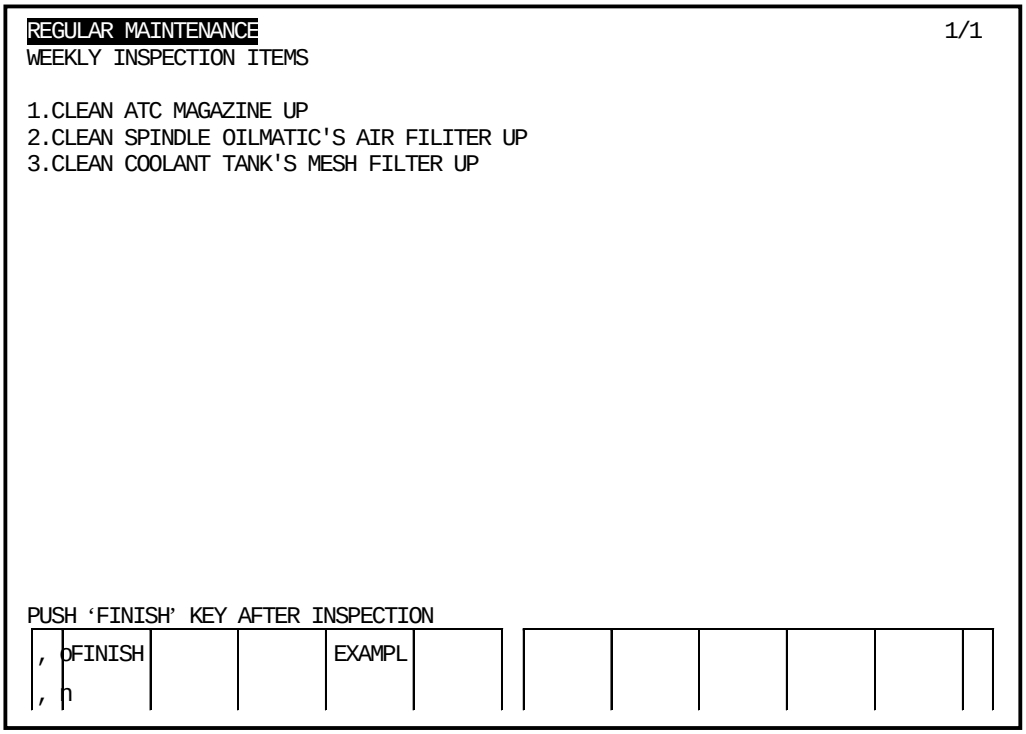


FIGURE 3-36 REGULAR MAINTENANCE SCREEN (WEEKLY)

3.11.1 Display Content

1. "IT IS NOT INSPECTION TIME YET"
   Appears when this screen is displayed on a day other than a regular maintenance day

2. Weekly, Six Month, Yearly Inspection Items
   Indicates the type of inspection items.

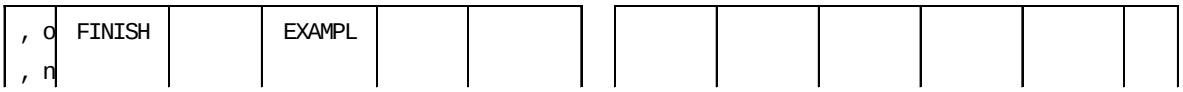
3. Display
   The inspection items are displayed.

4. PUSH "FINISH" KEY AFTER INSPECTION
   Instruction to operator upon completion of inspection.

5. EXAMPLE
   A display example can be displayed.

3.11.2 Soft Keys

1. Types of Soft Keys



2. Soft Key Description

[EXAMPL]	Inspection item examples are sequentially displayed when this key is pressed.
[FINISH]	Used when the inspection is completed.

3.11.2.1 Weekly, Six Month, Yearly Inspection Days

Inspection instructions are displayed on the weekly, six month and yearly inspection days when the power is turned On.

1. When this screen is displayed when power is turned On, perform the inspection according to the instructions on the screen.

2. Make sure to press the [FINISH] soft key when the inspection is completed. This notifies the system the inspection has been finished.

3. The next set of inspection items is displayed on a day when multiple inspections are to be performed.

4. To change to another screen after all inspections have been completed, press the [P O] soft key to select the primary operation screen. Refer to the primary operation screen for the screen selection procedure.

The system does not consider the inspection to have been completed if the [FINISH] soft key is not pressed upon completion of the inspection.
In this case, the inspection screen will be displayed when the power is turned On again.

3.11.2.2 Display Example

This function allows an example of the inspection screen to be displayed on a day which is not an inspection day

Examples are displayed in the following sequence when the [DISPLY] soft key is pressed:

→ Original screen → Weekly → Six month → Yearly

Chapter 4 Auto Tool Monitor Function

V33, V55

Professional 3

Chapter 4
Auto Tool Monitor Function

Contents

4.1 Outline

The Auto Tool Monitor Function (hereinafter called tool monitor) has the following functions:

1. AC, SL, study functions
2. Tool life monitor function (TL)
3. Broken tool sensor function (BTS)
4. Spare tool select function (STS)
5. Direct spare tool change function
6. Tool precheck function

The use of the tool monitor function facilitates monitoring of the cutting status and management of alarm tools, enhancing the level of machine automation.

4.2 AC, SL, Study Functions

4.2.1 Outline

The study mode is first utilized to perform test machining when using the AC and SL functions. The maximum actual spindle current load for each tool is detected by performing test machining. The detected maximum spindle current load value is multiplied by the multiplication factor specified by the M code in the machining program. The calculated results are automatically registered in the SL/AC value memory in the control unit for each tool. Registered data can be displayed and changed on the PC tool detail (data) screen.

The SL function monitors the SL spindle load value during cutting, and triggers an alarm in the event the spindle load during cutting exceeds the SL value set in the study mode. When an alarm occurs, feed axis movement stops. Spindle rotation and coolant discharge are stopped after axis motion stops.

The AC function controls the cutting feed override so that the actual spindle load during cutting approaches the AC value set in the study mode.

The AC function is used when M48 (override valid) is specified.
The M48 mode is activated when the machine power is turned On, and is not changed unless the M49 command is specified.

4.2.2 Study Function

This function is activated when the [STUDY MODE] soft key is selected on the PC tool monitor screen.

1. M Codes to Store SL/AC Values
   The following M codes are inserted in the machining program: (The SL/AC values are automatically registered by performing test machining. These M codes are modal.)

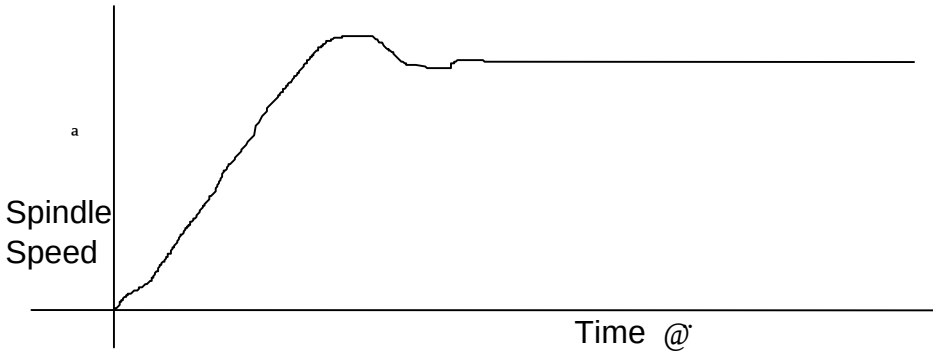
M Code	SL Coefficient	AC Coefficient
M41	1.25	0
M42	1.50	0
M43	2.00	0
M50	2.00	1.00
M44	0	0

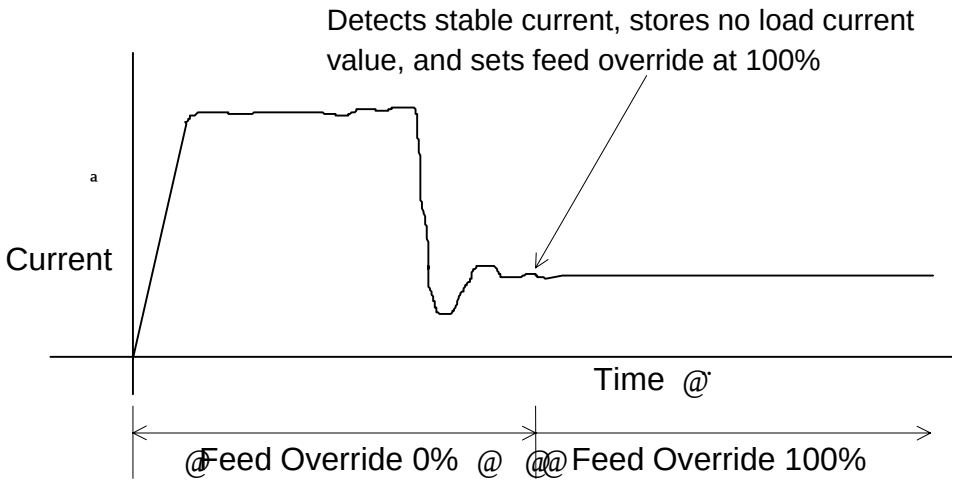
SL setting value = (Max. spindle load current – No load spindle current) x SL coefficient

AC setting value = (Max. spindle load current – No load spindle current) x AC coefficient

2. Control in Study Mode

   A. The feed override is set at 0% while the spindle comes up to speed. Rapid feed positioning is performed, but cutting feed is suspended until spindle rotation stabilizes and the no load current is properly detected.





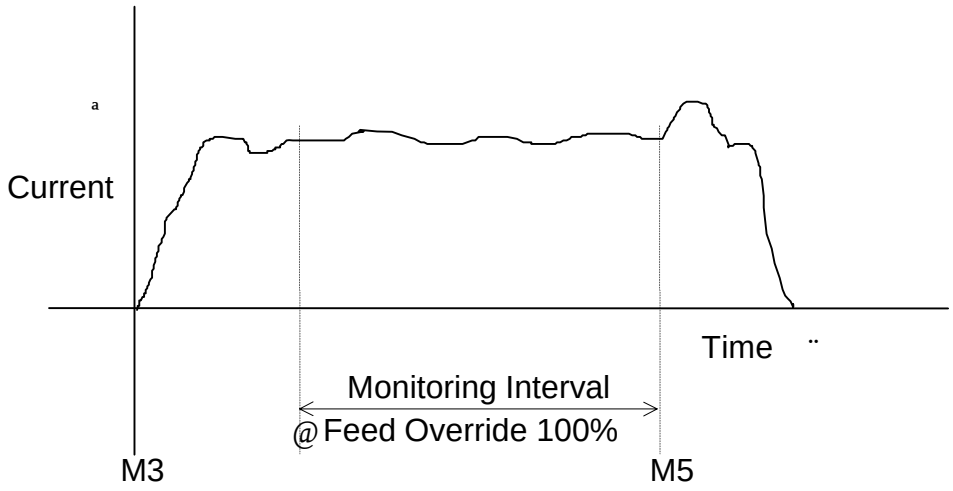
   B. The SL/AC values are stored when the spindle is stopped by an M05 or other M code.

   C. The SL/AC functions cannot be used for a tapping cycle (G84). Specify M44 (SL coefficient 0%, AC coefficient 0%).

4.2.3 SL Function

The SL function is valid when the SL mode is selected on the PC tool monitor screen and the SL value has been registered for the tool clamped in the spindle (SL value is not 0).

1. Monitoring Interval
   As for the study mode, feed override is set at 0% while the spindle is coming up to speed. Monitoring is performed after the spindle speed stabilizes. When the AC function is used at the same time, feed override is controlled by the AC function. Monitoring ceases when the spindle is stopped by the M05 or another M code, and the SL function is deactivated.



2. Monitoring Logic
   An alarm is triggered when the spindle load current exceeds the following value during the monitoring interval:

   Spindle load current > Spindle no load current + SL setting

   When an alarm is triggered, feed hold is applied, stopping feed axis movement. Spindle rotation and coolant discharge are stopped after axis movement stops.

3. The SL function cannot be used during the tapping cycle (G84).

4.2.4 AC Function

The AC function is valid when the AC mode is selected on the PC tool monitor screen and the AC value has been registered for the tool clamped in the spindle (SL value is not 0).

1. Monitoring Interval
   As for the study mode, feed override is set at 0% while the spindle is coming up to speed. After the spindle speed stabilizes, the initial feed override value is set at 150%, and AC monitoring commences. The feed override is adjusted as the spindle load changes due to cutting.

2. AC Control
   Feed Override Upper Limit : 150%
   Feed Override Lower Limit : 40%

   Feed override is controlled as shown below by the spindle load current:

	IL > IUP	IUP †IL †ILW	IL < ILW
Feed Override	Lower	No Change	Increase

   IL : Current spindle load current
   IUP : AC setting + Spindle no load current
   ILW : AC setting x 0.875 + Spindle no load current

   Formula to Decrease Override
   Feed override = Current cutting feed override – [Cutting feed override decrease amount + {(Current actual spindle load current/AC setting – 1) x Cutting feed override decrease ratio x 0.5}]

   Formula to Increase Override
   Feed override = Current cutting feed override + [Cutting feed override increase amount + {(Current actual spindle load current/AC setting – 1) x Cutting feed override increase ratio x 0.5}]

   Cutting feed override increase ratio : Parameter No. 005 (Std. 0%)
   Cutting feed override decrease ratio : Parameter No. 006 (Std. 0%)
   Cutting feed override increase amount : Parameter No. 007 (Std. 10%)
   Cutting feed override decrease amount: Parameter No. 008 (Std. 10%)

   When feed override drops to 40%, the spindle load is judged as being too large compared to the AC setting, and an AC alarm is triggered. When an alarm occurs, feed hold is applied, stopping feed axis movement. Spindle rotation and coolant discharge are stopped after axis movement stops.

1. The AC value and SL value (200%) are set by the M50 code in the study mode. When you wish to use the SL function while the AC function is used, the SL mode must be selected on the PC tool monitor screen.
2. The AC function cannot be used in the tapping cycle.

4.2.5 Sample Program

Create the following program and first perform test cutting in the study mode. After this, the same program can be executed, selecting the AC and SL modes:

```
O1234;
T0001;
M06;
T0002;
M42;
 ¥
 ¥
 ¥
M06;
T0003;
M50;
D10H11;
M56;
 ¥
 ¥
 ¥
M06;
T0004;
M44;
 ¥
 ¥
 ¥
M06;
T0;
M43;
 ¥
 ¥
 ¥
M06;
T0;
M30;
%
```

SL monitor functions for maching with T0001(SL coefficient 150%)

AC function used for maching with T0002. D10 H11;M56; is specified when a spare tool has been prepared.

AC and SL values set to "0",and AC/SL monitors do not function.
when a spare tool has been prepared.

SL monitoring of maching with T0002. (SL coefficient 200%)

4.3 Tool Life Monitor Function

4.3.1 Outline

The TL (Tool Life) Monitor calculates the time/distance/number of times that each tool is used, and registers an alarm (prohibit use) flag in the tool database when the tool usage exceeds the preset value.
The management method, counting method, and whether or not an alarm is triggered can be selected with the machine parameters.

1. Tool Life Management Method
   One of the following methods can be selected with machine parameter No. 9:

Parameter No. 9 Setting	@@@@@@@@ Description
@@@ 0	Cutting time (internally managed in 1 sec. increments, input/display performed in 1 min. increments)
@@@ 1	Cutting distance (managed in meters or inches)
@@@ 2	Machining quantity (managed using value entered by M919 Sxxxx)
@@@ 3	Cutting time (internally managed in 0.1 sec. increments, input/display performed in 1 min. increments)

@@- Set to 3 when machine is shipped (cutting time)

When cutting distance is used for tool life management, the remaining life value (or cumulative usage value) will increase dramatically when cutting operations (cutting feed) with small-diameter deep hold drill cycles (G83) and other operations (rapid feed) are repeated with a very high frequency. Therefore, a different management method should be used when this type of machining is performed.
A life value data error will be caused if the tool life management method is changed at an intermediate point. Make sure to reset the life value data when changing the management method.

2. Counting Method
   Remaining life or cumulative usage can be selected with machine parameter No. 10:

Parameter No. 10 Setting	@@@@@@@@ Description
@@@ 0	Cumulative usage (selected usage unit is added)
@@@ 1	Remaining life (selected usage unit is subtracted)

@@- Set to 1 when machine is shipped (remaining life)

3. Trigger Alarm/Do Not Trigger Alarm
   Whether or not an alarm (prohibit use) is triggered when the set value is exceeded can be selected with machine parameter No. 10:

Parameter No. 11 Setting	@@@@@@@@ Description
@@@ 0	Do not trigger alarm
@@@ 1	Trigger alarm

@@- Set to 1 when machine is shipped (trigger alarm)

4.3.2 Tool Life Monitor Function

The tool life monitor function is valid when the TL mode is selected on the PC tool monitor screen, and the TL value (life) has been registered for the tool clamped in the spindle (TL value is not 0).

1. Setting

@@ Method / Value	Managed Using Time	Managed Using Cutting Distance	Managed Using Machining Quantity
Coeff. Unit	1 sec / 0.1 sec	1 mm	
Setting Unit	1 min	1 m / 1 inch	1 pc.
Max. Value	99999 min	99999mm /9999inches	

2. Life Time Setting
   Refer to the PC tool detail screen.

3. Display
   The remaining time/cutting distance/quantity and tool life setting are displayed for each tool on the PC tool monitor screen and tool detail screen.

4. Tool Life Measurement
   Fundamentally, measurement of time/cutting distance is performed while the spindle is rotating, but measurement is not performed during the following operations:
   A. While spindle is being started and stopped.
      Neither is measurement performed when the spindle is stopped by the M00, M01, M02, M06 or M30 codes.
   B. During gear changes
   C. During orientation
   D. During rapid feed mode

5. Tool Life Processing
   When the remaining time/cutting distance/quantity reaches 0, a TL alarm is registered in the status memory for that tool, and the alarm lamp on the main control panel is turned On. Machining continues at this time. The alarm status is automatically reset when the tool for which a life alarm occurred is returned to the ATC magazine, and the alarm lamp on the main control panel goes out.
   (The TL alarm in the tool status is retained.)
   The status memory data is displayed on the PC tool detail screen.
   When the same tool is called again after that machining process has been completed, an alarm is displayed on the main control panel, and the machine is stopped.
   When a spare tool has been registered using the STS mode described later in this chapter, no alarm is triggered, and the spare tool is called.

4.4 Broken Tool Sensor (Option)

When a tool is judged as being broken after the tool length is measured by the auto tool length measurement function, usage of that tool can be prohibited by specifying the M20 command.

4.5 Spare Tool Select (STS) Function

4.5.1 Outline

This function consists of two separate functions: a Spare Tool Select Function which automatically calls the spare tool when a tool is specified which has been flagged as being defective or life expired by the SL, AC, TL or BTS function; and a Direct Spare Tool Change Function which temporarily stops machining when a life alarm occurs for the spindle tool, and restarts machining after the spindle tool is exchanged with the spare tool. These two functions are valid when Spare Tool Select is selected on the PC primary operation screen.

1. Spare Tool Registration
   Tools which have the same number in the KIND column on the PC tool detail screen can be used as spare tools for one another.
   When the Kind data is "0000", it indicates there is no spare tool.

2. Spare Tool Call Sequence Sample

Pot	Tool No.	Kind	Call Sequence
11	0001	0005	(2)
12	1000	0005	(5)
13	2000	0005	(1)
14	0002	0005	(3)
15	0003	0005	(4)

   When the above tool data is registered and T2000 is specified in the machining program, the tool call sequence is as follows:

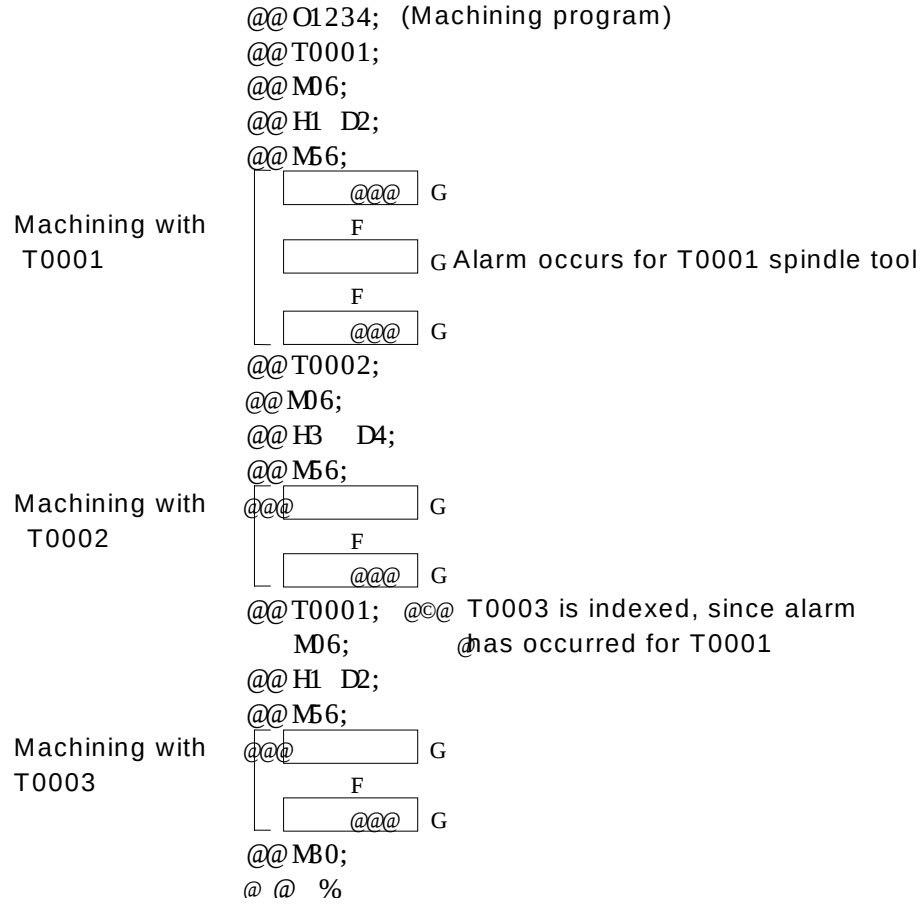
   T2000 is the base tool. The base tool has the highest priority. When an alarm has occurred for the base tool, the system checks whether not an alarm has occurred for the other tools in the sequence indicated above [(2), (3), (4), (5)], and calls the first tool for which an alarm has not occurred.

   When the alarm flag is cleared for the T2000 after the bit for T2000 has been replaced or it has otherwise been repaired, T2000 is called. When all spare tools are in the alarm status and there is no spare tool, an alarm is triggered, and the machine stops.

3. Tool Length/Diameter Offset when STS Function is Used
   When the spare tool select (STS) function is used, the tool called by the same T command will change. Therefore, it is necessary to update the tool length and tool diameter offset values which differ for each tool when a tool change (M06) is performed.
   The offset values can be updated by specifying "D_H_;M56;" after the M06 command in the machining program. When the M56 code is specified, the spindle tool offset values are set to the NC unit offset No. corresponding to the D_H_ specified before M56. When tool diameter compensation is not performed, "0" is set for D (tool diameter).
   The offset values are registered under tool length and tool diameter for each tool as absolute values on the PC tool detail screen. (Absolute values are set for spare tools.)
4. When there are no more spare tools, an alarm is triggered and the machine is stopped.

4.5.2 Spare Tool Select (STS) Function

This function automatically calls a spare tool of the same type (kind) when an SL, AC, TL or BTS alarm has occurred for the specified tool, enabling machining to be performed.
Example of Operation with STS Function (when T0001 and T0003 are registered as spare tools):



4.6 Direct Spare Tool Change Function (V55)

The direct spare tool change function will interrupt machining when a life alarm occurs for the tool in the spindle being used to perform machining, exchange the spindle tool with a spare tool (tool with the same Kind number on the tool detail screen), and restart machining from where it was interrupted.

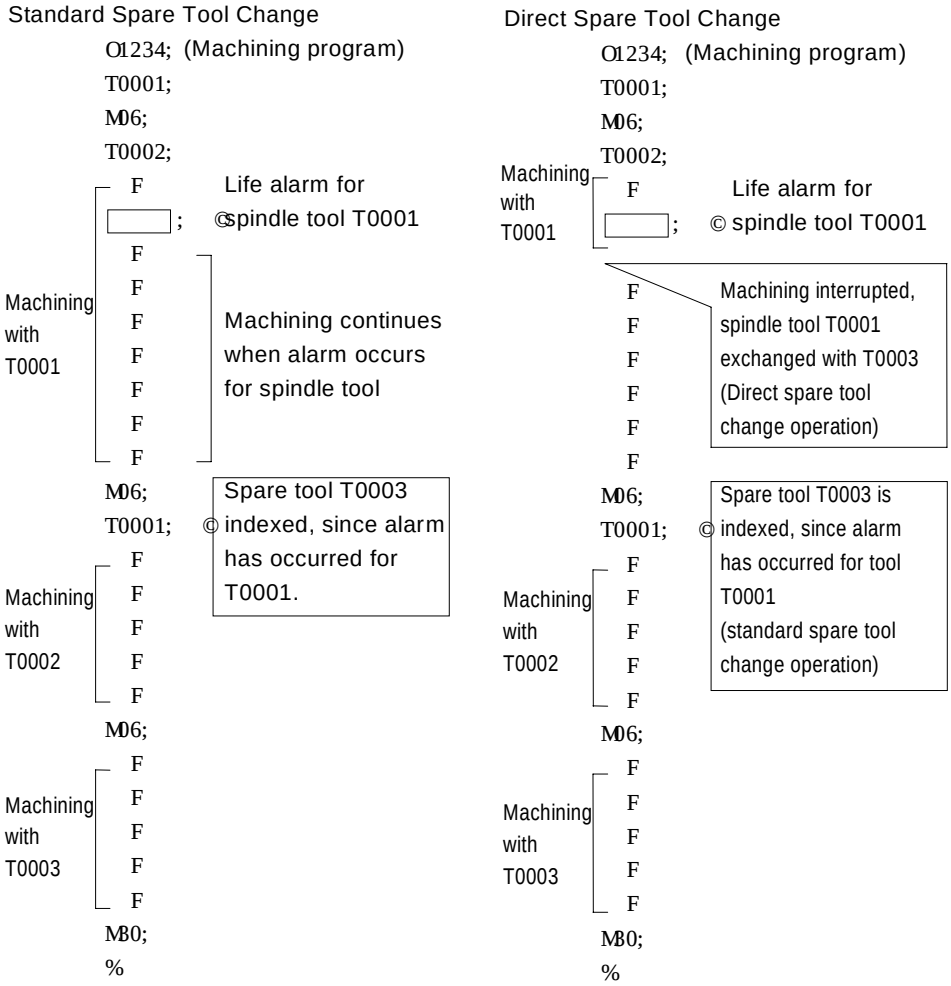
This operation program for the direct spare tool change function interrupts the machining program when a life alarm occurs for the spindle tool. The operation program contains a portion to exchange the spindle tool with the spare tool, and one to set the new tool length and tool diameter offset values. This procedure takes place automatically, and requires no operator intervention.

The direct spare tool function is only performed for a life alarm. No operation is performed for an SL monitor or other such alarm. The SpareTool Select function described in section 4.5 will operate when the direct spare tool function is used.

Operation Examples

Examples of operation with the standard spare tool change and direct spare tool change functions are shown below when tool number 1 and 3 are registered as spare tools:

Pot	Tool No.	Kind
Spindle	0001	0010
1	0001	0010
3	0003	0010



4.6.1 Direct Spare Tool Change Operation

The direct spare tool change operation is performed as described below. Operation steps 1. to 12. for the direct spare tool change are performed automatically. No operator intervention is required for these steps:

1. @Machining program is stopped by single block function
2. @Operation mode is changed to DNC operation mode (see Note 1).
3. @Spare tool call command is sent
4. @Z axis is moved to zero point.
5. @X/Y axes are moved to minus stroke end.
6. @X/Y axes moved to exchange spindle and spare tools.
7. @X axis is moved to minus stroke end.
8. @Z axis is moved to zero point.
9. @X/Y axes moved to original positions.
10. Z axis returned to machining position using new tool length offset value.
11. Next tool before change returned to standby position.

@Executed by DNC operation program (see Note 2)

12. DNC mode changed to machining operation mode
13. Single block mode is returned to machining program execution status.
14. Cycle start is performed to restart machining program.

1. Here, "DNC operation" refers to automatic operation using commands from the machine side software through a window prepared between the machine side software and CNC. This differs from operation by means of commands from an upper level computer or other external device.
2. Refer to section 4.6.6, Direct Spare Tool Change DNC Program, for details. This program is automatically generated by the machine side software. It does not need to be registered in the NC memory.

4.6.2 Execution of Direct Spare Tool Change

The direct spare tool change operation is performed when all of the following conditions are satisfied:

1. Spindle Tool
   Life alarm has occurred for spindle tool, the tool number is between 1 and 9999, and no other monitor alarm has occurred.
2. Spare Tool Select Mode
   Spare tool select mode is On.
3. Spare Tool
   Spare tool has been registered for spindle tool, and it can be used for machining. (Spare tool exists, and monitor alarm has not occurred for that tool.)
4. Automatic Operation
   Machine is in automatic operation mode (cycle start lamp is On). Feed hold status is not active.
5. Modal Data
   None of the following operations is being performed: Tool diameter offset, scaling, coordinate rotation, canned cycle, polar coordinate command, polar coordinate offset.

4.6.3 Direct Spare Tool Change Permission Modes

The direct spare tool change is performed by interrupting the machining program. There are some cases when you may not wish to execute this operation even when a spindle tool life alarm occurs since it involves Z axis movement. Therefore, the direct spare tool change permission mode is turned On with either of the methods listed below to instruct the machine to perform direct spare tool changes:

1. Method to perform the direct spare tool change before the next block when a spindle tool life alarm occurs in a machining program block in which the direct spare tool change operation can be performed. Refer to section 6.4, Direct Spare Tool Change at Specified Location.
2. Method to permit direct spare tool change in some blocks in machining program, and prohibit change in other blocks. Refer to section 6.5, Direct Spare Tool Change in Specified Range. In this case, the direct spare tool change operation is performed when a spindle tool life alarm occurs in specified range in which direct spare tool change is permitted, or when a life alarm has already occurred.

*Furthermore, the direct spare tool change operation cannot be performed in a **sub program**, during **binary operation** or while in the **GI or S-GI** mode. Make sure to prohibit the direct spare tool change operation before calling a sub program or changing to the binary operation or GI/S-GI mode.*

4.6.4 Direct Spare Tool Change at Specified Location

Specify M105 at a pick feed or other point in the machining program in which the direct spare tool change operation can be performed. When the M105 code is specified, the machine side software checks whether or not a life alarm has occurred for the spindle tool.
At this time, the machining program continues if a life alarm has not occurred. In the event a life alarm has occurred, the direct spare tool change operation is performed in the block after the M105 code.
The direct spare tool change specified by the M105 code is performed in the memory, MDI and external input operation modes.

Please note that the M105 code must be set in the NC parameters as an M code for which buffering is not performed.

NC Parameter	Description
No. 3415	M code 5, buffering not performed Set "105" to this parameter. When No. 3415 is already being used, set "105" to a parameter between No. 3416 and 3420 which is not being used.

Operation Example with M105
The example below shows the direct spare tool change operation when M105 is specified:

```
O1234;
T0001;
M06;        <---- T0001 clamped in spindle
 :
 :
M105;       <---- Nothing happens if spindle tool is not life alarm status
 :
 :
[      ];   <---- Life alarm occurs for T0001 spindle tool
 :
 :
M105;
 :          Direct spare tool change executed for spindle tool (since
            life alarm has occurred – DNC program executed)
M30;
%
```

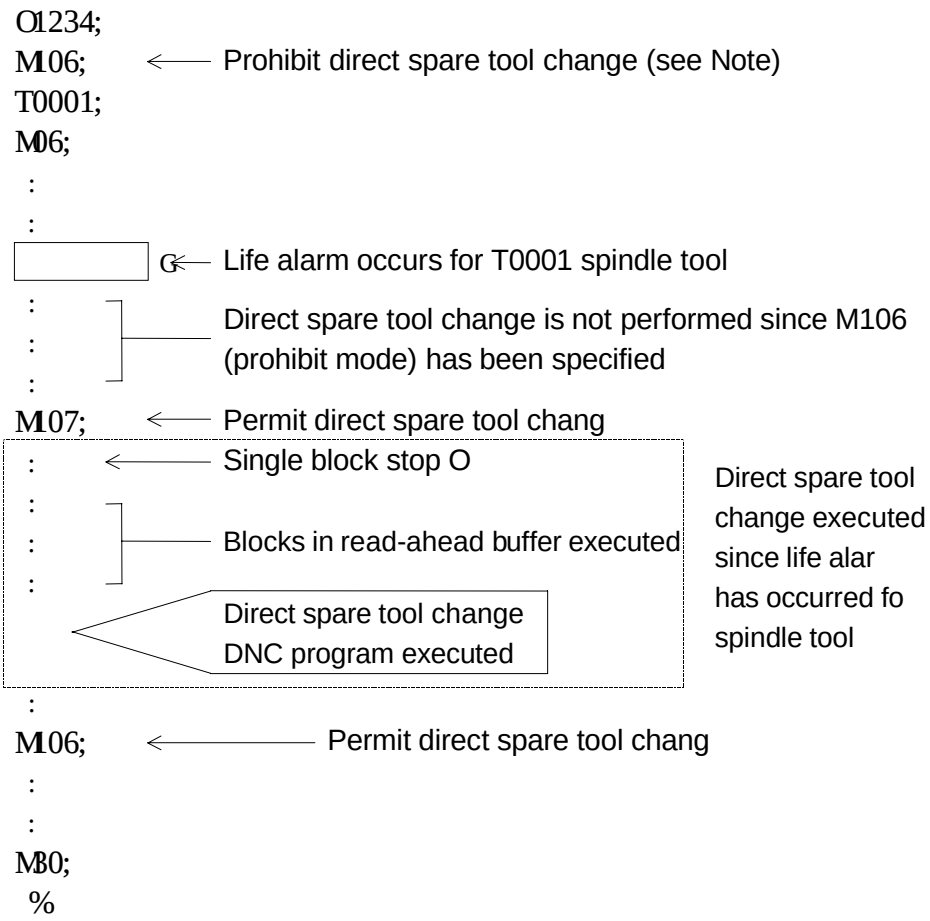
4.6.5 Direct Spare Tool Change in Specified Range

The M107 (permit mode) code is specified at locations in the machining program at which a direct spare tool change can be performed. Conversely, the M106 (prohibit mode) code is specified at locations where you wish to prohibit the direct spare tool change operation. The direct spare tool change operation will not be performed in the prohibit mode when a life alarm occurs for the spindle tool.
During the permit mode, the system periodically checks whether or not a life alarm has occurred for the spindle tool, and performs the direct spare tool change operation when a life alarm has already occurred for the spindle tool, or when one occurs at this time.
The direct spare tool change operation (exchanging spindle tool and spare tool) is performed if the machine is in the memory/external input operation mode when the M107 (permit mode) code is specified. The change operation is not performed if the machine is in the MDI mode when the M107 (permit mode) code is specified, but will start when automatic operation starts in the memory or external input operation mode.

1. The M106 mode (prohibit mode) is activated when power is turned On, by an emergency stop, resetting of the NC unit, and by the M2 and M30 codes.
2. The M106/M107 mode is not changed by the M6 code.
3. During the prohibit mode, conventional spare tool changes specified by a T command and direct spare tool changes specified by the M105 code are still performed.
4. When modal or other data after the machine is stopped by the single block function prevents the direct spare tool change operation from being executed (e.g. when a canned cycle is specified), the machining program is restarted without performing the direct spare tool change operation. The system periodically checks the modal or other data after this, and performs the direct spare tool change when the necessary conditions are satisfied.

Operation Example with M106, M107

The example below shows operation when a life alarm occurs for the spindle tool during the prohibit mode, after which the direct spare tool change is performed when the permit mode is activated:



The M106 mode (prohibit mode) is activated when power is turned On, by an emergency stop, resetting of the NC unit, and by the M2 and M30 codes.
In the example above, the M106 code has been inserted intentionally to make it easier to understand. The M106 code does not need to be specified when you know the machine is in the prohibit mode.

4.6.6 Direct Spare Tool Change DNC Operation Program

The following operations are performed by the direct spare tool change DNC operation program:

1. Index spare tool,
2. Move Z axis to reference (zero) point,
3. Move X/Y axes to ATC position,
4. Exchange spindle tool and spare tool,
5. Move Z axis to machining restart position using new tool length offset value,
6. Return next tool which was previously indexed,
7. Restore modal data.

This program is automatically generated by the machine side software. The content of the program cannot be modified by the user

```
M603;  ccccccccccccccccccc Start DNC operation program
G01 G91 Zz F1000;          see Note 1
M310;
M312;
G28 G91 Z0;
G49;
G53 G90 X-900. Y-500.;     see Note 2
Tt1;   ccccccccccccccccccc Index spare tool
M6;    ccccccccccccccccccc Exchange spindle tool/spare tool
G28 G91 Z0;
G53 G90 Xx Yy;
M313;
M311;
M56;   ccccccccccccccccccc Set new tool offset values
G01 G91 Gg1 Hh Z-z F1000 Tt2;
       ccccccccccccccccccc Move Z axis to machining restart
                           position, restore next too
Gg2;   ccccccccccccccccccc Reset G00 Ò3/G33
Gg3;   ccccccccccccccccccc Reset G90/G91
Ff;    ccccccccccccccccccc Reset F code
M602;  ccccccccccccccccccc End DNC operation program
;
```

t1: Spindle tool No. for which life alarm has occurred
t2: Tool No. called as next tool
z : Distance to Z axis zero point
g1: G43/44/49 G codes
g2: G00/01/02/03/33 G codes
g3: G90/91 G codes
h : H No.
f : F code

Data used by machining program (This data is stored before DN operation in order to restore machining status when restarting machining.)

M310 : Store spindle rotation status & stop
M311 : Restore spindle rotation
M312 : Store coolant On/Off status & stop
M313 : Restore coolant status
M602 : End DNC operation program

1. F1000 (mm/min) is used when the machine uses mm specifications.
   F40 (inches/min) is used for inch specifications.
2. X-900. X-500. is used for mm specifications.
   X-35.4 Y-19.6 is used for inch specifications.

4.7 Tool Precheck Function

4.7.1 Outline

This function utilizes the auxiliary functions (M codes) to check in advance whether or not tools are stored in the ATC magazine, and whether or not they can be used (tool alarm).

1. Auxiliary Functions (M Codes)
   M36 : Prior Tool Check Mode
   M37 : Tool Data Register Mode Off

2. Check Status of Tool No. Specified After M36
   When the spare tool select function is selected, the system checks whether or not there is a tool of the same kind (same FTN) when the specified tool cannot be used.
   When there is no tool which can be used, including any spare tools, a machine alarm is displayed and operation stops.

3. The following messages are displayed when an alarm occurs:

Alarm No.	Message
30020	Several Tools Have Been Registered to Same PTN
30021	Cannot Find the PTN Commanded
30020	Cannot Use the Tool Commanded
30020	Found Unusable Tool at Print Tool Check M36

4. The alarm is reset when the alarm reset soft key is pressed on the PC alarm screen.

4.7.2 Sample Program

Normally, the prior tool check (tool precheck) is performed at the beginning of the machining program. The tool number to be checked is specified between M36 and M37.

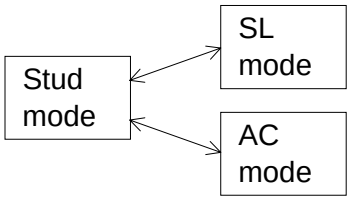
```
O1234;
M36;        ← Prior tool check function mode
T0001;      ← Check T0001
T0002;      ← Check T0002
T0003;      ← Check T0003
T0004;      ← Check T0004
T0005;      ← Check T0005
M37;        ← Turn M36 mode O
```

Machining program

```
M30;
%
```

4.8 Selecting Different Modes

1. Study, SL, AC Modes



The study mode and SL/AC mode cannot be selected at the same time. When the study mode is selected while the SL mode or AC mode is On, the SL mode/AC mode is turned Off.
Likewise, when the Sl mode or AC mode is selected while the study mode is On, the study mode is turned Off.
The SL/AC modes can be selected independently, and can both be On at the same time. Changing between the study, SL and AC modes can only be performed when the NC cycle start lamp is out. Tochange between modes after performing the cycle start operation, first activate the feed hold or single block stop status, and then change modes.

2. TL Mode
The TL mode can be independently selected at any time.

Changing of modes with the above soft keys takes precedence over M codes in the program and registration status on the PC tool detail screen.

4.9 Tool Monitor Alarms

There are four types of tool monitor alarms:

- TL
- SL
- AC
- BTS

1. Machine Operations When Alarm Occurs
   A. When a TL alarm occurs, the alarm lamp on the main control panel lights. The machine is not stopped.
   An internal alarm (on PC tool detail screen) is registered for the tool for which the TL alarm occurred.
   The alarm on the main control panel is automatically reset when the tool is returned to the ATC magazine. The next time that tool is specified, the alarm lamp on the main control panel is turned On, and the machine is stopped.
   If a spare tool has been registered, the machine searches for that spare tool, and no alarm is triggered.

   B. When an SL or AC alarm occurs, the alarm lamp on the main control panel lights, and feed axis movement stops. Spindle rotation and coolant discharge are stopped after this.
   An internal alarm is triggered for the tool at the same time, and this information is stored. The tool alarm status memory is not deleted when the alarm is reset on the PC alarm screen.
   It is deleted when the alarm flag is cleared on the PC tool detail screen as explained in 3. below.

   C. When a BTS alarm is detected, the spindle is already stopped. Otherwise, the procedures are the same as for B. above.

2. Alarm Display
   When an alarm occurs, the alarm lamp on the main control panel lights, a message is displayed at the top of the PC tool monitor screen, and details can be viewed on the alarm screen.

3. Clearing Alarm Flag on PC Tool Detail Screen
   When an alarm occurs, replace the tool cutting edge and clear the alarm flag on the PC tool detail screen (or simply clear the alarm flag if there is nothing wrong with the tool).

   To do this, align the cursor with the alarm message for the tool, and press the [ALARM RESET] soft key.

4.10 Tool Monitor M Codes

The M codes used by the tool monitor are used in machining programs.

4.10.1 M Codes in Machining Programs

M41 :	SL/AC coefficients in study mode	125%	0%
M42 :	SL/AC coefficients in study mode	150%	0%
M43 :	SL/AC coefficients in study mode	200%	0%
M42 :	SL/AC coefficients in study mode	0%	0%
M42 :	SL/AC coefficients in study mode	200%	100%
M20 :	BTS check (tool breakage check)		
M42 :	Transfer tool length/diameter data when spare tool is selected		

4.11 Tool Monitor Parameters

0000	COEFFICIENT OF SL AT M41 COMMAND		Power Off: Not required
	Setting: 125	Unit: %	Setting Range: 0 `400(%)

This is the M41 SL coefficient for the study function.

0001	COEFFICIENT OF SL AT M42 COMMAND		Power Off: Not required
	Setting: 150	Unit: %	Setting Range: 0 `400(%)

This is the M42 SL coefficient for the study function.

0002	COEFFICIENT OF SL AT M43/M50 COMMAND		Power Off: Not required
	Setting: 200	Unit: %	Setting Range: 0 `400(%)

This is the M43 and M50 SL coefficient for the study function.

0003	TIME INTERVAL OF SL MONITOR		Power Off: Not required
	Setting: 1	Unit: 0.1 sec.	Setting Range: 0 `255 (0 `25.5 sec.)

This is the sample time for the SL monitor.

0004	TIME INTERVAL OF AC MONITOR		Power Off: Not required
	Setting: 1	Unit: 0.1 sec.	Setting Range: 0 `255 (0 `25.5 sec.)

This is the sample time for the AC monitor.
Cutting feedrate override is controlled at this time interval.

0005	POWER TO INCREASE AC MONITOR FEEDRATE		Power Off: Not required
	Setting: 0	Unit: None	Setting Range: 0 `255

This is the multiplication factor to increase the AC monitor cutting feedrate override.

Formula to Increase Override

Feed override = Current cutting feed override + [Cutting feed override increase amount + {(Current actual spindle load current/AC setting – 1) x Cutting feed override increase ratio x 0.5}]

Cutting feed override increase ratio : Parameter No. 005 (Std. 0%)
Cutting feed override increase amount : Parameter No. 007 (Std. 10%)

0006	POWER TO DECREASE AC MONITOR FEEDRATE		Power Off: Not required
	Setting: 0	Unit: None	Setting Range: 0 `255

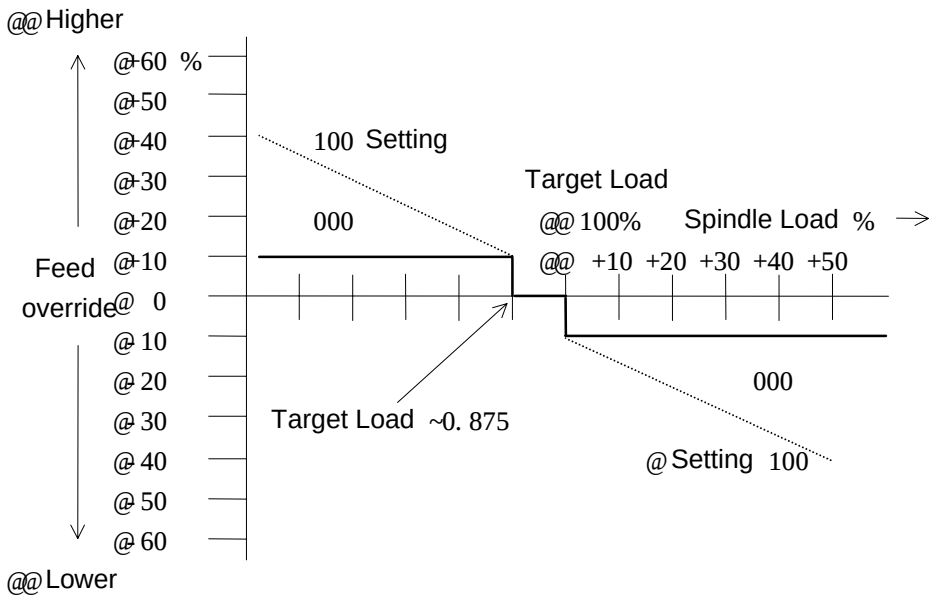
This is the multiplication factor to decrease the AC monitor cutting feedrate override.

Formula to Decrease Override

Feed override = Current cutting feed override – [Cutting feed override decrease amount + {(Current actual spindle load current/AC setting – 1) x Cutting feed override decrease ratio x 0.5}]

Cutting feed override decrease ratio : Parameter No. 006 (Std. 0%)
Cutting feed override decrease amount: Parameter No. 008 (Std. 10%)

When the setting is 100, and the spindle load exceeds the target load by 50%, –25% is added to –10%, and the feed override decreases.
When the setting is 50, and spindle load is 50% over, –12% is added.



0007	AMOUNT TO INCREASE AC MONITOR FEEDRATE		Power Off: Not required
	Setting: 0	Unit: None	Setting Range: 0 `255

This is the amount to increase the AC monitor cutting feedrate override.
When the setting is 0, the override is increased in 10% increments at the sampling time (interval) set by parameter 4.

0008	AMOUNT TO DECREASE AC MONITOR FEEDRATE		Power Off: Not required
	Setting: 0	Unit: None	Setting Range: 0 `255

This is the amount to decrease the AC monitor cutting feedrate override. When the setting is 0, the override is decreased in 10% increments at the sampling time (interval) set by parameter 4.

0009	TOOL LIFE MANAGEMENT (SELECTION 0-3)		Power Off: Not required
	Setting: 3	Unit: None	Setting Range: 0 `3

This setting specifies whether tool life is managed by cutting time, cutting distance or machining quantity.

Setting	Description
@0 @	Cutting time (internally managed in 1 sec. units, input/display in min.)
@1 @	Cutting distance (managed in meter or inch units)
@2 @	Machining quantity (managed in value specified by M919 S ¢¢¢¢)
@3 @	Cutting time (internally managed in 0.1 sec. units, input/display in min.)

0010	TOOL LIFE COUNT (0: ADD/ 1: REMAIN)		Power Off: Not required
	Setting: 1	Unit: None	Setting Range: 0 or 1

This setting specifies whether tool life is counted as remaining life or usage time is added (cumulative).

Setting	Description
@0 @	Add (cumulative)
@1 @	Remaining life

0011	TOOL LIFE ALARM (0: DON'T MAKE/ 1:MAKE)		Power Off: Not required
	Setting: 1	Unit: None	Setting Range: 0 or 1

This setting specifies whether or not the tool is handled as an alarm tool when its life is reached.

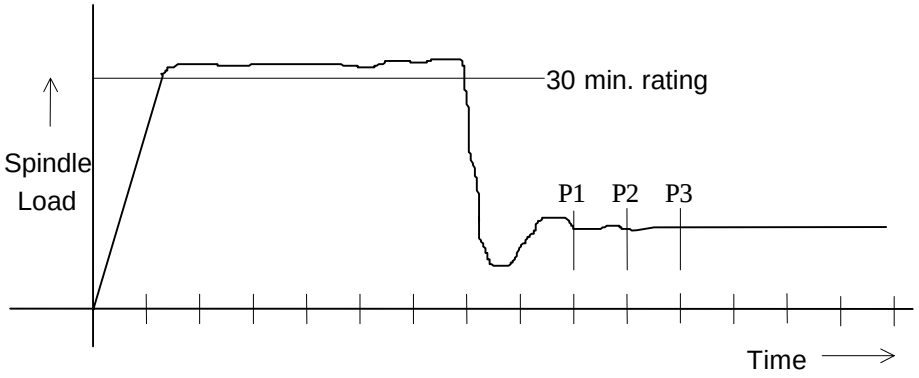
Setting	Description
@0 @	Do not trigger alarm. Alarm flag not set for tool status.
@1 @	Alarm is triggered when the tool is called again by T command.
@	Alarm flag is set under tool status.

0012	SPNDL LOAD STABILITY CHECK TIME INTERVAL		Power Off: Not required
	Setting: 3	Unit: 0.1 sec.	Setting Range: 0 `255 (0 `25.5 sec.)

This is the time interval setting for detection of spindle load current stabilization.

0005	RATE OF SPINDLE LOAD STABILITY CHECK		Power Off: Not required
	Setting: 5	Unit: %	Setting Range: 0 `100 (%)

This setting is used for checking of spindle stabilization. When the data for the last two checks of the spindle load current are within the set percentage, it is judged as having stabilized. Cutting feedrate override is fixed at 0% until stable current is detected.



Chapter 5 Auto Tool Change Function

V33, V55

Professional 3

Chapter 5
Auto Tool Change Function

Contents

5.1 Tool Capacity / Indexing Procedure

5.1.1 V55

The standard ATC magazine holds 15 tools. 25-tool, 40-tool, 80-tool and matrix magazines are optionally available.
The fixed tool address method is used for tool indexing. Therefore, the tool is always returned to the same position on the magazine after the tool change operation is performed by the M6 code.
The magazine is controlled to rotate in the nearest direction to the pot where the tool specified by the T code is stored in order to index the tool change position.

5.1.2 V33

The standard ATC magazine holds 15 tools.
The magazine is chain type, and uses a mechanism called a shifter to move tools from the magazine to the ATC arm.
The fixed tool address method is used for tool indexing. After the tool specified by the T code is indexed to the tool change position and transferred to the ATC arm by the shifter, the magazine automatically indexes the storage position for the spindle tool in order to save time.

5.2 ATC (Tool Changes)

5.2.1 V55

M6 is specified to exchange the spindle tool with the next tool.
The M6 command calls the O9020 macro program. This program contains an operation to move the X axis and Z axis to the ATC position, an operation to exchange the spindle tool and next tool, and one to return the X axis and Z axis to the specified positions.
Refer to Macro Program for the program content.

M6 should be specified in an independent block. The specified positions stated above should be positions where interference will not occur between the spindle tool and workpiece or other components.

For a 15-tool or 25-tool magazine, the spindle moves to remove and insert tools.
For a 40-tool, 80-tool or matrix magazine, the ATC magazine tool is moved to the ATC position by the shifter, and the tool insert/remove operation with the spindle tool after this is performed by the ATC arm.

Tools in the ATC magazine are indexed to the tool change position by the T function, and the actual tool change is performed by the M6 function. Correspondence between the program tool numbers used by the T function and pot numbers in the ATC magazine must be registered in advance.
Furthermore, for a 15-tool or 25-tool ATC, the T command is retained in the memory, with no indexing operation performed at this time. Indexing is performed when the M6 command is specified.

There is a high-speed mode and a low-speed mode for the tool change (M06) operation.
In the high speed mode, the X and Z axes are directly moved to the tool change position from the machine position specified by the M6 command. Therefore, it is necessary to move the spindle to a position where interference will not occur with the workpiece.
Furthermore, rapid feed override is fixed at 100%, regardless of the selection made with the rapid feed override switch on the main control panel.
In the low-speed mode, the tool change is performed after the Z axis is returned to the reference point, and the operation is completed at the Z axis reference point.
In this mode, the rapid feed override switch on the main control panel is valid.
The machine is set to the high-speed mode when it is shipped.
Consult regional distributor when changing to the low-speed mode.

5.2.1.1 15-Tool/25-Tool ATCs

T Commands

1. Indexing of Next Tool
   Since the T command is egg pot type, this T command is only retained by the machine side, and the indexing operation is not performed. The actual operation is performed by the M6 command.

2. T Commands for Other Than NextTool
   When a number which is the same as the spindle tool is specified, the next M6 command is skipped.

3. Return of Spindle Tool
   When T0; is specified, the return operation for the spindle tool is performed by the next M06 command.
   This command enables the spindle to be emptied of any tool.

ATC Command Programs

Take note of the following when generating programs to perform the ATC operation:

1. Restoring Spindle Rotation / Coolant Status
   When only the tool change operation is performed (auto offset / tool length measurement not performed), the spindle rotation and coolant On/Off status immediately prior to the M6 command are memorized, and restored to their previous status after completion of the tool change. When auto offset or tool length measurement is performed, the spindle and coolant remain stopped after the operation.

2. Tool Length Offset / Tool Diameter Offset
   These values are cancelled by the beginning of the macro program (O9020). They are not restored.

3. Start Position
   The M6 command can be specified at any location, but make sure to first move the respective axes to a location at which interference will not occur between the spindle tool and the workpiece, etc.
   Take particular care for the high-speed mode since the X axis and Z axis are simultaneously moved to the 2nd reference point when the M6 command is executed.
   When a tool length measuring unit is provided, also check for any interference between the length measuring unit and the spindle tool, and likewise for interference with the Y axis position. Move the Y axis as necessary before specifying the M6 command.

4. End Position
   Position the respective feed axes as follows when the M6 operation ends.

Ope / Axis	When only tool change is performed	Autooffset performed before tool cahnge	Auto measurment Performed after tool cahnge
X	Minus side stroke end pos.(Machine coordinate:-900mm)	Minus side stroke end pos.(Machine coordinate:-900mm)	Minus side stroke end pos.(Machine coordinate:-900mm)
Y	Position when M6 command and is specified	2nd reference point (Machine coordinate: -500mm)	2nd reference point (Machine coordinate: -500mm)
Z	High-speed mode:2nd reference point Low-speed mode:Ref. point	High-speed mode:2nd reference point Low-speed mode:Ref. point	High-speed mode:2nd reference point Low-speed mode:Ref. point

Sample Program

```
O1234;
T1;
Axes retracted;
M6;
T2;
Machining program;
Axes retracted;
M6;
T0;
Machining program;
Axes retracted;
M6;
M30;
%
```

ATC and Tool Length Measuring Operations

When the optional tool length measuring function is provided, the ATC and tool length measuring operations can be performed by specifying the argument in the M6 block.
The argument is not required when only the tool change is performed. Specify the argument as necessary when auto offset or tool length measurement is performed.

Only tool change : M06;
Auto offset/Tool length measurement
: M06 A_B_C_I_J_K_D_E_F_H_M_Q_R_S_T_U_V_W_Z_;

For details on the argument, refer to the Instruction Manual for the V55 Auto Tool Length Measuring Function.

Macro Program (O9020)

This is the macro program called by the M6 command for the 15-tool and 25-tool ATCs.

Do not change the macro program.
Make sure to contact regional distributor.

There are the following four types of operations depending upon the spindle tool status and T command:

1. Tool is retrieved : When there is no spindle tool
2. Tool change is performed
3. Tool is returned : When T0 is specified
4. M6 command is skipped : When same No. as spindle tool is specified

O9020 (V55 ATC15/25 AND TLS VER.5)

```
        IF [#4012 NE 66] GOTO3;
        #3000 = 100(G66 MODE EFFECTIVE);
N3      #16 = #104;
        IF [#20 NE #0] GOTO5;
        IF [#11 EQ #0] GOTO7;
N5      M05 M09;
N7      M621;
        #14=#4001;
        #15=#4003;
        G53;
        #10=1;
        #12=-900;
        IF[#4006 EQ 21] GOTO10;
        #10=25.4;
        #12=-35.43;
N10     IF[#20 EQ #0]GOTO20;
        M05 M549;
        G65 P9613    A#1   B#2   C#3
                     I#7   J#17  K#6
                     E#23  F#26  H#20
                     M#13  R#18  S#19  Y1.;
        IF[#104 EQ 1]GOTO130;
        IF[#104 EQ 5]GOTO130;
        IF[#104GE4]GOTO70;
        G91 G30 Y0.;
N20     IF[#104 EQ 1]GOTO135;
        IF[#104 EQ 5]GOTO135;
        IF[#104 NE 0]GOTO40;
        M559;
        G40;
        G91 G30 X0. Z0. M663;
        G49;
        G91 G00 Z[105/#10]M663;
        G91 G30 Z0. M663;
        IF[#11 EQ #0]GOTO30;
        G90 G53 G00 X[-1085/#10];
        G91 G28 Z0;
```

```
        G65 P9611    I#4    J#5    E#8
                     F#9    H#11   R#18
                     U#21   V#22   Y1.;
        GOTO140
N30     G90 G53 G00 X#12;
        G#14 G#15 M948;
        #104=#16;
        GOTO150;
N40     IF[#104 EQ 2]GOTO50;
        IF[#104 EQ 3]GOTO60;
        GOTO70;
N50     M559;
        G40;
        G91 G30 X0. Z0. M663;
        G49;
        G91 G00 Z[115/#10]M663;
        G90 G53 G00 X#12;
        G91 G30 Z0.;
        GOTO140;
N60     M559;
        G40;
        G90 G53 G00 Z[-75/#10];
        G49;
        G91 G30 X0. M663;
        G91 G30 Z0. M663;
        GOTO100;
N70     G91 G28 Z0. M319;
        G49;
        IF[#104 EQ 7]GOTO90;
        G90 G53 G00 X[-1085/#10];
        M559;
        G40;
        IF[#104 EQ 6]GOTO80;
        G91 G30 X0. Z0. M663;
        G91 G00 Z[105/#10]M663;
        G91 G30 Z0. M663;
        GOTO100;
```

```
N80     G91 G30 X0. Z0. M663;
        G91 G28 Z0. M663;
        G90 G53 G00 X#12;
        GOTO140;
N90     M559;
        G40;
        G91 G30 X0. M663;
        G91 G30 Z0. M663
N100    IF[#11 EQ #0]GOTO110;
        G90 G53 G00 X[-1085/#10];
N104    G91 G28 Z0. M549;
N107    G65 P9611 I#4J#5E#8F#9H#11R#18U#21V#22Y1.;
        GOTO140
N110    IF[#104 GE 4]GOTO120;
        G90 G53 G00 X#12;
        GOTO140;
N120    G90 G53 G00 X[-1085/#10];
N130    IF[#11 NE #0]GOTO104;
         G91 G28 Z0.;
        G90 G53 G00 X#12;
        GOTO140;
N135    IF[#11 NE #0] GOTO104;
N140    G#14 G#15 M948;
        #104=#16;
N150    M99;
```

5.2.1.2 40-Tool/80-Tool/Matrix ATCs

T Commands

1. Indexing of Next Tool
   When the T command is sent, the pot in which that tool is stored is indexed to the next tool standby position.

2. T Commands for Other Than NextTool
   When a number which is the same as the spindle tool is specified, the next M6 command is skipped.

3. Return of Spindle Tool
   When T0; is specified, the return operation for the spindle tool is performed by the next M06 command.
   This command enables the spindle to be emptied of any tool.

ATC Command Programs

Take note of the following when generating programs to perform the ATC operation:

1. Restoring Spindle Rotation / Coolant Status
   When only the tool change operation is performed (auto offset / tool length measurement not performed), the spindle rotation and coolant On/Off status immediately prior to the M6 command are memorized, and restored to their previous status after completion of the tool change. When auto offset or tool length measurement is performed, the spindle and coolant remain stopped after the operation.

2. Tool Length Offset / Tool Diameter Offset
   These values are cancelled by the beginning of the macro program (O9020). They are not restored.

3. Start Position
   The M6 command can be specified at any location, but make sure to first move the respective axes to a location at which interference will not occur between the spindle tool and the workpiece, etc.
   Take particular care for the high-speed mode since the X axis and Z axis are simultaneously moved to the 2nd reference point when the M6 command is executed.
   When a tool length measuring unit is provided, also check for any interference between the length measuring unit and the spindle tool, and likewise for interference with the Y axis position. Move the Y axis as necessary before specifying the M6 command.

4. End Position
   Position the respective feed axes as follows when the M6 operation ends:

Ope / Axis	When only tool change is performed	Autooffset performed before tool cahnge	Auto measurment Performed after tool cahnge
X	Minus side stroke end pos.(Machine coordinate:-900mm)	Minus side stroke end pos.(Machine coordinate:-900mm)	Minus side stroke end pos.(Machine coordinate:-900mm)
Y	Position when M6 command and is specified	2nd reference point (Machine coordinate: -500mm)	2nd reference point (Machine coordinate: -500mm)
Z	High-speed mode:2nd reference point Low-speed mode:Ref. point	High-speed mode:2nd reference point Low-speed mode:Ref. point	High-speed mode:2nd reference point Low-speed mode:Ref. point

Sample Program

```
O1234;
T1;
Axes retracted;
M6;
T2;
Machining program;
Axes retracted;
M6;
T0;
Machining program;
Axes retracted;
M6;
T0;
M30;
%
```

ATC and Tool Length Measuring Operations

When the optional tool length measuring function is provided, the ATC and tool length measuring operations can be performed by specifying the argument in the M6 block.
The argument is not required when only the tool change is performed. Specify the argument as necessary when auto offset or tool length measurement is performed.

Only tool change : M06;
Auto offset/Tool length measurement
: M06 A_B_C_I_J_K_D_E_F_H_M_Q_R_S_T_U_V_W_Z_;

For details on the argument, refer to the Instruction Manual for the V55 Auto Tool Length Measuring Function.

Macro Program (O9020)

This is the macro program called by the M6 command for the 40-tool, 80-tool and Matrix ATCs.

Do not change the macro program.
Make sure to contact regional distributor.

There are the following four types of operations depending upon the spindle tool status and T command:

1. Tool is retrieved : When there is no spindle tool
2. Tool change is performed
3. Tool is returned : When T0 is specified
4. M6 command is skipped : When same No. as spindle tool is specified

O9020 (V55 ATC40/80 AND TLS VER.3)

```
        IF [#4012 NE 66] GOTO3;
        #3000 = 100(G66 MODE EFFECTIVE);
N3      #16 = #104;
        IF [#20 NE #0] GOTO5;
        IF [#11 EQ #0] GOTO7;
N5      M05 M09;
N7      M621;
        #14=#4001;
        #15=#4003;
        G53;
        #10=1;
        #12=-900;
        IF[#4006 EQ 21] GOTO10;
        #10=25.4;
        #12=-35.43;
N10     IF[#20 EQ #0]GOTO20;
        M05 M549;
        G65 P9613    A#1    B#2    C#3
                     I#7    J#17   K#6
                     E#23   F#26   H#20
                     M#13   R#18   S#19   Y1.;
        IF[#104 EQ 1]GOTO50;
        IF[#104 EQ 5]GOTO50;
N20     IF[#104 EQ 1]GOTO65;
        IF[#104 EQ 5]GOTO65;
        IF[#104 NE 0]GOTO40;
        G40;
        M559;
        G91 G30 X0. Z0. M06;
        G49;
        IF[#11 EQ #0]GOTO30;
        G90 G53 G00 X[-940/#10];
        G65 P9611    I#4    J#5    E#8
                     F#9    H#11   R#18
                     U#21   V#22   Y1.;
        GOTO70
```

```
N30     G90 G53 G00 X#12;
        G#14 G#15 M948;
        #104=#16;
        GOTO80;
N40     G91 G30 Z0. M319;
        G49;
        G40;
        M559;
        G91 G30 X0. Z0. M06;
        IF[#11 EQ #0]GOTO30;
        G90 G53 G00 X[-940/#10];
N45     G65 P9611 I#4J#5E#8F#9H#11R#18U#21V#22Y1.;
        GOTO70
N50     IF[#11 NE #0]GOTO45;
         G91 G28Z0.;
N60     G90 G53 G00 X#12;
        GOTO70;
N65     IF[#11 NE #0] GOTO7;
        G91 G28 Z0. M549;
        GOTO45;
N70     G#14 G#15 M948;
        #104=#16;
N80     M99;
```

5.2.2 V33

The M98P9806 command is specified to exchange the spindle tool with the next tool. (Hereinafter, the P98P9806 command will be called the ATC command.)
The ATC command calls the O9806 sub program, which performs the operation to move the X axis and Z axis to the ATC position, operation to exchange the spindle tool and next tool, and operation to return the X axis and Z axis to the machining area.
Refer to "Sub Program" for the content of this program.

Specify the ATC command in an independent block at a position where the Z axis has been returned to its reference point and no interference will occur between the spindle tool and workpiece when the above operations are performed.

During the ATC operation, the tool in the ATC magazine is moved to the ATC arm by the shifter. The ATC arm removes the spindle tool and inserts the next tool.

The tool in the ATC magazine is indexed to the change position by the T function, and the tool change is performed by the ATC command. Correspondence between the program tool number used by the T function and the pot number in the ATC magazine must be registered in advance.

5.2.2.1 ATC

T Commands

1. Indexing Next Tool
   When the T command is specified, the pot in which that tool is stored is indexed to the next tool standby position, and the tool is moved to the ATC arm by the shifter.

2. T Command for Other Than Next Tool
   When the same number as the spindle tool is specified, the next ATC command is skipped.

3. Return of Spindle Tool
   The tool return operation is performed by the next ATC command when T0; is specified.
   This command enables the spindle to be emptied.

ATC Command Program

Take note of the following points when generating the program to perform the ATC operation:

1. Restoring Spindle Rotation / Coolant Status
   The spindle rotation and coolant On/Off status immediately prior to the ATC command are memorized, and restored to their previous status after completion of the tool change. When the tool change operation stops at an intermediate point due to an alarm or other cause, spindle rotation and coolant supply are not restored.

2. Start Position
   Specify the ATC command with the Z axis at its reference point. Also make sure to move the other axes to a location where interference will not occur between the spindle tool and workpiece before the ATC command is sent.

3. End Position
   The feed axes should be positioned as follows when the ATC operation is completed:

Operation / Axis	When only tool change is performed
X	Minus side stroke end pos.(Machine coordinate:-600mm)
Y	ATC command position. (Machine coordinate:-400mm)
Z	2nd reference point (Machine coordinate:-350mm)

Sample Program

```
O1234;
T1;
Retract axes
M98P9806;
T2;
Machining program
Retract axes
M98P9806;
T0;
Machining program
Retract axes
M98P9806;
M30;
%
```

Sub Program (O9806)

This is the sub program called by the ATC command.

Do not change the macro program.
Make sure to contact regional distributor.

There are the following three types of operations depending upon the spindle tool status and T command:

1. Tool change is performed
2. Tool is returned : When T0 is specified
3. ATC command is skipped : When same No. as spindle tool is specified

O9806 (V33 ATC PROG VER.2.0)

```
M559;
G53;
/M307;
/M548;
/G91G30X0;
/G91G30Z0;
/M549;
/G91G28Z0;
/M550;
/G91G30Z0;
/M551;
/G91G28Z0;
/M308;
M552;
G53;
/G91G53X-600.(MM);
/M553;
G53;
/G91G53X-23.6(INCH);
M948;
M99;
G53;
```

5.3 Tool Number Registration

Entering the tool arrangement on the ATC magazine into the machine memory is called tool number registration.
There are two methods to perform this: Entering the numbers on the PC Tool Detail Screen, and Entering the numbers using the program T function.

5.3.1 Entering Numbers on PC Tool Detail Screen

Refer to the Tool Detail Screen in the PC Screens chapter.

5.3.2 Entering Numbers Using Program T Command

There are two procedures which can be used with the T command, which are described in this section.

5.3.2.1 Entering Numbers for Consecutive Pot Numbers

A sample program is provided below to register tool numbers for the tool arrangement shown:

Sample Program

Pot No.	Tool No.	M57;	(Activate tool No. registration mode)
1	1001	T1001;	(see Note)
2	1002	T1002;	
3	1003	T1003;	
:	:	:	
:	:	:	
10	1010	T1010;	
		M37;	(or M02; or M30;)
			(Deactivate tool No. registration mode)

All registered data is cleared by the T command in the next block after the M57; command.

5.3.2.2 Entering Numbers for Specified Pot Numbers

A sample program is provided below to register tool numbers for the tool arrangement shown:

Sample Program

Pot No.	Tool No.		
		M57;	(Activate tool No. registration mode)
3	1003	S3	T1003;
7	1007	S7	T1007;
12	1012	S12	T1012;
20	1020	S20	T1020;
		M37;	(or M02; or M30;)
			(Deactivate tool No. registration mode)

Enter the S command and T command in the same block.
S command : Pot No.
T command: Tool No.

5.3.2.3 Clearing Tool Numbers

All pot tool numbers are cleared by the following program:

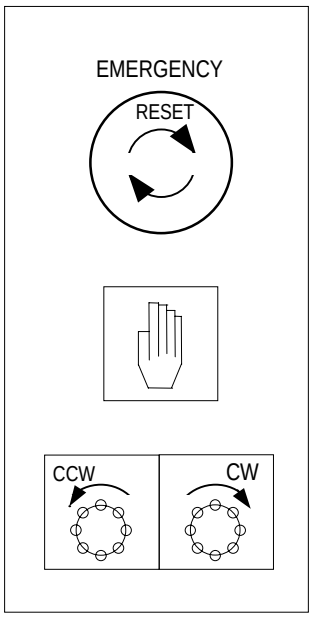
```
M57;
T0;
M02; (M30;)
%
```

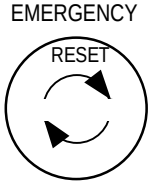
5.4 ATC Control Panel

5.4.1 V55

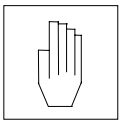
The ATC control panel is used to manually operate the ATC magazine when inserting and removing tools to/from the ATC magazine. The magazine can be manually indexed by activating the manual mode with the manual intervention button. Please note that automatic indexing is suspended while the manual mode is active, stopping progress for the current machining program.

5.4.1.1 ATC Control Panel (15-/25-/40-/80-Tool ATCs)



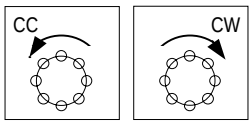


Emergency Stop Button
The "EMERGENCY" stop button on the control panel is used to immediately stop machine operation. This button is locked in place when it is pressed. The lock can be released by rotating the button in the direction (clockwise) indicated by the arrow
This button has the same function as the EMERGENCY button on the main control panel, and stops all machine operations.



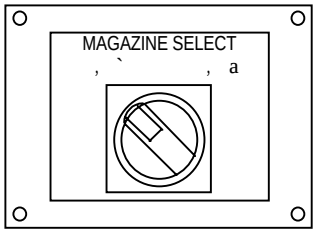
Manual Intervention Button (built-in lamp)
The manual intervention button is used when inserting and removing tools.
The manual mode is activated for the ATC magazine when this button is pressed, and the built-in lamp lights, indicating that manual indexing can be performed.
However, when this button is pressed during a tool change being performed in the automatic operation mode, or while the ATC magazine is being indexed, the reservation status is turned On, and the built-in lamp starts blinking. The manual mode is activated upon completion of automatic or the ATC operation, and the lamp goes to the constant on status. Press this button again to return to the automatic mode from the manual mode. The automatic mode is activated when this button is pressed during the manual mode or manual mode reserved status.

When the manual mode is activated, the desired pot can be manually indexed with the ATC magazine rotation buttons.
Furthermore, all tool changes and tool indexing operations are suspended during the manual mode, including MDI operation, and are executed when the automatic mode is activated again.

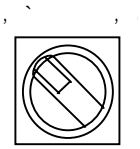


ATC Rotation Buttons (CW, CCW)
When the CW button is pressed while the manual mode is active, the ATC magazine is rotated in the clockwise (CW) direction, and when the CCW button is pressed, it is rotated in the counterclockwise (CCW) direction while the button is held down. The magazine stops at the nearest pot when either button is released.

Magazine Select Control Panel

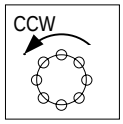


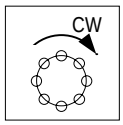
The magazine select control panel is only provided for the 80-tool ATC (option).



Magazine Select Control Panel Switch
This switch is used to select whether the left magazine (A) or right magazine (B) is rotated.

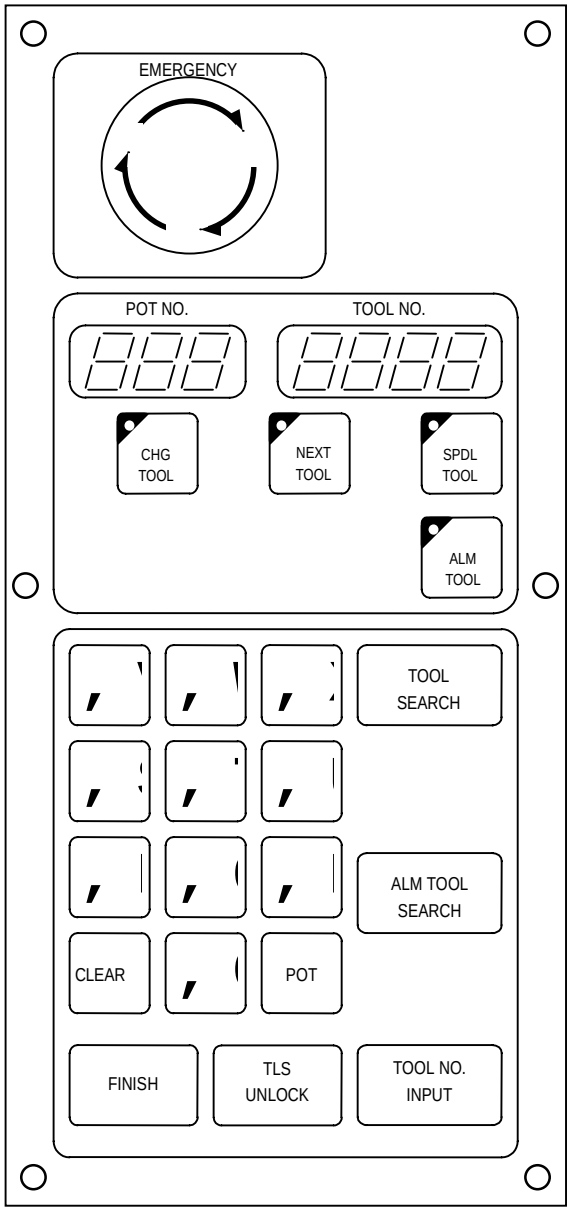
After the desired magazine has been selected with the magazine select switch, it can be rotated by holding down either of the following switches:





5.4.1.2 ATC Control Panel (Matrix Type)

The ATC control panel with tool number display enables the tool number corresponding to a pot number to be displayed, and transport of the tool which you wish to change to the tool loading station (T.L.S.).



Tool Number Display

1. Spindle Tool
   The built-in lamp lights when the [SPDL TOOL] key on the ATC control panel is pressed, and the spindle tool number is displayed.

2. Next Tool
   The built-in lamp lights when the [NEXT TOOL] key on the ATC control panel is pressed, and the next tool number is displayed.

3. Tool Loading Station Tool
   The built-in lamp lights when the [CHG TOOL] key on the ATC control panel is pressed, and the tool number on the tool loading station is displayed.

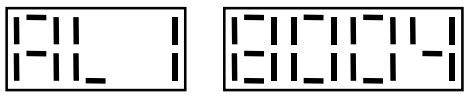
Tool Alarm Display

The built-in lamp for the [ALARM TOOL] key on the ATC control panel lights when the displayed tool is in the alarm status.

TLS Related Warning/Alarm Display

When a TLS related warning/alarm occurs, "ALOOOO" is displayed.

Sample for Alarm No. 18004



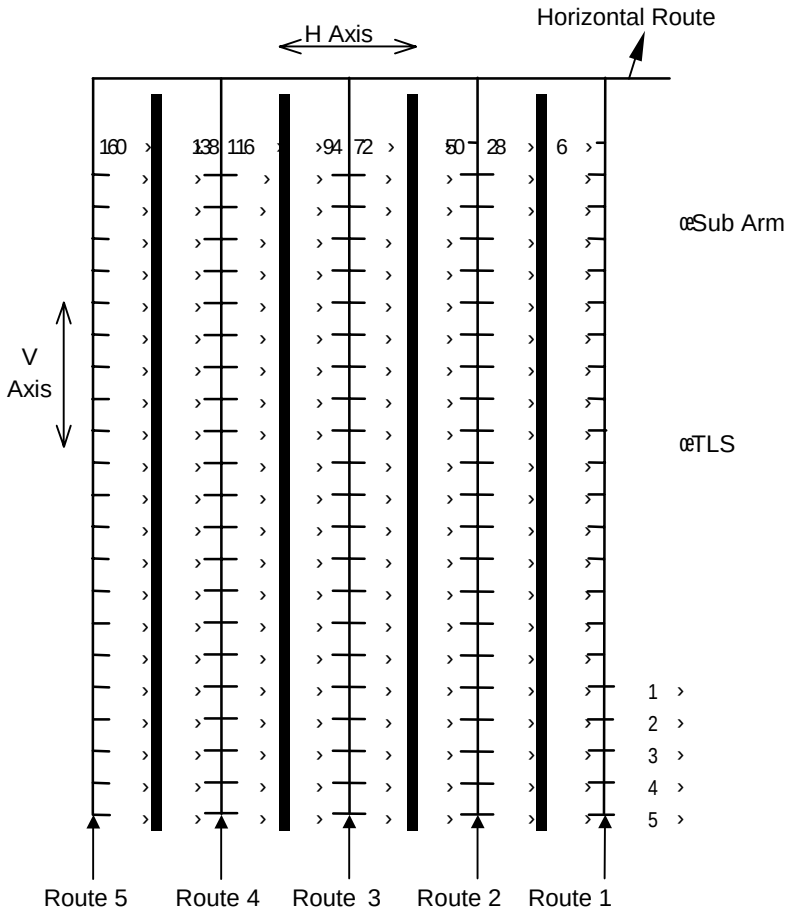
1. Warning
   A warning is triggered when a tool call/return command to/from the TLS is sent and the necessary conditions have not been satisfied. The details of the warning are displayed on the alarm screen. The warning is cancelled when any key on the ATC control panel is pressed.

2. Alarm During Operation
   When an alarm which prevents further operation from being performed occurs during operation, the alarm number blinks on the display. Details of this alarm are displayed on the alarm screen.
   The alarm is reset by pressing the [ALARM RESET] soft key on the PC alarm screen. The alarm cannot be reset with the ATC control panel.

The V55 ATC matrix magazine consists of a rack, pots, a carrier, TLS and ATC control panel.

Tools are stored and transported by pots in the magazine. The pots are stored in the rack, and pots are transported by the carrier. The Tool Loading Station (TLS) is a device used to store tools in the magazine and remove them.
Numbers are assigned to the rack positions, starting with number 1.
Pots are stored in varying locations on the magazine rack.
The actual pots do not have numbers.

A diagram of the ATC magazine rack number is provided below (181-tool):



Above hardware configuration will vary depending upon machine specifications

The arrows indicate the vertical routes on which the carrier moves up and down. The carrier moves between the routes on the H axis.
H axis (horizontal route) movement is also performed behind the rack.

Tool Call Operation

Tools can be called to the TLS by specifying the tool number, specifying the pot number and by performing the alarm tool search operation. When there is already a tool at the TLS, that tool is first returned to the rack, and then the called tool is transferred to the TLS. The specified tool number blinks when the call operation is started, and goes to the constant On status when the tool arrives at the TLS.
When the TLS unlock button is pressed when the display goes to the constant On status, the lock is released, allowing the TLS to be manually pulled out. (TLS door can be opened.)

1. Call by Tool Number
   Tools can be called to the TLS by specifying the tool number.

   A. Return the tool pull-out unit to the magazine (close TLS door).

   B. Enter the tool number with the "0" to "9" keys on the ATC control panel.
      The entered tool number is displayed.

   C. Press the [TOOL SEARCH] key on the ATC control panel.
      The tool number blinks, and the operation starts.

   D. When the specified tool is transferred to the TLS, the tool number goes to the constant On status.

2. Call by Pot Number
   Tools can be called to the TLS by specifying the pot number.
   Here pot number refers to the pot number.

   A. Return the tool pull-out unit to the magazine (close TLS door).

   B. Press the [TOOL SEARCH] key on the ATC control panel.

   C. Enter the tool number with the "0" to "9" keys on the ATC control panel.
      The entered tool number is displayed.

   D. Press the [TOOL SEARCH] key on the ATC control panel.
      The tool number blinks, and the operation starts.

   E. When the specified tool is transferred to the TLS, the tool number goes to the constant On status.
      If the tool number has not been registered, "0000" is displayed on the tool number display.

3. Calling Alarm Tool
   Alarm tools in the rack can be called to the TLS. The alarm tool in the lowest rack number is called. If there is already an alarm tool on the TLS, no operation is performed.
   If the tool on the TLS is not in the alarm status, or if the alarm for the alarm tool has already been reset, the tool on the TLS is first returned to the rack, and then the alarm tool is transferred to the TLS.

   A. Return the tool pull-out unit to the magazine (close TLS door).

   B. Press the [ALM TOOL SEARCH] key on the ATC control panel.
      When there is an alarm tool in the magazine, the operation starts at the same time as the alarm tool number begins to blink.
      When there is no alarm tool in the magazine, "0" blinks twice, but no operation is performed.

   C. When the alarm tool reaches the TLS, the tool number is displayed, and the built-in lamp for the [ALM TOOL SEARCH] key on the ATC control panel lights.

Tool Return Operation

When the [FINISH] key on the ATC control panel is pressed, the tool (pot) on the TLS is returned to the rack.

1. Return the tool pull-out unit to the magazine (close TLS door).

2. Press the [FINISH] key.
   The tool number blinks, and the operation starts.

3. When the tool is returned to the magazine, the tool number goes to the constant On status.

Tool Number Registration

The tool number for the tool called to the TLS can be overwritten.

1. Press the [CHG TOOL] key on the ATC control panel to display the tool called to the TLS.

2. Enter the tool number with the "0" to "9" keys on the ATC control panel.
   The entered tool number is displayed.

3. Press the [TOOL NO. INPUT] key on the ATC control panel.

The tool number blinks twice, and the tool number is overwritten.

Resetting Tool Alarms

1. Press the [CHG TOOL] key on the ATC control panel to display the tool called to the TLS.
   If the tool is in the alarm status, the built-in lamp for the [ALM TOOL SEARCH[key on the ATC control panel lights.

2. Press the [ALM TOOL SEARCH] key on the ATC control panel.
   When the alarm is reset, the tool number blinks twice, and the lamp for the [ALM TOOL SEARCH] key on the ATC control panel goes out.

Tool alarms can also be reset on the tool detail screen.

TLS Lock/Unlock

When the [TLS UNLOCK] key on the ATC control panel is pressed, the TLS lock is released, allowing the door to be opened.

1. Unlocking TLS
   Press the [TLS UNLOCK] key on the ATC control panel.

   While tool call/return is being performed during a T command, the lamp blinks and releasing of the lock is suspended. The lamp goes to the constant on status upon completion of the operation (when suspend status is released), and the TLS is unlocked.

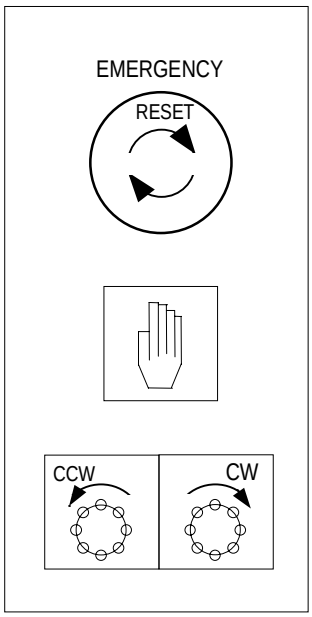
2. Locking TLS
   When the [TLS UNLOCK] key on the ATC control panel is pressed, the lamp goes out and the door is locked.

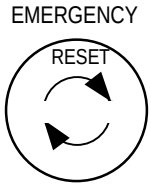
   When the TLS is pulled out, it is locked, but the lamp will blink.

5.4.2 V33

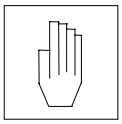
The ATC control panel is used to manually operate the ATC magazine when inserting and removing tools to/from the ATC magazine. The magazine can be manually indexed by activating the manual mode with the manual intervention button. Please note that automatic indexing is suspended while the manual mode is active, stopping progress for the current machining program.

5.4.2.1 ATC Control Panel



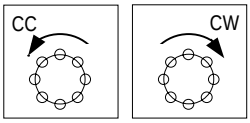


Emergency Stop Button
The "EMERGENCY" stop button on the control panel is used to immediately stop machine operation. This button is locked in place when it is pressed. The lock can be released by rotating the button in the direction (clockwise) indicated by the arrow
This button has the same function as the EMERGENCY button on the main control panel, and stops all machine operations.



Manual Intervention Button (built-in lamp)
The manual intervention button is used when inserting and removing tools.
The manual mode is activated for the ATC magazine when this button is pressed, and the built-in lamp lights, indicating that manual indexing can be performed.
However, when this button is pressed during a tool change being performed in the automatic operation mode, or while the ATC magazine is being indexed, the reservation status is turned On, and the built-in lamp starts blinking. The manual mode is activated upon completion of automatic or the ATC operation, and the lamp goes to the constant on status.
Manual intervention can be performed during the M98P9806 operation performed in the automatic operation mode.
Press this button again to return to the automatic mode from the manual mode. The automatic mode is activated when this button is pressed during the manual mode or manual mode reserved status.

When the manual mode is activated, the desired pot can be manually indexed with the ATC magazine rotation buttons.
Furthermore, all tool changes and tool indexing operations are suspended during the manual mode, including MDI operation, and are executed when the automatic mode is activated again.



ATC Rotation Buttons (CW, CCW)
When the CW button is pressed while the manual mode is active, the ATC magazine is rotated in the clockwise (CW) direction, and when the CCW button is pressed, it is rotated in the counterclockwise (CCW) direction while the button is held down. The magazine stops at the nearest tool indexing position when either button is released.

Chapter 6 Machine Data Macro Variable Output Function (Option)

V33, V55

Professional 3

Chapter 6
Machine Data Macro Variable Output Function

Contents

6.1 Outline

Machine data used in NC programs can be output to custom macro variables. This function is realized with custom macro common variables and M codes.
When this function is utilized, custom macro common variable #100 to #109 and #110 are used. #110 can be changed with the machine parameter settings.

6.2 Program Format

M483 is specified after the type of machine data required is set to the custom macro variables. When M483 is executed, that data is output to the custom macro variables.
To view the data obtained immediately after the M code, set M483 as an M code for which buffering is not performed, or insert the G53 read-ahead control code after the M code.
To set M483 as an M code for which buffering is not performed, enter "483" to any available NC parameter between No. 3416 and No. 3420.

The custom macro common variables use #100 to #109 to specify the data to be output. Currently, #103 to #109 are not being used. They have been reserved for future expansion of functions.
Data is output to #110, but this can be changed using the setting for machine parameter No. 324.

```
#100 = Type of data;
#101 = Data detail 1;
#102 = Data detail 2;
#103 = Data detail 3;
#104 = Data detail 4;
#105 = Data detail 5;
#106 = Data detail 6;
#107 = Data detail 7;
#108 = Data detail 8;
#109 = Data detail 9;
M483;
G53;          Read ahead control (required when M483 is not set
              as M code for which buffering is not performed)
```

6.3 #100: Specify Data to be Output

The type of data to be output is specified by custom macro variable #100.

Setting	Type
0.0	Not used
1.0	Tool data
2.0 and after	Not used

6.4 #101 - #109: Data Detail 1 - Data Detail 9

The details of data to be output are specified by custom macro variables #101 and #109. The value is specified by the integer. The value after the decimal point should be 0.

6.4.1 Tool Data

#101 : Specifies the tool.
#102 : Specifies the data.
#103 - #109 : Not used

6.4.1.1 #101: Tool Specification, #102: Data Specification

1. #101 :Tool Specification
   Spindle Tool : Enter 0.0 for #101
   Next Tool : Enter -1.0 for #101
   OtherTool : Enter tool number for #101

2. #102 : Data Specification
   0.0 : Not used
   1.0 : Tool number (PTN)
   3.0 : Type
   4.0 : Kind (FTN)
   5.0 : Life
   6.0 : Remaining life (cumulative value)
   7.0 : Tool length
   8.0 : Tool diameter
   9.0 : Status (alarm)
   10.0 : SL value
   11.0 : AC value
   12.0 : ITN
   13.0 : Not used
   14.0 : Not used
   15.0 : Not used
   16.0 : Through-spindle coolant suction time for each tool
   20.0 : ATC arm rotation speed for each tool

6.4.1.2 #110: Output Data

The specified tool data is output to custom macro variable #110.

1. Tool No. (PTN)
   Output Data : 1.0 - 9999.0

2. Pot No.
   Output Data : 1.0 - Max. pot number

3. Type
   Output Data : 0.0 - 9.0
   A diagram is displayed on the tool detail screen, but the value registered on the tool detail screen is output. Refer to the PC tool detail screen for the relationship between the diagram and this value.

4. Kind (FTN)
   Output Data : 1.0 - 9999.0

5. Life
   The range of data output and the unit used differ depending upon the settings for machine parameter No. 009 and No. 264.

   Cutting Time
   Output Data : 0.0 - 5999940.0
   When parameter No. 9 is set to "3", the first digit after the decimal point is valid.
   Unit : sec. (same when parameter No. 9 is set to "0" or "3")

   Cutting Distance
   Output Data : 0.0 - 99999.0
   Unit : mm when parameter No. 264 is set to "0"
   inches when parameter No. 264 is set to "1"

   Machining Quantity
   Output Data : 0.0 - 99999.0
   Unit : pieces

   Machining Parameter No. 9

Setting		Description
0	:	Cuting time (Min. internal management unit: 1 sec.)
1	:	Cuting distance (Internally managed in m or inch units)
2	:	Machining quantity
3	:	Cuting time (Min. internal management unit: 0.1 sec.)

Machining Parameter No. 246

Setting		Description
0	:	mm system
1	:	inch system

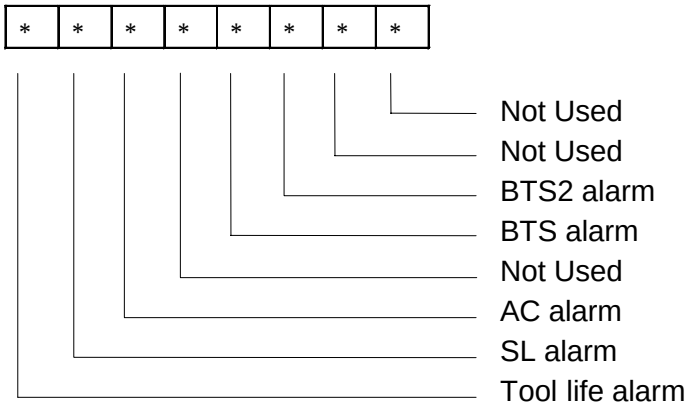
6. Remaining Life (cumulative)
   The same values/units are used as for life - refer to item 5.

7. Tool Length
   When Machine Parameter No. 264 is set to 0 (mm)
   Output Data : 0.000 - 999.999
   Unit : mm

   When Machine Parameter No. 264 is set to 1 (inches)
   Output Data : 0.0000 - 99.9999
   Unit : inches

8. Tool Diameter
   The same values/units are used as for tool length - refer to item 7.

9. Status (alarm)
   Output Data : 0.0 - 11111111.0
   The integer digit indicates the alarm status.
   When an alarm has occurred, the corresponding digit is 1.
   The correspondence between alarm and the respective digits is shown below:



10. SL Value
    Output Data : 0.0 - 999.9
    Entered value valid up to first decimal place.
    Unit : A

11. AC Value
    Output Data : 0.0 - 999.9
    Entered value valid up to first decimal place.
    Unit : A

12. ITN
    Output Data : 0.0 - 9999.0

13. Through-Spindle Coolant Suction Time for Each Tool
    Output Data : 0.0 - 99.0
    Unit : sec.

6.4.1.3 Sample Programs

Program to Ouput Remaining Life Value for Spindle Tool

```
#100=1.;      Tool data output command
#101=0.;      Spindle tool command
#102=6.;      Remaining life output command
M483;         Remaining life for spindle tool is output
G53;          Read-ahead control
```

Program to Ouput Tool Length for NextTool

```
#100=1.;      Tool data output command
#101=-1.;     Next tool command
#102=7.;      Tool length output command
M483;         Tool length for next tool is output
G53;          Read-ahead control
```

Program to Ouput Pot No. for Tool No. 1234

```
#100=1.;      Tool data output command
#101=1234.;   PTN 1234 tool command
#102=2.;      Pot No. output command
M483;         Pot No. containing PTN 1234 is output
G53;          Read-ahead control
```

Chapter 7 Scraper Conveyor

(V55 Option)

Professional 3

Chapter 7
Scraper Conveyor

Contents

7.1 Outline

The scraper conveyor transports the chips which have dropped into the trough to the lift-up chip conveyor. The scraper conveyor can be started and stopped with the respective buttons and M codes. However, during automatic operation (during which the lamp for the "START" button on the main control panel lights), the scraper conveyor is automatically started when the spindle or coolant are started.

7.2 Automatic Operation

During automatic operation (at which time the lamp for the "START" button on the main control panel lights), the scraper conveyor is automatically started while the spindle or coolant discharge are operating.
At this time, the stop commands with the "START" button on the main control panel and M codes are ignored.

7.3 Manual Operation

Normally, the conveyor is operated in the forward direction. Forward operation is turned On and Off with the buttons on the main control panel or with the M codes.

1. Operating From Main Control Panel
   The conveyor is turned On when the [SCRAPER CONVEYOR] button on the main control panel is pressed, and the built-in lamp lights. The conveyor is stopped when the button is pressed (while the lamp is On), and the lamp goes out.

2. Starting/Stopping with M Codes
   The conveyor can be turned On/Off by executing the following M codes:
   M740 : Off
   M741 : On

7.4 Reverse Operation

The conveyor is operated in the reverse direction when its becomes plugged up with chips in order to remove them.
The conveyor is operated in the reverse direction while the [ON] soft key is held down after selecting the [SCRAPER CONV.REV] function on the PC primary operation screen. The conveyor stops when the key is released.

In the event the forward operation of the conveyor is stopped and it is then operated in the reverse direction, forward operation will not be automatically restarted upon completion of reverse operation. However, the conveyor will automatically be started during automatic operation or coolant discharge upon completion of reverse operation.

Chapter 8 Tool Data Dump Function

V33, V55

Professional 3

Chapter 8
Tool Data Dump Function

Contents

8.1 Outline

An M code can be used to dump the tool data into the NC memory. Tool data dumped into the NC memory is in the same NC program format as registered machine data. Therefore, executing this NC program enables the same values to be restored as when the tool data was dumped.

8.2 Specifications

When an "O" number is specified following S after M233 is specified, the tool data is dumped to that "O" program number.

The following tool data is dumped:

1. PTN (program tool number)
2. ITN (individual tool number)
3. Life time setting value
4. Remaining life value (or usage value)
5. Tool diameter/tool length offset values
6. FTN (functional tool number)
7. Tool alarm data
8. SL values
9. AC values
10. Type of tool
11. Through-spindle coolant suction time for each tool (option)
12. ATC arm rotation speed data for each tool (option)

1. The S command value range is 1 to 7999 (NC program O1 to O7999).
2. When an O number is not specified by the S command, machine alarm "NC COMMAND IS ILLEGAL" is triggered.
3. When an existing NC program number is specified by the S command, machine alarm "THIS PROGRAM ALREADY EXISTS IN MEMORY ON NC" is triggered.
4. When there is insufficient space in the NC memroy, machine alarm "THERE ISN'T ENOUGH SPACE IN MEMORY ON NC" is triggered.
5. When the M233 command is sent, make sure to press the [START] button on the main control panel after changing to a screen other than the program screen. Executing the M code without changing the screen will trigger the following machine alarm: "CANNOT COMMAND BECAUSE PROGRAM SCREEN OPENED."

8.3 Operation Procedure

Confirm that the machine is not performing automatic operation, and execute the respective procedure described in this section.
If automatic operation is being performed, end operation before commencing the procedure.

8.3.1 Dumping Tool Data to NC Program

1. Select the MDI mode on the main control panel for the machine.

2. Release the memory protect function.

3. Enter the M code and the program number to which the tool data is to be dumped with the S code.
   Input Sample
   M233 S1000; (Stores current tool data in NC program O1000)

4. Change to an NC screen other than the NC program screen.

5. The dump operation is started when the [START] button on the main control panel is pressed.

The program dumped by the machine data dump function is stored in the NC memory in the registration NC program format. Therefore, starting the program in the memory mode allows the tool data to be set.

8.3.2 Setting Tool Data from NC Program

1. Select memory operation mode for the machine on the main control panel.

2. Call the program into which the tool data was dumped by the dump function.

3. The tool data is set when the [START] button on the main control panel is pressed.

Chapter 9 Main Options

V33, V55

Professional 3

Chapter 9
Main Options

Contents

9.1 Rigid Tap

9.1.1 Outline

There are two methods to perform tapping cycles (G84) and reverse tapping cycles (G74): Use of a conventional float tapper, and the rigid tap procedure.

When a conventional float tapper is used, the spindle is rotated with the M03 (spindle clockwise) and M04 (spindle counterclockwise) auxiliary functions and stopped according to the operation of the tapping axis in order to perform tapping.

With the rigid tapping method, the spindle motor is controlled like a control motor, synchronizing the tapping axis and spindle.

When the rigid tapping method is used, the spindle is rotated one revolution for each predetermined feed of the tapping axis (thread lead), and does not change during acceleration or deceleration. Accordingly, this eliminates the necessity of using a float tapper, enabling high-speed high-precision tapping to be performed.

9.1.2 Command Format

The rigid tap command can be sent as an "M135 S****" command , or by specifying G84.2 (G84.3) in the FS15 format before the tap cycle comand. With the Professional 3, it is necessary to determine the spindle torque range with the S**** command before these commands.
When the rigid tap function is cancelled by the G80 or group 01 G code or another canned cycle G code, the spindle speed setting up to that point is lost. Therefore, the S code must be sent again to set the speed in order to rotate the spindle with the M03 or M04 command.
Furthermore, refer to the NC Instruction Manual for the format of G84 and G74, and details of operation.

Standard Format

```
S****;
M135 S****;
G84 X___ Y___ Z___ R___ P___ F___ K___;
        :
G80;
        :
S**** M03;
        :
```

F15 Format

```
S****;
G84.2 X__ Y__ Z__ R__ P__ F__ K__ S**** L__;
        :
G80;
        :
S**** M03;
```

9.2 Warning Lamps

9.2.1 Outline

The warning lamp is provided to inform the operator of the status of the machine. There are three types of warning lamps. The conditions for turning On the lamp differ for the respective types of lamps.

9.2.2 Procedure to Turn On

The warning lamp is turned on when the "Turn On Conditions" are satisfied while the warning lamp mode is On. The warning lamp will not be turned On if the mode is Off.
The warning lamp mode is turned On and Off on the PC primary operation screen. "●" is displayed to the left of "WARNING LIGHT" when the mode is On, and "❍" is displayed when it is Off.

The warning light will not be turned On if the warning lamp mode is turned On after the "Turn On Conditions" are satisfied.

9.2.3 Turn On Conditions

Type	Conditions
Warning Lamp 1 (Red)	Machine alarms NC alarms Emergency stop
Warning Lamp 2 (Yellow)	Program end (M02/M30) Program stop (M00/M01)
Warning Lamp 3 (Green)	Automatic operation being performed

9.2.4 Procedure to Turn Off

There are the following two methods to turn off the warning light:

1. Change the [WARNING LIGHT OFF] soft key status on the PC primary screen from Off to On.

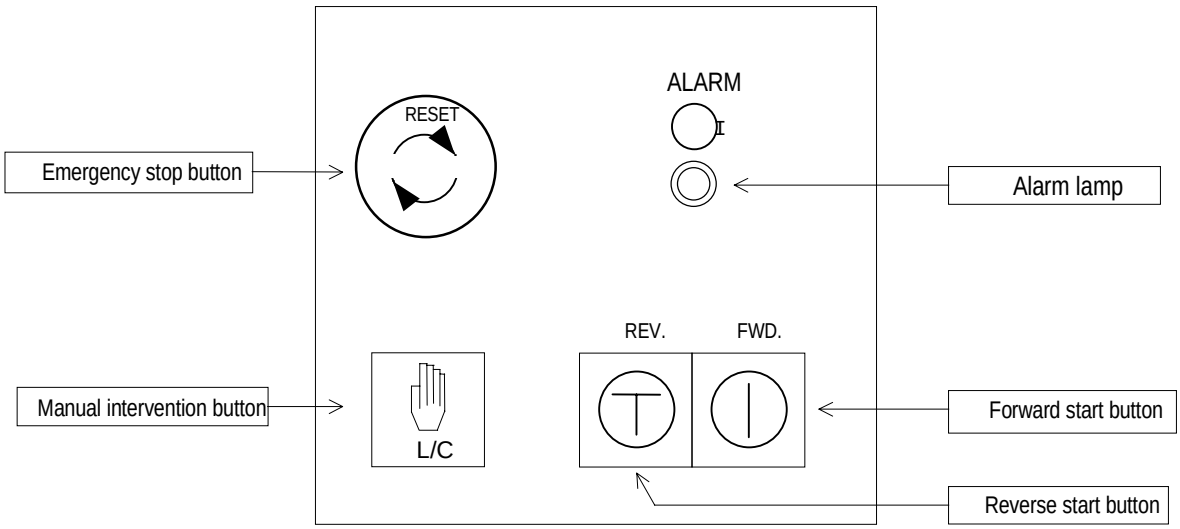
2. Change the [WARNING LIGHT] soft key status on the PC primary screen from On to Off.

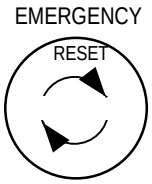
9.3 Lift-Up Chip Conveyor (V55 Option)

9.3.1 Outline

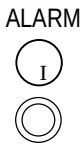
The lift-up chip conveyor transports chips dumped by the scraper conveyor into the chip bucket. It can be operated in the automatic operation and manual operation modes.

9.3.2 Lift-Up Chip Conveyor Control Panel



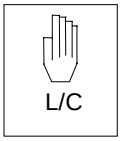


Emergency Stop Button
The [EMERGENCY] button on the control panel is used to immediately stop the machine. This button is locked in place when it is pressed. The lock can be released by rotating the button in the direction indicated by the arrow (clockwise). This button has the same function as the [EMERGENCY] button on the main control panel, and stops all machine operations.



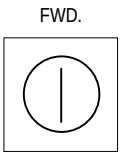
Alarm Lamp
This lamp lights in the following cases:

1. When a coolant-related thermal alarm occurs.
2. When the "Manual intervention" mode is turned On for the lift-up chip conveyor during machining (while the spindle is operating or the coolant is On), and a certain time elapses (lamp turns On to warn operator that chips may plug up).

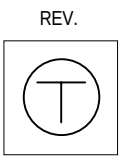


Manual Intervention Button (built-in lamp)
The "Manual intervention" button on the control panel is used to change between the manual and automatic modes for the lift-up chip conveyor. The manual mode is activated when this button is pressed, and the built-in lamp lights, activating the "FWD." / "REV." buttons on the control panel.

This button is also used to return to the automatic mode from the manual mode. The machine returns to the automatic mode when it is pressed while in the manual mode or manual mode reserved status, and the lamp goes out.



Forward Button (built-in lamp)
This button is used to start the lift-up chip conveyor in the forward direction. The built-in lamp lights when this button is pressed, and the lift-up chip conveyor is operated in the forward direction.
The conveyor stops when it is pressed again, and the lamp goes out.
This button is activated when the "Manual intervention" button on the control panel is pressed to turn On the manual mode.
The built-in lamp will also be turned On during the automatic operation mode.



Reverse Button (built-in lamp)
This button is used to operate the lift-up chip conveyor in the reverse direction. The built-in lamp lights while this button is held down, and the lift-up chip conveyor is operated in the reverse direction.
This button is activated when the "Manual intervention" button on the control panel is pressed to turn On the manual mode.

9.3.3 Automatic Operation

Automatic operation is performed when the automatic mode is selected with the manual intervention (auto/manual changeover) button on the lift-up chip conveyor control panel.
During the automatic operation mode, the lift-up chip conveyor is continuously operated in the forward direction when the scraper conveyor or coolant supply operates.
The lift-up chip conveyor stops a certain interval after operation of the coolant supply or scraper conveyor stops.
The built-in lamp for the "FWD." button on the lift-up chip conveyor control panel lights during the automatic operation mode.

1. The "FWD." button and "REV." button on the lift-up chip conveyor control panel are void during automatic operation.
2. When the manual mode is activated by pressing the manual intervention button on the lift-up chip conveyor control panel while the scraper conveyor is operating or coolant is being discharged, automatic operation of the lift-up chip conveyor is stopped.
3. When the automatic operation mode is activated by pressing the manual intervention button on the lift-up chip conveyor control panel during operation of the scraper conveyor or coolant discharge, automatic operation of the lift-up chip conveyor is started.

9.3.4 Manual Operation

Manual operation is performed when the manual mode is activated by pressing the manual intervention button on the lift-up chip conveyor control panel.
The lift-up chip conveyor is operated with the "FWD." button and "REV." button on the lift-up chip conveyor control panel during the manual operation mode.

9.3.4.1 Continuous Manual Operation in Forward Direction

1. Press the Manual intervention button on the lift-up chip conveyor control panel to activate the manual mode.

2. Press the "FWD." button on the lift-up chip conveyor control panel. The lift-up chip conveyor starts operating at this time, and the "REV." button lamp lights. To stop the conveyor, press the "FWD. button again.

9.3.4.2 Continuous Manual Operation in Reverse Direction

1. Press the Manual intervention button on the lift-up chip conveyor control panel to activate the manual mode.

2. Press the "REV." button on the lift-up chip conveyor control panel. The conveyor operates while the button is held down, and stops when it is released.

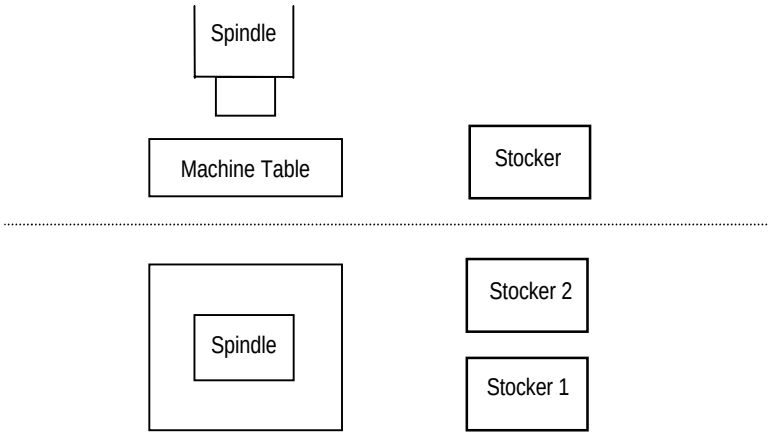
9.3.4.3 Alarm During Manual Operation

Machine alarm No. 13050 "CANNOT START LIFTUP CONVEYER FOR LIFTUP MANUAL MODE" is triggered when the lift-up chip conveyor is stopped for more than a certain length of time while the scraper conveyor is operating or while coolant is being discharged to warn the operator.

9.4 Automatic Pallet Changer (V55 Option)

This function is only provided on the V55, and not on the V33.

9.4.1 Outline



Pallet Changer

The pallet changer automatically exchanges the pallet on the machine table with the pallet on the stocker.
Idle time can be minimized by performing setup of the workpiece on the stocker while the pallet on the machine table is being machined, enabling machining to be continuously performed.

There are two types of continuous machining modes: Standard operation and Random operation.

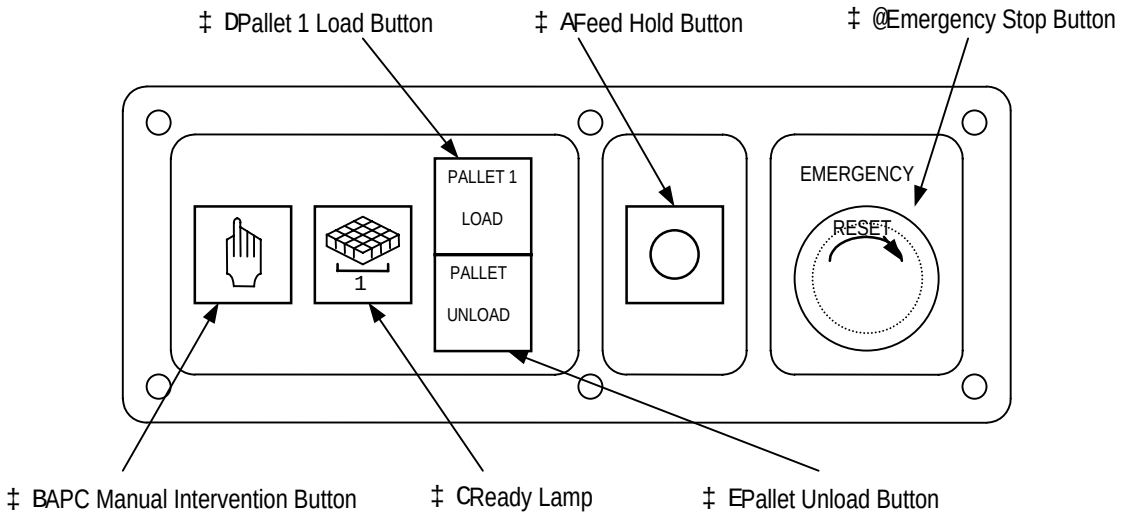
Standard operation is a mode in which the program started by the operator is repeatedly executed.

Random operation is a mode in which the machining program specified for the respective pallet (program No. registered in advance on work detail screen) is automatically searched for and started. After machining is completed, the machined pallet is automatically exchanged with the unmachined pallet, allowing machining to proceed.

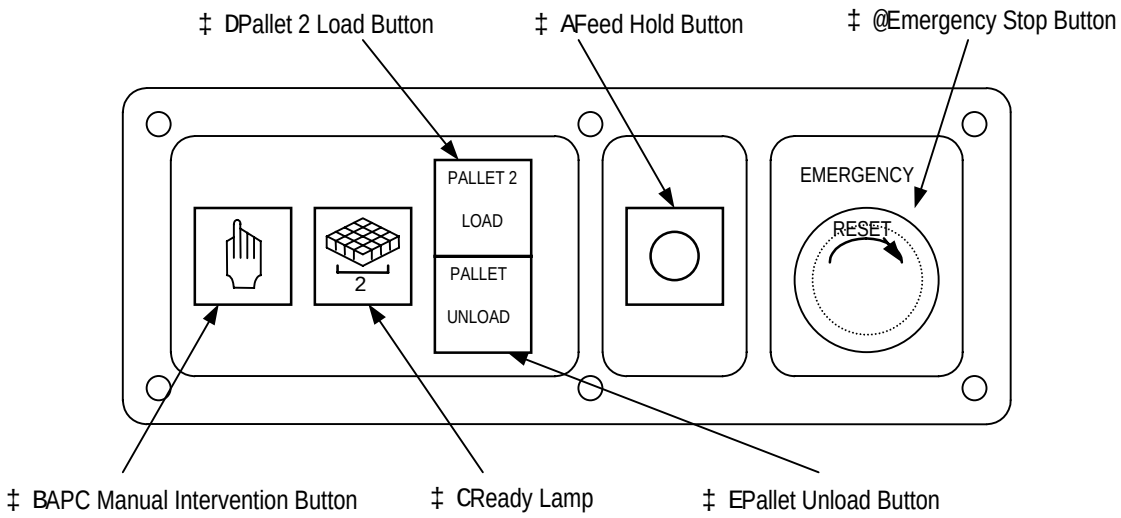
1. The optional random operation function is required in order to perform random operation. Random operation cannot be performed on machines that do not have the random operation function.
2. Machines that have the random operation can perform both standard operation and random operation.

9.4.2 APC Control Panel

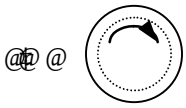
The APC control panel is used to perform the pallet ready and other operations to change pallets.



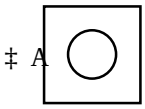
Stocker 1 APC Control Panel



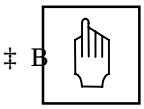
Stocker 2 APC Control Panel



Emergency Stop Button
The "EMERGENCY" button on the control panel is used to immediately stop machine operation. This button is locked in place when it is pressed. The button is unlocked when it is rotated in the direction indicated by the arrow (clockwise).
This button has the same function as the "EMERGENCY" button on the main control panel and stops all machine operations.



Feed Hold Button (built-in lamp)
The feed hold button is used to suspend automatic operation.
Automatic operation stops when this button is pressed. The built-in lamp lights while operation is stopped. This button has the same function as the "STOP" button on the main control panel.
Press the "START" button to restart automatic operation.

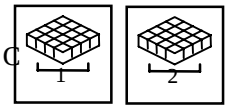


APC Manual Intervention Button (built-in lamp)
The APC manual intervention button is used when mounting/removing workpieces on the stocker pallet, and to turn the ready status On and Off. The ready status On/Off operation cannot be performed until this button is pressed to turn On the APC manual intervention mode. Furthermore, when the APC safety door is provided with a lock, it cannot be opened until the APC manual intervention mode is turned On.

When this button is pressed, the APC manual intervention mode is turned On and the built-in lamp lights, at which time the ready status On/Off operation can be performed.
Furthermore, while the APC manual intervention mode is On, all automatic operation mode pallet change commands are suspended, including MDI operation, and are executed after the APC manual intervention mode is turned Off. As a safety precaution, make sure to first turn the APC manual intervention mode On before working on the stocker side pallet.

When this button is pressed while the pallet change operation is being performed in the automatic operation mode, the APC manual intervention mode reserve status is activated, and the built-in lamp starts blinking. The APC manual intervention mode will be turned On upon completion of the pallet change operation, and the built-in lamp goes to the constant On status.
Press this button again to turn Off the APC manual intervention mode. Pressing this button during the APC manual intervention mode or APC manual intervention mode reserve status turns the APC manual intervention mode Off, and the built-in lamp goes out.

Check the following when the APC manual intervention mode cannot be turned Off by pressing this button:
1. Pallet is positioned at proper stocker position.
2. APC manual intervention mode cannot be turned Off if the door is not closed on a machine with an APC safety door.

‡ C 

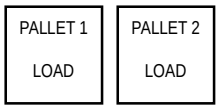
Ready Buttons (built-in lamp)

The ready buttons are used to turn the ready status for the stocker pallet On and Off. Press the respective ready button upon completion of workpiece setup in order to perform the pallet change operation. The pallet change operation can be performed when the ready status is On. (The ready On status indicates that workpiece setup has been completed, and that machining can be performed.)

Press the button again to turn the ready status Off after it has been turned On. The built-in lamp lights when the ready status is On, and goes out when the ready status is Off.
When the lamp is blinking, it indicates that machining has been interrupted during random operation by a tool monitor or other alarm. A description of the alarm can be viewed on the work detail screen. Refer to section 9.4.13, Random Operation, for details.
To turn the ready status On while the lamp is blinking, press the Ready button after resetting the alarm.

Alarms can be reset by pressing the [ALARM RESET] soft key on the work detail screen or by pressing the [READY] button.
This ready status is automatically turned Off when a pallet is loaded.

In the event the ready status is not turned On when the Ready button is pressed, check the following:
1. Ready status cannot be turned On unless APC manual intervention mode is On.
2. Confirm that the pallet is positioned at the proper stocker position.
3. The ready status cannot be turned On if the program No. on the work detail screen corresponding to that pallet is "0" when the random operation mode is On and the setting for machine parameter No. 1514 is "1". Refer to section 9.4.4, Confirming Program No. When Turning On Pallet Ready Status, for details on machine parameter No. 1514.

‡ D 

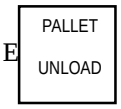
Pallet 1, Pallet 2 Load Buttons (built-in lamp)

These buttons are pressed to load pallets on the machine table. The pallet corresponding to the pressed button is loaded onto the machine table. If the other pallet is on the machine table when the button is pressed, it is loaded after the other pallet is unloaded.

These buttons can be used when the APC manual intervention mode is On.

The built-in lamp lights during the pallet load operation after one of these buttons is pressed. The built-in lamp blinks in the event of a machine alarm during the load operation.

Refer to section 9.4.6.2, Pallet Change Operation from APC Control Panel, for details.

‡ E 

Pallet Unload Button (built-in lamp)

This button is pressed to unload the pallet on the machine table. The pallet is unloaded onto the empty stocker

This button can be used when the APC manual intervention mode is On.

The built-in lamp lights during the pallet unload operation when this button is pressed. The built-in lamp blinks in the event of a machine alarm during the unload operation.

Refer to section 9.4.6.2, Pallet Change Operation from APC Control Panel, for details.

9.4.3 Mounting/Removing Workpieces, Activating Ready

In order to mount and/or remove a workpiece and activate the ready status, first press the APC manual intervention button to turn On the APC manual intervention mode. The ready status On operation cannot be performed unless the APC manual intervention mode is turned On.

1. Press the APC manual intervention button to turn On the APC manual intervention mode.
   If the lamp starts blinking when the button is pressed, it indicates that the pallet change operation is being performed. Do not start installation or removal of the workpiece until the pallet change operation is completed, at which time the lamp will go to the constant On status.

2. To perform machining after setup of the workpiece has been completed, press the ready button to turn On the ready status.
   The built-in lamp lights when the ready status is turned On. Confirm that the lamp is On. The ready status cannot be turned On or Off for the pallet on the machine table.

3. If an APC safety door is provided, close the door.

4. Press the APC manual intervention button to turn Off the APC manual intervention mode.
   The pallet change operation will not be performed while the APC manual intervention mode is On, even if the ready status for the pallet on the stocker is turned On.
   The pallet change operation starts when the APC manual intervention mode is turned Off.

9.4.4 Confirming Program No. When Turning On Pallet Ready Status

When the random operation mode is On and the program No. for that pallet or machining face is "0", the ready status On operation for the pallet can be prohibited with the setting for machine parameter No. 1514. This parameter is set to "0" (allow ready On) when the machine is shipped.

This machine parameter setting is void for a machine which does not have the random operation function, or when the random operation mode is Off for a machine with the random operation function.

Machine Parameter No. 1514

Display : Confirm Program No. when Pallet Ready Status is Turned On

Setting :

Value:	Description
0	With this setting, the ready status On operation can be performed even if the machining program No. for that pallet is set to “0” on the work detail screen when the random operation mode is turned On. * This is the setting when the machine is shipped.
1	With this setting, the ready status On operation cannot be performed if the machining program No. for that pallet is set to “0” on the work detail screen when the random operation mode is turned On.

9.4.5 APC Safety Door

There are two types of APC safety doors: One which locks the door with a lock pin so that the door can only be opened and closed when the APC manual mode is On, and another type which has no lock pin and can be opened and closed at any time.

9.4.5.1 APC Safety Door Without Door Lock

The door can be opened at any time. However, if it is opened during the pallet change operation, a machine alarm is triggered and the operation is stopped.
In the event the pallet change command is sent while the door is open, a machine alarm is triggered and the operation is not performed.
To perform the operation, close the door and press the [RETRY] soft key on the alarm screen (see note below).
When the [RETRY] soft key is pressed, the alarm is automatically reset and the pallet change operation starts (see note below). (The operation will not be performed when the [RETRY] soft key on the alarm screen is pressed while the door is still open.)
Furthermore, the APC manual intervention mode cannot be turned Off until the door is closed.

A machine warning is triggered if the door is open when the APC manual intervention mode is turned Off. This warning is automatically reset when the door is closed.

9.4.5.2 APC Safety Door With Door Lock

The door is unlocked when the APC manual intervention mode is turned On, allowing the door to be opened. The APC manual intervention mode cannot be turned Off if the door is not closed.

If the door is opened while the APC manual invention mode is Off (door locked), an alarm is triggered if a PC operation is being performed, stopping the operation. (Normally, it will not be possible to open the door since it is locked. This situation makes an allowance for when the door is opened due to a faulty limit switch or other part.)

A machine warning is triggered if the door is open when the APC manual intervention mode is turned Off. This warning is automatically reset when the door is closed.

If the [FEED HOLD] button on the main control panel/APC control panel is lit when the [RETRY] soft key is pressed, press the [START] cycle start button after pressing the [RETRY] soft key. This will start the pallet change operation.

9.4.6 Pallet Change Operation

9.4.6.1 Pallet Change Operation in MDI or Memory Mode

The following procedure is used to perform the pallet change operation in the standard operation or random operation mode:

1. Set the operations for the pallet change command when the ready status is Off. For details, refer to section 9.4.10.3 Check Loaded Pallet, Waiting for Ready (M85, M94) and section 9.4.14, Preparations and Starting Random Operation.
   This setting is retained when the machine power is turned Off. Therefore, once it is made, start with the operations in step 2.

2. Position the feed axes at the APC position.
   A. Position the Z axis at the reference point.
      Use the "G28 G91 Z0;" command to position at the reference point.
   B. Move the X axis to the – stroke end as necessary.

3. Stop the spindle and coolant supply.

4. To load a pallet, turn On the ready status for the pallet.
   Perform the following operations after turning the ready status On for the pallet:
   A. Close the APC safety door if one is provided.
   B. Turn Off the APC manual intervention mode.

5. To load a pallet, send the "M98P9810;" command in the MDI or memory mode.

6. To unload a pallet, send the "M98P9820;" command in the MDI or memory mode.
   When the "M98P9820;" command is executed in the memory mode, and there is a pallet on the stocker which is ready, it is loaded after the unload operation is performed. In the MDI mode, only the unload operation is performed.
   To perform continuous operation, refer to section 9.4.7, Standard Operation, and section 9.4.13, Random Operation.

9.4.6.2 Pallet Change Operation from APC Control Panel

When the [PALLET 1 LOAD] / [PALLET 2 LOAD] button corresponding to the desired pallet or [PALLET UNLOAD] button on the APC control panel is pressed in the APC manual intervention mode, the X, Y and Z axes are moved to the P/C position, and the pallet is automatically loaded or unloaded. (The X/Y/Z axes are not returned to their original position after the load/unload operation is performed.)
The built-in lamp lights during the load/unload operation and starts blinking in the event an alarm occurs.

The start switch is valid when the following status is satisfied:
1. Automatic operation not being performed.
2. P/C operation not being performed.
3. PC arm in standby status.
4. Random operation not being performed.
5. APC manual intervention mode is On.
6. When a pallet load command is sent, the pallet to be loaded is on stocker.
7. When the pallet unload command is sent, the stocker is empty.
8. When an APC safety door is provided, the door is closed.

The following operations are performed after the start conditions are satisfied:
1. Spindle and coolant are stopped, and Z axis is positioned at reference point.
2. X axis is positioned at – stroke end.
3. Y axis is positioned at stocker position for load/unload operation.
4. Pallet load/unload operation is performed.

When the [RETRY] soft key on the alarm screen is pressed after an alarm occurs during the pallet load/unload operation, the alarm is reset and operation will continue. However, in some cases, the built-in lamp may stay On or be blinking. In this case, press the [ONE TH START] soft key on the primary operation screen.
(This operation is only performed for the V55 FS16MC. The key is provided on the main control panel for the V55 FS16i-MA and V33.)

9.4.7 Standard Operation

Standard operation is performed when the random operation function is not provided, or when the random operation function is Off when it is provided.
In the standard operation mode, the specified program (program started by the operator) is repeatedly executed.

The following functions can be used in the standard operation mode:

‡ @
- Function to repeat execution of machining program upon completion of machining
- Function to turn Off machine power upon completion of machining

→ Refer to section 9.4.11, Program Repeat Function When M30 Specified in Standard Operation Mode.

‡ A
- Function to start pallet change operation when ready status is turned On
- Function to check that the pallet loaded on the table corresponds with the pallet specified in the machining program.

→ Refer to section 9.4.10.3, Check Loaded Pallet, Waiting for Ready (M84, M95).

‡ B
- Function to record machining start time and machining end time.

→ Refer to section 9.4.12, Recording Machining Start/End Time in Standard Operation Mode (M478, M479).

9.4.8 Preparing for and Starting Standard Operation

1. Perform the preparations described in section 9.4.6, Pallet Change Operation.

2. Register the machining program in the NC memory.
   Generate the machining program in the format specified in section 9.4.10, Machining Program Format in Standard Operation Mode.

3. Close the safety door and otherwise put the machine in the status in which machining can be performed.

4. Select the memory mode and press the start button on the main control panel to perform the cycle start operation.

5. If you wish to automatically turn Off the machine power upon completion of all machining or when machining can no longer proceed due to a machine alarm or other cause, turn the power shut-off mode On with the Shut-off button on the main control panel.
   In this case, the machine power is automatically turned Off when the M30 code in the machining program is executed or when machining can no longer proceed due to a machine alarm or other cause.

9.4.9 Operation in Standard Operation Mode

With standard operation, differing from random operation, no operations other than those specified in the machining program are automatically performed. Therefore, processing of the M30 code when the waiting for ready status function is used differs. Refer to section 9.4.10.3, Check Loaded Pallet, Waiting for Ready (M85, M94).

9.4.10 Machining Program Format in Standard Operation Mode

When continuous machining is performed in the standard operation mode, the pallet change command is included in the machining program. Position the Z axis at the reference point before specifying the pallet change command, and stop the spindle and coolant supply.

There are two different procedures for operation in the standard operation mode: Continuous machining of the same type of workpiece on two pallets, and Alternate machining of different types of workpieces on two pallets.
Refer to the following pages for the respective program format for these two procedures.

9.4.10.1 Continuous Machining of One Type of Workpiece

The format for the machining program used when the same type of work-piece is mounted on two pallets is shown below:

```
Oxxxx;
N01  M98P9810;  <---- Pallet load command (see Note 2)

  +---------------------------+
  | Common machining          |
  | program for two pallets   |
  +---------------------------+

N02  G91 G28 Z0. ;
N03  M5;
N04  M9;
N05  M98P9820; <----------   Pallet unload command (see Note 1
M30; <--------------------   Make sure to specify M30 (see Note 3)
 “
```

1. In the memory (tape) mode, when the pallet on the stocker is ready, it is loaded after the unload operation is completed. In the MDI mode, only the unload operation is performed.
2. When the Unload then Load operation is performed by N05, the O9810 operation is not performed.
3. When the Unload then Load operation is performed by N05, cycle start is performed after reset and rewind. Refer to section 9.4.11, Program Repeat Function when M30 is Specified in Standard Operation Mode.

9.4.10.2 Continuous Machining of Two Types of Workpieces

The following format is used when different types of workpieces are mounted on the two pallets, and continuous machining is alternately performed. Make sure to take note of the pallet No. from which machining is started when starting the machining program generated in this format. When starting from pallet No. 2, use the NC edit function to move the cursor to the proper intermediate point in the machining program:

```
Oxxxx;
N01  M84; <-------------- Pallet No. 1 ready check (see Note 1)
N02  M98 P9810; <-------- Pallet No. 1 load command (see Note 5)
N03  M84; <-------------- Pallet No. 1 load check (see Note 1

     Machining progra
     for pallet No. 1

N04  G91G28Z0.;
N05  M5;
N06  M9;
N07  M98P9820; <-------- Pallet No. 1 unload command (see Note 2)
N08  M95; <-------------- Pallet No. 2 ready check (see Note 1)
N09  M98P9810; <-------- Pallet No. 2 load command (see Note 3)
N10  M95; <-------------- Pallet No. 2 load check (see Note 1

     Machining progra
     for pallet No. 2

N11  G91G28Z0.;
N12  M5;
M13  M9;
N14  M98P9820; <-------- Pallet No. 2 unload command (see Note 4)
M30; <------------------- Make sure to specify M30 (see Note 6)
%
```

1. Pallet ready, load check (M84, M95)
   M84/M95 are the M codes to check correspondence between the pallet No. and machining program. These codes are used to ensure that machining is performed on the proper pallet. Refer to section 9.4.10.4, Check Loaded Pallet, Waiting for Ready (M84, M95).
2. In the memory (tape) mode, pallet 2 is loaded if it is ready. Only the unload operation is performed in the MDI mode.
3. When loading is performed by N07, no operation is performed by O9810.
4. In the memory (tape) mode, pallet 1 is loaded if it is ready. Only the unload operation is performed in the MDI mode.
5. When loading is performed by N07, no operation is performed by O9810.
6. When the Load then Unload operation is performed by N14, cycle start is performed after reset and rewind. Refer to section 9.4.11, Program Repeat Function, when M30 is specified in Standard Operation Mode.

9.4.10.3 Check Loaded Pallet, Waiting for Ready (M84, M95)

When M84 is specified before pallet loading (O9810), the system checks to see if pallet No. 1 is ready, and triggers an alarm if it is not. When M95 is specified, the system checks to see if pallet No. 2 is ready, and triggers an alarm if it is not. The machine power is turned Off when an alarm is triggered if the power shut-off mode has been turned On.

When M84 is specified after the pallet is loaded, an alarm is triggered if pallet No. 2 has been loaded. When M95 is specified, an alarm is triggered if pallet No. 1 has been loaded.

Omitting the M84/M95 in N01/N08 in the above program will prevent an alarm from being triggered by the ready check step, and the system waits for the ready status to be turned On when M98 P9810 is specified in the next block.

Whether or not the "Wait for ready" function is used by M84/M95 is selected with machine parameter No. 1406. Setting "1" is selected to use the "Wait for ready" function, and "0" is specified when you do not wish to use this function. When "0" is specified for parameter No. 1406 (do not use), the machine power is turned Off when M84 or M95 is specified while the ready status is Off and the power shut-off mode is On. When the power shut-off mode is Off, machine alarm No. 1002 is triggered, and operation stops at that command block.

When "1" is specified for parameter No. 1406 (use wait for ready function), the machine power is turned Off when M84 or M95 is specified while the ready status is Off and the power shut-off mode is On. When the power shut-off mode is Off, machine alarm No. 1002 is triggered, and operation stops at that command block. When the ready status is turned On after this, the machine warning is automatically reset, the pallet change operation is performed, and the machine proceeds to the next block. This function is valid when the pallet change command is performed in the MDI mode.

Furthermore, to cancel restarting of operation when machine warning No. 1002 is displayed, press the [ALARM RESET] soft key on the machine alarm screen. The "Wait for ready" status is reset when the [ALARM RESET] soft key is pressed, and the machine warning is also reset. In this case, the M60 operation will not start when the ready status is turned On.

When the "Wait for ready" function is used, there are two methods to restart operation which are set with machine parameter No. 1407. With one, operation is restarted by simply turning the ready status On, and with the other, operation is not restarted until the [ALARM RESET] soft key is pressed on the machine alarm screen.

Waiting for Ready Function When M84, M95 is Specified

Content	Machine Parameter Setting	
	No. 1406	No. 1407
Wait for ready function not used	0	0
Operation restarted when ready status goes from Off to On	1	0
Operation restarted by pressing Retry key on machine alarm screen after ready status goes from Off to On * Default setting when machine is shipped	1	1

The differences between waiting for ready for M84/M95, and waiting for ready O9810 is executed are described below:

M84 : Waits for pallet 1 to go to ready status
M95 : Waits for pallet 2 to go to ready status
O9810 : Waits for pallet 1 or 2 to go to ready status

Furthermore, the machine parameters can be set so that the wait for ready function is not used for M84/M95, but with the O9810 command, the machine always waits for the ready status, regardless of the parameter setting.

Machine Parameter No. 1406

Display : Restart Function for Pallet Ready Off at M60 Command

Setting : This setting selects whether or not the restart function is used if t pallet ready status is Off when the M84 or M95 command is sent, and whether or not the random operation is started when the pallet ready status is turned On and the APC manual intervention mode i turned Off during random operation.
"1" (use) is the default setting when the machine is shipped.

Setti	Description
0	Operation is not restarted when the ready status goes On. To restart operation, cancel automatic operation by pressing the [ALARM RESET] soft key, and send the command again. Furthermore, random operation is not started when the ready status goes On during the random operation mode.
1	Automatic operation is not restarted when the ready status goes On after M84/M95 have been specified. With this setting, machine parameter No. 1407 can be used so that operation is not restarted until the [ALARM RESET] soft key is pressed on the alarm screen. Furthermore, random operation is started when the ready status goes On and the APC manual intervention mode is turned Off during the random operation mode.

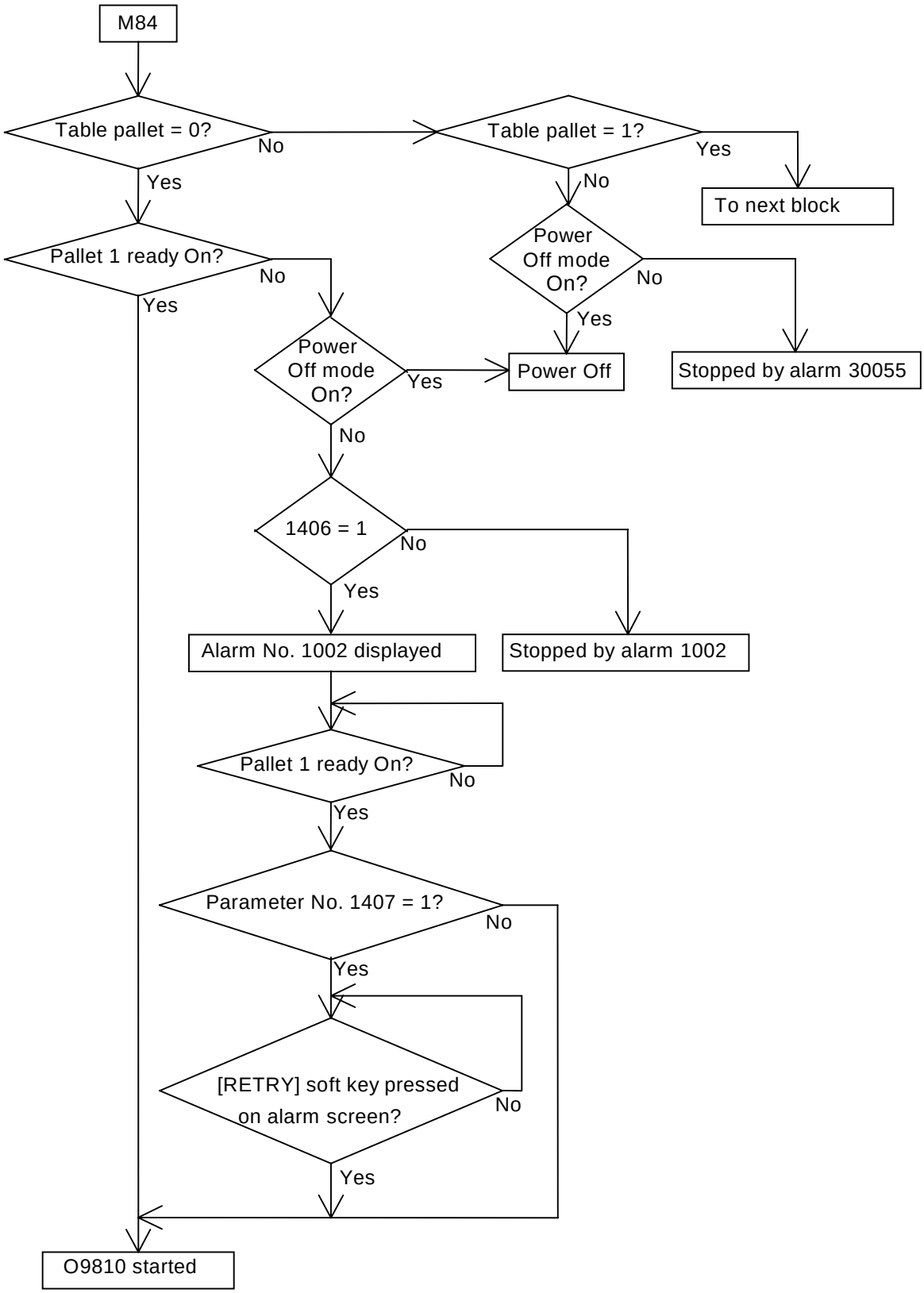
Machine Parameter No. 1407

Display : Restart Procedure for Pallet Ready Off at M60 Command

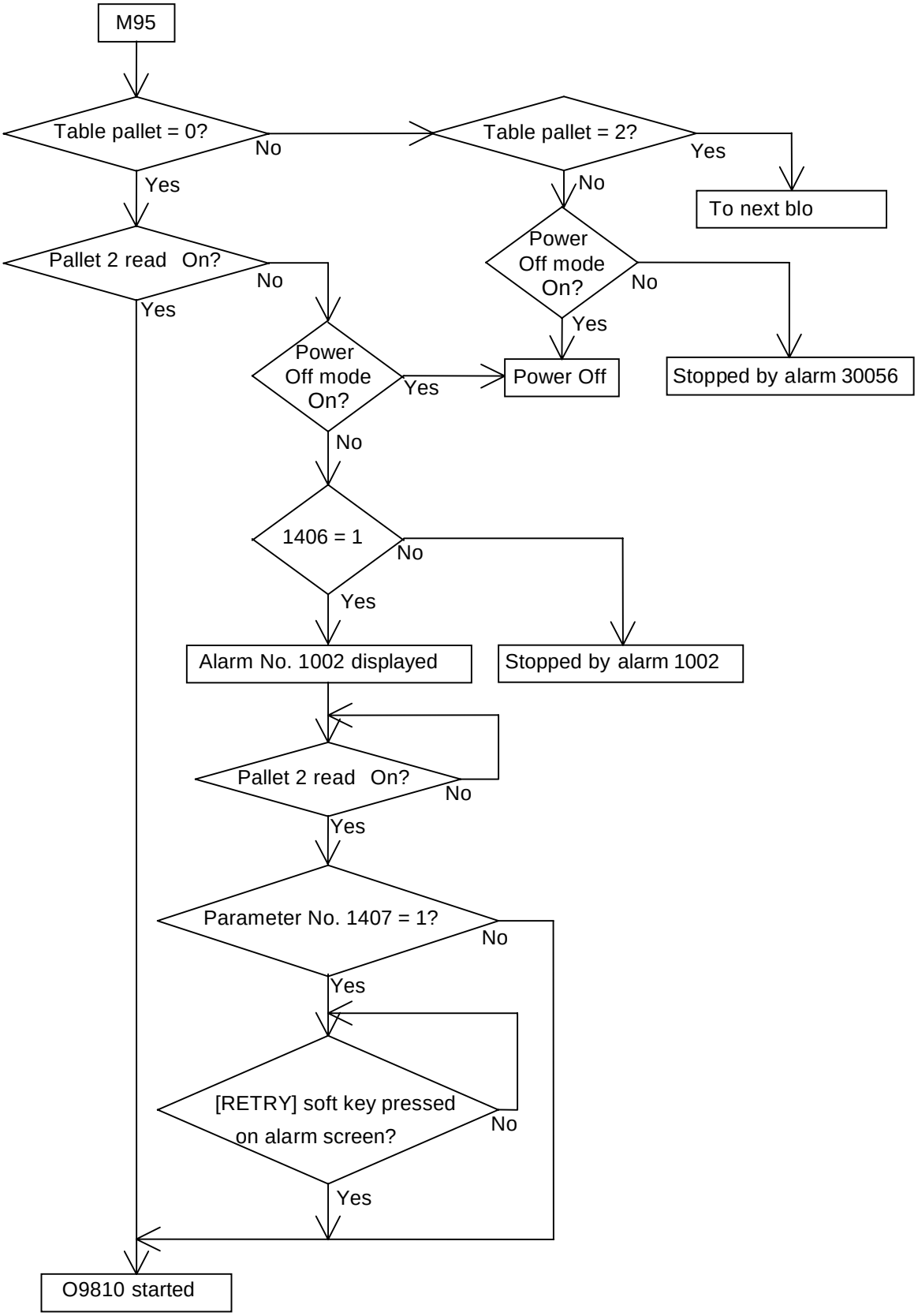
Setting : This setting selects whether operation is restarted immediately when the pallet ready status goes On for a setting of "1" for machine parameter No. 1406, or operation is not restarted until the [ALARM RESET] soft key is pressed on the machine alarm screen after t pallet ready status goes On.
"1" (Restart operation when [ALARM RESET] soft key is pressed) is the default setting when the machine is shipped.

Setti	Description
0	Pallet change operation is started when ready status goes On, and automatic operation is restarted.
1	Pallet change operation is started when [ALARM RESET] soft key is pressed on machine alarm screen after ready status goes On, and automatic operation is restarted.

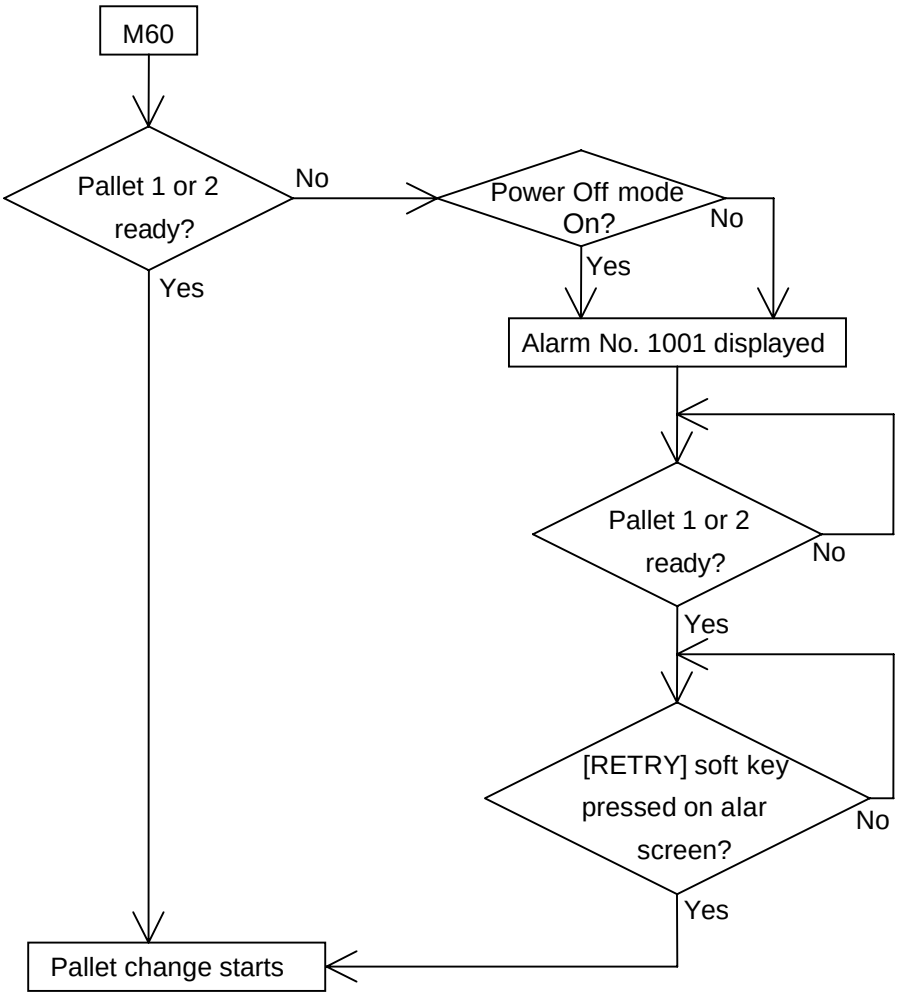
M84 Operation



M95 Operation



M60 Operation Within O9810



9.4.11 Program Repeat Function when M30 is Specified in Standard Operation Mode

The M30 command performs the reset and rewind operation for the NC unit. It has a feature called the "Program Repeat Function" which allows cycle start to be automatically performed after this.
Whether or not the program repeat function is used is selected with machine parameter Nos. 1420 and 1475. This function is valid in the memory and tape modes.

To use the program repeat function when O9820 has ended with the unload operation, parameter No. 1420 is set to "1".

To use the program repeat function when the unload → load operation is performed by O9820, parameter No. 1420 is set to "0". To not use the function, set the parameter to "1".

1. Selection of Program Repeat Function When Ready is Off

Content	Machine Parameter Setting
	No. 1420
Cycle start is not performed when O9820 operation ends with unload (Pallet ready status Off) * Default setting when machine is shipped.	0
Cycle start is automatically performed when O9820 operation ends with unload (Pallet ready status Off)	1

2. Selection of Program Repeat Function When Ready is On

Content	Machine Parameter Setting
	No. 1475
Cycle start is automatically performed when unload → load operation is performed by O9820 operation (Pallet ready status On) * Default setting when machine is shipped.	0
Cycle start is not performed when unload → load operation is performed by O9820 (Pallet ready status On)	1

Machine Parameter No. 1420

Display : Cycle Start Function for Pallet Ready Off at M30 Command

Setting : This setting selects whether or not the cycle start function is used when the O9820 operation ends with unload (pallet ready Off). This machine parameter is valid during the standard operation mode. This parameter is set to “0” (Use cycle start function) when the machine is shipped.

Setting	Description
0	Cycle start is not performed if ready status is Off when M30 command is sent.
1	Cycle start is automatically performed after program rewind even if ready status is Off when M30 command is sent.

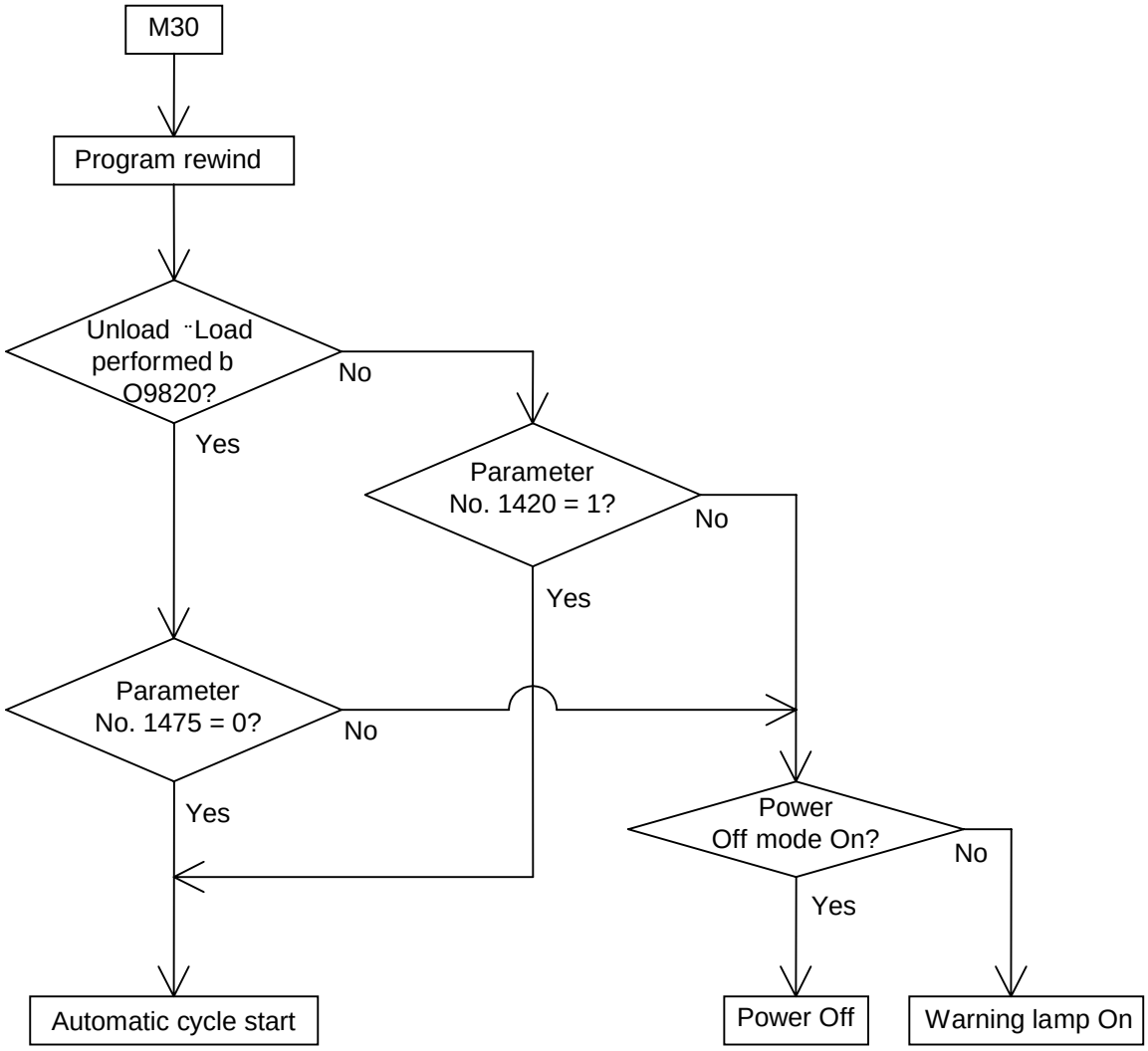
Machine Parameter No. 1475

Display : No Cycle Start Even When Pallet Ready On at M30 Command

Setting : This setting selects whether or not the cycle start function is used when the unload ¨ load operation is performed by O9820 (pallet ready On).
This machine parameter is valid during the standard operation mode. This parameter is set to “0” (Use cycle start function) when the machine is shipped.

Setting	Description
0	Cycle start is automatically performed after program rewind if ready status is On when M30 command is sent.
1	Cycle start is not performed even if ready status is On when M30 command is sent.

M30 Operation



9.4.12 Recording Machining Start/End Time in Standard Operation Mode (M478, M479)

The respective machining start time, machining end time, machining time and automatic operation time can be recorded for the two pallets by the M478 and M479 commands. These times are displayed on the machine work data screen.
The machining start date/time (month/day/hour/minute) is recorded when the M479 command is sent, and the machining end date/time (month/day/hour/minute) is recorded when the M478 command is sent (see Note).
The machining time and automatic operation time from when the M479 is sent until the M478 command is calculated up to a maximum of 99999 minutes.

If the recorded time is incorrect, correct the time on the NC setting screen.

1. Machining Start Time
   The month/day/hour/minute are recorded when the M479 command is sent.

2. Machining End Time
   The month/day/hour/minute are recorded when the M478 command is sent.

3. Machining Time
   The time from when the M479 command is sent until the M478 command is calculated. This includes time during which the machine is stopped by an emergency stop or alarm.

4. Automatic Operation Time
   The time from when the M479 command is sent until the M478 command is calculated as for 3. above. However, automatic operation time only counts the time during which automatic operation is being performed (Start lamp on main control panel On, excluding execution of M00/M01 and wait for ready alarm No. 1001), and the spindle is rotating.

Sample Program

```
O0001;
    :
M479;   <-- Record machining start time
    :
M478;   <-- Record machining end time
    :
M30;
%
```

9.4.13 Random Operation

Random operation is activated by turning On the random operation mode when the random operation function is provided. The standard operation mode is activated when the random operation mode is turned Off.
The random operation mode is turned On and Off with the [ON] [OFF] soft keys on the PC primary operation screen.

The following functions can be used in the random operation mode in order to exchange the machine table pallet with the stocker pallet and automatically call different programs for different pallets to enable machining to proceed.

‡ @ Function to start random operation when read status goes On. → Refer to section 9.4.14, Preparing for and Starting Random Operation.

‡ A Function to confirm axis position and load pallet when starting random operation. → Refer to section 9.4.17, Confirming Feed Axis Position When Startin Random Operation.

‡ B Function to turn block skip – 9 On or Off when starting random operation. → Refer to section 9.4.18, Setting Block Skip 2 – 9 for Random Operation.

‡ C Function to transfer workpiece origin shift values for X/Y/Z axes to NC unit when starting random operation. → Refer to section 9.4.19, Transfer Workpiece Origin Shift Values for Rando Operation.

‡ D Function to search for and start program when starting random operation. → Refer to section 9.4.20, Search for and Start Program for Random Operation.

‡ E Function to record machining start time/machining end time when starting random operation. → Refer to section 9.4.21, Record Machining Start/ End Time for Random Operation.

‡ F Function to interrupt machining and start next machining process when tool monitor function alarm occurs; Function to turn Off machine power when all machining processes end. → Refer to section 9.4.22, Auto Unload/Auto Power Off for Random Operation.

9.4.14 Preparing for and Starting Random Operation

1. Refer to section 9..4.6.1, Pallet Change Operation in MDI or Memory mode.

2. Register the machining program in the NC memory.
   Prepare the machining programs corresponding to the respective pallets.

3. Set the Machining program O numbe , Block skip 2 - 9, and Workpiece shift values on the work data screen.

4. Select the memory mode and then select the random mode on the PC primary operation screen to turn On the random operation mode. If you wish to automatically perform the next machining process when a tool monitor function alarm occurs, turn the auto unload mode On.

5. Start random operation using one of the following methods:
   Method 1
   Random operation is started when random start on the PC primary operation screen is turned On.

   Method 2
   Random operation is started when M30 is executed while start operation is being performed in the memory mode.

   Method 3
   Random operation is started when the ready status is turned On.
   This method is valid when "1" is set for machine parameter No. 1406.
   Random operation is started when the ready status is turned On after the workpiece is set when setup of the workpiece is not completed in time. Therefore, it is not necessary to turn On random start on the PC primary operation screen (see Note).
   In this case, first check that other personnel are not present and it is otherwise safe before turning the ready status On.

Operation is started when the APC manual intervention mode is turned Off after the ready status is turned On.

6. If you wish to automatically turn Off the power when all machining processes have been completed or machining cannot proceed due to a machine alarm or other cause, turn On the power Off mode with the Power Off button on the main control panel. Machine power is automatically turned Off when the M30 code is executed or machining can no longer continue due to a machine alarm or other cause.

9.4.15 Random Operation

The following respective operations are performed, depending on whether or not the four-face program automatic indexing function is provided:

1. Confirm the feed axis positions. A machine alarm is triggered if the proper conditions are not satisfied.

2. Start the pallet change program to load the stocker pallet on the machine table.

3. When the block skip 2 – 9 option is provided, set block skip 2 – 9.

4. Transfer the workpiece reference point (origin) shift values for the X/Y/Z axes.

5. Record the machining start time.
   The machining end time is cleared. ("–" is displayed for the month/day/hour/minute.)
   The machining time and automatic operation time are cleared to 0 minutes, and counting commences.

6. Search for the machining program and start it.

7. The machining end time is recorded by the M30 command.
   Counting of the machining time and automatic operation time stops.
   Operation is repeated from step 1. if there is a ready pallet.
   If there is not a ready pallet and the power Off mode is On, the machine power is turned Off.

9.4.16 Machining Program Format in Random Operation Mode

The machining program format differs for the random operation and standard operation modes.
In the random operation mode, it is not necessary to include the pallet change command in the machining program since pallet changes are automatically performed.
Send the M30 command after the Z axis reference point return command is performed at the end of the machining program. This M30 command enables transition to the next machining process in the random operation mode.
Any number between 1 and 7999 can be used for machining programs.

```
Oxxxx;
(Machining progra
G91G28Z0. ;
M30;
%
```

9.4.17 Confirm Feed Axis Position When Starting Random Operation

Machine parameter Nos. 1410 to 1414 are set to specify whether or not the feed axis position is confirmed as necessary when random operation is started.
A machine alarm is triggered if the respective axis is not at the predetermined position. In this case, start operation after resetting the alarm and moving to the prescribed position or performing reference point return.

Parameter No.	Axis	Content
1410	X axis	The respective position can be specified for each axis. "0" is the default setting when the machine is shipped (do not confirm). Setting Content 0 Do not confirm 1 Confirm positioning at 1st reference point. 2 Confirm positioning at 2nd reference point 3 Confirm positioning at 3rd reference point
1411	Y axis	
1412	Z axis	
1413	B axis	
1414	5th axis	

9.4.18 Setting Block Skip 2 – 9 for Random Operation

Setting the On/Off status for block skip 2 – 9 to be used during machining on the work data screen changes to the set status before the machining program is started (see Note).
This setting can be performed in pallet units.
Block skip 1 cannot be set. The setting on the control panel is valid for all pallets.

Block skip 2 – 9 is turned Off by the M30 command.
When the random operation mode is On, block skip 2 – 9 cannot be turned On or Off on the primary operation screen. When necessary, perform this using the M command.

Block skip 2 – 9 is an optional function.
They cannot be used if this function is not provided.

9.4.19 Transfer Workpiece Origin Shift Values for Random Operation

Registering the workpiece origin (reference point) shift values on the work data screen enables the workpiece origin shift values to be transferred to the NC unit before the machining program is started.
These values can be registered for the X/Y/Z axes. Workpiece origin shift values cannot be registered for other axes. Values for other axes set on the NC workpiece coordinate system screen are valid.
These shift values are transferred to the NC external workpiece offset values and shift all workpiece coordinate systems from G54 to G59.
These settings can be performed in pallet units.

Millimeter/inch input and Unit system for the shift values can be set as follows:

	Unit System	
	1 μ	0.1 μ
Millimeter input	± 99999.999 mm	± 99999.9990 mm (see 1.)
Inch input	± 9999.9999 in.	± 9999.99990 in. (see 2.)

1. When the minimum command unit is 1/1000 mm, the 1/1000 mm digit cannot be set. "0" (zero) is used for the 1/1000 mm digit when the workpiece reference point shift value is transferred to the NC unit.
2. When the minimum command unit is 1/10000 inch, the 1/10000 inch digit cannot be set. "0" (zero) is used for the 1/10000 inch digit when the workpiece reference point shift value is transferred to the NC unit.

9.4.20 Search for and Start Program for Random Operation

After the ready pallet is loaded, the program number set on the work data screen is automatically searched for and started.
This starts the machining program corresponding to each pallet.
Any machining program number between 1 and 7999 can be used.

9.4.21 Recording Machining Start/End Time for Random Operation

The month/day/hour/minute are recorded when the machining program is started and when machining is completed (see Note).
The time from when machining is started until it is completed is also recorded. The record operation is performed by the M code in the machining program in the standard operation mode, but is automatically performed in the random operation mode. Therefore, during random operation, the M478/M479 M codes are not required.
The start of machining is the time that the machining program is started after it is found, and the machining end time is the time when the M30 code is executed. Machining is considered to have ended when the M30 code is executed, even if it was not in the machining program.
For example, the M30 code in the auto unload program (O9819) used to automatically unload the pallet or an M30 code specified in the MDI mode will also signify the end of machining.

This time is displayed on the work data screen.
Recording is performed in pallet units.

If the recorded time is not correct, make the necessary correction on the NC setting screen.

1. Machining Start Time
   The month/day/hour/minute when the machining program is started after it is found is recorded.

2. Machining End Time
   The month/day/hour/minute when the machining program is finished is recorded.

3. Machining Time
   The time from when the machining program is started after it is found until the M30 process is completed is calculated. This time is reset to 0 minutes when machining is started, and any time during which operation is stopped by an emergency stop or alarm is included.
   Time is calculated up to a maximum of 99999 minutes.

4. Automatic Operation Time
   The time from when the machining program is started until the M30 process is completed is calculated as for 3. above. However, automatic operation time only counts the time during which automatic operation is being performed (Start lamp on main control panel On, excluding execution of M00/M01), and the spindle is rotating.
   This time is reset to 0 minutes when machining is started, at which time calculation starts.
   Time is calculated up to a maximum value of 999999 minutes.

9.4.22 Auto Unload/Auto Power Off for Random Operation

The auto power shut-off function automatically turns Off the machine power when machining on all pallets has been completed or machining can no longer continue due to a machine alarm or other cause.
This function is valid when the power off mode is On (see Note 1).

The auto unload function interrupts the current machining process when a tool monitor function alarm occurs, and proceeds to machining of the next pallet.
This function is valid when the auto unload mode is On (see Note 2).

The auto unload operation is performed as follows:
1. The feed hold status is activated for the machining program.
2. The spindle is stopped.
3. The coolant is stopped.
4. The feed axes are moved to the ATC position/APC position, and the spindle tool is returned to the tool magazine (see Note 3).
5. After this, machining proceeds on the stocker pallet according to the same procedure as when machining is normally completed (see Note 4).

1. The power shut-off mode can be turned On and Off with the power off button on the main control panel.
2. The auto unload mode can be turned On and Off on the primary operation screen, and with the M51/M52 codes.
3. This operation is performed by executing the O9819 NC program. The auto unload operation includes feed axis movement. Specify M52 in the machining program to turn Off the auto unload mode when you wish to prohibit the auto unload operation for the back-boring or another such operation.
   The M51 code can be specified to turn on the auto unload mode when the auto unload operation may be performed.
4. When auto unload is performed, it will not be possible to call that tool with the T command after that. When the tool for which an alarm occurred is used by the next machining process, the spare tool change mode should be turned On in order to use the spare tool change function.

When auto unload is caused by an alarm triggered by the tool monitor function, the details of the alarm can be confirmed on the work data screen. When power is turned Off by another alarm, check the details on the alarm record screen.

9.4.22.1 Discriminating Between Auto Unload and Normal End

The ready lamp on the APC control panel and work data screen are used to discriminate between when machining is ended by the auto unload function and when it normally ends.

	Auto Unload	Normal End
APC Control Panel Ready Lamp	Blinks	Off
Work Data Screen	Alarm displayed	Nothing displayed

9.4.22.2 Auto Unload Record

When the auto unload operation is performed, the details of the alarm, program number, sequence number and spindle tool number at that time are recorded. The machining end time is the time at which the auto unload operation is completed.
This data is displayed on the work data screen.

1. Alarm Details
   The cause for the auto unload operation is displayed.

Work Data Screen	Description
Tool Precheck Alarm	Indicates machining was not performed since tool to be used for machining, including any spare tools, was (were) found to be in alarm status by M36 (precheck of tool to be used).
BTS Alarm	Indicates machining was interrupted since broken tool was detected by M20 (broken tool detect).
BTS2	Indicates machining was interrupted since tool was judged to be too long and therefore abnormal by M20 (broken tool detect).
AC Alarm	Indicates machining was interrupted by AC monitor alarm.
SL Alarm	Indicates machining was interrupted by SL monitor alarm.
No NC Program	Indicates machining was not performed since machining program registered on work data screen is not registered in the NC memory.

2. Program Number
   The O number of the program being executed when the alarm occurred is recorded. When the alarm occurred within a sub program called from a main program, the number of the sub program is recorded.

3. Sequence Number
   The sequence when the alarm occurred is recorded.

4. Spindle Tool Number
   The tool number clamped in the spindle when the alarm occurred is recorded.

9.4.22.3 Auto Unload and Power Shut Off Operations

The operations described on the following pages are performed by the auto unload/auto power shut-off function depending on the type of the alarm which occurred, whether or not the pallet is ready, auto unload mode, power shut-off mode and setting of machine parameter No. 1403.

Machine Parameter No. 1403

Display : Leave Pallet on Machine Upon Completion of Random Machining

Setting : This setting selects whether or not the pallet is left on the machine table when machining is completed on the last pallet in the rando operation mode.

Setting	Description
0	Unload
1	Leave on machine

Auto Power Off Mode	Auto Unload Mode	Normal End/Alarm			Operation
Off	Off	Other than tool monitor alarm			Remains stopped
		Tool monitor alarm			Remains stopped
		Normal End	Ready on stocker pallet		Machining proceeds to stocker pallet
			No ready on stocker pallet	No. 1403 = 0	Warning lamp On after pallet unload
				No. 1403 = 1	Warning lamp lights, pallet left on table
Off	On	Other than tool monitor alarm			Remains stopped
		Tool Monitor Alarm	Ready on stocker pallet		Machining performed on stocker pallet after O9819 is executed
			No ready on stocker pallet	No. 1403 = 0	Pallet unloaded, Warning lamp On after O9819 is executed
				No. 1403 = 1	Warning lamp lights, pallet left on table after O9819 is executed
		Normal End	Ready on stocker pallet		Machining proceeds to stocker pallet
			No ready on stocker pallet	No. 1403 = 0	Warning lamp On after pallet unload
				No. 1403 = 1	Warning lamp lights, pallet left on table

Auto Power Off Mode	Auto Unload Mode	Normal End/Alarm			Operation
On	Off	Other than tool monitor alarm			Power shut off
		Tool monitor alarm			Power shut off
		Normal End	Ready on stocker pallet		Machining proceeds to stocker pallet
			No ready on stocker pallet	No. 1403 = 0	Power shut off after pallet unload
				No. 1403 = 1	Power shut off, pallet left on table
On	On	Other than tool monitor alarm			Power shut off
		Tool Monitor Alarm	Ready on stocker pallet		Machining performed on stocker pallet after O9819 is executed
			No ready on stocker pallet	No. 1403 = 0	Pallet unloaded, power shut off after O9819 is executed
				No. 1403 = 1	Power shut off, pallet left on table after O9819 is executed
		Normal End	Ready on stocker pallet		Machining proceeds to stocker pallet
			No ready on stocker pallet	No. 1403 = 0	Power shut off after pallet unload
				No. 1403 = 1	Power shut off, pallet left on table

9.4.23 Read Pallet No. on Machine Table (M462)

The pallet number loaded on the machine table can be read by macro variable #100 by sending the M462 command.
The value of #100 becomes "1.0" when pallet No. 1 is loaded on the machine table, and "2.0" when pallet No. 2 is loaded on the machine table. This enables the pallet No. to be verified by the machining program in the standard operation mode, and the program corresponding to that pallet to be executed.

Specify G53 before reading #100 after the M462 code is sent.
This prevents the next block from being executed before the M462 operation is completed by the NC read-ahead function.

9.4.24 Pallet No. on Machine Table and Block Skip On/Off (M417, M418, M419)

- When M417 is sent, block skip 1 is turned Off if pallet No. 1 is on the machine table, and block skip 1 is turned On if pallet No. 2 is on the machine table.
- When M418 is sent, block skip 1 is turned On if pallet No. 1 is on the machine table, and block skip 1 is turned Off if pallet No. 2 is on the machine table.
- M419 returns the block skip On/Off status activated by M417 or M418 to the setting by the button on the main control panel.

When these M functions are used, the same machining is performed (same machining program can be used), but it enables the workpiece off-set values for pallets No. 1 and No. 2 to be changed.
Furthermore, the block skip function turned On/Off by M417/M418 is also returned to the main control panel button setting by resetting the NC unit or by an emergency stop, in addition to the M419 code.

Pallet on Machine Table	M417	M418
1	Off	On
1	On	Off

Send G53 after the M417/M418/M419 command block, and send the command corresponding to the pallet No. after that.
The reason for this is that the block skip 1 On/Off status is not valid for the block in the NC read-ahead buffer even when block skip 1 is turned On or Off by the M417, M418 or M419 code.

M417 : Confirm Pallet 1 on Machine Table
When pallet No. 1 is loaded on the machine table, block skip 1 is turned Off. If pallet No. 2 is on the table, block skip 1 is turned On. If a pallet No. other than 1 or 2 is on the machine table, an alarm is triggered and operation stops.

M418 : Confirm Pallet 2 on Machine Table
When pallet No. 1 is loaded on the machine table, block skip 1 is turned On. If pallet No. 2 is on the table, block skip 1 is turned Off. If a pallet No. other than 1 or 2 is on the machine table, an alarm is triggered and operation stops.

M419 : MachineTable Pallet Confirm End
Block skip 1 is returned to the status set by the button on the main control panel.

Usage Sample

O0001;
M60;
M417;
G53; ← Read-ahead control
/M98 P1 (Workpiece offset value for pallet No. 1) G
M418;
G53; ← Read-ahead control
/M98 P2 (Workpiece offset value for pallet No. 2) G
M419;
G53; ← Read-ahead control

Common machining progra for pallet No. 1 and 2

M30;
%

9.4.25 Built-in Programs

These programs are used to perform pallet changes and random operation, and are stored in the NC memory before the machine is shipped. The program content and program numbers cannot be changed.

1. Pallet Load Program

```
O9810;
M60;
G53;
/G53 G90 Ysee1 M65;
M80;
G53;
/G53 G90 Ysee2 M65;
M62;
G28 G91 Y0.;
G53;
M600;
M99;
```

2. Pallet Unload Progra

```
O9820;
M61;
G53;
/G53 G90 Ysee1 M65;
M80;
G53;
/G53 G90 Ysee2 M65;
M63;
G53;
/G53 G90 Ysee1;
M66;
G53;
/G53 G90 Ysee2;
M67;
G53;
/G28 G91 Y0.;
M64;
G28 G91 Y0.;
G53;
M600;
M99;
```

, P	Millimeter System:	-25.
@@	Inch System :	-0.9842
, Q	Millimeter System:	-475.
@@	Inch System :	-18.7007

3. Auto Pallet Unload Program
(only registered when random operation function is provided)

```
O9819;
G28 G91 Z0.;
G53 G90 G49 Xsee1 Ysee2;
T0;
M6;
T0;
G28 G91 Z0.;
G28 G91 Y0.;
M30;
```

1) Millimeter System : -900.
Inch System : -35.433
2) Millimeter System : -500.
Inch System : -19.685

9.4.25.1 Pallet Change Program Details

Load Program

O9810;

M60;

Unload ¨ Load Operation
‡ @Block skip On

Pallet 1 or 2 Loaded
‡ @Ready che
‡ AStart condition che
‡ BPallet 2 Loaded: Block skip On
Pallet 1 Loaded: Block skip Off

G53; Read-ahead prohibit blo

/G53 G90 Y-25. M65 ;

Pallet 1 Loaded
‡ @Y axis moved to stocker 1
‡ APallet unclamped
‡ BPallet lifted
‡ CS/G opened

M80;

Unload ¨ Load Operation
‡ @Block skip On

Pallet 1 Loaded
‡ @Block skip On

Pallet 2 Loaded
‡ @Block skip On

G53; Read-ahead prohibit blo

/G53 G90 Y-475. M65

Pallet 2 Loaded
‡ @Y axis moved to stocker 2
‡ APallet unclamped
‡ BPallet lifted
‡ CS/G opened

M62;

Unload ¨ Load Operation
‡ @Block skip reset

Pallet 1 or 2 Loaded
‡ @Arm advanced
‡ APallet down
‡ BPallet clamped
‡ CPallet seating confir
‡ DArm retracted
‡ EBlock skip reset
‡ FFIN returned
‡ GS/G opened

G28 G91 Y0.; Y axis returned to origin

G53; Read-ahead prohibit blo

M600;

Rando Operation
‡ @Search & start machining progra

Not Random Operation
‡ @No processing

M99;

Unload Program

O9820;

M61; ‡ @Start condition check
‡ ADetermine Unload only or Unload ¨ Load Operation
‡ BUnload pallet 2: Block skip On
Unload pallet 1: Block skip Off

G53; Read-ahead prohibit block

/G53 G90 Y-25. M65; Pallet 1 Unloaded
‡ @Y axis moved to stocker 1
‡ AS/G opened

M80; Pallet 1 Unloaded
‡ @Block skip On

Pallet 2 Unloaded
‡ ABlock skip Off

G53; Read-ahead prohibit block

/G53 G90 Y-475. M65; Pallet 2 Unloaded
‡ @Y axis moved to stocker 1
‡ AS/G opened

M63; ‡ @Arm advanced
‡ APallet unclamped
‡ BPallet lifted

Unload ¨ Load Operation
‡ CPallet 2 Loaded:
Block skip On
Pallet 1 Loaded:
Block skip Off
‡ DArm retracted
(FIN returned at reduction LS Off)

Unload Only
‡ CBlock skip On
‡ DArm retracted
(FIN returned at reduction LS Off)
‡ EPallet down
‡ FPallet clamped
‡ GS/G opened

G53; Read-ahead prohibit block

/G53 G90 Y-25.; Pallet 1 Loaded
‡ @Y axis moved to stocker 1

M66; Unload Only
‡ @Block skip On

Pallet 1 Loaded
‡ @Block skip On

Pallet 2 Loaded
‡ @Block skip Off

G53; Read-ahead prohibit block

/G53 G90 Y-475.; Pallet 2 Loaded
‡ @Y axis moved to stocker 2

M67; Unload Only
‡ @Block skip On

Pallet 1 or 2 Loaded
‡ @Block skip On

G53; Read-ahead prohibit block

/G28 G91 Y0.; Unload Only
‡ @Y axis returned to origin

M64;

Unload Only	Pallet 1 or 2 Loaded
‡ @Block skip reset	‡ @Arm advanced
	‡ APallet down
	‡ BPallet clamped
	‡ CPallet seating confir
	‡ DArm retracted
	‡ EBlock skip reset
	‡ FFIN returned
	‡ GS/G opened

G28 G91 Y0.; Y axis returned to origin

G53; Read-ahead prohibit block

M600:

Rando Operation	Not Random Operation
‡ @Search & start machining progra	‡ @No processing

M99;

9.4.25.2 Details of Auto Unload Program

This program is only registered when the random operation function is provided.

```
O9819;
G28G91Z0.;                          Z axis returned to origin
G53 G90 G49 X see, PY see, QG       X, Y axis moved to end of stroke
T0;                                 ┐
M6;                                 │ Spindle tool returned to magazine
T0;                                 ┘
G28G91Z0.;                          Z axis returned to origin
G28G91Y0.;                          Y axis returned to origin
M30;
```

, PjMillimeter System	: -900.
@@Inch System	: -35.433
, QjMillimeter System	: -500
@@Inch System	: -19.685

9.5 Manual Pallet Changer (Option for V55-5XA)

This function is only available for the V55-5XA. It is not available for the V33.

9.5.1 Outline

The manual pallet changer is a simplified pallet changing device which can be added at a later date to the V55-5XA. It utilizes the structure of the 5XA which allows the table and pallet to be separated, enabling jigs to be prepared for multiple pallets according to the type of machining, and in turn facilitates continuous machining.

This manual pallet changer is designed for applications where machining time is relatively long, with only one pallet change usually being performed per day. This unit is also convenient when you wish to check frequently the location being machined inside the machining chamber
WIth this device, unloading, rotation and loading are all manually performed, but an auxiliary hydraulic mechanism (gravity direction) is provided to facilitate work.

The entire pallet changer can be shifted to the left after the pallet change has been completed, enabling the area in front of the machining chamber to be used. This allows the machine to be used in the same way as for a standard configuration.

9.5.2 Machine Status When Performing Changes

The machine must be in the following status when changing the pallet:

- Y, A, C axes at machine reference point
- Spindle stopped
- Coolant stopped
- Scraper stopped
- NC unit in handle mode

If these conditions are not satisfied, a warning is triggered.
Perform the pallet change immediately before the end of the program, or use the MDI mode to put the machine in the above status.

9.5.3 Change Procedure

Use the following procedure to perform the pallet change:

1. Put the machine in the status described in section 9.5.2:
   - Y, A, C axes at reference point (G28)
   - Spindle stopped (M5)
   - Coolant stopped (M9)
   - Scraper stopped (M740)
   - Handle mode selected

2. Press the [PALLET CLAMP] switch on the main control panel to unclamp the pallet.
   (The built-in lamp for this switch lights at this time.)

3. Open the operator door

4. Unload (take out) the pallet.

5. Load the new pallet.

6. Press the [PALLET CLAMP] switch on the main control panel to clamp the pallet.
   (The built-in lamp for this switch goes out at this time.)

Chapter 10 Machine I/O Tables

V33, V55

Professional 3

Chapter 10
Machine I/OTables

Contents

10.1 Outline

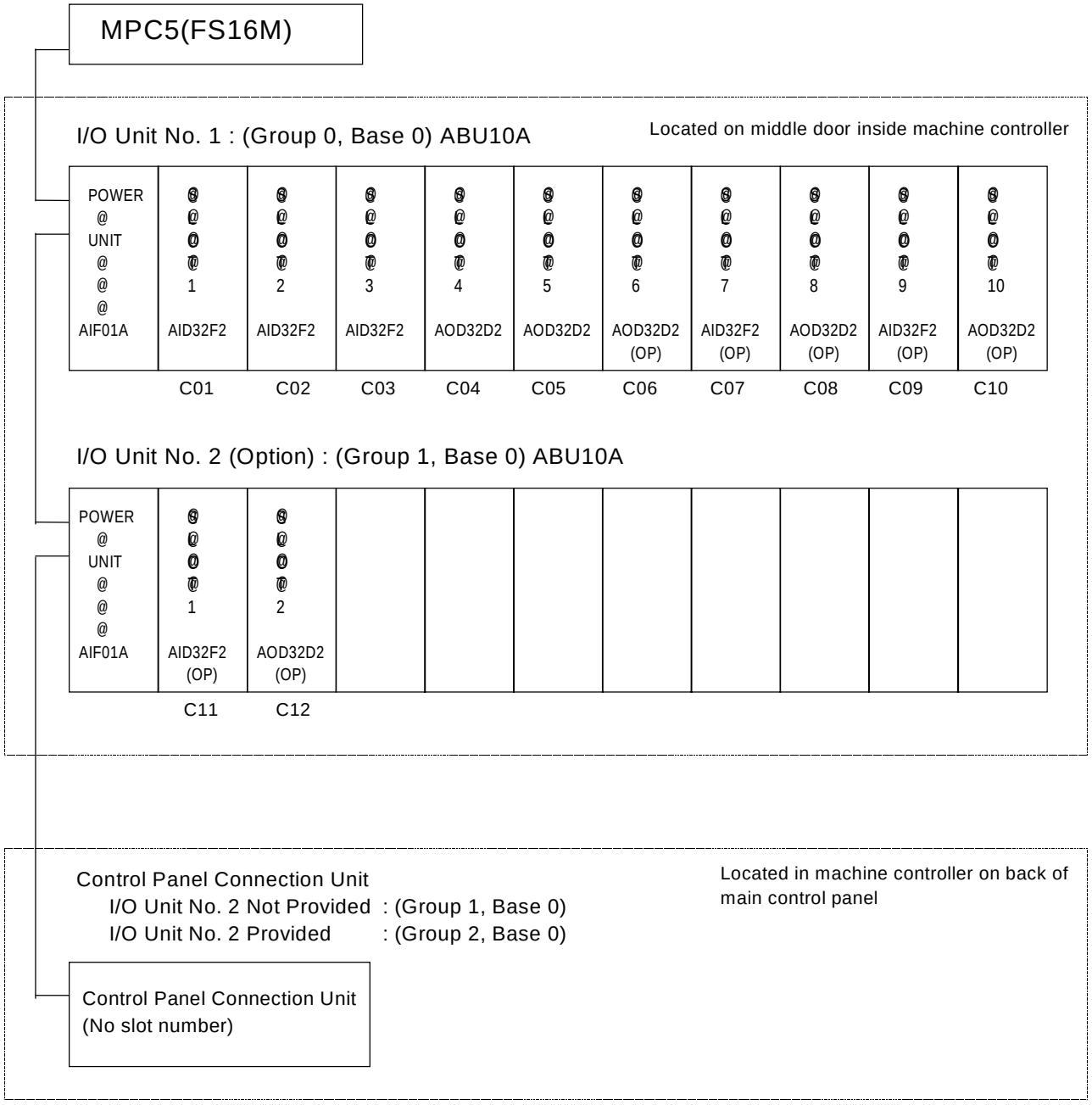
The machine I/O tables are used to check where the signals for the various solenoids, limit switches and main control components are displayed on the diagnose (I/O) data screen.

10.2 Machine Side I/O Hardware Configuration

1. V55
   The machine side I/O hardware configuration differs for machines with the FS16M, and machines provided with the FS16i-MA (see Note). The respective hardware configurations are shown in Fig. 10.1 and Fig. 10.2.
   I/O unit No. 2 is an option. It may or may not be provided, depending upon the machine specifications.
   Please note that the control panel connection unit group numbers will vary, depending upon whether or not I/O unit No. 2 is provided. The explanations in Fig. 10.1 and Fig. 10.2 assume that I/O unit No. 2 is provided.

The software version on the help screen is "MDJ5000__" for the FS16M, and the software version is "MKJ5000__" for the FS16i-MA. Refer to the PC Help Screen chapter for details.

2. V33
   The machine side I/O hardware configuration is shown in Fig. 10.3. The number of line division I/O unit provided differs depending upon the machine specifications. Fig. 10.3 shows the machine with one line division I/O unit.

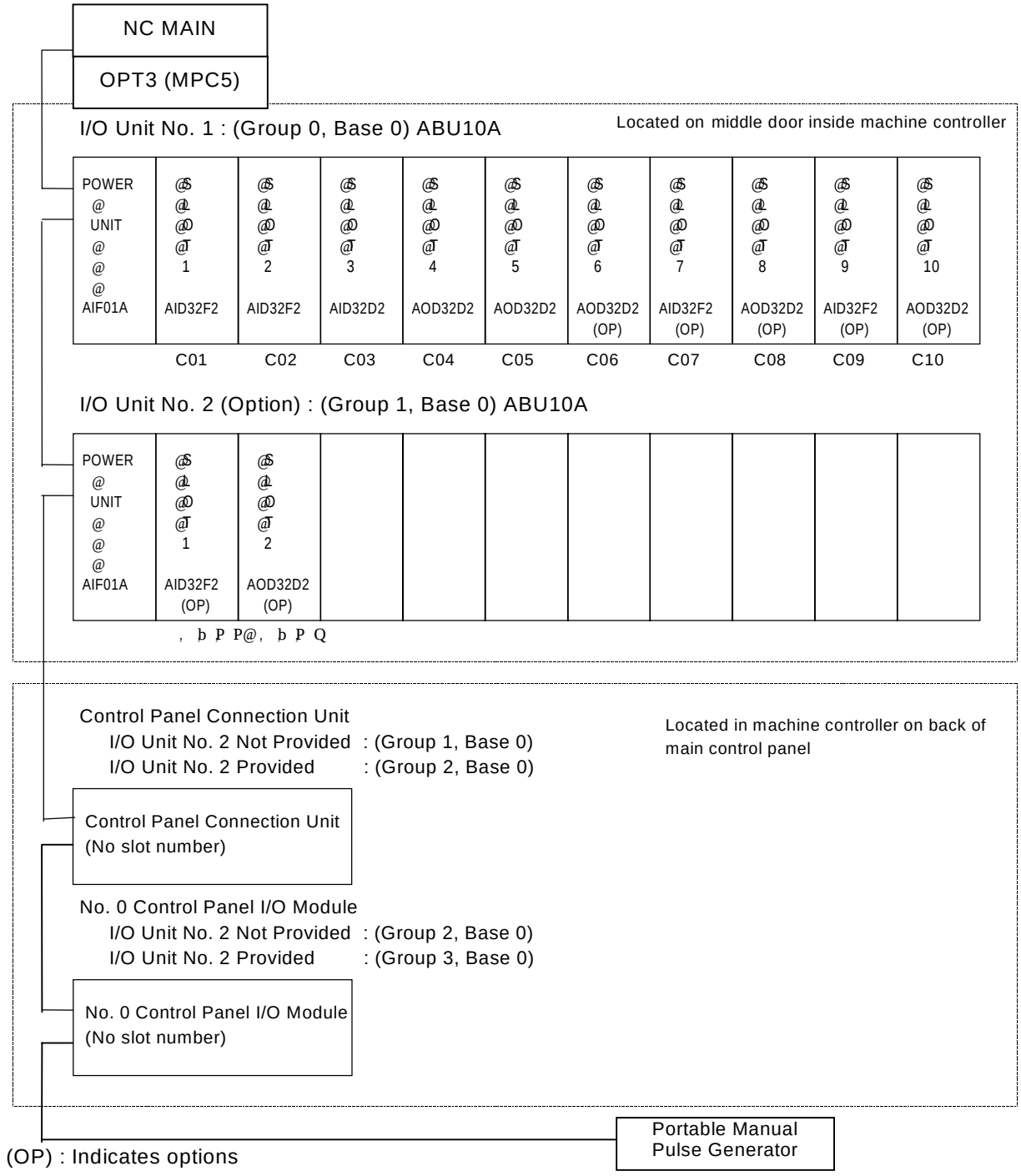


(OP) : Indicates options

@ @ @rovided, depending upon specifications

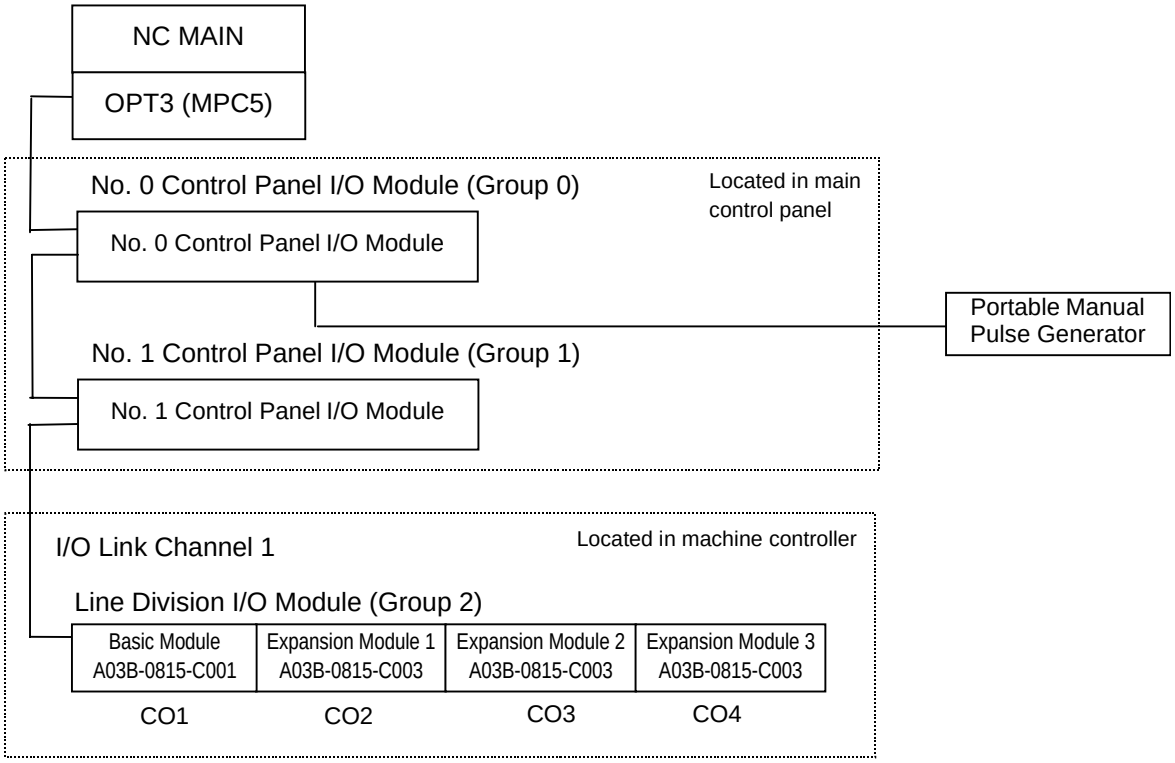
Above hardware configuration will vary depending upon machine specifications.

FIGURE 10-1 V55 MACHINE SIDE I/O HARDWARE CONFIGURATION (FOR FS16M)



Above hardware configuration will vary depending upon machine specifications.

FIGURE 10-2 V55 MACHINE SIDE I/O HARDWARE CONFIGURATION (FOR FS16I-MA)



Above hardware configuration will vary depending upon machine specifications.

FIGURE 10-3 V33 MACHINE SIDE I/O HARDWARE CONFIGURATION

10.2.1 I/O Modules

One of the modules listed in this section is provided in each I/O unit slot. The type and number of signals differ for each module.

1. For Input Signals
   AID32F2 (No. of Signals: 32 points)

2. For Output Signals
   AOD32D2 (No. of Signals: 32 points)

3. For Input/Output Signals
   AO3B-0815-C001 (No. of Input Signals: 24, No. of Output Signals: 16)
   AO3B-0815-C003 (No. of Input Signals: 24, No. of Output Signals: 16)

10.2.2 Diagnose No. Allocation

The following diagnose numbers (signals) are allocated to the respective I/O unit slots and control panel connection unit. Diagnose numbers correspond to the number under "No." on the P/C diagnose (I/O) data screen.

10.2.2.1 V55 Diagnose No. Allocation

I/O Unit No. 1	Slot 1	000 – 003 (machine input signal)
	Slot 2	004 – 007 (")
	Slot 3	008 – 011 (")
	Slot 4	200 – 203 (machine output signal)
	Slot 5	204 – 207 (")
	Slot 6	208 – 211 (")
	Slot 7	012 – 015 (machine input signal)
	Slot 8	212 – 215 (machine output signal)
	Slot 9	016 – 019 (machine input signal)
	Slot 10	216 – 219 (machine output signal)
I/O Unit No. 2	Slot 1	020 – 023 (machine input signal)
	Slot 2	224 – 227 (machine output signal)
Control Panel Connection Unit		000 – 003 (main control panel input signal)
" "		296 – 299 (" " output signal)

10.2.2.2 V33 Diagnose No. Allocation

I/O Link Channel 1		
Line Division I/O Unit No. 0		
	Basic Module	000 – 002 (machine input signal)
		200 – 201 (machine output signal)
	Expansion Module 1	003 – 005 (machine input signal)
		202 – 203 (machine output signal)
	Expansion Module 2	006 – 008 (machine input signal)
		204 – 205 (machine output signal)
	Expansion Module 3	009 – 011 (machine input signal)
		206 – 207 (machine output signal)
No. 0 Control Panel I/O Module		096 – 102 (machine input signal)
		296 – 299 (machine output signal)
No. 1 Control Panel I/O Module		112 – 117 (machine input signal)
		300 – 313 (machine output signal)

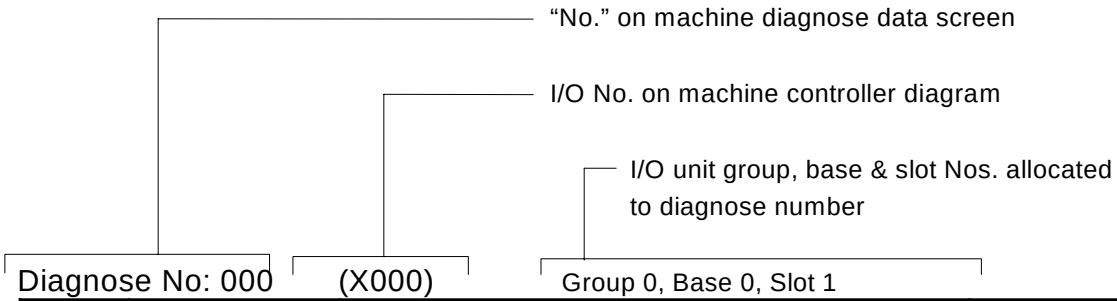
10.2.3 Input/Output Signal Allocation

Eight signals are allocated to each diagnose number. The diagnose numbers, respective bit signal names and their meanings are described in section 10.4, Machine I/OTables.

10.3 Viewing Machine Signal I/O Table

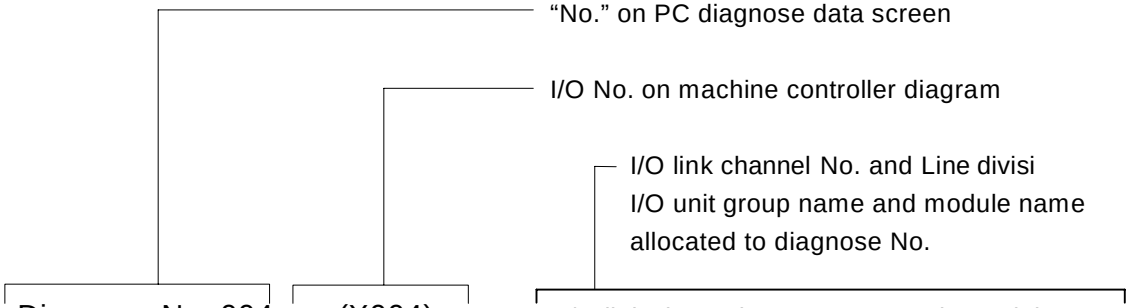
The configuration of the tables on the following pages is described in this section.

- **V55**



Bit	Symbol	Signal Name	Connector No.
7	RCH2	Spindle winding status confirm 2	C01-A20
6	RCH1	Spindle winding status confirm 1	C01-B20
5			C01-A21
4	LS1340	Union malfunction detect	C01-B21
3	LS602	Spindle tool exist detect	C01-A22
2	LS601	Spindle tool seating confirm	C01-B22
1	LS01	Spindle tool unclamp	C01-A23
0	LS00	Spindle tool clamp	C01-B23

- **V33**



Bit	Symbol	Signal Name	Connector No.
7	LS00	Tool clamp	C01-49
6	LS01	Tool unclamp	C01-48
5	LS905	Air pressure switch	C01-47
4	LS912	S/G door interlock limit switch	C01-46
3	TH18	Oil skimmer	C01-45
2	*OMAL	Spindle Oilmatic alarm	C01-44

- Bit : Indicates bit position on PC diagnose data screen. Counting starts from the left on the screen (7, 6...), and the number on the far right is 0.
- Symbol : Symbol for signal corresponding to each bit.
- Signal Name : Signal name corresponding to each bit.

- Connector No. : I/O module connector number actually wired to that signal.

In some cases, two signal names are allocated to each bit. In this event, the meaning of the respective signal names is as shown below:

Signal Name A / Signal Name B : Meaning of Signal Name A / Meaning of Signal Name B

10.4 V55 Machine I/O Tables

10.4.1 Machine Side I/O Tables

Diagnose No. : 000 (X000) Group 0, Base 0, Slot 1

Bit	Symbol	Signal Name	Connector No.
7	RCH2	Spindle winding status confirm 2	C01-A20
6	RCH1	Spindle winding status confirm 1	C01-B20
5			C01-A21
4	LS1340	Union malfunction detect	C01-B21
3	LS602	Spindle tool exist detect	C01-A22
2	LS601	Spindle tool seating confirm	C01-B22
1	LS01	Spindle tool unclamp	C01-A23
0	LS00	Spindle tool clamp	C01-B23

Diagnose No. : 001 (X001) Group 0, Base 0, Slot 1

Bit	Symbol	Signal Name	Connector No.
7	MZRC	ATC magazine CCW switch	C01-A14
6	MZR	ATC magazine CW switch	C01-B14
5	ATCMAS	ATC magazine manual switch	C01-A15
4			C01-B15
3			C01-A16
2	LS748	ATC shutter open	C01-B16
1	LS747	ATC shutter close	C01-A17
0	LS99	ATC magazine signal tool exist confirm	C01-B17

Diagnose No. : 002 (X002) Group 0, Base 0, Slot 1

Bit	Symbol	Signal Name	Connector No.
7	LS1307	Through-tool coolant flow switch	C01-A8
6	LS1319	Coolant tank empty detect	C01-B8
5	LS181	Nozzle coolant flow switch	C01-A9
4	LS193	Through-spindle coolant flow switch	C01-B9
3	MS11C	Workpiece cleaning gun On	C01-A10
2	LS905	Main air pressure switch	C01-B10
1	LS170	Spindle Oilmatic flow switch	C01-A1
0	LS173	Spindle Oilmatic clog detect	C01-B1

Diagnose No. : 000 (X003) Group 0, Base 0, Slot 1

Bit	Symbol	Signal Name	Connector No.
7	ALSXYP	Auto grease supply unit pressure rise	C01-A2
6	LS138	S/G door open	C01-B2
5	LS137	S/G door close	C01-A3
4			C01-B3
3	IRKEY	Operator side S/G door lock release	C01-A4
2	LS942	ATC door lock	C01-B4
1	LS912	Operator side S/G door lock	C01-A5
0	SGLKS	Operator side S/G door interlock mode	C01-B5

Diagnose No. : 004 (X004) Group 0, Base 0, Slot 2

Bit	Symbol	Signal Name	Connector No.
7	SKIP	Skip signal	C02-A20
6			C02-B20
5	LCREV	Lift-up chip conveyor reverse switch	C02-A21
4	LCFWD	Lift-up chip conveyor forward switch	C02-B21
3	LCMAS	Lift-up chip conveyor manual switch	C02-A22
2			C02-B22
1			C02-A23
0			C02-B23

Diagnose No. : 005 (X005) Group 0, Base 0, Slot 2

Bit	Symbol	Signal Name	Connector No.
7			C02-A14
6	H5S	Manual pulse gen. 5th axis select	C02-B14
5	H4S	Manual pulse gen. 4th axis select	C02-A15
4	HZS	Manual pulse gen. Z axis select	C02-B15
3	HYS	Manual pulse gen. Y axis select	C02-A16
2	HXS	Manual pulse gen. X axis select	C02-B16
1	MP2S	Manual pulse gen. multiplication X100	C02-A17
0	MP1S	Manual pulse gen. multiplication X10	C02-B17

Diagnose No. : 006 (X006) Group 0, Base 0, Slot 2

Bit	Symbol	Signal Name	Connector No.
7	OCALM	Spindle oil controller alarm	C02-A8
6	OCFIS	Spindle oil controller filter sign	C02-B8
5	DAIN	Spindle oil controller data receive	C02-A9
4	OCACK	Spindle oil controller data ACK	C02-B9
3	OCD|3	Spindle oil controller input data 3	C02-A10
2	OCD|2	Spindle oil controller input data 2	C02-B10
1	OCD|1	Spindle oil controller input data 1	C02-A1
0	OCD|0	Spindle oil controller input data 0	C02-B1

Diagnose No. : 007 (X007) Group 0, Base 0, Slot 2

Bit	Symbol	Signal Name	Connector No.
7			C02-A2
6			C02-B2
5	DTCH5	5th axis remove	C02-A3
4	L155	5th axis unclamp	C02-B3
3	L154	5th axis clamp	C02-A4
2	DTCH4	4th axis remove	C02-B4
1	L152	4th axis unclamp	C02-A5
0	L151	4th axis clamp	C02-B5

Diagnose No. : 008 (X008) Group 0, Base 0, Slot 3

Bit	Symbol	Signal Name	Connector No.
7	CPTP	In panel circuit protector tripped	C03-A20
6	CBTP	In panel breaker tripped	C03-B20
5	EMI	Emergency stop	C03-A21
4	*ESP	Emergency stop signal	C03-B21
3	CPTP1	In panel protector trip 1	C03-A22
2			C03-B22
1			C03-A23
0	AONMD	Auto power shut-off On mode	C03-B23

Diagnose No. : 009 (X009) Group 0, Base 0, Slot 3

Bit	Symbol	Signal Name	Connector No.
7			C03-A14
6	*DEC7	ATC magazine B, AH axis zero ret. decelerate	C03-B14
5	*DEC6	ATC magazine B, AV axis zero ret. decelerate	C03-A15
4	*DEC5	5th axis zero return decelerate	C03-B15
3	*DEC4	4th axis zero return decelerate	C03-A16
2	*DEC3	Z axis zero return decelerate	C03-B16
1	*DEC2	Y axis zero return decelerate	C03-A17
0	*DEC2	X axis zero return decelerate	C03-B17

Diagnose No. : 010 (X010) Group 0, Base 0, Slot 3

Bit	Symbol	Signal Name	Connector No.
7	LS1700	Z axis brake belt broken detect	C03-A8
6	LS190	Separate tank filter clogged detect	C03-B8
5	LS184	Separate tank filter empty detect	C03-A9
4	LS1339	Through-spindle filter clogged detect	C03-B9
3	SCSLP1	Scraper conveyor 1 slip detect	C03-A10
2	OT2Z	Z axis OT2	C03-B10
1	OT2Y	Y axis OT2	C03-A1
0	OT2X	X axis OT2	C03-B1

Diagnose No. : 011 (X011) Group 0, Base 0, Slot 3

Bit	Symbol	Signal Name	Connector No.
7	MSALB	Battery error	C03-A2
6	MSALA	Receive alarm	C03-B2
5	TH19	Oil mist collector thermal alarm	C03-A3
4	AIRAL	Air dryer alarm	C03-B3
3	L154	5th axis clamp	C03-A4
2	DTCH4	4th axis remove	C03-B4
1	L152	4th axis unclamp	C03-A5
0	L151	4th axis clamp	C03-B5

Diagnose No. : 012 (X012) Group 0, Base 0, Slot 7

Bit	Symbol	Signal Name	Connector No.
7	LS56	Pallet unclamp	C07-A20
6	LS55	Pallet clamp	C07-B20
5	LS136	APC auto S/G door intermediate position	C07-A21
4	LS131	APC auto S/G door open	C07-B21
3	LS130	APC auto S/G door close	C07-A22
2	LS971	Pallet seating confirm	C07-B22
1	LS322	Pallet lift	C07-A23
0	LS321	Pallet down	C07-B23

Diagnose No. : 013 (X013) Group 0, Base 0, Slot 7

Bit	Symbol	Signal Name	Connector No.
7	LS1073	Spindle tool clamp	C07-A14
6	LS1070	Ref. point range & motor stop	C07-B14
5	IV1ALM	ATC inverter alarm	C07-A15
4	MGSELB	ATC magazine B select	C07-B15
3	LS320	Confirm pallet on table	C07-A16
2	LS761	Pot unclamp	C07-B16
1	LS760	Pot clamp	C07-A17
0	LS668	Shifter pot confirm/carrier pot confirm	C07-B17

Diagnose No. : 014 (X014) Group 0, Base 0, Slot 7

Bit	Symbol	Signal Name	Connector No.
7	LS682	Shifter 3 retract	C07-A8
6	LS681	Shifter 3 advance	C07-B8
5	LS680	Shifter 2 retract	C07-A9
4	LS679	Shifter 2 advance	C07-B9
3	LS751 / LS756	Shifter 1 retract / Sub arm 0 deg.	C07-A10
2	LS750 / LS757	Shifter 1 advance / Sub arm 90 deg.	C07-B10
1	LS669B	Magazine B pot exist confirm	C07-A1
0	LS669A	Magazine A pot exist confirm	C07-B1

Diagnose No. : 015 (X015) Group 0, Base 0, Slot 7

Bit	Symbol	Signal Name	Connector No.
7	USDI8	User DI 8	C07-A2
6	USDI7	User DI 7	C07-B2
5	USDI6	User DI 6	C07-A3
4	USDI5	User DI 5	C07-B3
3	USDI4	User DI 4	C07-A4
2	USDI3	User DI 3	C07-B4
1	USDI2	User DI 2	C07-A5
0	USDI1	User DI 1	C07-B5

Diagnose No. : 016 (X016) Group 0, Base 0, Slot 9

Bit	Symbol	Signal Name	Connector No.
7			C09-A20
6			C09-B20
5			C09-A21
4			C09-B21
3			C09-A22
2			C09-B22
1			C09-A23
0			C09-B23

Diagnose No. : 017 (X017) Group 0, Base 0, Slot 9

Bit	Symbol	Signal Name	Connector No.
7			C03-A14
6			C03-B14
5			C03-A15
4			C03-B15
3			C03-A16
2			C03-B16
1			C03-A17
0	MQLLOW	Mist unit oil low limit detect	C03-B17

Diagnose No. : 018 (X018) Group 0, Base 0, Slot 9

Bit	Symbol	Signal Name	Connector No.
7			C03-A8
6			C03-B8
5			C03-A9
4			C03-B9
3			C03-A10
2			C03-B10
1			C03-A1
0			C03-B1

Diagnose No. : 019 (X019) Group 0, Base 0, Slot 9

Bit	Symbol	Signal Name	Connector No.
7			C03-A2
6			C03-B2
5			C03-A3
4			C03-B3
3			C03-A4
2			C03-B4
1			C03-A5
0			C03-B5

Diagnose No. : 020 (X020) Group 1, Base 0, Slot 1

Bit	Symbol	Signal Name	Connector No.
7	LS105	Arm 2 advance	C20-46
6	LS1761	Arm 2 decelerate	C20-30
5	LS1714	Arm 2 intermediate position	C20-47
4	LS104	Arm 2 retract	C20-31
3	LS101	Arm 1 advance	C20-15
2	LS1760	Arm 1 decelerate	C20-48
1	LS1711	Arm 1 intermediate position	C20-32
0	LS100	Arm 1 retract	C20-16

Diagnose No. : 021 (X021) Group 1, Base 0, Slot 1

Bit	Symbol	Signal Name	Connector No.
7	LS111	Pallet 2 exist confirm	C20-42
6	LS110	Pallet 1 exist confirm	C20-10
5			C20-43
4			C20-27
3			C20-11
2			C20-44
1			C20-28
0			C20-12

Diagnose No. : 022 (X022) Group 1, Base 0, Slot 1

Bit	Symbol	Signal Name	Connector No.
7			C20-37
6	PCINS2	Pallet 2 load switch	C20-22
5	PDYPB2	Pallet 2 ready switch	C20-38
4	PCOUTS	Pallet unload switch	C20-23
3	PCINS1	Pallet 1 load switch	C20-6
2	PDYPB1	Pallet 1 ready switch	C20-39
1	PCSPC	APC stop switch	C20-24
0	PCMAS	APC manual intervention switch	C20-7

Diagnose No. : 023 (X023) Group 1, Base 0, Slot 1

Bit	Symbol	Signal Name	Connector No.
7	LS966	APC door interlock	C07-33
6			C07-1
5			C07-34
4			C07-19
3			C07-2
2			C07-35
1			C07-20
0	IV2ALM	APC inverter alarm	C07-3

Diagnose No. : 054 (X054) Group 2, Base 0, Slot 3

Bit	Symbol	Signal Name	Connector No.
7	FINISH	Return	C42-A20
6	ALT	Alarm tool	C42-B20
5	SPNT	Spindle tool	C42-A21
4	NEXT	Next tool	C42-B21
3	MCT	Tool change	C42-A22
2	TLREG	Tool number registration	C42-B22
1	ATLSCH	Alarm tool search	C42-A23
0	TLSCH	Tool search	C42-B23

Diagnose No. : 055 (X055) Group 2, Base 0, Slot 3

Bit	Symbol	Signal Name	Connector No.
7	KS-7	Data setting key 7	C42-A14
6	KS-6	Data setting key 6	C42-B14
5	KS-5	Data setting key 5	C42-A15
4	KS-4	Data setting key 4	C42-B15
3	KS-3	Data setting key 3	C42-A16
2	KS-2	Data setting key 2	C42-B16
1	KS-1	Data setting key 1	C42-A17
0	KS-0	Data setting key 0	C42-B17

Diagnose No. : 056 (X056) Group 2, Base 0, Slot 3

Bit	Symbol	Signal Name	Connector No.
7			C42-A8
6			C42-B8
5			C42-A9
4	POTMS	Pot mode switch	C42-B9
3	KS-C	Data setting clear key	C42-A10
2	KS-P	Data setting pot key	C42-B10
1	KS-7	Data setting key 7	C42-A1
0	KS-6	Data setting key 6	C42-B1

Diagnose No. : 057 (X057) Group 2, Base 0, Slot 3

Bit	Symbol	Signal Name	Connector No.
7	TLULS	Tool loader unload switch	C42-A2
6	LS677	Tool loader unlock	C42-B2
5	LS674	Tool loader retract	C42-A3
4	LS1946	Sub arm tool lock	C42-B3
3	LS1945	Sub arm tool unlock	C42-A4
2	LS758	Sub arm pot confirm	C42-B4
1	LS90	Carrier pot unclamp	C42-A5
0	LS89	Carrier pot clamp	C42-B5

Diagnose No. : 200 (Y000) Group 0, Base 0, Slot 4

Bit	Symbol	Signal Name	Connector No.
7	SL905	Main air On	C04-A20
6	RCHP	Spindle winding changeover	C04-B20
5			C04-A21
4	POUT2	Auto power shut-off 2	C04-B21
3	POUT1	Auto power shut-off 1	C04-A22
2	OT	OT release	C04-B22
1	SA	Servo preparation complete	C04-A23
0	MA	NC preparation complete	C04-B23

Diagnose No. : 201 (Y001) Group 0, Base 0, Slot 4

Bit	Symbol	Signal Name	Connector No.
7	HAMOD	Handle mode	C04-A14
6			C04-B14
5	SL1310	Through-spindle suction solenoid	C04-A15
4	SL1309	Through-spindle rotary coupling drain	C04-B15
3	SL1308	Through-spindle rotary coupling back-up air	C04-A16
2	SL1306	Through-spindle suction solenoid spindle side	C04-B16
1	SL09	Spindle taper cleaning air	C04-A17
0	SL01	Spindle tool unclamp	C04-B17

Diagnose No. : 202 (Y002) Group 0, Base 0, Slot 4

Bit	Symbol	Signal Name	Connector No.
7	MS15	Through-tool coolant	C04-A8
6	MS10	Ceiling shower coolant	C04-B8
5	MS8	Through-spindle coolant	C04-A9
4	MSSP	Secondary processing unit suction pump	C04-B9
3			C04-A10
2	SL95	Magazine tool cleaning air	C04-B10
1	MS19	Oil mist collector	C04-A1
0	MS2	Nozzle coolant	C04-B1

Diagnose No. : 203 (Y003) Group 0, Base 0, Slot 4

Bit	Symbol	Signal Name	Connector No.
7	SL192	Through-spindle coolant/air changeover	C04-A2
6	SL189	Through-tool air	C04-B2
5	SL181	Air blow	C04-A3
4	SGWP	S/G wiper	C04-B3
3	MS7R	Scraper conveyor reverse	C04-A4
2	MS7F	Scraper conveyor forward	C04-B4
1	SL1340	Mist blow	C04-A5
0	SL1339	Through-spindle mist	C04-B5

Diagnose No. : 204 (Y004) Group 0, Base 0, Slot 5

Bit	Symbol	Signal Name	Connector No.
7			C05-A20
6			C05-B20
5			C05-A21
4	SL171	Spindle lubricant push-out air	C05-B21
3	MS102	Ball screw shaft cooling pump	C05-A22
2	MS101	Spindle lubricant relay pump	C05-B22
1	MS83	Spindle lubricant suction pump	C05-A23
0	OMON	Spindle Oilmatic start	C05-B23

Diagnose No. : 205 (Y005) Group 0, Base 0, Slot 5

Bit	Symbol	Signal Name	Connector No.
7	ATCMAL	ATC manual mode lamp	C05-A14
6	SL711B	ATC shutter open	C05-B14
5	SL711A	ATC shutter close	C05-A15
4			C05-B15
3			C05-A16
2			C05-B16
1	SL132B	S/G door open	C05-A17
0	SL132A	S/G door close	C05-B17

Diagnose No. : 206 (Y006) Group 0, Base 0, Slot 5

Bit	Symbol	Signal Name	Connector No.
7			C05-A8
6			C05-B8
5	DAOUT	Spindle oil controller sending data	C05-A9
4	OCSTB	Spindle oil controller data strobe	C05-B9
3	OCD03	Spindle oil controller output data 3	C05-A10
2	OCD02	Spindle oil controller output data 2	C05-B10
1	OCD01	Spindle oil controller output data 1	C05-A1
0	OCD00	Spindle oil controller output data 0	C05-B1

Diagnose No. : 207 (Y007) Group 0, Base 0, Slot 5

Bit	Symbol	Signal Name	Connector No.
7	MLT	Light in S/G	C05-A2
6	ALSXYR	Auto lubricant supply unit reverse	C05-B2
5	ALSXYF	Auto lubricant supply unit forward	C05-A3
4	PLTUCL	Pallet unclamp mode	C05-B3
3	BZ1	Buzzer 1	C05-A4
2	PTL3	Signal light 3 (green)	C05-B4
1	PTL2	Signal light 2 (yellow)	C05-A5
0	PTL1	Signal light 1 (red)	C05-B5

Diagnose No. : 208 (Y008) Group 0, Base 0, Slot 6

Bit	Symbol	Signal Name	Connector No.
7	LCRUNL	Lift-up conveyor operation lamp	C06-A20
6	LCALML	Lift-up conveyor alarm lamp	C06-B20
5	LCMAL	Lift-up conveyor manual lamp	C06-A21
4	MS6R	Lift-up conveyor reverse	C06-B21
3	MS6F	Lift-up conveyor forward	C06-A22
2	MS6A	Lift-up conveyor filter back wash	C06-B22
1	SL913	ATC door unlock	C06-A23
0	SGOP	Operator side S/G door unlock mode	C06-B23

Diagnose No. : 209 (Y009) Group 0, Base 0, Slot 6

Bit	Symbol	Signal Name	Connector No.
7			C06-A14
6			C06-B14
5	SL193	IMM cleaning air	C06-A15
4	OPPON	Probe power On	C06-B15
3	SL301	Stylus cleaning air	C06-A16
2	M33X	Tool length measure circuit check	C06-B16
1	M32X	Tool length measure mode	C06-A17
0	NMSMD	Non-measure mode	C06-B17

Diagnose No. : 210 (Y010) Group 0, Base 0, Slot 6

Bit	Symbol	Signal Name	Connector No.
7	STLR	Auto operation being performed	C06-A8
6	SAR	Spindle rotating	C06-B8
5	PRES4	Coolant pressure changeover No. 4	C06-A9
4	PRES3	Coolant pressure changeover No. 3	C06-B9
3	PRES2	Coolant pressure changeover No. 2	C06-A10
2	PRES1	Coolant pressure changeover No. 1	C06-B10
1	SL151	5th axis unclamp	C06-A1
0	SL150	4th axis unclamp	C06-B1

Diagnose No. : 211 (Y011) Group 0, Base 0, Slot 6

Bit	Symbol	Signal Name	Connector No.
7			C06-A2
6			C06-B2
5			C06-A3
4			C06-B3
3			C06-A4
2			C06-B4
1			C06-A5
0			C06-B5

Diagnose No. : 212 (Y012) Group 0, Base 0, Slot 8

Bit	Symbol	Signal Name	Connector No.
7			C08-A20
6			C08-B20
5	SL130B	APC auto S/G open	C08-A21
4	SL130A	APC auto S/G close	C08-B21
3	SL61B	Pallet lift	C08-A22
2	SL61A	Pallet down	C08-B22
1	SL52	Pallet locate pin cleaning air	C08-A23
0	SL51	Pallet unclamp	C08-B23

Diagnose No. : 213 (Y013) Group 0, Base 0, Slot 8

Bit	Symbol	Signal Name	Connector No.
7	IV1STF	ATC inverter 1 forward	C08-A14
6	SL759A	Shifter 3 retract	C08-B14
5	SL758A	Shifter 2 retract	C08-A15
4	SL759B	Shifter 3 advance	C08-B15
3	SL758B	Shifter 2 advance	C08-A16
2	SL750B / SL753B	Shifter 1 advance / Sub arm 90 deg.	C08-B16
1	SL750A / SL753A	Shifter 1 retract / Sub arm 0 deg.	C08-A17
0	SL754	Clamper unclamp	C08-B17

Diagnose No. : 214 (Y014) Group 0, Base 0, Slot 8

Bit	Symbol	Signal Name	Connector No.
7	MGBKB	ATC magazine B brake release	C08-A8
6	MGBKA	ATC magazine A brake release	C08-B8
5			C08-A9
4			C08-B9
3			C08-A10
2	IV1RST	ATC inverter reset	C08-B10
1	IV1RM	ATC inverter speed 2	C08-A1
0	IV1RH	ATC inverter speed 1	C08-B1

Diagnose No. : 215 (Y015) Group 0, Base 0, Slot 8

Bit	Symbol	Signal Name	Connector No.
7	USDO 8	User DO 8	C08-A2
6	USDO 7	User DO 7	C08-B2
5	USDO 6	User DO 6	C08-A3
4	USDO 5	User DO 5	C08-B3
3	USDO 4	User DO 4	C08-A4
2	USDO 3	User DO 3	C08-B4
1	USDO 2	User DO 2	C08-A5
0	USDO 1	User DO 1	C08-B5

Diagnose No. : 216 (Y016) Group 0, Base 0, Slot 10

Bit	Symbol	Signal Name	Connector No.
7			C10-A20
6			C10-B20
5			C10-A21
4	MQLHIP	Mist unit oil level high press. (acceleration air)	C10-B21
3	MQLMIN	Mist unit minimum oil level	C10-A22
2	MQLSATD	Mist unit standard oil level	C10-B22
1	MQLMAX	Mist unit maximum oil level	C10-A23
0	mQLON	Mist unit start	C10-B23

Diagnose No. : 217 (Y017) Group 0, Base 0, Slot 10

Bit	Symbol	Signal Name	Connector No.
7			C10-A14
6			C10-B14
5			C10-A15
4			C10-B15
3			C10-A16
2			C10-B16
1			C10-A17
0			C10-B17

Diagnose No. : 218 (Y018) Group 0, Base 0, Slot 10

Bit	Symbol	Signal Name	Connector No.
7			C10-A8
6			C10-B8
5			C10-A9
4			C10-B9
3			C10-A10
2			C10-B10
1			C10-A1
0			C10-B1

Diagnose No. : 219 (Y019) Group 0, Base 0, Slot 10

Bit	Symbol	Signal Name	Connector No.
7			C10-A2
6			C10-B2
5			C10-A3
4			C10-B3
3			C10-A4
2			C10-B4
1			C10-A5
0			C10-B5

Diagnose No. : 220 (Y020) Group 1, Base 0, Slot 2

Bit	Symbol	Signal Name	Connector No.
7			C41-46
6			C41-30
5			C41-47
4			C41-31
3			C41-15
2			C41-48
1	MS97	APC arm 2 drive	C41-32
0	MS96	APC arm 1 drive	C41-16

Diagnose No. : 221 (Y021) Group 1, Base 0, Slot 2

Bit	Symbol	Signal Name	Connector No.
7			C41-42
6			C41-10
5			C41-43
4	IV2RST	APC inverter reset	C41-27
3	IV2X2	APC inverter speed 2	C41-11
2	IV2X1	APC inverter speed 1	C41-44
1	IV2STR	APC inverter reverse	C41-28
0	IV2STF	APC inverter forward	C41-12

Diagnose No. : 222 (Y022) Group 1, Base 0, Slot 2

Bit	Symbol	Signal Name	Connector No.
7			C41-37
6	PCINL2	Pallet 2 load switch lamp	C41-22
5	PRDY2	Pallet 2 ready switch lamp	C41-38
4	PCOUTL	Pallet unload switch lamp	C41-23
3	PCINL1	Pallet 1 load switch lamp	C41-6
2	PRDY1	Pallet 1 ready switch lamp	C41-39
1	PCSPL	APC stop switch lamp	C41-24
0	PCMAL	APC manual switch lamp	C41-7

Diagnose No. : 223 (Y023) Group 1, Base 0, Slot 2

Bit	Symbol	Signal Name	Connector No.
7	S914	APC door unlock	C41-33
6			C41-1
5			C41-34
4			C41-19
3			C41-2
2			C41-35
1			C41-20
0			C41-3

Diagnose No. : 254 (Y054) Group 2, Base 0, Slot 4

Bit	Symbol	Signal Name	Connector No.
7			C43-A20
6	STRB	Tool No. & pot No. strobe	C43-B20
5	ATCBZR	ATC buzzer	C43-A21
4	ALTL	Alarm tool lamp	C43-B21
3	SPNTL	Spindle tool lamp	C43-A22
2	POTML	Pot mode lamp	C43-B22
1	NEXTL	Next tool lamp	C43-A23
0	MCTL	Tool change lamp	C43-B23

Diagnose No. : 255 (Y055) Group 2, Base 0, Slot 4

Bit	Symbol	Signal Name	Connector No.
7	TD7	Tool No. & pot No. data 7	C43-A14
6	TD6	Tool No. & pot No. data 6	C43-B14
5	TD5	Tool No. & pot No. data 5	C43-A15
4	TD4	Tool No. & pot No. data 4	C43-B15
3	TD3	Tool No. & pot No. data 3	C43-A16
2	TD2	Tool No. & pot No. data 2	C43-B16
1	TD1	Tool No. & pot No. data 1	C43-A17
0	TD0	Tool No. & pot No. data 0	C43-B17

Diagnose No. : 256 (Y056) Group 2, Base 0, Slot 4

Bit	Symbol	Signal Name	Connector No.
7	TLULL	Tool loader unlock lamp	C43-A8
6	SL717	Tool loader unlock	C43-B8
5			C43-A9
4			C43-B9
3	TA8	Tool No. & pot No. address 8	C43-A10
2	TA4	Tool No. & pot No. address 4	C43-B10
1	TA2	Tool No. & pot No. address 2	C43-A1
0	TA1	Tool No. & pot No. address 1	C43-B1

Diagnose No. : 257 (Y057) Group 2, Base 0, Slot 4

Bit	Symbol	Signal Name	Connector No.
7			C43-A2
6			C43-B2
5	SL770B	Sub arm tool lock	C43-A3
4	SL770A	Sub arm tool unlock	C43-B3
3	SL754B	Sub arm pot unclamp	C43-A4
2	SL754A	Sub arm pot clamp	C43-B4
1	SL89B	Carrier pot unclamp	C43-A5
0	SL89A	Carrier pot clamp	C43-B5

10.4.2 Control Panel Side I/O Tables

Diagnose No. : 096 (X096) Group 2, Base 0

Bit	Symbol	Signal Name	Connector No.
7	HS	Handle mode	CM1-21
6	JS	Jog mode	CM1-3
5	RTS	Rapid feed mode	CM1-35
4	ZRNS	Zero return mode	CM1-20
3	EDTS	Edit mode	CM1-2
2	MEMS	Memory mode	CM1-34
1	DS	MDI mode	CM1-19
0	TS	Tape mode	CM1-1

Diagnose No. : 097 (X097) Group 2, Base 0

Bit	Symbol	Signal Name	Connector No.
7	OTRS	OT release	CM1-6
6	JOG+	Jog (+) switch	CM1-38
5	JOG–	Jog (–) switch	CM1-23
4	5AXS	5th axis select	CM1-5
3	4AXS	4th axis select	CM1-37
2	ZAXS	Z axis select	CM1-22
1	YAXS	Y axis select	CM1-4
0	XAXS	X axis select	CM1-36

Diagnose No. : 098 (X098) Group 2, Base 0

Bit	Symbol	Signal Name	Connector No.
7	FXS03	Flexible switch 03 (scraper)	CM1-9
6	FXS02	Flexible switch 02 (nozzle coolant)	CM1-41
5	FXS01	Flexible switch 01 (coolant On/Off)	CM1-8
4	STS	Cycle start	CM1-40
3	SPS	Feed hold	CM1-25
2	SPST	Spindle start	CM1-7
1	SPSP	Spindle stop	CM1-39
0	KEY I	Memory protect release	CM1-24

Diagnose No. : 099 (X099) Group 2, Base 0

Bit	Symbol	Signal Name	Connector No.
7	STUCS	Spindle tool unclamp	CM1-44
6			CM1-28
5	FXS09	Flexible switch 09 (handle interrupt)	CM1-11
4	FXS08	Flexible switch 08 (single block)	CM1-43
3	FXS07	Flexible switch 07 (optional stop)	CM1-27
2	FXS06	Flexible switch 06 (dry run)	CM1-10
1	FXS05	Flexible switch 05 (light)	CM1-42
0	FXS04	Flexible switch 04 (power off)	CM1-26

Diagnose No. : 100 (X100) Group 2, Base 0

Bit	Symbol	Signal Name	Connector No.
7	FXS12	Flexible switch 12 (program restart)	CM1-31
6	FXS11	Flexible switch 11 (program skip)	CM1-14
5	JVM	Jog feed rate switch inhibit	CM1-46
4	JV16 I	Jog feed rate switch 16	CM1-30
3	JV8 I	Jog feed rate switch 8	CM1-13
2	JV4 I	Jog feed rate switch 4	CM1-45
1	JV2 I	Jog feed rate switch 2	CM1-29
0	JV1 I	Jog feed rate switch 1	CM1-12

Diagnose No. : 101 (X101) Group 2, Base 0

Bit	Symbol	Signal Name	Connector No.
7	POFFS	Power Off	CM1-50
6			CM1-17
5			CM1-49
4			CM1-16
3	ROVM	Rapid feed override switch inhibit	CM1-48
2	ROV4 I	Rapid feed override 4	CM1-32
1	ROV2 I	Rapid feed override 2	CM1-15
0	ROV1 I	Rapid feed override 1	CM1-47

Diagnose No. : 102 (X102) Group 2, Base 0

Bit	Symbol	Signal Name	Connector No.
7	OTFST	One-touch function start	CM2-21
6	OTFSP	One-touch function stop	CM2-3
5	FVM	Feed override switch inhibit	CM2-35
4	FV16 I	Feed override switch 16	CM2-20
3	FV8 I	Feed override switch 8	CM2-2
2	FV4 I	Feed override switch 4	CM2-34
1	FV2 I	Feed override switch 2	CM2-19
0	FV1 I	Feed override switch 1	CM2-1

Diagnose No. : 103 (X103) Group 2, Base 0

Bit	Symbol	Signal Name	Connector No.
7	OTFS4	One-touch function 4 (auto tool change)	CM2-6
6	OTFS3	One-touch function 3 (specified tool change)	CM2-38
5	OTFS2	One-touch function 2 (set up position return)	CM2-23
4	OTFS1	One-touch function 1 (all axes zero return)	CM2-5
3	SOVM	Spindle override switch inhibit	CM2-37
2	SOV4 I	Spindle override 4	CM2-22
1	SOV2 I	Spindle override 2	CM2-4
0	SOV1 I	Spindle override 1	CM2-36

Diagnose No. : 104 (X104) Group 2, Base 0

Bit	Symbol	Signal Name	Connector No.
7	CHK–Z	Rakuraku checker –Z	CM2-9
6	CHK–Y	Rakuraku checker –Y	CM2-41
5	CHK+Y	Rakuraku checker +Y	CM2-8
4	CHK–X	Rakuraku checker –X	CM2-40
3	CHK+X	Rakuraku checker +X	CM2-25
2	CHKCTR	Rakuraku checker center point measure	CM2-7
1	CHKFIN	Rakuraku checker finish	CM2-39
0	CHKST	Rakuraku checker start	CM2-24

Diagnose No. : 105 (X105) Group 2, Base 0

Bit	Symbol	Signal Name	Connector No.
7			CM2-44
6			CM2-28
5			CM2-11
4			CM2-43
3			CM2-27
2			CM2-10
1			CM2-42
0	CHKHL	Rakuraku checker hole measure	CM2-26

Diagnose No. : 106 (X106) Group 2, Base 0

Bit	Symbol	Signal Name	Connector No.
7			CM2-31
6			CM2-14
5			CM2-46
4			CM2-30
3			CM2-13
2			CM2-45
1			CM2-29
0			CM2-12

Diagnose No. : 107 (X107) Group 2, Base 0

Bit	Symbol	Signal Name	Connector No.
7			CM2-50
6			CM2-17
5			CM2-49
4			CM2-16
3			CM2-48
2			CM2-32
1			CM2-15
0			CM2-47

Diagnose No. : 296 (Y096) Group 2, Base 0

Bit	Symbol	Signal Name	Connector No.
7			CM3-21
6	MI5L	Mirror image 5th axis	CM3-3
5	MI4L	Mirror image 4th axis	CM3-35
4	MIYL	Mirror image Y axis	CM3-20
3	MIXL	Mirror image X axis	CM3-2
2	MCREF	Machine reference position	CM3-34
1	WRNL	Warning lamp	CM3-19
0	ALML	Alarm lamp	CM3-1

Diagnose No. : 297 (Y097) Group 2, Base 0

Bit	Symbol	Signal Name	Connector No.
7	OTFS4L	One-touch function 4 (auto tool change)	CM3-6
6	OTFS3L	One-touch function 3 (specified tool change)	CM3-38
5	OTFS2L	One-touch function 2 (set up position return)	CM3-23
4	OTFS1L	One-touch function 1 (all axes zero return)	CM3-5
3	OTFSTL	One-touch function start	CM3-37
2	OTFSPL	One-touch function stop	CM3-22
1	FXL12	Flexible switch 12 (program restart)	CM3-4
0	FXL11	Flexible switch 11 (program skip)	CM3-36

Diagnose No. : 298 (Y098) Group 2, Base 0

Bit	Symbol	Signal Name	Connector No.
7	FXL03	Flexible switch lamp 03 (scraper)	CM3-9
6	FXL02	Flexible switch lamp 02 (nozzle coolant)	CM3-41
5	FXL01	Flexible switch lamp 01 (coolant On/Off)	CM3-8
4	STLO	Cycle start lamp	CM3-40
3	SPSLO	Feed hold lamp	CM3-25
2	SPSTL	Spindle start lamp	CM3-7
1			CM3-39
0	POFFL	Power Off	CM3-24

Diagnose No. : 299 (Y099) Group 2, Base 0

Bit	Symbol	Signal Name	Connector No.
7	STUCL	Spindle tool unclamp lamp	CM3-44
6			CM3-28
5	FXL09	Flexible switch lamp 09 (handle interrupt)	CM3-11
4	FXL08	Flexible switch lamp 08 (single block)	CM3-43
3	FXL07	Flexible switch lamp 07 (optional stop)	CM3-27
2	FXL06	Flexible switch lamp 06 (dry run)	CM3-10
1	FXL05	Flexible switch lamp 05 (light)	CM3-42
0	FXL04	Flexible switch lamp 04 (power off)	CM3-26

Diagnose No. : 300 (Y100) Group 2, Base 0

Bit	Symbol	Signal Name	Connector No.
7			CM3-31
6			CM3-14
5			CM3-46
4			CM3-30
3			CM3-13
2			CM3-45
1			CM3-29
0			CM3-12

Diagnose No. : 301 (Y101) Group 2, Base 0

Bit	Symbol	Signal Name	Connector No.
7			CM3-50
6			CM3-17
5			CM3-49
4			CM3-16
3			CM3-48
2			CM3-32
1			CM3-15
0			CM3-47

Diagnose No. : 302 (Y102) Group 2, Base 0

Bit	Symbol	Signal Name	Connector No.
7			CM4-3
6			CM4-16
5			CM4-9
4			CM4-2
3			CM4-15
2			CM4-8
1	CHKBUZ	Rakuraku checker buzzer	CM4-1
0	CHKSTL	Rakuraku checker start	CM4-14

Diagnose No. : 303 (Y103) Group 2, Base 0

Bit	Symbol	Signal Name	Connector No.
7			CM4-19
6			CM4-12
5			CM4-5
4			CM4-18
3			CM4-11
2			CM4-4
1			CM4-17
0			CM4-10

10.5 V33 Machine I/O Tables

10.5.1 Machine Side I/O Tables

Diagnose No. : 004 (X004) I/O Link Channel 1, Group 2, Basic Module

Bit	Symbol	Signal Name	Connector No.
7	SKIP	Skip signal	CB150A-49
6	CB2	Branch circuit protection breaker trip signal	CB150A-48
5	*OMAL	Spindle Oilmatic alarm	CB150A-47
4	TH18	Oil skimmer thermal alarm	CB150A-46
3	LS912	S/G door interlock limit switch	CB150A-45
2	LS905	Air pressure switch	CB150A-44
1	LS01	Tool unclamp	CB150A-43
0	LS00	Tool clamp	CB150A-42

Diagnose No. : 005 (X005) I/O Link Channel 1, Group 2, Basic Module

Bit	Symbol	Signal Name	Connector No.
7	LS942	Manual tool change cover open	CB150A-32
6	LS748	ATC shutter open	CB150A-31
5	LS747	ATC shutter close	CB150A-30
4	LS679	ATC shifter advance	CB150A-29
3	LS680	ATC shifter retract	CB150A-28
2	LS760	ATC shifter down	CB150A-27
1	LS761	ATC shifter up	CB150A-26
0	lS99	Tool exist confirm	CB150A-25

Diagnose No. : 006 (X006) I/O Link Channel 1, Group 2, Basic Module

Bit	Symbol	Signal Name	Connector No.
7	LS901	Lubricant pressure switch	CB150A-17
6	LS900	Lubricant flow switch	CB150A-16
5	SGLKS	S/G door interlock mode	CB150A-15
4	TH3	Lubricant pump motor thermal alarm	CB150A-14
3			CB150A-13
2	MGCCW	ATC magazine counterclockwise switch	CB150A-12
1	MGCW	ATC magazine clockwise switch	CB150A-11
0	ATCMAS	ATC manual interrupt	CB150A-10

Diagnose No. : 007 (X007) I/O Link Channel 1, Group 2, Expansion Module 1

Bit	Symbol	Signal Name	Connector No.
7	TH11	Work cleaning gun pump motor thermal alarm	CB150A-49
6	MS11C	Workpiece cleaning gun	CB150A-48
5	LS1946	Tool lock	CB150A-47
4	LS1945	Main arm lock	CB150A-46
3	LS77	Main arm counterclockwise	CB150A-45
2	LS76	Main arm clockwise	CB150A-44
1	LS750	Main arm advance	CB150A-43
0	LS751	Main arm retract	CB150A-42

Diagnose No. : 008 (X008) I/O Link Channel 1, Group 2, Expansion Module 1

Bit	Symbol	Signal Name	Connector No.
7	OT2Z	Z axis overtravel	CB150B-32
6	OT2Y	Y axis overtravel	CB150B-31
5	OT2X	X axis overtravel	CB150B-30
4	*ESP	Emergency stop signal	CB150B-29
3	*EMI	Emergency stop	CB150B-28
2	TH7	Spiral chip conveyor motor thermal alarm	CB150B-27
1	RCH2	Spindle high speed	CB150B-26
0	RCH1	Spindle low speed	CB150B-25

Diagnose No. : 009 (X009) I/O Link Channel 1, Group 2, Expansion Module 1

Bit	Symbol	Signal Name	Connector No.
7	LS170	Spindle lubricant flow detect	CB150B-17
6	LS173	Spindle lubricant filter press. differential detect	CB150B-16
5	*DEC6	ATC magazine zero return/6th axis zero return decelerate signal	CB150B-15
4	*DEC5	ATC magazine zero return/5th axis zero return decelerate signal	CB150B-14
3	*DEC4	ATC magazine zero return/4th axis zero return decelerate signal	CB150B-13
2	*DECZ	Z axis zero return decelerate signal	CB150B-12
1	*DECY	Y axis zero return decelerate signal	CB150B-11
0	*DECX	X axis zero return decelerate signal	CB150B-10

Diagnose No. : 010 (X010) I/O Link Channel 1, Group 2, Expansion Module 2

Bit	Symbol	Signal Name	Connector No.
7			CB150C-49
6			CB150C-48
5			CB150C-47
4	CPTP	In panel protector trip	CB150C-46
3	OMAL2	Coolant Oilmatic alarm	CB150C-45
2			CB150C-44
1	TH2	Nozzle coolant thermal alarm	CB150C-43
0	AIRAL	Air dryer alarm	CB150C-42

Diagnose No. : 011 (X011) I/O Link Channel 1, Group 2, Expansion Module 2

Bit	Symbol	Signal Name	Connector No.
7	LS152	4th axis unclamp	CB150C-32
6	LS151	4th axis clamp	CB150C-31
5	DTCH4	4th axis ignore	CB150C-30
4			CB150C-29
3	LS303	Tool length sensor protect cover open confirm	CB150C-28
2	LS302	Tool length sensor protect cover close confirm	CB150C-27
1	LS316	Calibration ring cover open confirm	CB150C-26
0	LS315	Calibration ring cover close confirm	CB150C-25

Diagnose No. : 012 (X012) I/O Link Channel 1, Group 2, Expansion Module 2

Bit	Symbol	Signal Name	Connector No.
7			CB150C-17
6	TH19	Mist collector thermal alarm	CB150C-16
5	UMDI 2	User DI signal 2	CB150C-15
4	UMDI 1	User DI signal 1	CB150C-14
3	ATON	Warming up On	CB150C-13
2	MSALB	Battery error	CB150C-12
1	MSALA	Receive alarm	CB150C-11
0	ATONMD	Auto power On/Running mode	CB150C-10

Diagnose No. : 013 (X013) I/O Link Channel 1, Group 2, Expansion Module 3

Bit	Symbol	Signal Name	Connector No.
7	LCREV	L/C reverse switch	CB150D-49
6	LCFWD	L/C forward switch	CB150D-48
5	LCMAS	L/C manual switch	CB150D-47
4	TH6A	Filter back wash motor thermal alarm	CB150D-46
3	TH6	Lift-up chip conveyuor motor thermal alarm	CB150D-45
2	LS1319	Coolant tank flow switch	CB150D-44
1	LS1306	Lift-up chip conveyor slip detect	CB150D-43
0	LS181	Nozzle coolant flow switch	CB150D-42

Diagnose No. : 014 (X014) I/O Link Channel 1, Group 2, Expansion Module 3

Bit	Symbol	Signal Name	Connector No.
7			CB150D-32
6			CB150D-31
5			CB150D-30
4	5NG	5th axis ignore	CB150D-29
3	–L5	5th axis – stroke end	CB150D-28
2	+L5	5th axis + stroke end	CB150D-27
1	LS155	5th axis unclamp	CB150D-26
0	LS154	5th axis clamp	CB150D-25

Diagnose No. : 011 (X011) I/O Link Channel 1, Group 2, Expansion Module 2

Bit	Symbol	Signal Name	Connector No.
7			CB150D-17
6			CB150D-16
5			CB150D-15
4			CB150D-14
3			CB150D-13
2			CB150D-12
1			CB150D-11
0			CB150D-10

Diagnose No. : 200 (Y000) I/O Link Channel 1, Group 2, Basic Module

Bit	Symbol	Signal Name	Connector No.
7	SL01B	Tool unclamp	CB150A-41
6	SL01A	Tool clamp	CB150A-40
5	SL181	Air blow	CB150A-39
4	OMON	Spindle Oilmatic start	CB150A-38
3	MS3	Lubricant pump	CB150A-37
2	OTR	OT release	CB150A-36
1	SA	Servo ready	CB150A-35
0	POUT1	Auto power Off	CB150A-34

Diagnose No. : 201 (Y001) I/O Link Channel 1, Group 2, Basic Module

Bit	Symbol	Signal Name	Connector No.
7	SL750B	Swing arm advance	CB150A-09
6	SL750A	Swing arm retract	CB150A-08
5	SL711B	Shutter open	CB150A-07
4	SL711A	Shutter close	CB150A-06
3	SL758B	Shifter advance	CB150A-05
2	SL758A	Shifter retract	CB150A-04
1	SL754B	Shifter down	CB150A-03
0	SL754A	Shifter up	CB150A-02

Diagnose No. : 202 (Y002) I/O Link Channel 1, Group 2, Expansion Module 1

Bit	Symbol	Signal Name	Connector No.
7	LGT	Machine light	CB150B-41
6	ATCMAL	ATC manual interrupt	CB150B-40
5	MS19	Mist collector	CB150B-39
4			CB150B-38
3	SL09	Taper cleaning air 1	CB150B-37
2	SL770	Main arm lock	CB150B-36
1	SL73B	Main arm counterclockwise	CB150B-35
0	SL73A	Main arm clockwise	CB150B-34

Diagnose No. : 007 (X007) I/O Link Channel 1, Group 2, Expansion Module 1

Bit	Symbol	Signal Name	Connector No.
7	POUT2	Auto power Off 2	CB150B-09
6	M330	Tool length measure circuit check	CB150B-08
5	M320	Tool length measure mode	CB150B-07
4	NMSMD	Non-measure mode (M86 mode)	CB150B-06
3			CB150B-05
2	SGOP	S/G door unlock mode	CB150B-04
1	HAMOD	Handle mode	CB150B-03
0	RCHP	Spindle winding changeover	CB150B-02

Diagnose No. : 204 (Y004) I/O Link Channel 1, Group 2, Expansion Module 2

Bit	Symbol	Signal Name	Connector No.
7	SL913	ATC door lock	CB150C-41
6	MS2	Coolant	CB150C-40
5	HOUR2	Time count meter (auto operation)	CB150C-39
4	HOUR1	Time count meter (spindle rotation)	CB150C-38
3	OPPON	Probe power On	CB150C-37
2	PTL3	3rd signal light/3rd revolving light	CB150C-36
1	PTL2	2nd signal light/2nd revolving light	CB150C-35
0	PTL1	1st signal light/1st revolving light	CB150C-34

Diagnose No. : 205 (Y005) I/O Link Channel 1, Group 2, Expansion Module 2

Bit	Symbol	Signal Name	Connector No.
7	SL192	Through-spindle air	CB150C-09
6	SL150	4th axis unclamp	CB150C-08
5	SL302	Spindle tool cleaning air	CB150C-07
4	SL300B	Tool length sensor protect cover open	CB150C-06
3	SL300A	Tool length sensor protect cover close	CB150C-05
2	SL180	Oil mist	CB150C-04
1	UMDO 2	User DO signal 2	CB150C-03
0	UMDO 1	User DO signal 1	CB150C-02

Diagnose No. : 206 (Y006) I/O Link Channel 1, Group 2, Expansion Module 3

Bit	Symbol	Signal Name	Connector No.
7	SL311A	Calibration ring cover close	CB150D-41
6	SL301	Tool length sensor cleaning air	CB150D-40
5			CB150D-39
4	MS18	Oil skimmer	CB150D-38
3	MS7	Scraper chip conveyor	CB150D-37
2	SL16	Taper cleaning air 2	CB150D-36
1			CB150D-35
0			CB150D-34

Diagnose No. : 207 (Y007) I/O Link Channel 1, Group 2, Expansion Module 3

Bit	Symbol	Signal Name	Connector No.
7	SL151	5th axis unclamp	CB150D-09
6	LCRUNL	L/C operation lamp	CB150D-08
5	LCALML	L/C alarm lamp	CB150D-07
4	LSMAL	L/C manual lamp	CB150D-06
3	MS6R	Lift-up chip conveyor reverse	CB150D-05
2	MS6F	Lift-up chip conveyor forward	CB150D-04
1	SL312	Calibration ring cleaning air	CB150D-03
0	SL311b	Calibration ring cover open	CB150D-02

10.5.2 Control Panel Side I/O Tables

Diagnose No. : 096 (X096) I/O Link Channel 1, Group 0

Bit	Symbol	Signal Name	Connector No.
7	ZRNS	Zero return mode	CE56A-B05
6	RTS	Rapid feed mode	CE56A-A05
5	JS	Jog mode	CE56A-B04
4	HS	Handle mode	CE56A-A04
3	TS	Tape mode	CE56A-B03
2	DS	MDI mode	CE56A-A03
1	MEMS	Memory mode	CE56A-B02
0	EDTS	Edit mode	CE56A-A02

Diagnose No. : 097 (X097) I/O Link Channel 1, Group 0

Bit	Symbol	Signal Name	Connector No.
7	FPS8	Flexible switch 08 (single block)	CE56A-B09
6	FPS7	Flexible switch 07 (optional stop)	CE56A-A09
5	FPS6	Flexible switch 06 (dry run)	CE56A-B08
4	FPS5	Flexible switch 05 (light)	CE56A-A08
3	FPS4	Flexible switch 04 (auto power Off)	CE56A-B07
2	FPS3	Flexible switch 03 (air blow)	CE56A-A07
1	FPS2	Flexible switch 02 (nozzle coolant)	CE56A-B06
0	FPS1	Flexible switch 01 (coolant On/Off)	CE56A-A06

Diagnose No. : 098 (X098) I/O Link Channel 1, Group 0

Bit	Symbol	Signal Name	Connector No.
7			CE56A-B13
6			CE56A-A13
5			CE56A-B12
4			CE56A-A12
3			CE56A-B1
2			CE56A-A1
1			CE56A-B10
0			CE56A-A10

Diagnose No. : 099 (X099) I/O Link Channel 1, Group 0

Bit	Symbol	Signal Name	Connector No.
7			CE57A-B05
6			CE57A-A05
5			CE57A-B04
4	FPS13	Flexible switch 13	CE57A-A04
3	FPS12	Flexible switch 12 (program restart)	CE57A-B03
2	FPS11	Flexible switch 11 (block skip)	CE57A-A03
1	FPS10	Flexible switch 10	CE57A-B02
0	FPS9	Flexible switch 09 (handle interrupt)	CE57A-A02

Diagnose No. : 100 (X100) I/O Link Channel 1, Group 0

Bit	Symbol	Signal Name	Connector No.
7	OTFST	One-touch function start	CE57A-B09
6	OTFSP	One-touch function stop	CE57A-A09
5			CE57A-B08
4			CE57A-A08
3	OTFS4	One-touch function 04 (spec. tool change 2)	CE57A-B07
2	OTFS3	One-touch function 03 (specified tool change)	CE57A-A07
1	OTFS2	One-touch function 02 (set up position return)	CE57A-B06
0	OTFS1	One-touch function 01 (all axes zero return)	CE57A-A06

Diagnose No. : 101 (X101) I/O Link Channel 1, Group 0

Bit	Symbol	Signal Name	Connector No.
7	JOG+	Feed direction (+)	CE57A-B13
6	JOG–	Feed direction (–)	CE57A-A13
5	CsAXS	Cs axis select	CE57A-B12
4	5AXS	5th axis select	CE57A-A12
3	4AXS	4th axis select	CE57A-B1
2	ZAXS	Z axis select	CE57A-A1
1	YAXS	Y axis select	CE57A-B10
0	XAXS	X axis select	CE57A-A10

Control Panel I/O Module 2

Diagnose No.: 112 (X112) I/O Link Channel 1, Group 1

Bit	Symbol	Signal Name	Connector No.
7			
6			
5	JVM	Jog feedrate switch (inhibit)	CE56B-B05
4	JV16 I	Jog feedrate switch (16)	CE56B-A05
3	JV8 I	Jog feedrate switch (8)	CE56B-B04
2	JV4 I	Jog feedrate switch (4)	CE56B-A04
1	JV2 I	Jog feedrate switch (2)	CE56B-B03
0	JV1 I	Jog feedrate switch (1)	CE56B-A03

Diagnose No.: 113 (X113) I/O Link Channel 1, Group 1

Bit	Symbol	Signal Name	Connector No.
7	SOVM	Spindle override switch (inhibit)	CE56B-B09
6	SOV4 I	Spindle override switch (4)	CE56B-A09
5	SOV2 I	Spindle override switch (2)	CE56B-B08
4	SOV1 I	Spindle override switch (1)	CE56B-A08
3	ROVM	Rapid feed override switch (inhibit)	CE56B-B07
2	ROV4 I	Rapid feed override switch (4)	CE56B-A07
1	ROV2 I	Rapid feed override switch (2)	CE56B-B06
0	ROV1 I	Rapid feed override switch (1)	CE56B-A06

Diagnose No.: 114 (X114) I/O Link Channel 1, Group 1

Bit	Symbol	Signal Name	Connector No.
7			CE56B-B14
6			CE56B-A14
5	FVM	Feed override switch (inhibit)	CE56B-B13
4	FV16 I	Feed override switch (16)	CE56B-A13
3	FV8 I	Feed override switch (8)	CE56B-B12
2	FV4 I	Feed override switch (4)	CE56B-A12
1	FV2 I	Feed override switch (2)	CE56B-B1
0	FV1 I	Feed override switch (1)	CE56B-A1

Diagnose No.: 115 (X115) I/O Link Channel 1, Group 1

Bit	Symbol	Signal Name	Connector No.
7	MGCCW	ATC magazine counterclockwise switch	CE57B-B05
6	MGCW	ATC magazine clockwise switch	CE57B-A05
5	ATCMAS	ATC magazine manual interrupt	CE57B-B04
4	STUCS	Spindle tool unclamp	CE57B-A04
3	SPST	Spindle start	CE57B-B03
2	SPSP	Spindle stop	CE57B-A03
1	STS	Spindle stop	CE57B-B02
0	SPS	Feed hold	CE57B-A02

Diagnose No.: 116 (X116) I/O Link Channel 1, Group 1

Bit	Symbol	Signal Name	Connector No.
7	H5S	Handle select (5th axis)	CE57B-B05
6	H4S	Handle select (4th axis)	CE57B-A05
5	HZ2S	Handle select (Z axis: 2nd manual pulse)	CE57B-B04
4	HZS	Handle select (Z axis)	CE57B-A04
3	HYS	Handle select (Y axis)	CE57B-B03
2	HXS	Handle select (X axis)	CE57B-A03
1	MP2S	Handle multiplication X100	CE57B-B02
0	MP1S	Handle multiplication X10	CE57B-A02

Diagnose No.: 117 (X117) I/O Link Channel 1, Group 1

Bit	Symbol	Signal Name	Connector No.
7	POFFL	Power Off	CE57B-B13
6	SPLKS	Spindle lock	CE57B-A13
5	DRYMS	Dry machining mode	CE57B-B12
4	OTRS	OT release	CE57B-A12
3	KEY1	Memory protect release	CE57B-B1
2	EPSBI	S/G door interlock release	CE57B-A1
1	MOPMUL	Main control panel mode unlock	CE57B-B10
0	HCSI	Handle select (Cs axis)	CE57B-A10

Diagnose No. : 296 (Y096) I/O Link Channel 1, Group 0

Bit	Symbol	Signal Name	Connector No.
7	ZRNL	Zero return mode	CE56A-B19
6	RTL	Rapid feed mode	CE56A-A19
5	JL	Jog feed mode	CE56A-B18
4	HL	Handle mode	CE56A-A18
3	TL	Tape mode	CE56A-B17
2	DL	MDI mode	CE56A-A17
1	MEML	Memory mode	CE56A-B16
0	EDTL	Edit mode	CE56A-A16

Diagnose No. : 297 (Y097) I/O Link Channel 1, Group 0

Bit	Symbol	Signal Name	Connector No.
7	FXL09	Flexible switch 08 (single stop)	CE56A-B23
6	FXL08	Flexible switch 07 (optional stop)	CE56A-A23
5	FXL07	Flexible switch 06 (dry run)	CE56A-B22
4	FXL06	Flexible switch 05 (light)	CE56A-A22
3	FXL05	Flexible switch 04 (auto power Off)	CE56A-B21
2	FXL04	Flexible switch 03 (air blow)	CE56A-A21
1	FXL02	Flexible switch 02 (nozzle coolant)	CE56A-B20
0	FXL01	Flexible switch 01 (coolant On/Off)	CE56A-A20

Diagnose No. : 298 (Y098) I/O Link Channel 1, Group 0

Bit	Symbol	Signal Name	Connector No.
7			CE57A-B19
6			CE57A-A19
5	FXL14	Flexible switch 14	CE57A-B18
4	FXL13	Flexible switch 13	CE57A-A18
3	FXL12	Flexible switch 12 (program restart)	CE57A-B17
2	FXL11	Flexible switch 11 (block skip)	CE57A-A17
1	FXL10	Flexible switch 10	CE57A-B16
0	FXL09	Flexible switch 09 (handle interrupt)	CE57A-A16

Diagnose No. : 299 (Y099) I/O Link Channel 1, Group 0

Bit	Symbol	Signal Name	Connector No.
7	OTFSTL	One-touch function start	CE57A-B23
6	OTFSPL	One-touch function stop	CE57A-A23
5			CE57A-B22
4			CE57A-A22
3	OTF04L	One-touch function 4 (specified tool change 2)	CE57A-B21
2	OTF03L	One-touch function 3 (specified tool change)	CE57A-A21
1	OTF02L	One-touch function 2 (set up position return)	CE57A-B20
0	OTF01L	One-touch function 1 (all axes zero return)	CE57A-A20

Diagnose No. : 300 (Y100) I/O Link Channel 1, Group 1

Bit	Symbol	Signal Name	Connector No.
7	MCREF	Machine reference point return complete	CE56B-B19
6	WRNL	Warning display	CE56B-A19
5	ALML	Alarm display	CE56B-B18
4		Cs axis mirror image	CE56B-A18
3	MI5L	5th axis mirror image	CE56B-B17
2	MI5L	4th axis mirror image	CE56B-A17
1	MIYL	Y axis mirror image	CE56B-B16
0	MIXL	X axis mirror image	CE56B-A16

Diagnose No. : 301 (Y101) I/O Link Channel 1, Group 1

Bit	Symbol	Signal Name	Connector No.
7			CE56B-B23
6			CE56B-A23
5			CE56B-B22
4			CE56B-A22
3			CE56B-B21
2			CE56B-A21
1			CE56B-B20
0			CE56B-A20

Diagnose No. : 302 (Y102) I/O Link Channel 1, Group 0

Bit	Symbol	Signal Name	Connector No.
7			CE57B-B19
6			CE57B-A19
5	ATCMAL	ATC manual interrupt	CE57B-B18
4	PL97	Spindle tool unclamp	CE57B-A18
3	SPSTL	Spindle start	CE57B-B17
2			CE57B-A17
1	STLO	Cycle start	CE57B-B16
0	SPLO	Feed hold	CE57B-A16

Diagnose No. : 303 (Y103) I/O Link Channel 1, Group 1

Bit	Symbol	Signal Name	Connector No.
7	POFFL	Power Off	CE57B-B23
6	SPLKL	Spindle lock	CE57B-A23
5	DRYML	Dry machining mode	CE57B-B22
4	TSBUZ	Touch sensor buzzer	CE57B-A22
3			CE57B-B21
2			CE57B-A21
1			CE57B-B20
0			CE57B-A20

Chapter 11 ATC, APC, ATC Magazine Restore Procedure

V33, V55

Professional 3

Chapter 11
ATC, APC, ATC Magazine Restore Procedure

Contents

11.1 ATC

11.1.1 V55

11.1.1.1 15-/25-Tool ATC

Outline

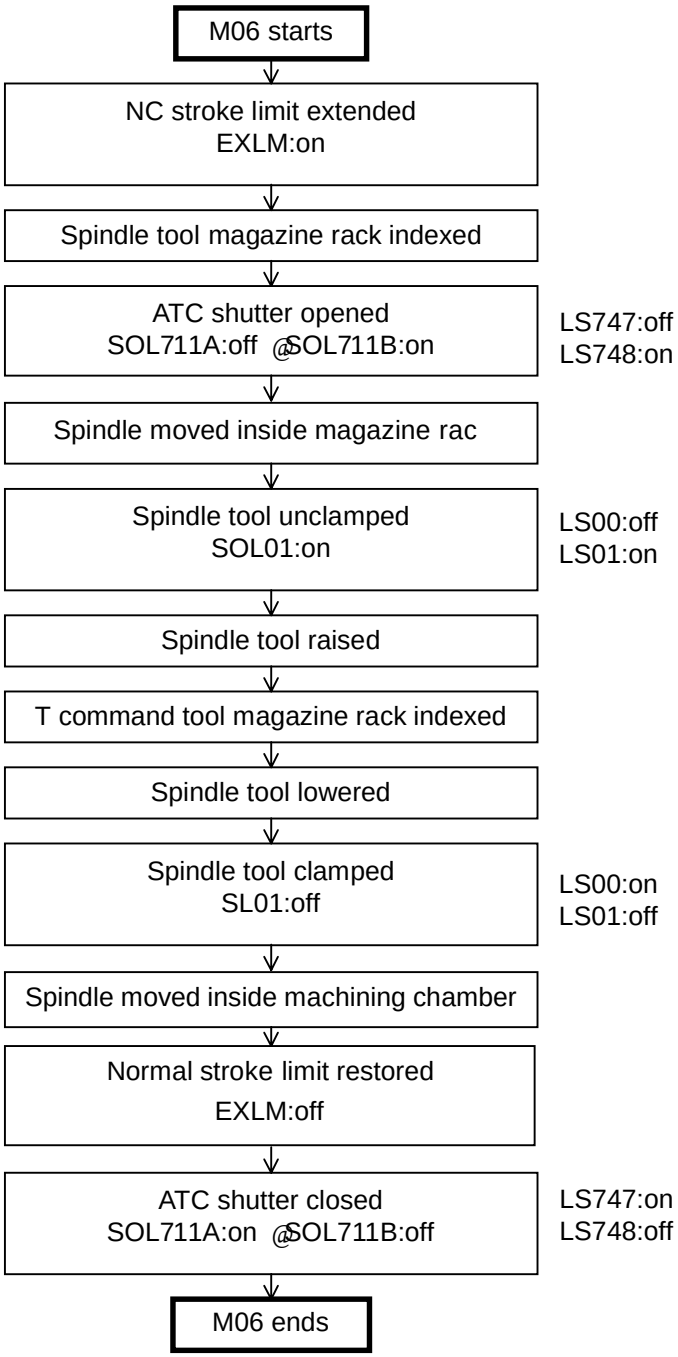
The ATC on this machine is egg-pot type. With this type of magazine, tool changes are performed by moving the magazine rotation axis and spindle.

Restore Operation

Operation is restored from the ATC maintenance screen and main control panel. Refer to section 2.9.2, ATC Maintenance Screen (PC Screens, 9 inch LCD/MDI panel chapter) or section 3.9.2, ATC Maintenance Screen (PC Screens, 14 inch LCD/MDI panel chapter) for the ATC maintenance screen usage procedure.

ATC Flow Chart

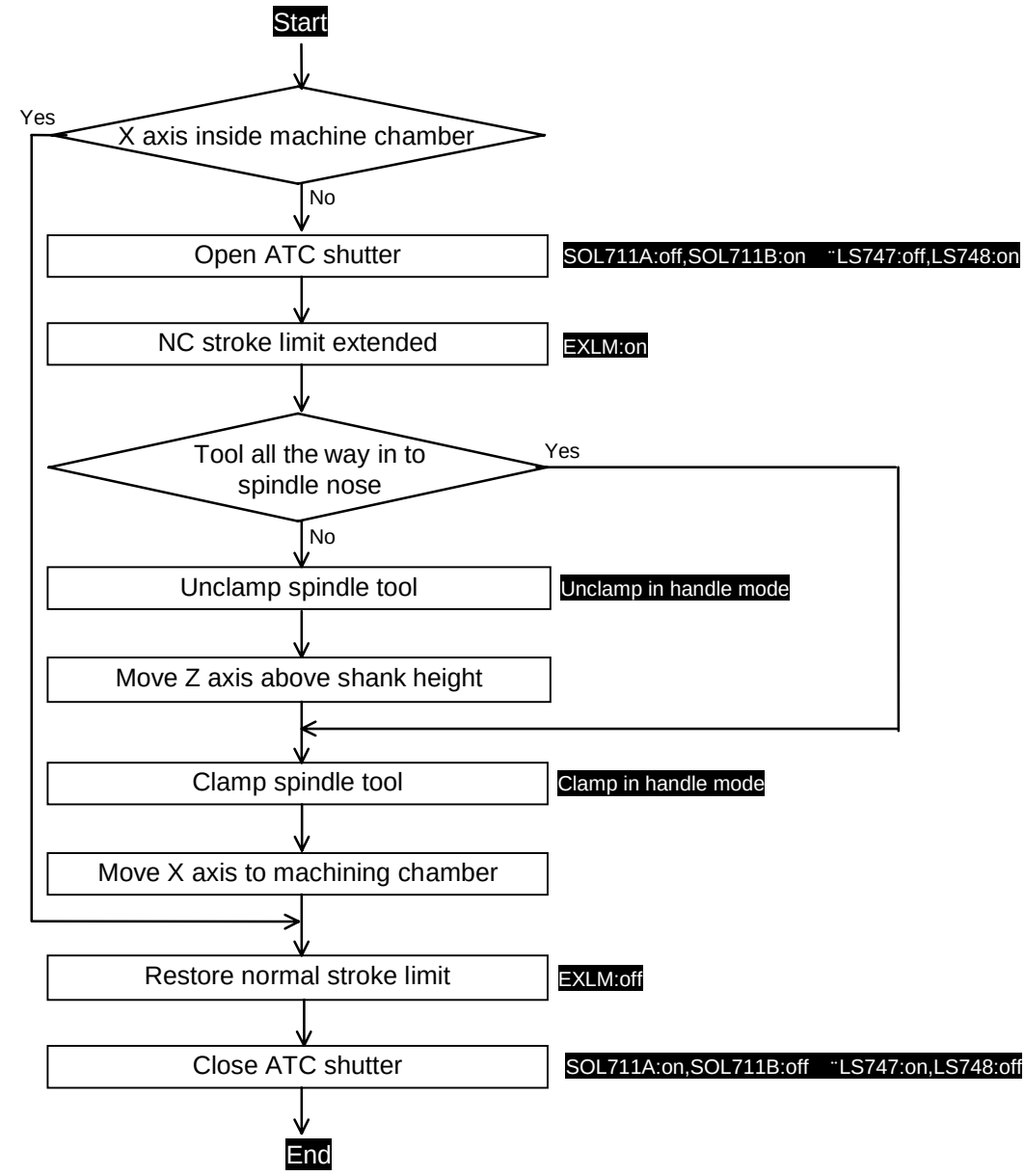
There is a high speed mode and low speed mode for ATC (M06) (automatic tool changes). In addition, in some cases, only the tool return or tool retrieve operation may be performed. However, the basic flow is the same.



Restore Procedure

The following procedure is used to restore operation. Nothing needs to be performed if the machine status already coincides with the maintenance operation.

The OT RELEASE button on the main control panel can be held down to perform an operation when it is prevented by an interlock. Please make sure to take adequate precautions at this time since releasing of interlocks may be dangerous.



Overwrite the spindle tool pot number after the restore procedure

11.1.1.2 40-/80-Tool / Matrix ATC

Outline

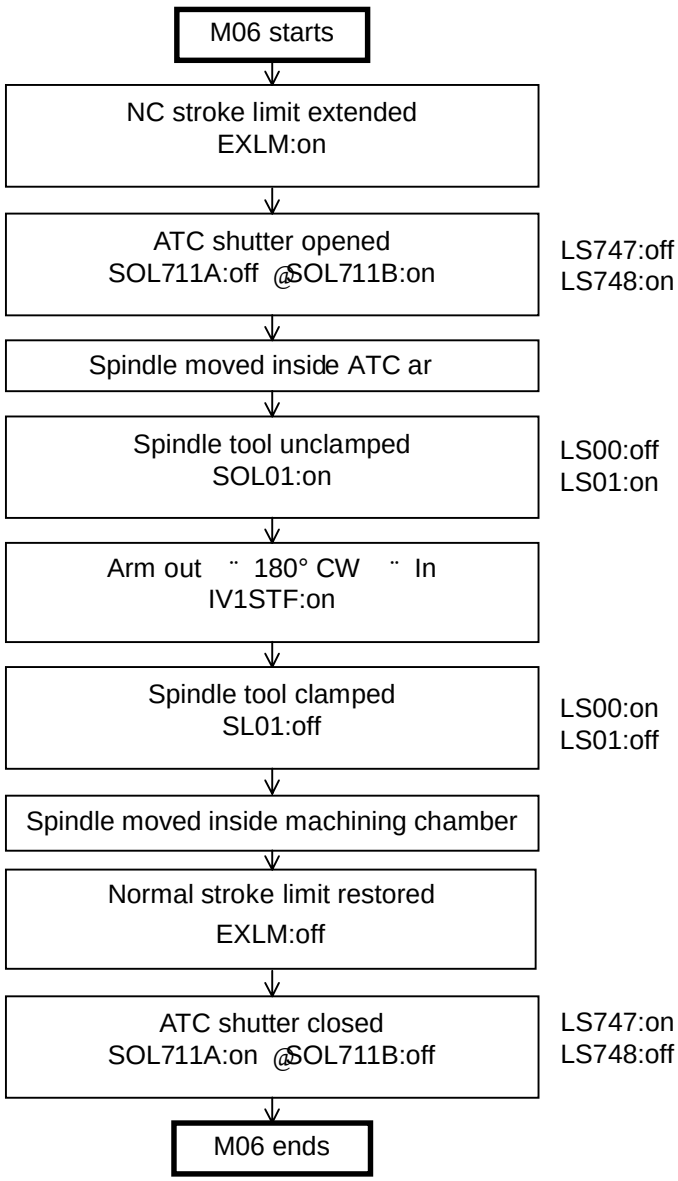
The ATC on this machine performs tool changes by moving the ATC arm (cam) and spindle. The ATC arm is controlled by an inverter.

Restore Operation

Operation is restored from the ATC maintenance screen and main control panel. Refer to section 2.9.2, ATC Maintenance Screen (PC Screens, 9 inch LCD/MDI panel chapter) or section 3.9.2, ATC Maintenance Screen (PC Screens, 14 inch LCD/MDI panel chapter) for the ATC maintenance screen usage procedure.

ATC Flow Chart

There is a high speed mode and low speed mode for ATC (M06) (automatic tool changes). In addition, in some cases, only the tool return or tool retrieve operation may be performed. However, the basic flow is the same.

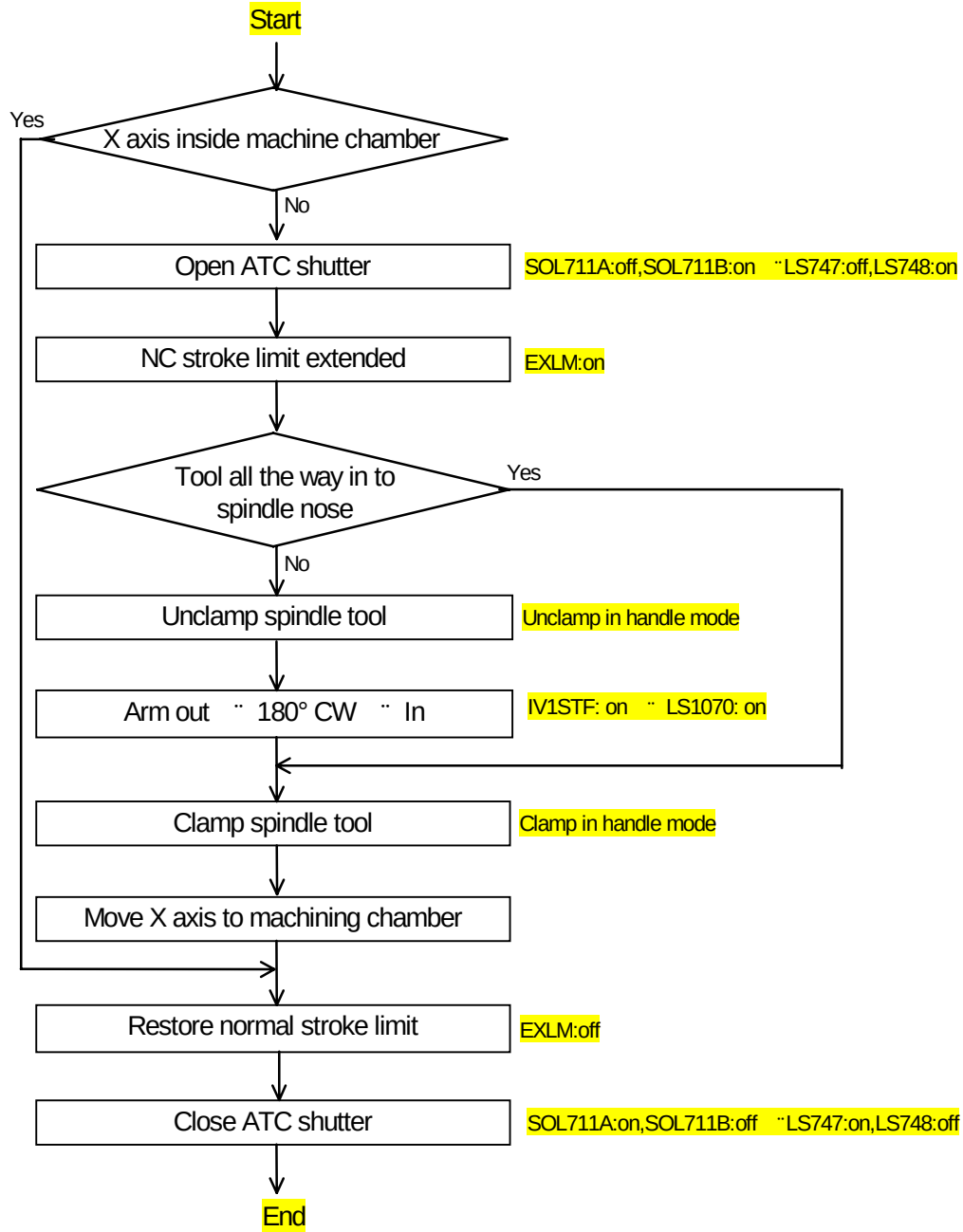


Restore Procedure

The following procedure is used to restore operation. Nothing needs to be performed if the machine status already coincides with the maintenance operation.

WARNING

The OT RELEASE button on the main control panel can be held down to perform an operation when it is prevented by an interlock. Please make sure to take adequate precautions at this time since releasing of interlocks may be dangerous.



Overwrite the spindle & next tool pot numbers after the restore procedure.

11.1.2 V33

11.1.2.1 ATC

Outline

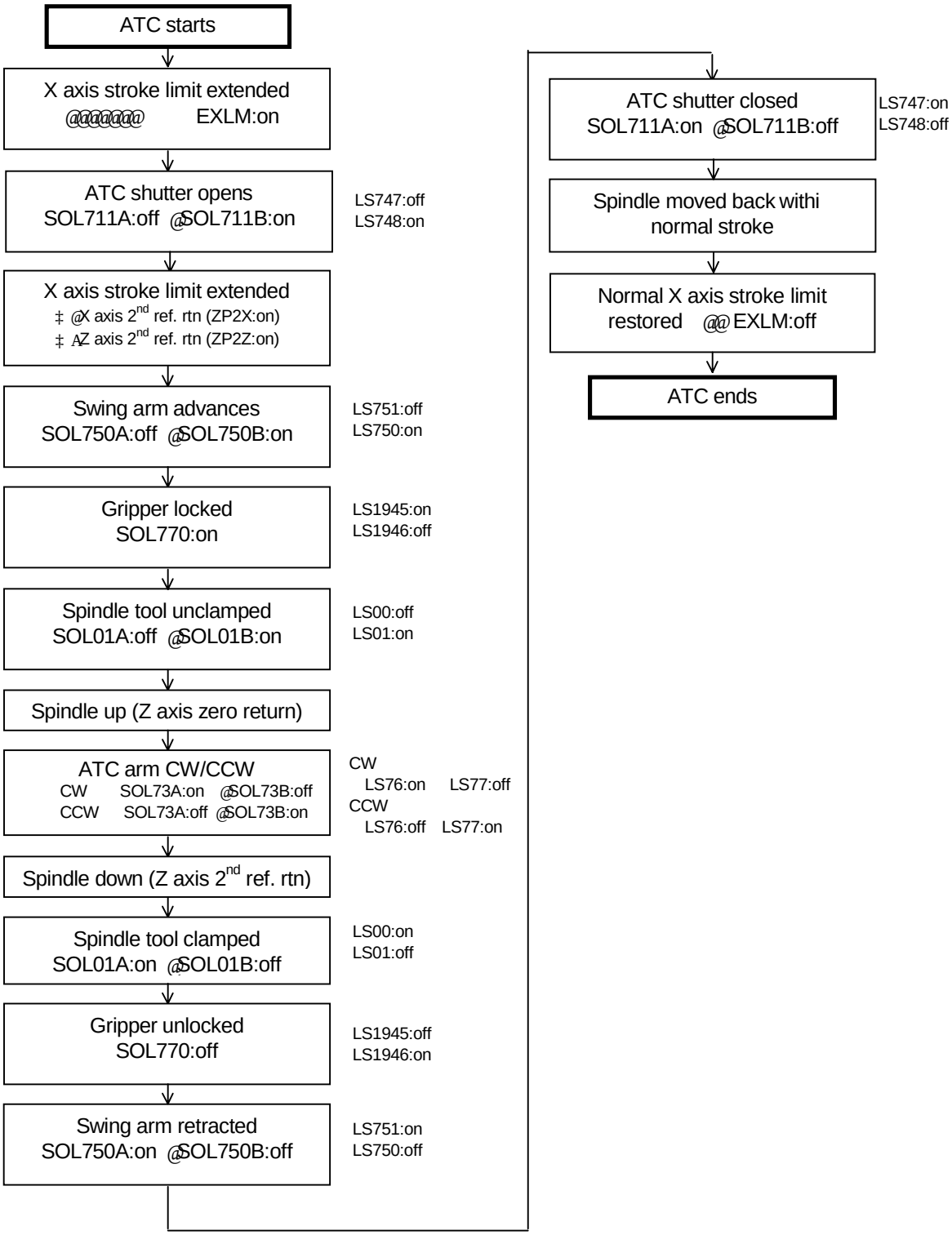
The ATC on this machine has mechanisms which use the movement of a cylinder controlled by solenoids and limit switches and the movement of the Z axis to perform tool changes.

Restore Operation

Operation is restored from the ATC maintenance screen and main control panel. Refer to section 2.9.2, ATC Maintenance Screen (PC Screens, 9 inch LCD/MDI panel chapter) or section 3.9.2, ATC Maintenance Screen (PC Screens, 14 inch LCD/MDI panel chapter) for the ATC maintenance screen usage procedure.

ATC Flow Chart

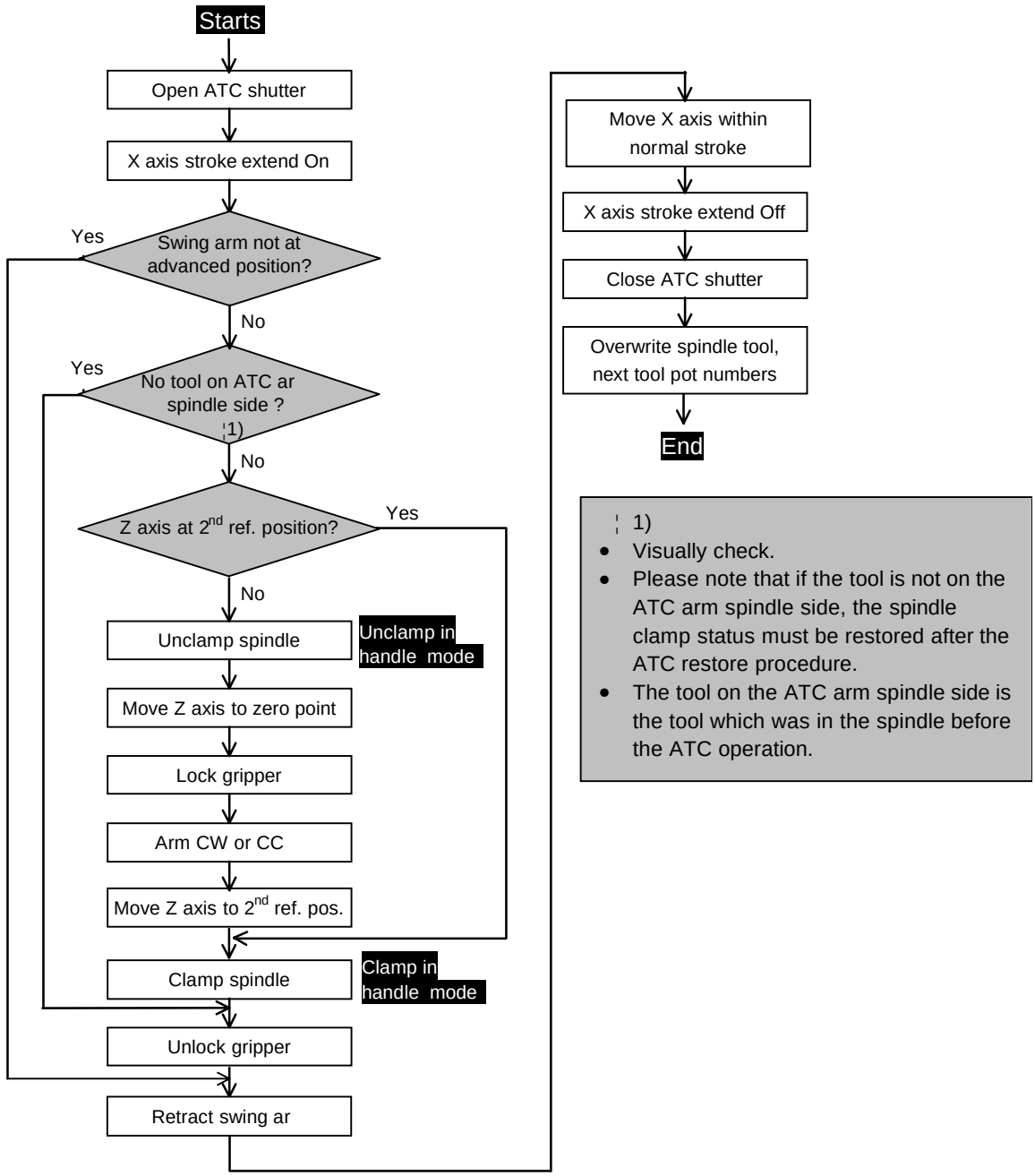
In some cases, only the tool return or tool retrieve operation may be performed during the tool change operation, but the basic flow is the same.



Restore Procedure

The following procedure is used to restore operation. Nothing needs to be performed if the machine status already coincides with the maintenance operation.

The OT RELEASE button on the main control panel can be held down to perform an operation when it is prevented by an interlock. Please make sure to take adequate precautions at this time since releasing of interlocks may be dangerous.



¦ 1)

- Visually check.
- Please note that if the tool is not on the ATC arm spindle side, the spindle clamp status must be restored after the ATC restore procedure.
- The tool on the ATC arm spindle side is the tool which was in the spindle before the ATC operation.

Overwrite the spindle & next tool pot numbers after the restore procedure

11.2 Pallet Changer (V55 Option)

11.2.1 Pallet Changer

11.2.1.1 Outline

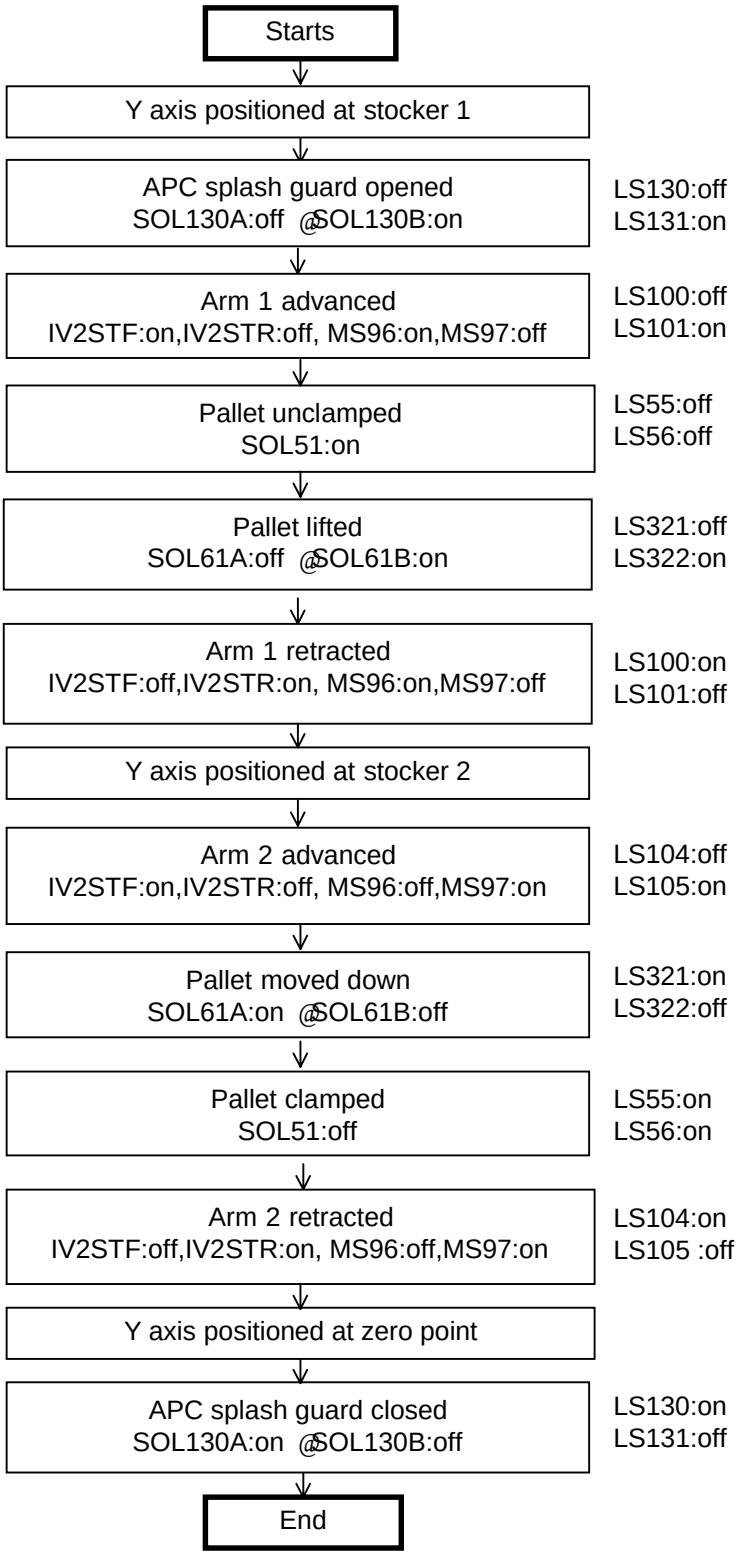
The pallet changer on this machine uses an inverter for the APC arm, and switches the hydraulic circuits by means of solenoid valves to perform the other operations.

11.2.1.2 Restore Operation

The APC arm is advanced/retracted and the solenoid valves are turned On/Off from the P/C maintenance screen. Refer to section 2.9.3, P/C Maintenance Screen (PC Screens, 9 inch LCD/MDI panel chapter) or section 3.9.3, P/C Maintenance Screen (PC Screens, 14 inch LCD/MDI panel chapter) for the P/C maintenance screen usage procedure.

11.2.1.3 Load/Unload Flow Chart

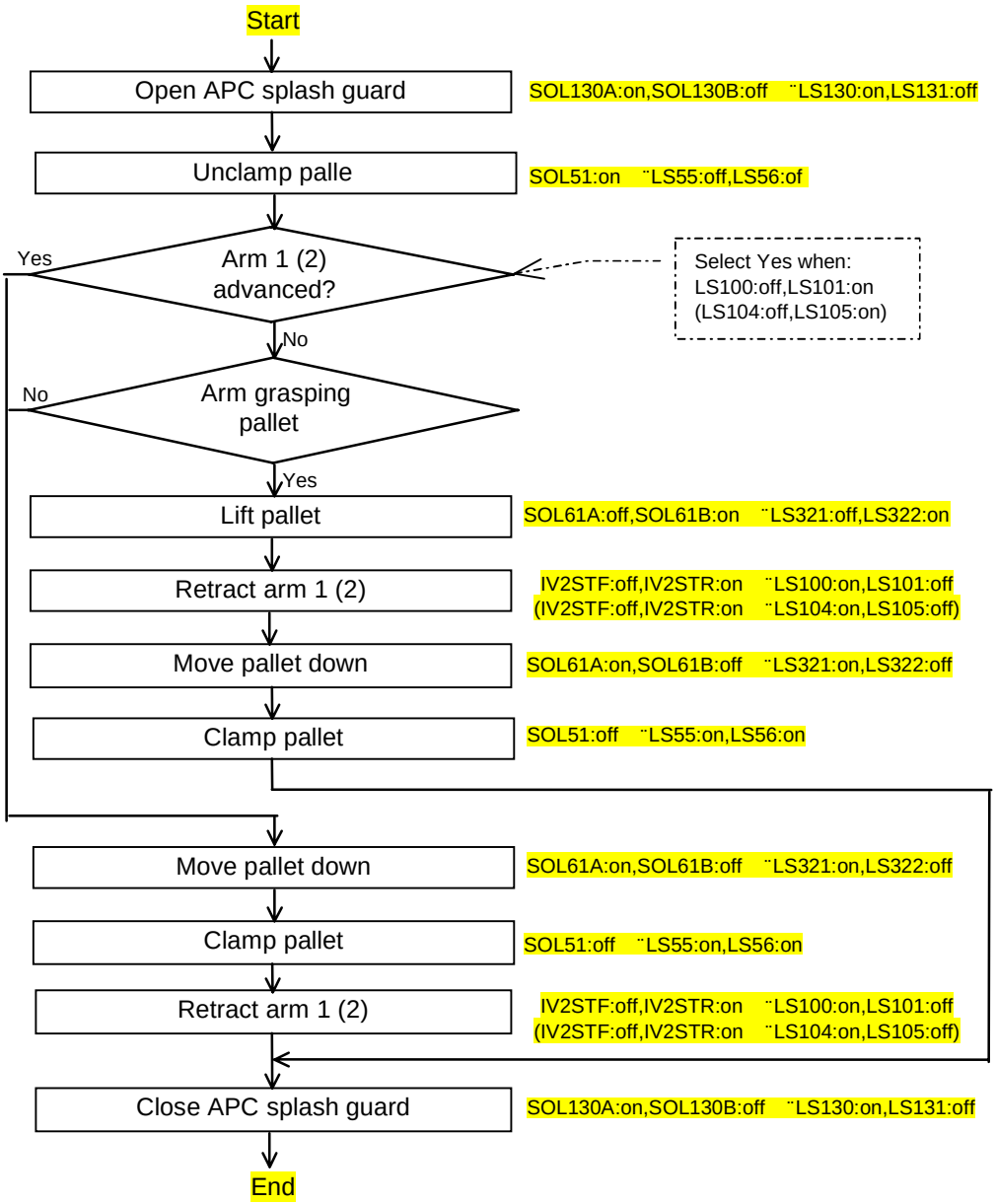
The following movements are performed during the pallet change operation. Some components move at the same time. The flow below uses unloading of pallet 1 and loading of pallet 2 for the operation sequence.



11.2.1.4 Restore Procedure

The following procedure is used to restore operation. Nothing needs to be performed if the machine status already coincides with the maintenance operation.

The OT RELEASE button on the main control panel can be held down to perform an operation when it is prevented by an interlock. Please make sure to take adequate precautions at this time since releasing of interlocks may be dangerous.



Overwrite the tabl pallet No. after completing the restore operation.

11.3 ATC Magazine

11.3.1 V55

11.3.1.1 15-/25-Tool ATC

Outline

This ATC magazine uses a servo motor to rotate the magazine.

Restore Operation

The restore operation is not required for this ATC magazine since it is egg-pot type.

Magazine Indexing

Since this magazine is egg-pot type, the T command cannot perform the magazine operation by only memorizing the tool number.
The magazine is rotated during the M06 (tool change) operation. See the flow chart on page 2 of this chapter.

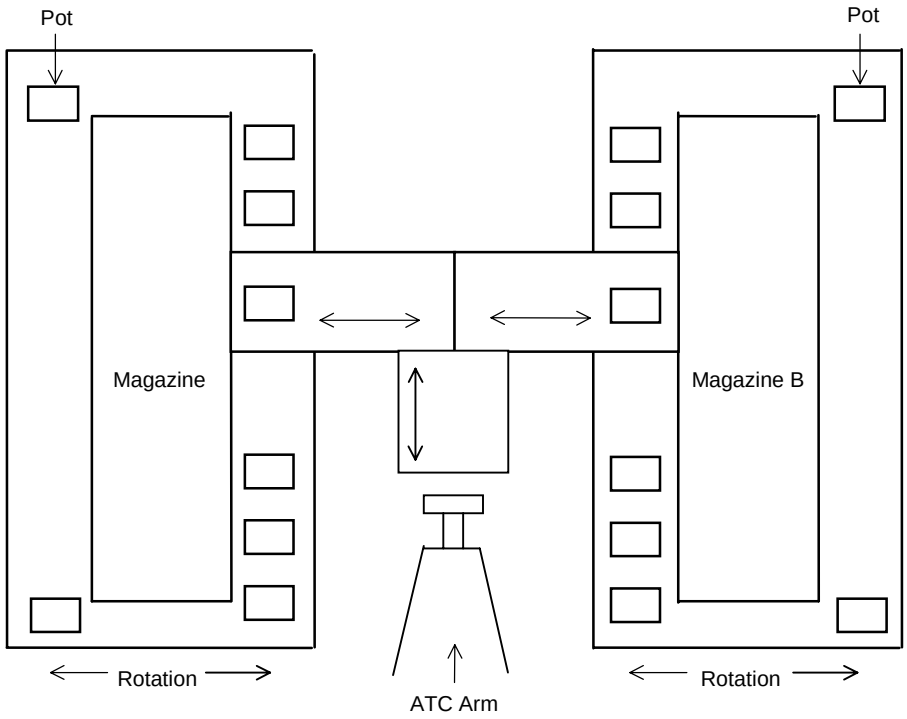
Restore Procedure

No hydraulic or pneumatic devices are used since this magazine is egg-pot type. The magazine is rotated from the ATC control panel when this operation is necessary. To perform a maintenance operation other than pot indexing, refer to the ATC maintenance screen described in chapter 2 (PC Screens, 9 inch LCD/MDI panel) or chapter 3 (PC Screens, 14 inch LCD/MDI panel chapter).

11.3.1.2 40-/80-Tool ATC

Outline

A magazine rotation servo motor and shifter solenoid valves are used to operate this ATC magazine.
The 40-tool ATC does not have a magazine B or a shifter 3, but the basic operations are the same. Operation is restored by turning the solenoid valves On/Off and indexing the motor.

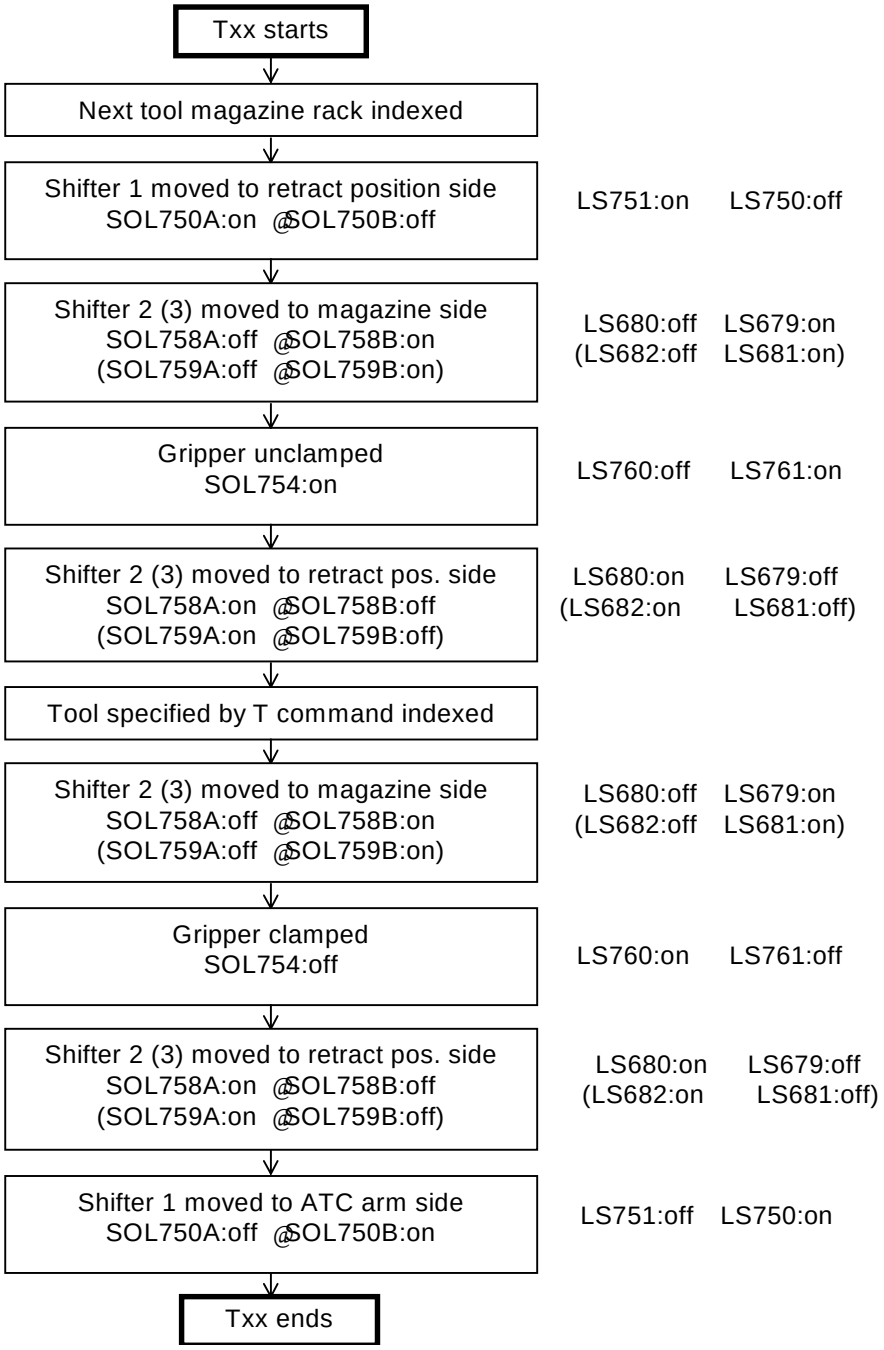


Restore Procedure

Operation is restored by turning the solenoid valves On and Off from the ATC maintenance screen and by rotating the magazine from the ATC control panel. Refer to ATC Maintenance Screen in chapter 2 (PC Screens, 9 inch LCD/MDI panel chapter) or ATC Maintenance Screen in chapter 3 (PC Screens, 14 inch LCD/MDI panel chapter) for the ATC maintenance screen usage procedure, and ATC Control Panel in the Auto Tool Change Function chapter for the ATC control panel usage procedure.

Tool Indexing Flow Chart

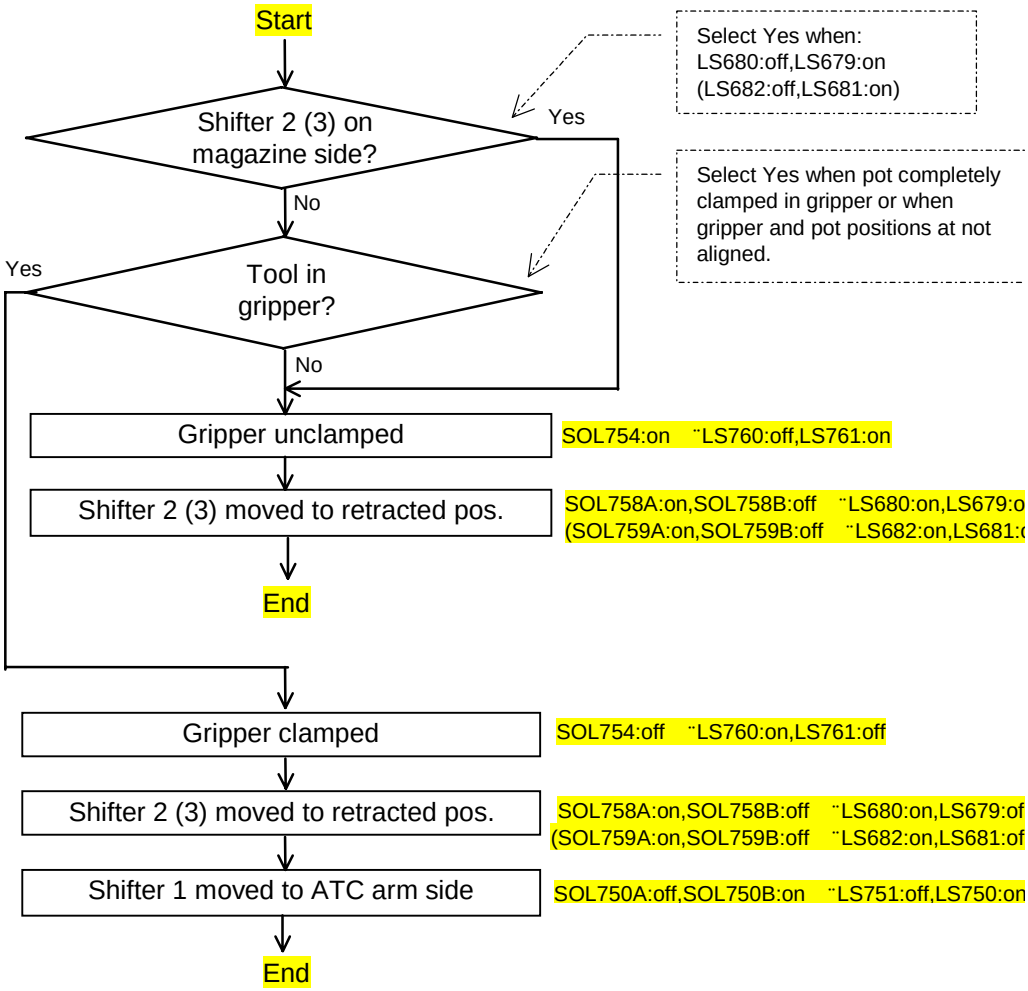
The following movements are performed during the tool indexing command (Txxxx).



Restore Procedure

The following procedure is used to restore operation. Nothing needs to be performed if the machine status already coincides with the maintenance operation.

The OT RELEASE button on the main control panel can be held down to perform an operation when it is prevented by an interlock. Please make sure to take adequate precautions at this time since releasing of interlocks may be dangerous.



Overwrite the spindle and next tool pot numbers after the restore operation.
When a tool is clamped in the spindle, the spindle tool pot is at the position in the magazine described below:
Pot position set by machine parameter No. 1011
Therefore, there is no pot in the pot No. position for the magazine spindle tool.
When a tool is not clamped in the spindle, there is no pot in the position specified by the above parameter.

11.3.1.3 Matrix Type (181-Tool or Larger ATC)

Outline of Restore Procedure

Procedures to restore operation which require a minimum of specialized knowledge are described in the first part of this section.
Contact regional distributor for the "Problems Requiring Maintenance" described in the latter part of this section, or when you are worried about being able to perform any procedure properly.

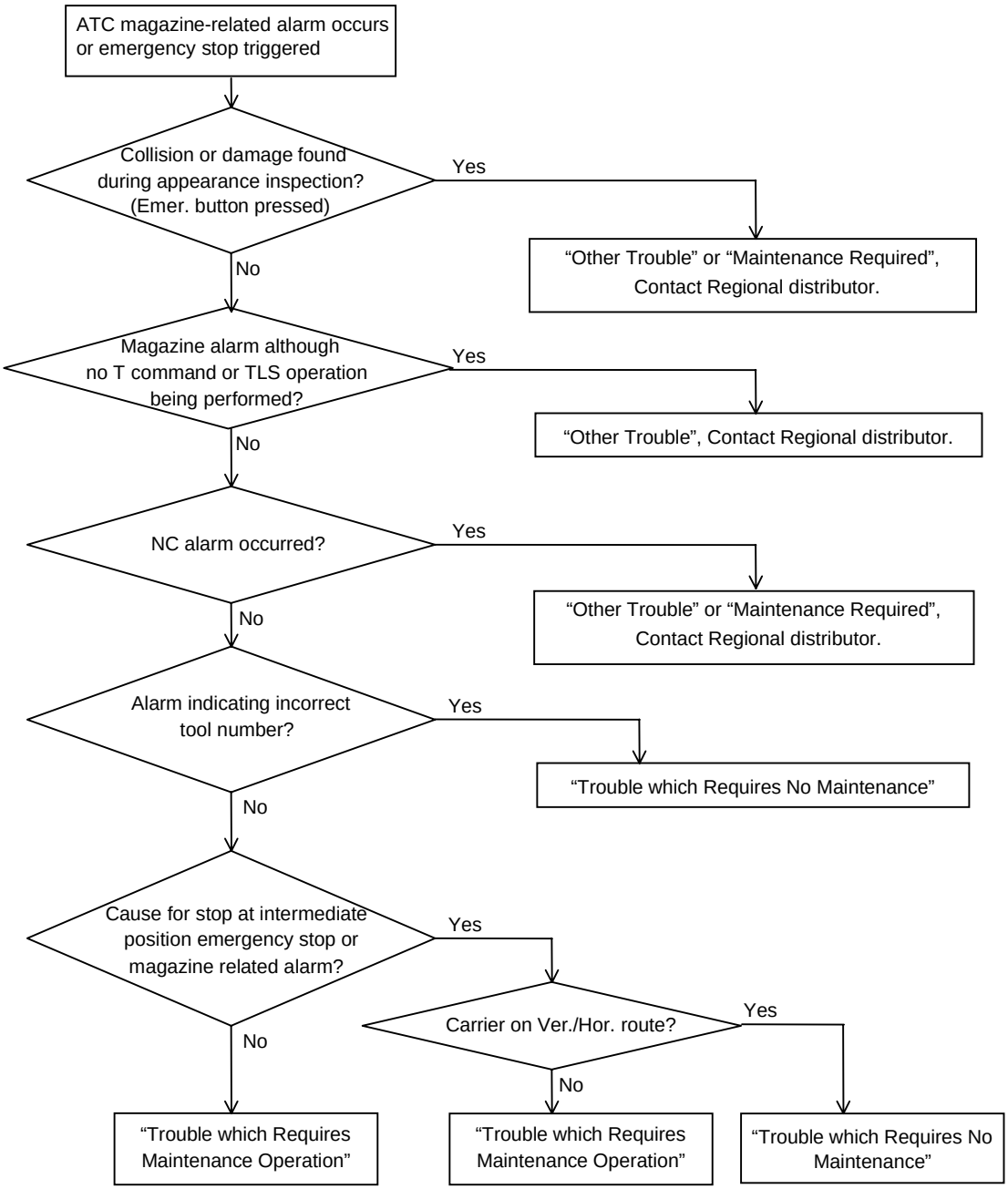
Depending upon the axis position, it may be necessary to perform operation in the unconditional mode. Be careful to select the correct movement direction and axis since there are no interlocks at this time.
Also make sure to activate the emergency stop status when entering the area inside the magazine.

Types of Trouble

- Trouble which requires no maintenance operation
- Trouble which requires maintenance operation
- Other types of trouble

Determine the type of trouble with the following procedure:

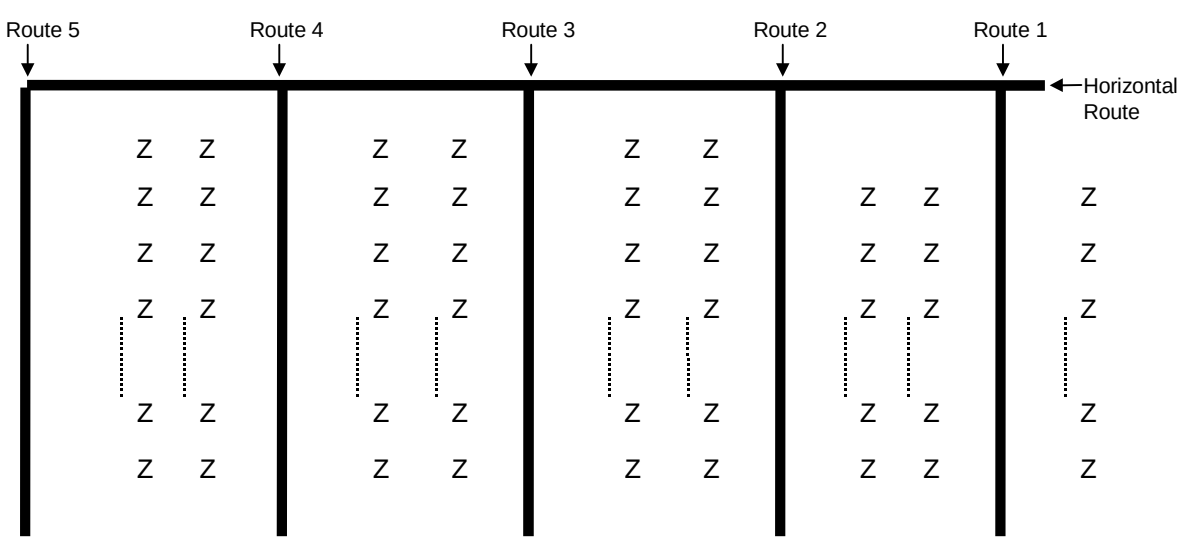
Most trouble is caused by the triggering of an emergency stop or improper adjustment of sensors. The procedure listed below may not cover unexpected breakdowns of control or other devices.



Trouble which Requires Maintenance Operation

In many cases when an alarm occurs before mechanical movement is started for the TLS operation or T command, the incorrect tool number or a prohibited operation may have been specified. In these situations, no maintenance operation is required. Simply specify the correct command. Furthermore, if the stopped position is a vertical/horizontal route when an emergency stop has been triggered or an alarm not related to the magazine has occurred, no maintenance operation is necessary

Route Concept



The thick lines above indicate the vertical routes/horizontal route along which the carrier can be positioned during automatic operation.
The coordinates are set by the machine parameters.
Each route has a certain width. The range set by the machine parameter ±0.5 mm is the vertical/horizontal route.
When the carrier is not positioned on a route, it must be moved to the route using the maintenance operation mode.
The horizontal route is AV = 0.

Machine Parameter Nos. for Vertical Route Coordinates

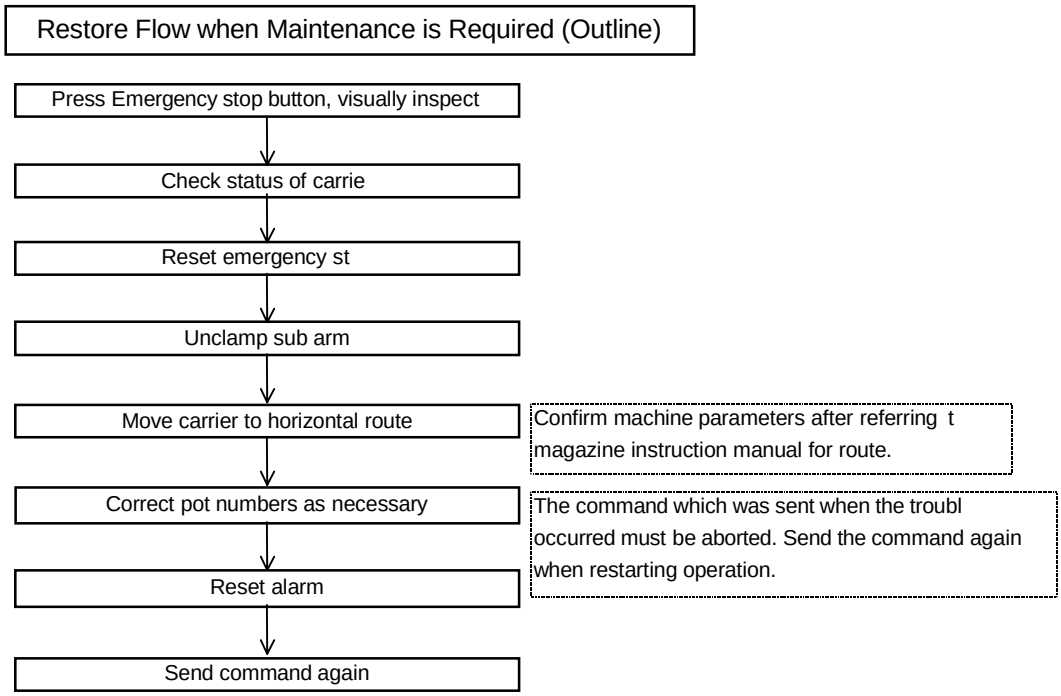
	Route 1	Route 2	Route 3	Route 4	Route 5	Route 6	Route 7	Route 8	Route 9	Route 10
No.	1144	114	1146	1147	1148	1149	1150	1151	1152	2802

Depending upon the type of magazine, the number of pot rows may be fewer than shown in the diagram above, but the parameter numbers for the routes do not change.

Restoring Operation when Maintenance is Required

Press the Emergency stop button since you must enter the area inside the covers to perform an external inspection.
Visually check the moving parts for any collisions or damage with the emergency stop status activated.
If operation is stopped at an intermediate point for a cause other than an emergency stop, contact regional distributor.
We may request you to perform operations on the maintenance screen depending upon the conditions when it is possible to restart operation.

Contact regional distributor if the same problem repeatedly occurs even if operation can be restarted by performing the maintenance operation.

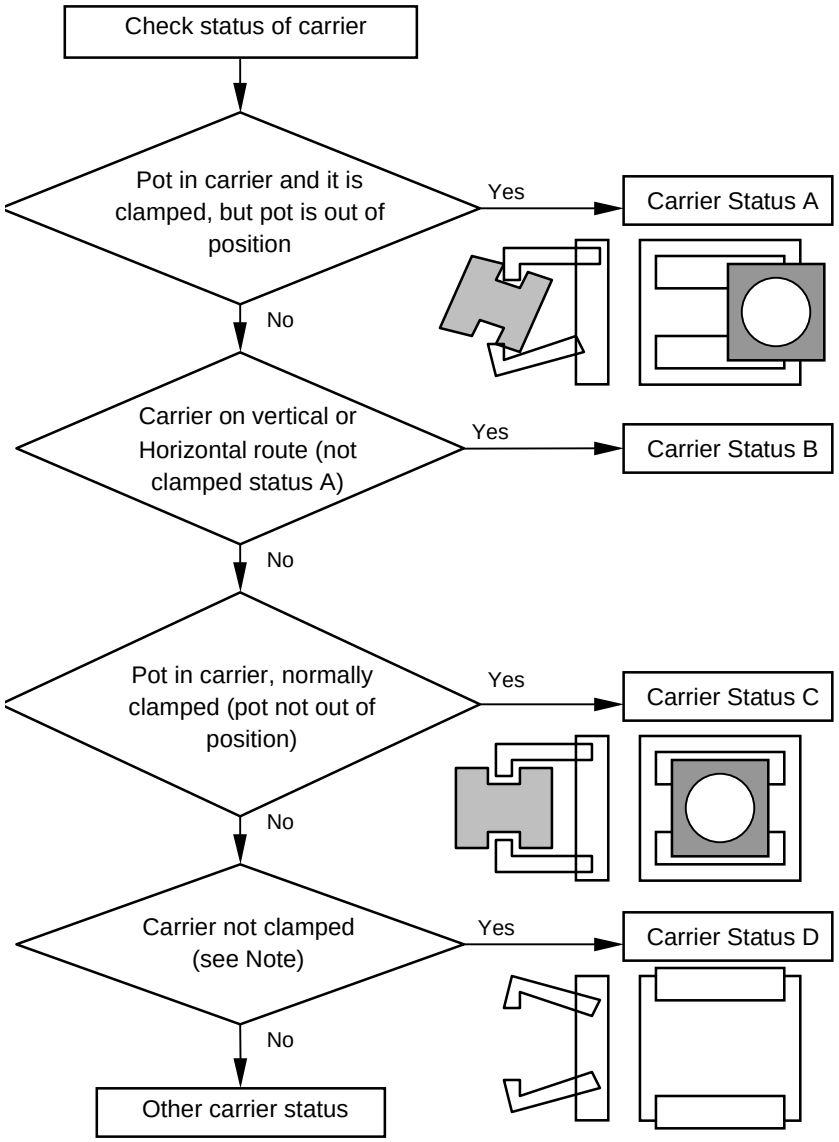


Visual Inspection

Press the Emergency stop button since you may enter the area inside the covers when performing a visual inspection. The inspection should be carried out with the emergency stop status active. Contact regional distributor in the event that components have collided with one another or any damage has taken place. Also check for a breakdown of the control unit, or discrepancy in the coordinates due to a dead battery.
Exit the area inside the covers and reset the emergency stop after completing the visual inspection.

Checking Carrier Status

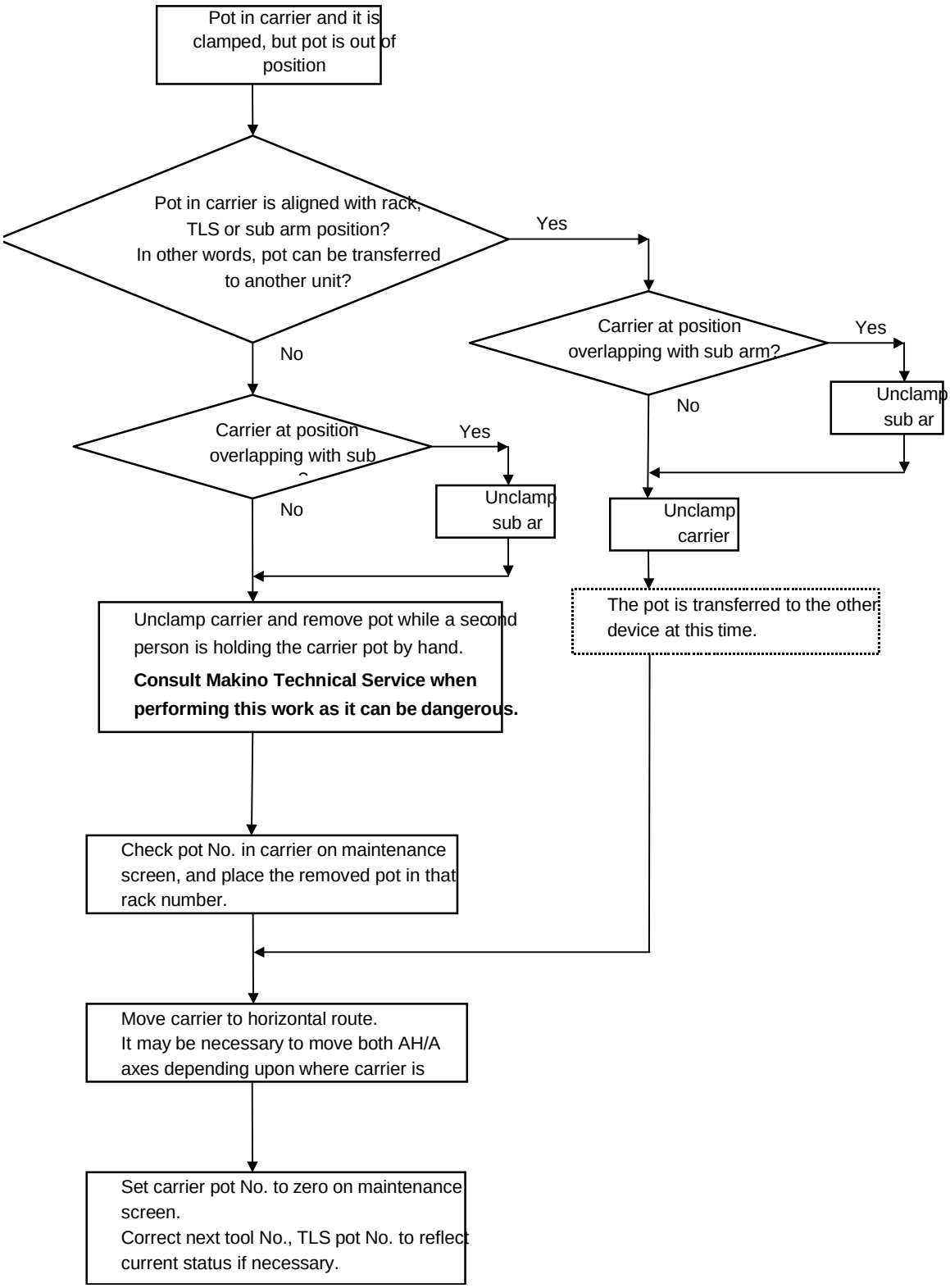
Check for any of the types of carrier status:



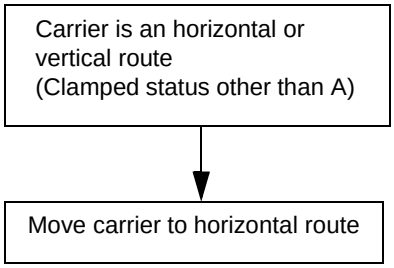
Note: When the carrier is near the sub arm, rack or TLS, the carrier may be in a position which overlaps with the pot, but this is still Carrier Status D if the carrier is unclamped.

In the event the carrier is unclamped, the carrier claws ma be stuck in the pot. This indicates “Other carrier status.”

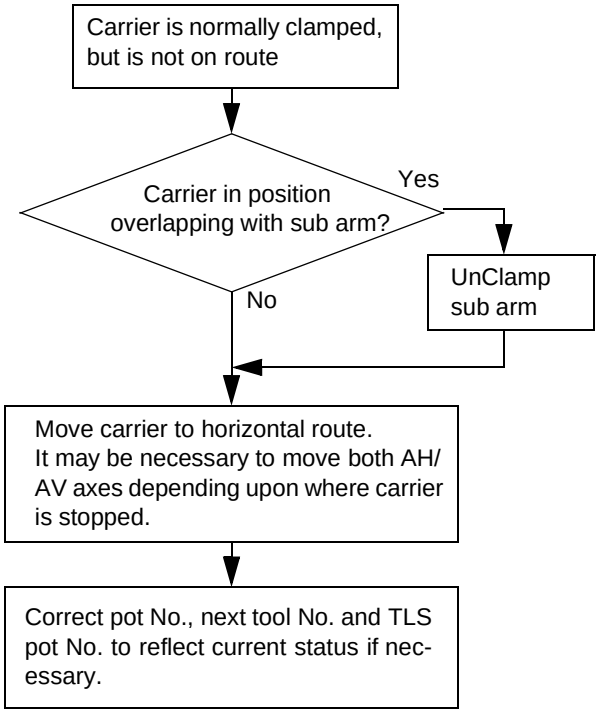
Procedure When Carrier Pot is Out of Position (Status A)



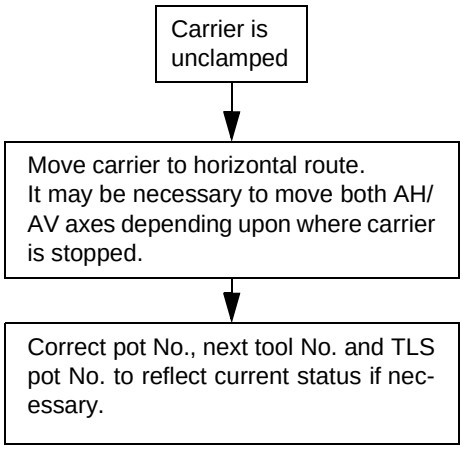
Procedure When Carrier is on Route (Status B)



Procedure When Carrier is Normally Clamped, But Not on Route (Status C)



Procedure When Carrier is Not Clamped (Status D)



Moving Carrier to Horizontal Route

The carrier must be moved to the horizontal route to restore operation when the magazine has stopped at an intermediate position.
Perform the work described in this section when the AV axis coordinate is not on the horizontal route.
AV = 0 when the carrier is on the horizontal route. The vertical route coordinates are set by the machine parameters.

Machine Parameter Nos. for Vertical Route Coordinates

	Route 1	Route 2	Route 3	Route 4	Route 5	Route 6	Route 7	Route 8	Route 9	Route 10
No.	1144	114	1146	1147	1148	1149	1150	1151	1152	2802

1. Set override to "MIN."

2. When the carrier is not on the vertical route ±0.5 mm, move the AH axis to the nearest vertical route in the inching mode. (Selection of a small movement amount will minimize any damage in the event of a mistake in operation is made.)

3. Confirm that the AH axis is on a vertical route.

4. Check the AV axis coordinate, and move the carrier to the horizontal axis in the inching mode.

Other Types of Trouble

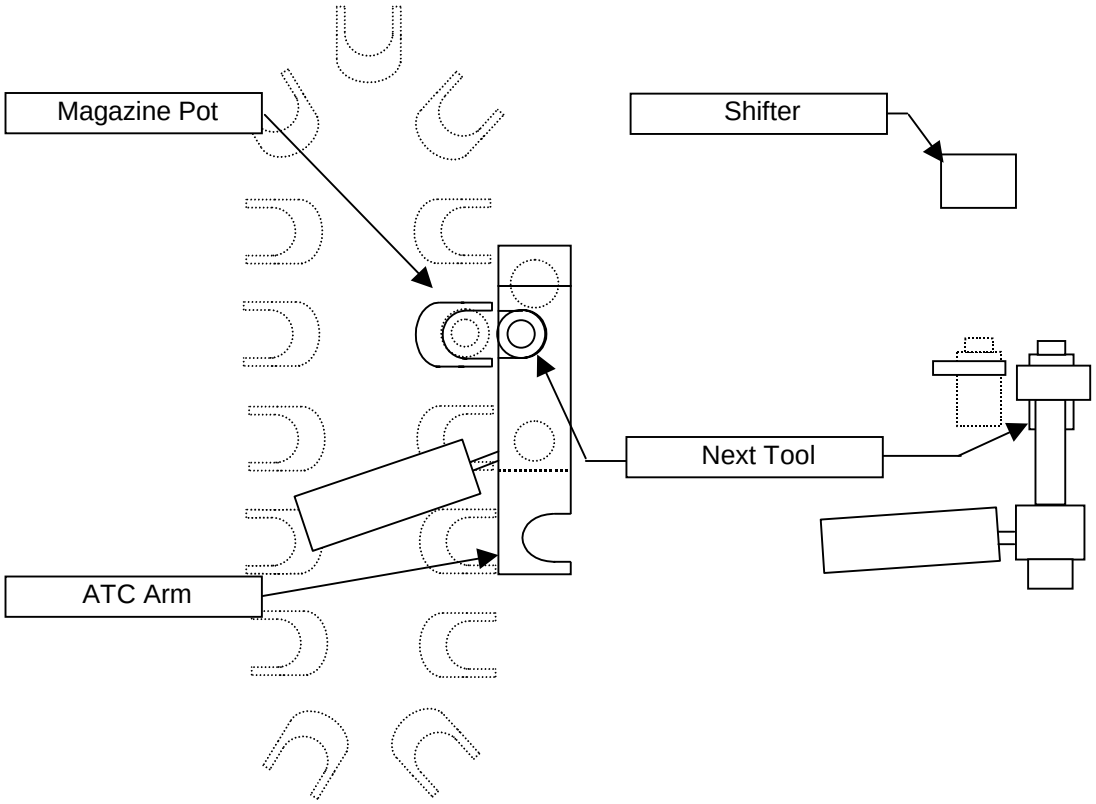
Contact regional distributor in the event of control unit or other trouble which cannot be solved with the procedure described herein.

11.3.2 V33

11.3.2.1 ATC

Outline

The ATC magazine on this machine uses a servo motor to rotate the magazine, and solenoid valves to operate the shifter.



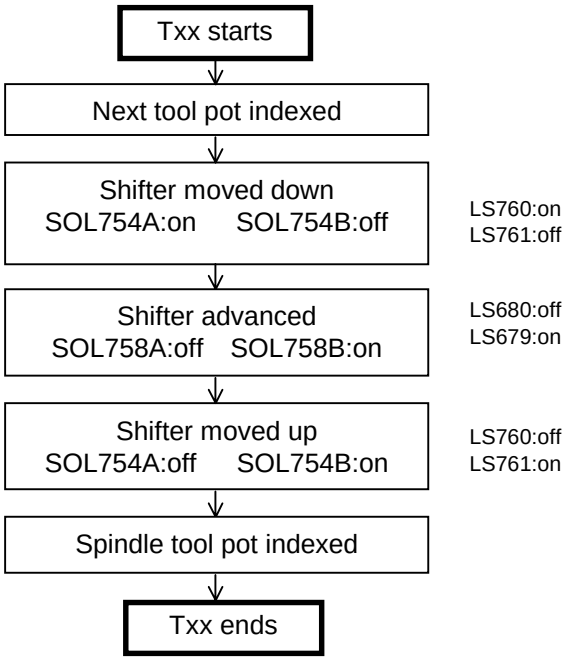
Restore Operation

Operation is restored by turning the solenoid valves On and Off and moving the shifter from the ATC maintenance screen, and by rotating the magazine from the main control panel. Refer to ATC Maintenance Screen in chapter 2 (PC Screens, 9 inch LCD/MDI panel chapter) or ATC Maintenance Screen in chapter 3 (PC Screens, 14 inch LCD/MDI panel chapter) for the ATC maintenance screen usage procedure.
Refer to ATC Control Panel in the Auto Tool Change Function chapter for the ATC control panel usage procedure.

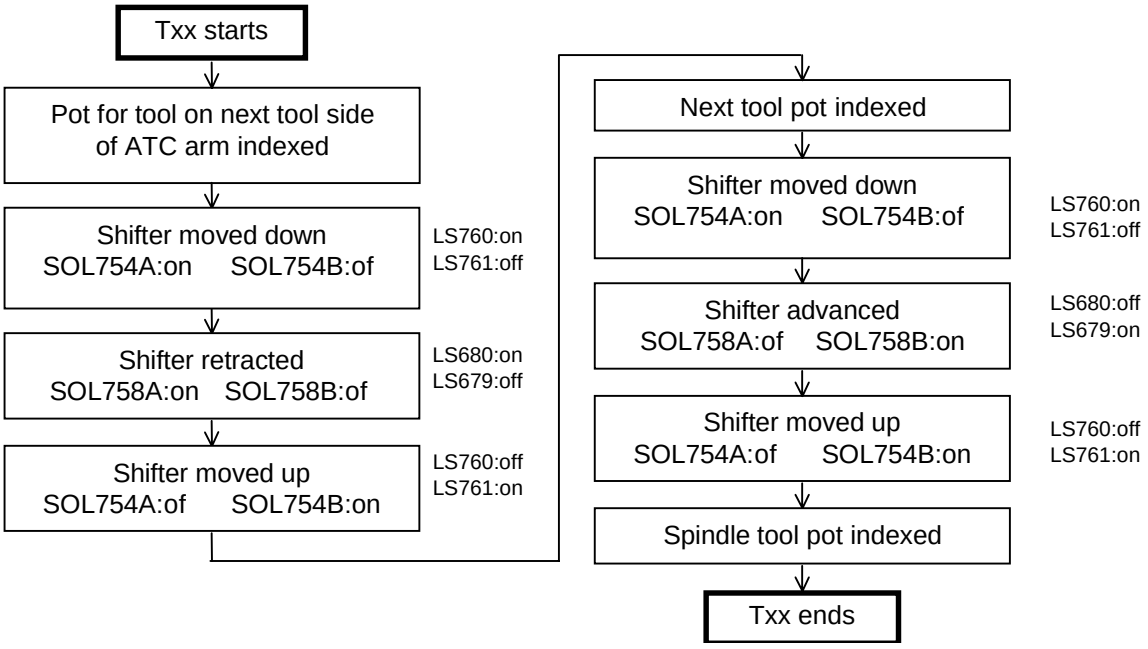
Tool Indexing Flow Chart

The following operations are performed by the tool indexing command (Txxxx):

1. When there is no tool on ATC arm next tool side:
   (Tool transported from magazine to arm)



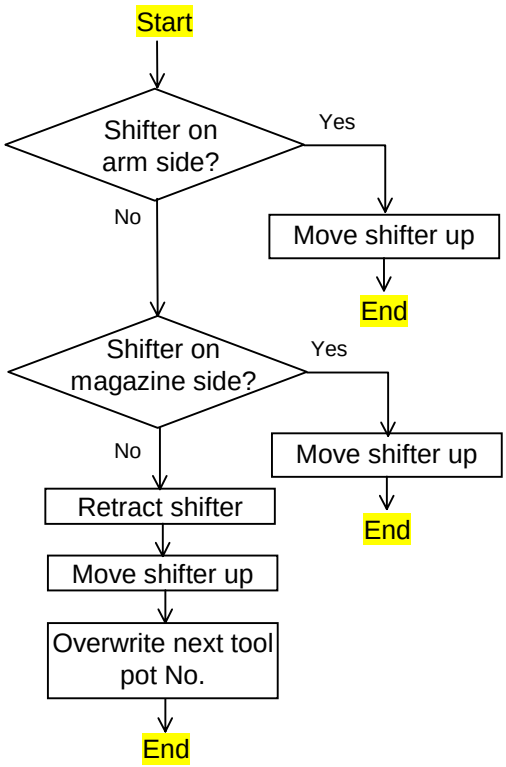
2. When there is tool on next tool side of ATC arm:
   (Next tool replaced)



Restore Procedure

The following procedure is used to restore operation. Nothing needs to be performed if the machine status already coincides with the maintenance operation.

The OT RELEASE button on the main control panel can be held down to perform an operation when it is prevented by an interlock. Please make sure to take adequate precautions at this time since releasing of interlocks may be dangerous.



Chapter 12 User I/O Interface (Option)

V33, V55

Professional 3

Chapter 12
User I/O Interface (Option)

Contents

12.1 Outline

The User I/O interface consists of M code commands (M580 – M596, software) provided to control actuators, production counters and other peripheral devices prepared by the user, and an interface (hardware) to provide an electrical connection with peripheral devices.
Output signals can be sent to peripheral devices from the machine by executing M code commands. The peripheral devices are operated by these output signals, and completion of operations is verified when the operation confirm switch signal is input.

12.2 Basic Operation

Eight output signals (points) are provided to operate peripheral devices, and eight input signals (points) are provided to verify peripheral device operation. Input and output signals are activated by M code commands, enabling peripheral devices to be operated.

Input Signals

No.		
0	USDI 1	User Di 1
1	USDI 2	User Di 2
2	USDI 3	User Di 3
3	USDI 4	User Di 4
4	USDI 5	User Di 5
5	USDI 6	User Di 6
6	USDI 7	User Di 7
7	USDI 8	User Di 8

Output Signals

No.		
0	USDI 1	User Di 1
1	USDI 2	User Di 2
2	USDI 3	User Di 3
3	USDI 4	User Di 4
4	USDI 5	User Di 5
5	USDI 6	User Di 6
6	USDI 7	User Di 7
7	USDI 8	User Di 8

12.3 Types of User I/O Interfaces

One of five different input/output control methods can be selected depending upon the specifications of the peripheral devices to be controlled.

The type of user M function is set with the machine parameter described in this section.
Furthermore, refer to section 13.1.1, Setting Procedure in the Machine Parameter Explanation chapter, for details on changing machine parameters.

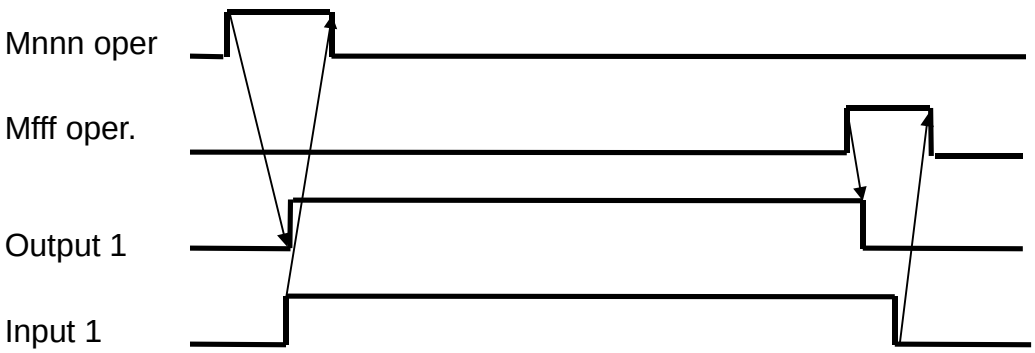
1800 TYPE OF USER I/O

This parameter sets the type of user M function:

- 0 : Type 0 – 8 set - 1 signal control
- 1 : Type 1 – 4 set - 2 signal control
- 2 : Type 2 – 2 set - 2 signal control & 4 set - 1 signal control
- 3 : Type 3 – 4 set - 1 signal control & 1 set - 4 signal control
- 4 : Type 4 – 2 set - 2 signal control & 1 set - 4 signal control

12.3.1 Type 0 Operation

This type is used when controlling one set of input/output signals with two M code commands. This is called 1 signal control.
For example, this type is used when controlling a certain actuator with a single solenoid valve.



1. Timing Chart

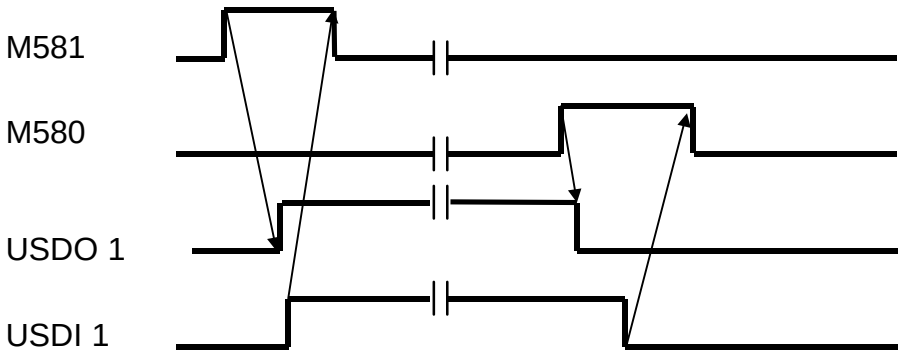
This timing chart shows control of USDO 1 and USDI 1 with M580 and M581. USDO1 is turned On by executing M581, and the operation starts. The operation is completed after a certain length of time, and the M581 command is completed when USDI 1 is turned On.
USDO 1 is turned Off by executing M580, and the opposite operation is started. The operation is completed after a certain length of time, and the M580 command is completed when USDI 1 is turned Off.

The M code simply changes for the following, but the control process is the same:

USDO2, USDO3, USDO4, USDO5, USDO6, USDO7, USDO8

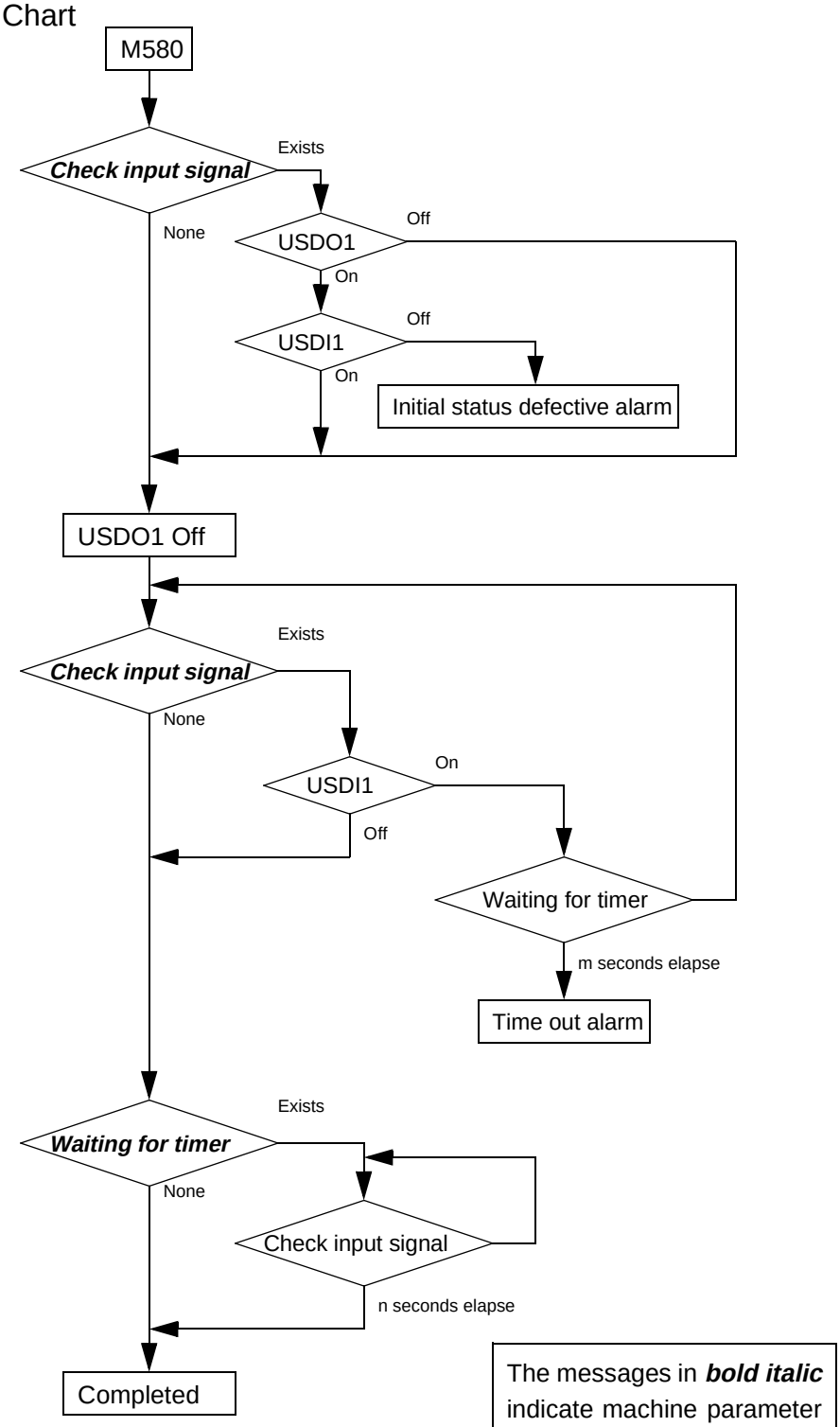
USDI 2, USDI 3, USDI 4, USDI 5, USDI 6, USDI 7, USDI 8

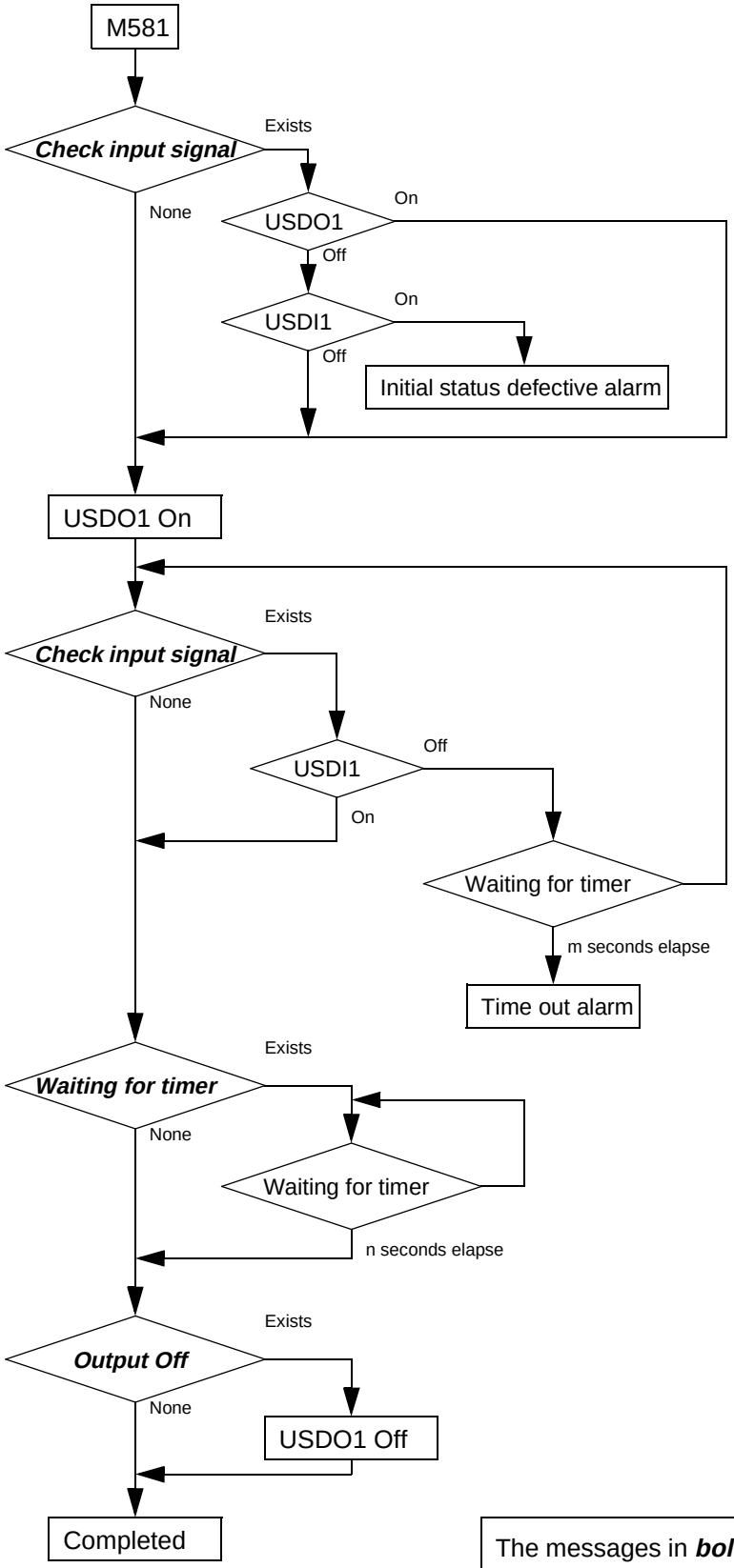
Refer to "M Codes and Operation" for the correspondence between input/output being controlled and the M codes.



The above timing chart shows operation when the "Function to Check On or Off of Input Signal" is used.

2. Flow Chart


M580
Check input signal
Exists
None
USDO1
Off
On
USDI1
Off
On
Initial status defective alarm
USDO1 Off
Check input signal
Exists
None
USDI1
On
Off
Waiting for timer
m seconds elapse
Time out alarm
Waiting for timer
Exists
None
Check input signal
n seconds elapse
Completed
The messages in bold italic indicate machine parameter settings.



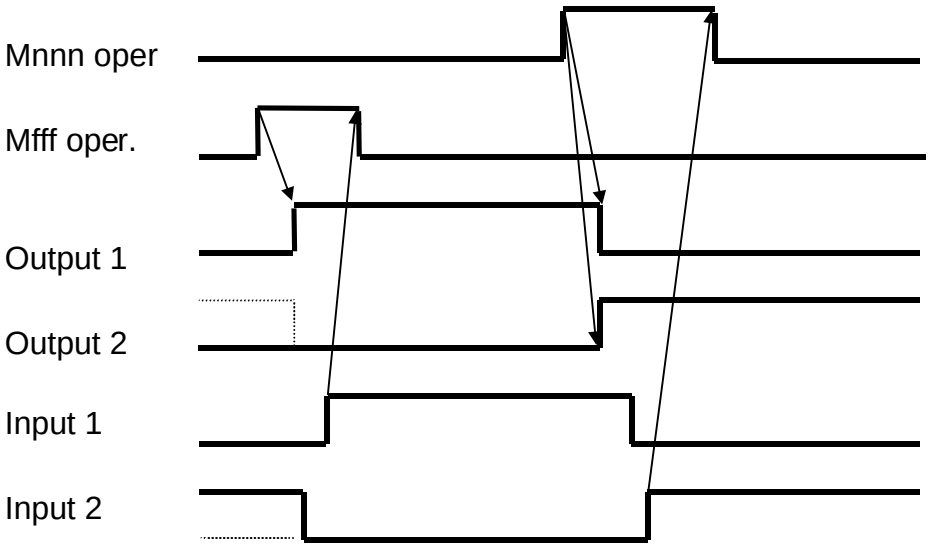
The messages in ***bold italic*** indicate machine parameter settings.

3. M Codes and Operation

	Input/Output Signal		Machine Parameters				
M Code	Output	Input	Check Input Signal	Time Out (Unit: sec)	Output Signal Off Function	Off Timer (Unit: 0.1 sec)	On Timer (Unit: 0.1 sec)
580	USDO1 Off	USDI1 Off	1801	1817	– – –	1803	– – –
581	USDO1 On	USDI1 On	1801	1817	1802	– – –	1804
582	USDO2 Off	USDI2 Off	1805	1818	– – –	1807	– – –
583	USDO2 On	USDI2 On	1805	1818	1806	– – –	1808
584	USDO3 Off	USDI3 Off	1809	1819	– – –	1811	– – –
585	USDO3 On	USDI3 On	1809	1819	1810	– – –	1812
586	USDO4 Off	USDI4 Off	1813	1820	– – –	1815	– – –
587	USDO4 On	USDI4 On	1813	1820	1814	– – –	1816
588	USDO5 Off	USDI5 Off	1821	1837	– – –	1823	– – –
589	USDO5 On	USDI5 On	1821	1837	1822	– – –	1824
590	USDO6 Off	USDI6 Off	1825	1838	– – –	1827	– – –
591	USDO6 On	USDI6 On	1825	1838	1826	– – –	1828
592	USDO7 Off	USDI7 Off	1829	1839	– – –	1831	– – –
593	USDO7 On	USDI7 On	1829	1839	1830	– – –	1832
594	USDO8 Off	USDI8 Off	1833	1840	– – –	1835	– – –
595	USDO8 On	USDI8 On	1833	1840	1834	– – –	1836

12.3.2 Type 1 Operation

This type is used when controlling two sets of input/output signals with two M code commands. This is called 2 signal control.
For example, this type is used when controlling a certain actuator with a double solenoid valve.



In the initial status, both outputs are Off.

1. Timing Chart

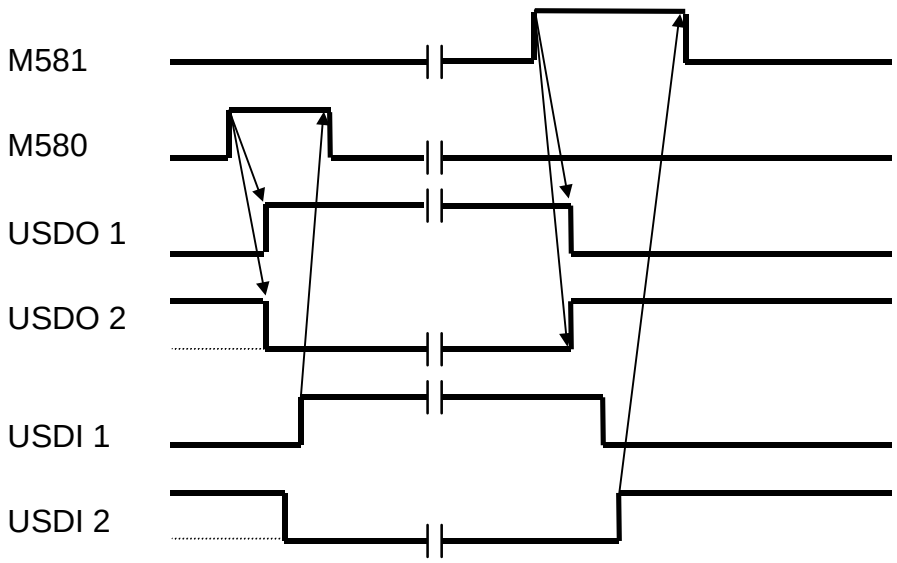
This timing chart shows control of USDO 1, USDO 2, USDI 1 and USDI 2 with M580 and M581.
USDO1 is turned On and USDO 2 is turned Off by executing M580.
USDO1 is turned Off and USDO 2 is turned On by executing M581.

The M code simply changes for the following, but the control process is the same:

USDO3, USDO4, USDO5, USDO6, USDO7, USDO8

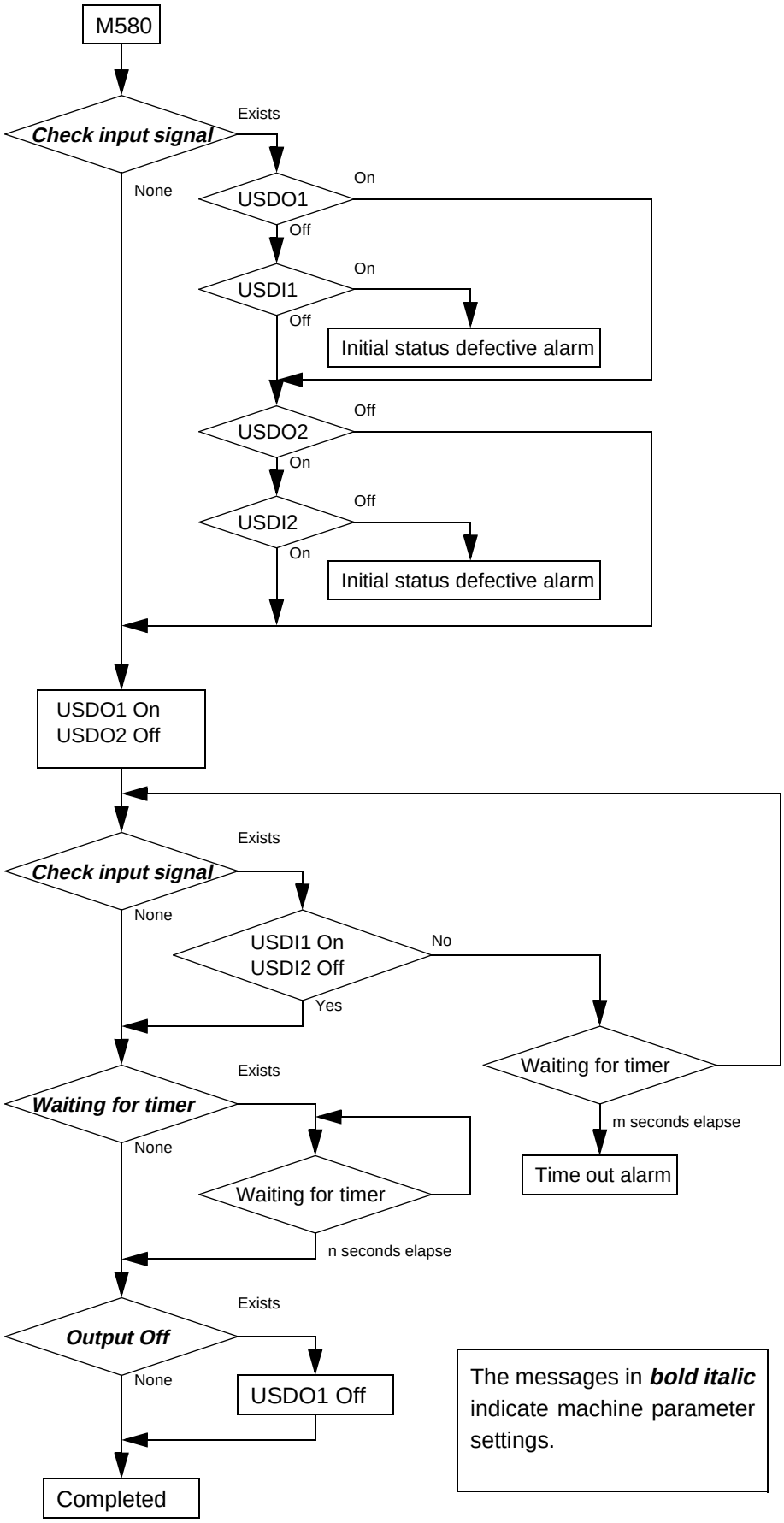
USDI 3, USDI 4, USDI 5, USDI 6, USDI 7, USDI 8

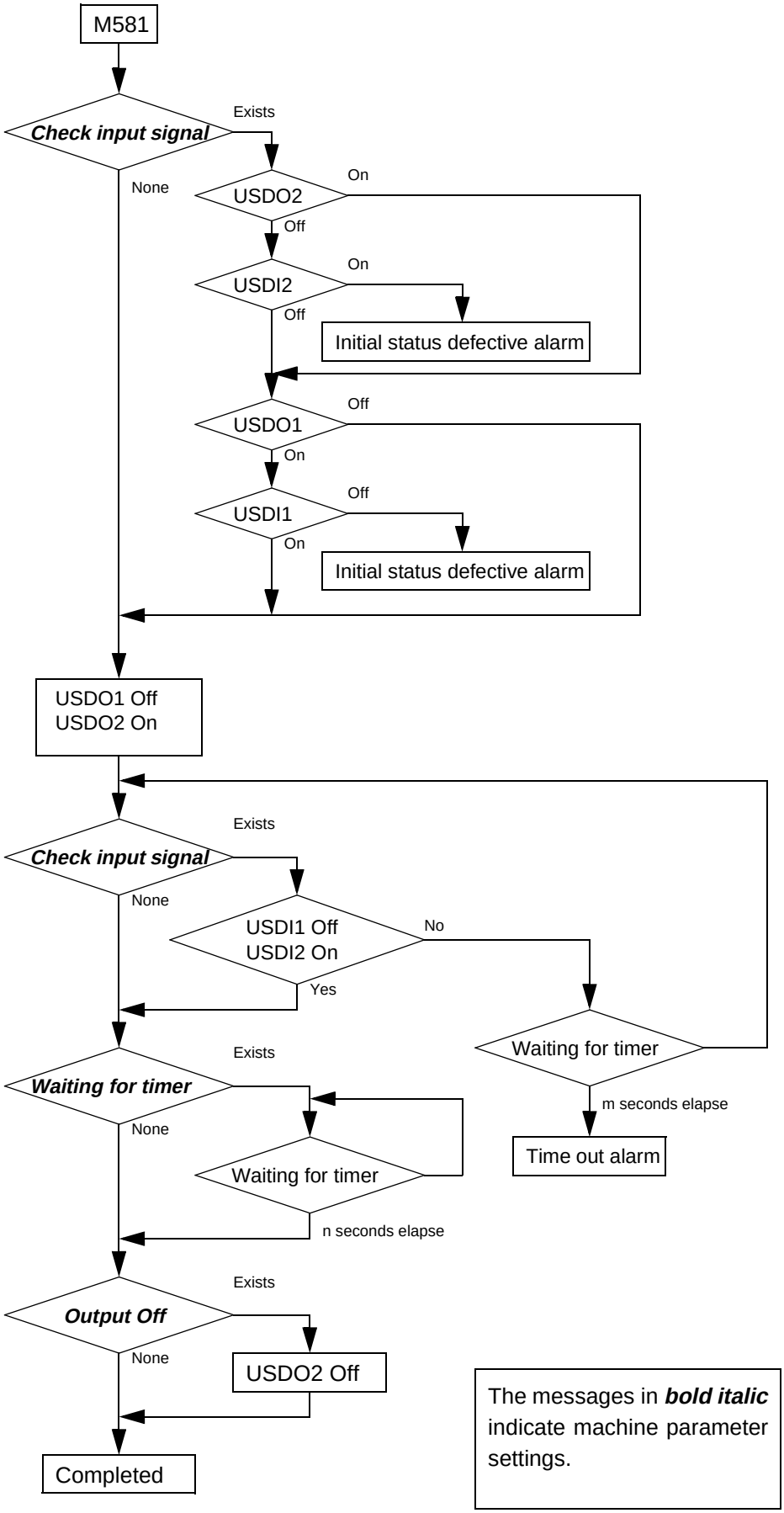
Refer to "M Codes and Operation" for the correspondence between input/output being controlled and the M codes.



The above timing chart shows operation when the "Function to Check On or Off of Input Signal" is used.

2. Flow Chart


M580
Check input signal
Exists
None
USDO1
On
Off
USDI1
On
Off
Initial status defective alarm
USDO2
Off
On
USDI2
Off
On
Initial status defective alarm
USDO1 On
USDO2 Off
Check input signal
Exists
None
USDI1 On
USDI2 Off
No
Yes
Waiting for timer
m seconds elapse
Time out alarm
Waiting for timer
Exists
None
Waiting for timer
n seconds elapse
Output Off
Exists
None
USDO1 Off
Completed
The messages in bold italic indicate machine parameter settings.


M581
Check input signal
Exists
None
USDO2
On
Off
USDI2
On
Off
Initial status defective alarm
USDO1
Off
On
USDI1
Off
On
Initial status defective alarm
USDO1 Off
USDO2 On
Check input signal
Exists
None
USDI1 Off
USDI2 On
No
Yes
Waiting for timer
m seconds elapse
Time out alarm
Waiting for timer
Exists
None
Waiting for timer
n seconds elapse
Output Off
Exists
None
USDO2 Off
Completed
The messages in bold italic indicate machine parameter settings.

3. M Codes and Operation

	Input/Output Signal		Machine Parameters				
M Code	Output	Input	Check Input Signal	Time Out (Unit: sec)	Output Signal Off Function	Off Timer (Unit: 0.1 sec)	On Timer (Unit: 0.1 sec)
580	USDO1 On USDO2 Off	USDI1 On USDI2 Off	1801	1817	1802	Not used	1804
581	USDO1 Off USDO2 On	USDI1 Off USDI2 On	1805	1818	1806	Not used	1808
582	USDO3 On USDO4 Off	USDI3 On USDI4 Off	1809	1819	1810	Not used	1812
583	USDO3 Off USDO4 On	USDI3 Off USDI4 On	1813	1820	1814	Not used	1816
584	USDO5 On USDO6 Off	USDI5 On USDI6 Off	1821	1837	1822	Not used	1824
585	USDO5 Off USDO6 On	USDI5 Off USDI6 On	1825	1838	1826	Not used	1828
586	USDO7 On USDO8 Off	USDI7 On USDI8 Off	1829	1839	1830	Not used	1832
587	USDO7 Off USDO8 On	USDI7 Off USDI8 On	1833	1840	1834	Not used	1836

* The M588 to M595 commands are ignored. No operation is performed.

12.3.3 Type 2 Operation

Two signal control is used for USDO1 to USDO4, and one signal control is used for USDO5 to USDO8. A combination of USDO1 & USDO2 and USDO3 & USDO4 is used for 2 signal control.

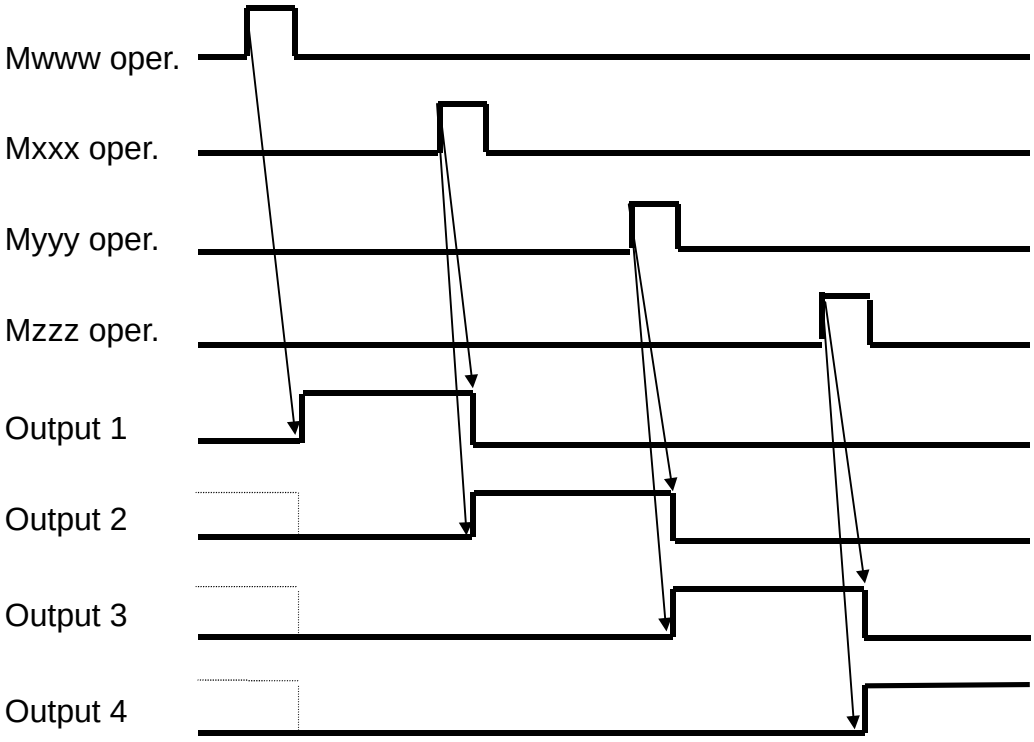
1. M Codes and Operation

	Input/Output Signal		Machine Parameters				
M Code	Output	Input	Check Input Signal	Time Out (Unit: sec)	Output Signal Off Function	Off Timer (Unit: 0.1 sec)	On Timer (Unit: 0.1 sec)
580	USDO1 On USDO2 Off	USDI1 On USDI2 Off	1801	1817	1802	Not used	1804
581	USDO1 Off USDO2 On	USDI1 Off USDI2 On	1805	1818	1806	Not used	1808
582	USDO3 On USDO4 Off	USDI3 On USDI4 Off	1809	1819	1810	Not used	1812
583	USDO3 Off USDO4 On	USDI3 Off USDI4 On	1813	1820	1814	Not used	1816
584	Not used	Not used	Not used	Not used	Not used	Not used	Not used
585	Not used	Not used	Not used	Not used	Not used	Not used	Not used
586	Not used	Not used	Not used	Not used	Not used	Not used	Not used
587	Not used	Not used	Not used	Not used	Not used	Not used	Not used
588	USDO5 Off	USDI5 Off	1821	1837	– – –	1823	– – –
589	USDO5 On	USDI5 On	1821	1837	1822	– – –	1824
590	USDO6 Off	USDI6 Off	1825	1838	– – –	1827	– – –
591	USDO6 On	USDI6 On	1825	1838	1826	– – –	1828
592	USDO7 Off	USDI7 Off	1829	1839	– – –	1831	– – –
593	USDO7 On	USDI7 On	1829	1839	1830	– – –	1832
594	USDO8 Off	USDI8 Off	1833	1840	– – –	1835	– – –
595	USDO8 On	USDI8 On	1833	1840	1834	– – –	1836

12.3.4 Type 3 Operation

Four set - one signal control is used for USDO1 to USDO4, and four signal control is used for USDO5 to USDO8.

Four signal control is comprised of four sets of input/output signals. When a command is sent, one of the four sets of signals is turned On, and the remaining three sets of signals are turned Off.



1. Timing Chart

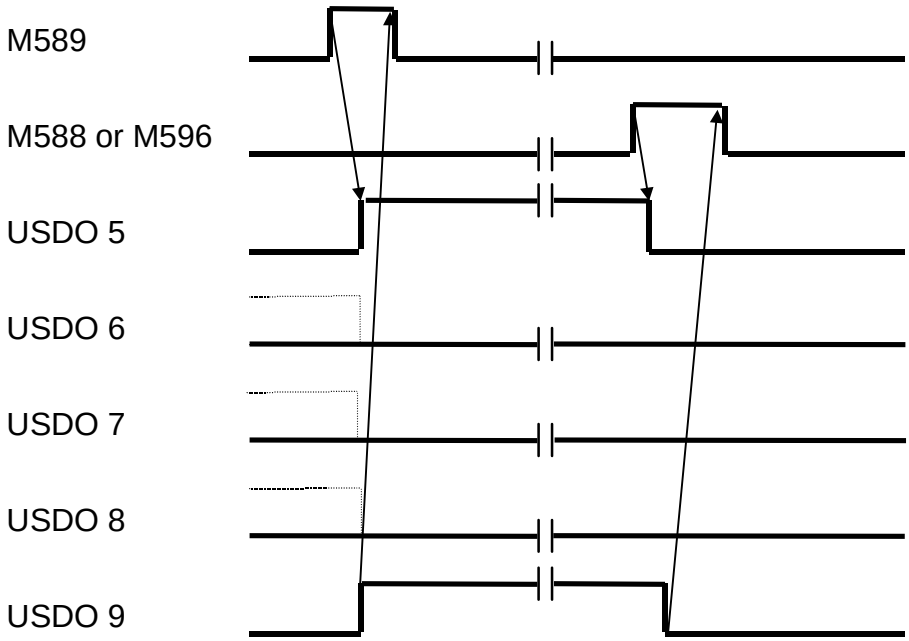
This timing chart shows control of USDO 1 and USDO 5 with M589 and M588 (or M596).
USDO5 is turned On and USDO 6 to USDO8 are turned Off by executing M589. USDO5 to USDO8 are all turned Off by executing M596.

The M code simply changes for the following, but the control process is the same:

USDO6, USDO7, USDO8

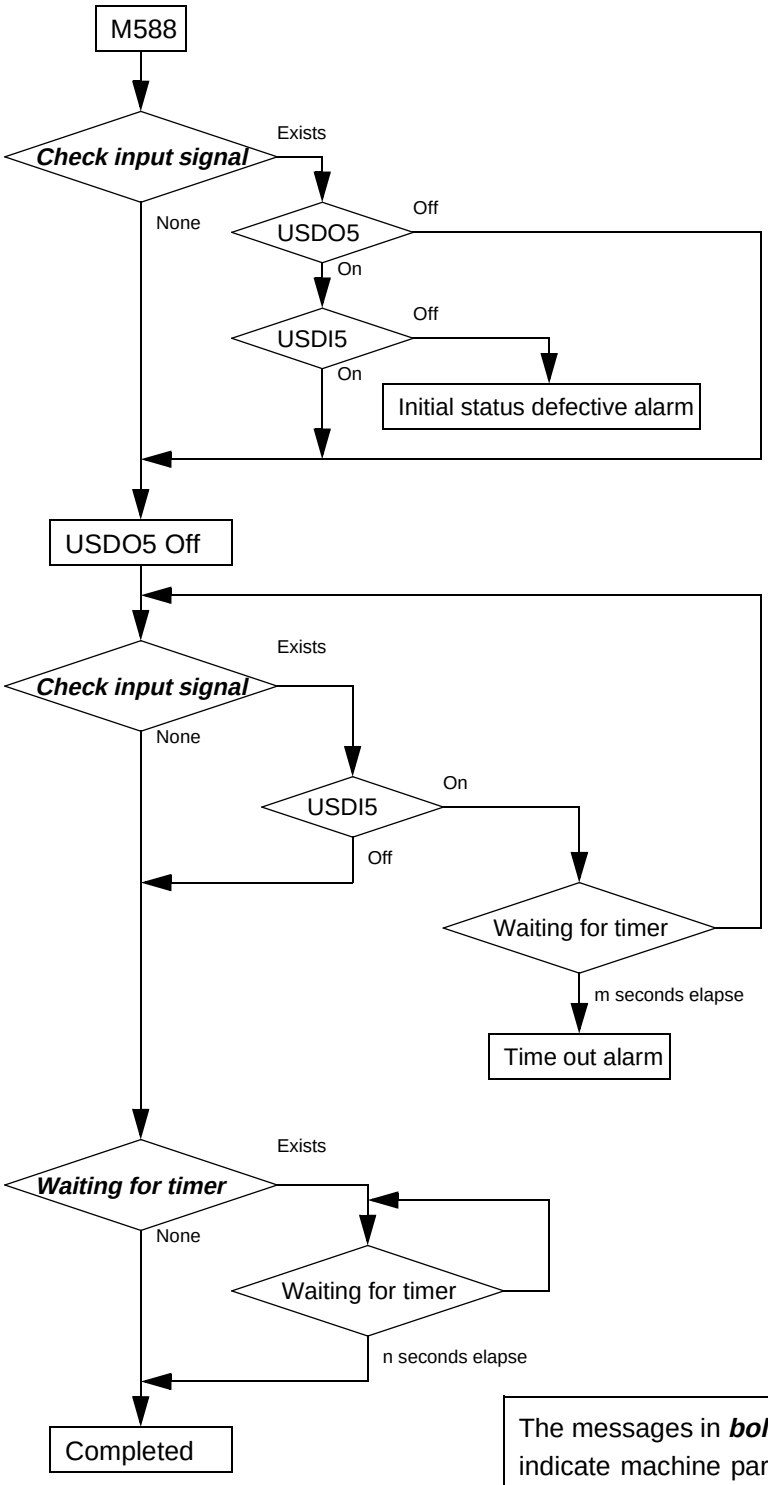
USDI 6, USDI 7, USDI 8

Refer to "M Codes and Operation" for the correspondence between input/output being controlled and the M codes.

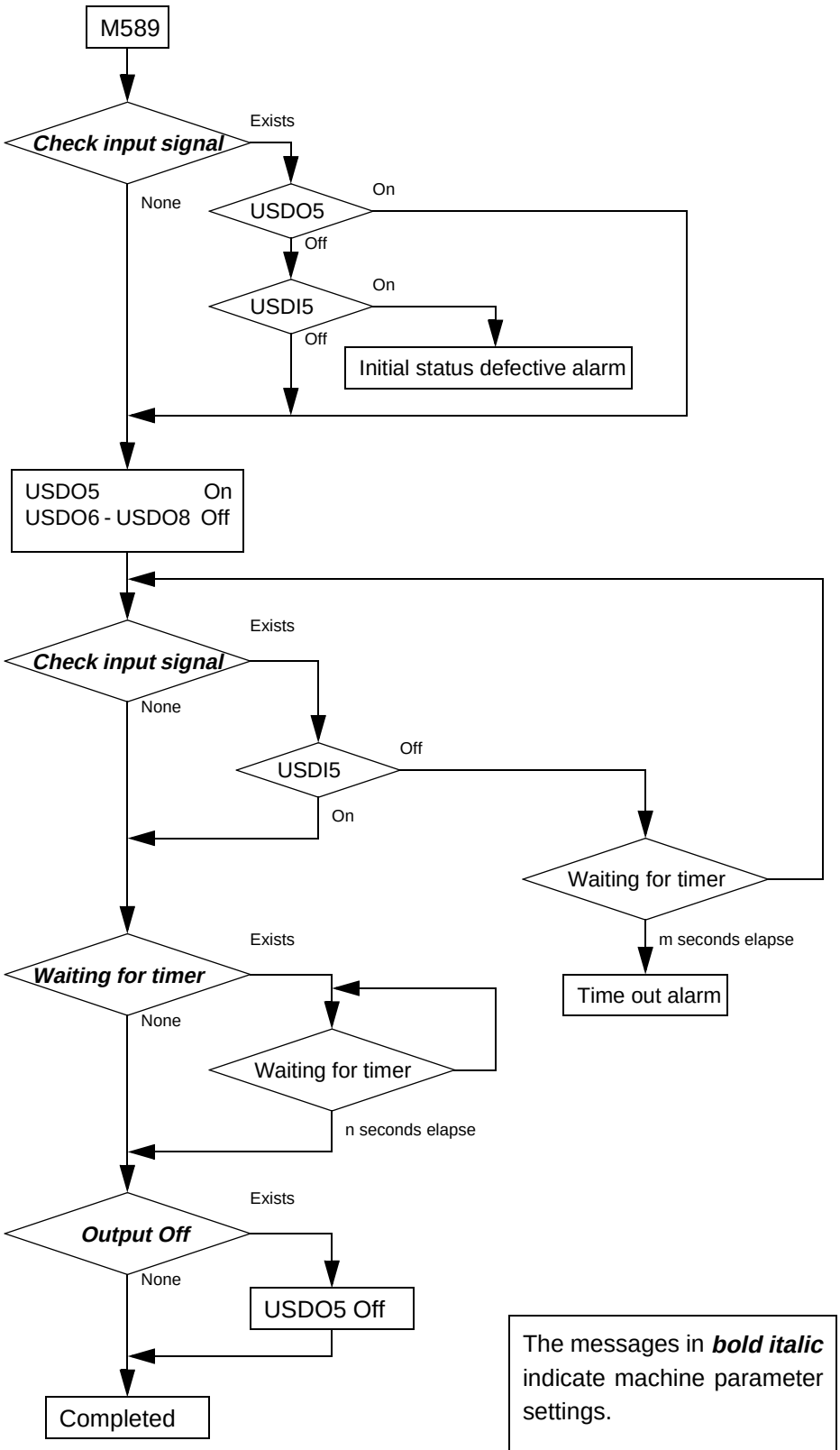


The above timing chart shows operation when the "Function to Check On or Off of Input Signal" is used.

2. Flow Chart



The messages in ***bold italic*** indicate machine parameter settings.


M589
Check input signal
Exists
None
USDO5
On
Off
USDI5
On
Off
Initial status defective alarm
USDO5 On
USDO6 - USDO8 Off
Check input signal
Exists
None
USDI5
Off
On
Waiting for timer
m seconds elapse
Time out alarm
Waiting for timer
Exists
None
Waiting for timer
n seconds elapse
Output Off
Exists
None
USDO5 Off
Completed
The messages in bold italic indicate machine parameter settings.

3. M Codes and Operation

	Input/Output Signal		Machine Parameters				
M Code	Output	Input	Check Input Signal	Time Out (Unit: sec)	Output Signal Off Function	Off Timer (Unit: 0.1 sec)	On Timer (Unit: 0.1 sec)
580	USDO1 Off	USDI1 Off	1801	1817	– – –	1803	– – –
581	USDO1 On	USDI1 On	1801	1817	1802	– – –	1804
582	USDO2 Off	USDI2 Off	1805	1818	– – –	1807	– – –
583	USDO2 On	USDI2 On	1805	1818	1806	– – –	1808
584	USDO3 Off	USDI3 Off	1809	1819	– – –	1811	– – –
585	USDO3 On	USDI3 On	1809	1819	1810	– – –	1812
586	USDO4 Off	USDI4 Off	1813	1820	– – –	1815	– – –
587	USDO4 On	USDI4 On	1813	1820	1814	– – –	1816
588	USDO5 Off	USDI5 Off	1821	1837	– – –	1823	– – –
589	USDO5 On USDO6 Off USDO7 Off USDO7 Off	USDI5 On	1821	1837	1822	– – –	1824
590	USDO6 Off	USDI6 Off	1825	1838	– – –	1827	– – –
591	USDO5 Off USDO6 On USDO7 Off USDO8 Off	USDI6 On	1825	1838	1826	– – –	1828
592	USDO7 Off	USDI7 Off	1829	1839	– – –	1831	– – –
593	USDO5 Off USDO6 Off USDO7 On USDO8 Off	USDI7 On	1829	1839	1830	– – –	1832
594	USDO8 Off	USDI8 Off	1833	1840	– – –	1835	– – –
595	USDO5 Off USDO6 Off USDO7 Off USDO8 On	USDI8 On	1833	1840	1834	– – –	1836
596	USDO5 Off – USDO8 Off	– – –	– – –	– – –	– – –	– – –	– – –

12.3.5 Type 4 Operation

Two set - two signal control is used for USDO1 to USDO4, and four signal control is used for USDO5 to USDO8.

Two signal control is comprised of a combination of USDO1 & USDO2, and USDO3 & USDO4.

1. M Codes and Operation

	Input/Output Signal		Machine Parameters				
M Code	Output	Input	Check Input Signal	Time Out (Unit: sec)	Output Signal Off Function	Off Timer (Unit: 0.1 sec)	On Timer (Unit: 0.1 sec)
580	USDO1 On USDO2 Off	USDI1 On USDI2 Off	1801	1817	1802	– – –	1804
581	USDO1 Off USDO2 On	USDI1 Off USDI2 On	1805	1818	1806	– – –	1808
582	USDO3 On USDO4 Off	USDI3 On USDI4 Off	1809	1819	1810	– – –	1812
583	USDO3 Off USDO4 On	USDI1 Off USDI2 On	1813	1820	1814	– – –	1816
584 to 587 are not used.							
588	USDO5 Off	USDI5 Off	1821	1837	– – –	1823	– – –
589	USDO5 On USDO6 Off USDO7 Off USDO7 Off	USDI5 On	1821	1837	1822	– – –	1824
590	USDO6 Off	USDI6 Off	1825	1838	– – –	1827	– – –
591	USDO5 Off USDO6 On USDO7 Off USDO8 Off	USDI6 On	1825	1838	1826	– – –	1828

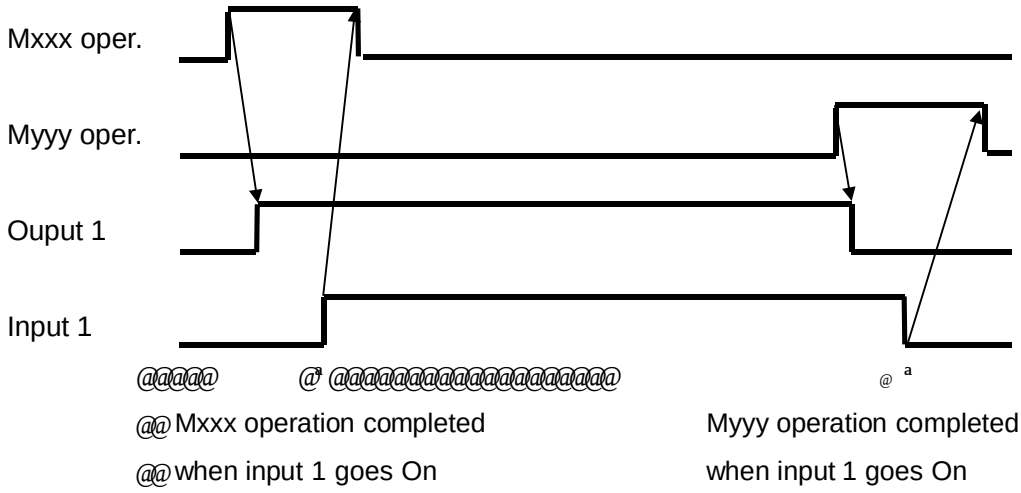
	Input/Output Signal		Machine Parameters				
M Code	Output	Input	Check Input Signal	Time Out (Unit: sec)	Output Signal Off Function	Off Timer (Unit: 0.1 sec)	On Timer (Unit: 0.1 sec)
592	USDO7 Off	USDI7 Off	1829	1839	– – –	1831	– – –
593	USDO5 Off USDO6 Off USDO7 On USDO8 Off	USDI7 On	1829	1839	1830	– – –	1832
594	USDO8 Off	USDI8 Off	1833	1840	– – –	1835	– – –
595	USDO5 Off USDO6 Off USDO7 Off USDO8 On	USDI8 On	1833	1840	1834	– – –	1836
596	USDO5 Off USDO6 Off USDO7 Off USDO8 Off	– – –	– – –	– – –	– – –	– – –	– – –

12.4 Various User M Functions

The user M functions described in this section are provided. "Use" or "Do not use" can be selected with the machine parameters, depending upon the specifications of the peripheral devices being controlled.

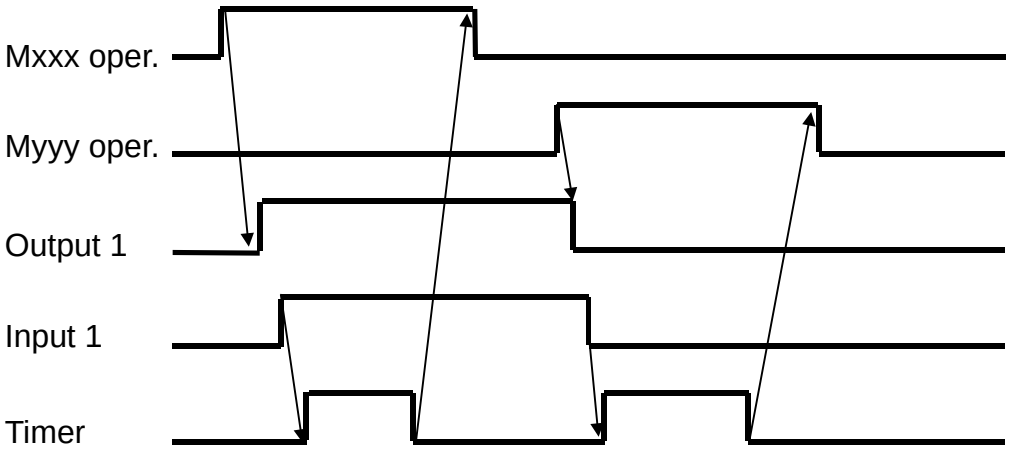
12.4.1 Function to Check On or Off Status of Input Signal

This function confirms whether or not the synchronized input signal is On or Off and completes the M command after an output signal is turned On or Off by an M command.
The machine parameter setting selects whether the M command is completed after confirmation, or completion of the M command without any confirmation.
Selection can be made to "Confirm"/"Do not confirm" for the On/Off of each output signal.
Refer to "M Codes and Operation" for the corresponding machine parameters for the respective output signals.
This function can be used to complete the M command when the output signal goes On or Off, or to wait for completion of the operation to complete the M command when an actuator is connected to an output signal or the signal to confirm completion of actuator operation is connected to the input signal.



12.4.2 Delay Timer Function

M commands can be completed a certain interval after the output signal goes On or Off, or a certain time after On/Off of the input signal is confirmed.
Whether or not this function is used can be selected for each output signal when On or Off is specified.
The delay timer can be set between 0 and 25.5 seconds in 0.1 second increments with the machine parameters. The delay time function is void when a setting of 0 seconds is made.
Refer to "M Codes and Operation" for the correspondence between the respective output signals and machine parameters.
By using this function in combination with the Output Signal Off Function, output signals can be turned On for a certain length of time.



12.4.3 Output Signal Off Function

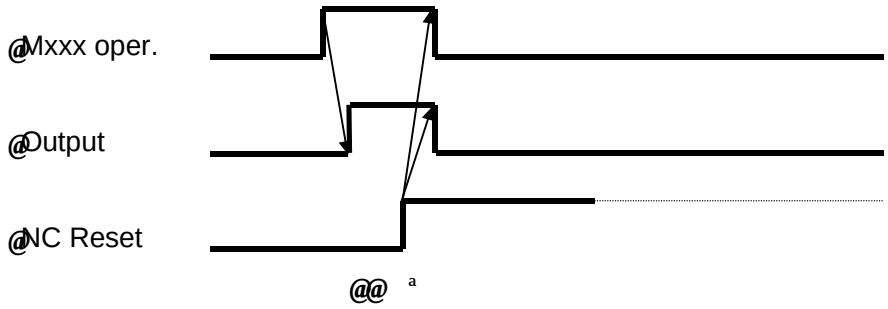
This function allows the output signal which was turned On by an M command to be turned Off and the M command to be completed after confirming On/Off of the input signal or after waiting a certain interval.
Refer to "M Codes and Operation" for the correspondence between the respective output signals and machine parameters.

12.5 Signal Processing in Emergency

12.5.1 Processing when NC is Reset

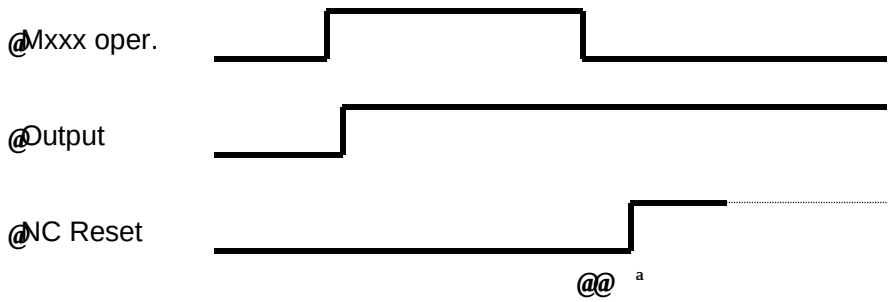
When the NC reset button is pressed while a special user I/O interface command (M580 to M587) is being executed, the output signals which were turned On by the M command being executed are turned Off and the process is interrupted.
When the NC [RESET] key is pressed while no command was being executed or when an M command not related to the special user I/O interface was being executed, the output signal turned On by the previous M command is not turned Off.

1. Example when NC RESE key is pressed during operation (Type 0)



Output is turned Off and Mxxx operation
is interrupted when NC RESE key is pressed.

2. Example when NC RESE key is pressed during non-operation (Type 0)



Output is not turned Off when NC RESE key
is pressed if no operation was being executed.

12.5.2 Processing During Emergency Stop

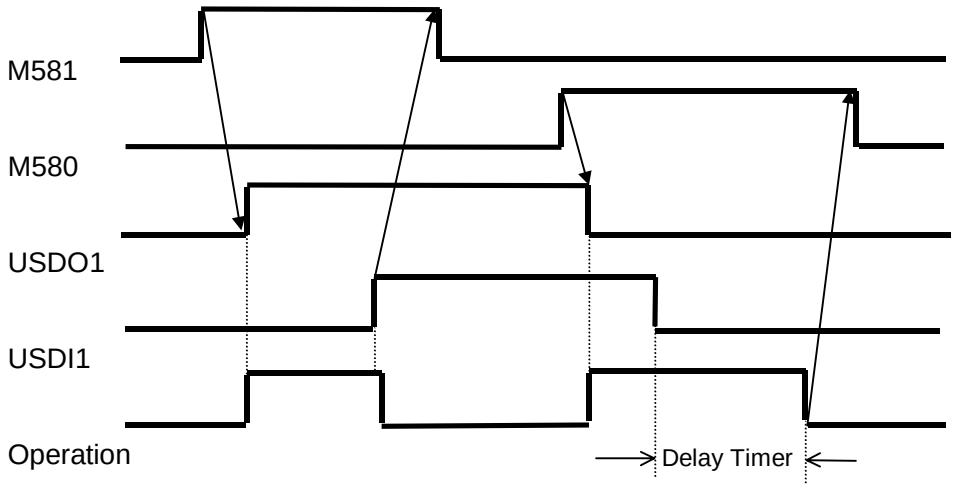
When the emergency stop status has been activated by pressing the [EMERGENCY] button on the main control panel or by a servo alarm, etc., all outputs (USDO1 – USDO8) are turned Off unconditionally. Any user I/O interface process being executed is cancelled.

12.6 Operation Examples

12.6.1 Controlling Single Actuator Provided by User

The control procedure when a single actuator which has one solenoid and one limit switch is described in this section.
When only one limit switch is provided, the delay timer function is used since one operation will not be completed by the change of a normal limit switch. When two limit switches are provided, the delay timer function is used as necessary.
This will be explained with the timing chart shown in this section.

1. Select Type of User M Function



USDO1: Solenoid
USDI1: Limit switch

The delay timer is set when the operation is not completed even though USDI1 goes Off after USDO1 is turned Off by M580 to start the operation.

The machine parameter for the above timing chart are set as described in this section.

1800 TYPE OF USER I/O
0: Type 0 – 8 set - 1 signal control

1801 CHECK USI1 (0: NO / 1: YES)
1: Check

1802 TURN OFF USO1 AFTER COMPLETE (0: NO / 1: YES)

0: Do not turn Off

1803 DELAY TIME TO SEND MFIN AFTER USO1 OFF
Unit: 0.1 sec.
20: If the operation is not completed when 2 seconds elapse after the USDI1 signal goes Off, the operation is completed. This value should be set as appropriate for single actuator operation.

1804 DELAY TIME TO SEND MFIN AFTER USO1 ON Unit: 0.1 sec.
0: The operation is completed after USDI1 goes On. (Set if stable time is required.)

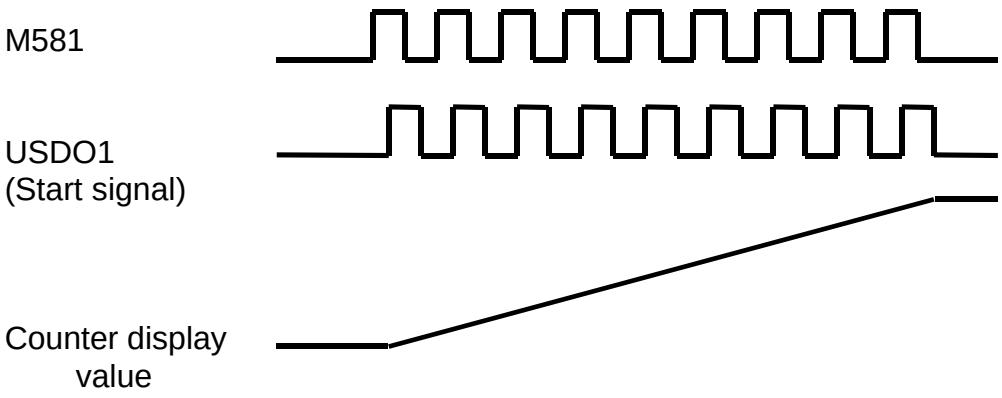
1817 CONFIRM TIME OF USI1 Unit: sec.
30: A machine alarm is triggered if the USDI1 signal does not go On after 30 seconds. Set this timer parameter to a sufficiently large value according to operation time for the single actuator.

2. Connect the solenoids and limit switches to the machine control panel by cable.

3. M580 and M581 can be specified in the MDI mode to confirm single actuator operation. Adjust the values to the ideal level in order to provide the proper stable operation time.

12.6.2 Controlling Production Counter

In this section, the procedure to enter a start command by sending an external signal (pulse signal) in order to control incremental counting by the counter will be described.
The control procedure for every company's counter device is described on the specifications. The explanation in this section is based on the timing chart shown below:



1. Select the type of user M function.
   The machine parameters described in the timing chart on the previous page are set as follows:

   1800 TYPE OF USER I/O
   0: Type 0 – 8 set - 1 signal control

   1801 CHECK USI1 (0: NO / 1: YES)
   0: Do not check

   1802 TURN OFF USO1 AFTER COMPLETE (0: NO / 1: YES)
   1: Turn Off

   1804 DELAY TIME TO SEND MFIN AFTER USO1 ON Unit: 0.1 sec.
   10: 1 sec. (pulse time)

   1817 CONFIRM TIME OF USI1 Unit: sec.
   0: 0 sec. (since USDI1 signal is not used)

2. Connect the peripheral device to the machine control panel by cable.

3. Specify M581 in the MDI mode to confirm counter operation.

Chapter 13 Machine Parameters

V33, V55

Professional 3

Chapter 13
Machine Parameters

Contents

13.1 Machine Parameter Setting Procedure

The machine parameters are set by pressing the [CUSTOM] NC key on the LCD/MDI panel to display the PC screen, and then pressing the proper soft key to select the PC parameter screen.
There are the following types of machine parameters:

Parameter No.	Description
0000 – 0199	MONITOR MESURE
0200 – 0399	DSPL OPN PTR
0400 – 0599	NC FUNCTION
0600 – 0799	SPINDLE
0800 – 0999	FEED AXIS
1000 – 1199	ATC
1200 – 1399	COOLANT
1400 – 1599	P/C & P/M
1600 – 1799	WARNING & LIGHT
1800 – 1999	USER M-CODE
2000 – 2199	TRACE FUNCTION
2200 – 2399	SYSTEM
2400 – 2599	I/O UNIT
2600 – 2799	P/C & P/M 2
2800 – 2799	ATC 2
3000 – 3199	FEED AXIS 2
3200 – 3399	SPINDLE 2 (1)
3400 – 3599	SPINDLE 2 (2)
3600 – 3799	COOLANT 2
3800 – 3999	SPINDLE 3

The above types of machine parameters are displayed on the menu page when the PC parameter screen is first selected.

13.1.1 Setting Procedure

1. Select the PC parameter screen.
2. Select the desired parameter item on the menu page.
3. Press the [MENU PAGE] soft key
4. Press the [LOCK RELESE] soft key
   "PASSWORD" appears on the input line.
5. Enter the password (PRO).
   When "PRO" is entered, "***" appears on the input line.
6. The lock is released when the correct password is entered, and the input line appears. The parameter can be changed from this status.
7. Enter the parameter that you wish to change.
8. Press the [LOCK RELESE] soft key again.
9. Turn Off the power for the machine side control unit and turn the power back On again to complete the parameter setting procedure.

Do not change the settings for machine parameters which are not explained in this operation manual.

13.1.2 Professional 3 Machine Side Retained Memory All Clear Procedure

The Professional 3 has NC side retained (non-volatile) memory in which NC programs and NC parameters are stored, and machine side retained memory in which machine parameters, tool numbers and other such data is stored.
In the event that a machine side retained memory parity error occurs when the power is turned On for the Professional 3, an NMI system alarm is triggered on the NC side. If this happens, perform the "All Clear" procedure described in this section to delete the Professional 3 machine side retained memory.
This procedure deletes the following types of data:

- Machine parameters
- Tool data
- NC function data set when power is turned On
- Work data
- Alarm history
- Regular maintenance date
- Tool monitor data
- User M codes

This procedure does not delete the NC side retained memory content. Furthermore, when the All Clear procedure is performed for the NC side retained memory (by pressing [RESET] and [DELETE] NC keys when power is turned On), the machine side retained memory is not deleted.
In the event the all clear procedure is performed for the machine side retained memory, make sure to enter the I/O unit machine parameter settings. The initial setting function can be used to quickly and easily reset the standard parameter settings, but be sure to remember any changes that have been made. The machine side retained memory all clear procedure is as follows:

1. Turn On the power while holding down the [Xu] and [CAN] NC keys on the LCD/MDI control panel.
2. Release the keys and turn Off the power after waiting 20 seconds.
3. The machine is started up with all machine parameters in the "0" status when power is turned On the next time.

The emergency stop status is triggered at this time since the I/O unit settings have not been made.

All data is deleted when the "All Clear" operation is performed. All parameters, tool and other data must be reset in order to operate the machine normally.
Accordingly,. when the all clear procedure is performed for the retained memory, make sure to follow instructions provided by Regional distributor.

13.2 Machine Parameter Content

13.2.1 Monitor Measuring Settings (0000 – 0199)

Machine parameter number 0000 to 0199 are tool monitor related parameters. Make sure to read and understand the explanation in the Auto Tool Monitor Function chapter before changing a parameter

0005

POWER TO INCREASE AC MONITOR FEEDRATE		Power Off: Not required
Standard Setting: 0	Unit: %	Setting Range: 0 – 255 (%)

This sets the multiplication factor by which the AC monitor cutting feedrate override is increased.

0006

POWER TO DECREASE AC MONITOR FEEDRATE		Power Off: Not required
Standard Setting: 0	Unit: %	Setting Range: 0 – 255 (%)

This sets the multiplication factor by which the AC monitor cutting feedrate override is decreased.

0007

AMOUNT TO INCREASE AC MONITOR FEEDRATE		Power Off: Not required
Standard Setting: 10	Unit: None	Setting Range: 0 – 255

This sets the amount by which the AC monitor cutting feedrate override is increased.

0008

AMOUNT TO DECREASE AC MONITOR FEEDRATE		Power Off: Not required
Standard Setting: 10	Unit: None	Setting Range: 0 – 255

This sets the amount by which the AC monitor cutting feedrate override is decreased.

0009

TOOL LIFE MANAGEMENT (SELECTION 0-3)		Power Off: Not required
Standard Setting: 3	Unit: None	Setting Range: 0 – 255

This setting determines whether tool life is managed in cutting time or cutting distance:

0 : Cutting time (internally managed in 1 second units, displayed in minute units)
1 : Cutting distance (managed in meter or inch units)
2 : Machining quantity (managed in value specified by M919 SΔΔΔΔΔ)
3 : Cutting time (internally managed in 0.1 second units, displayed in minute units)

0010

TOOL LIFE COUNT (0: ADD / 1: REMAIN)		Power Off: Not required
Standard Setting: 1	Unit: nONE	Setting Range: 0 or 1

This setting determines whether tool life is counted as a remaining value or cumulative value:

0 : The number of minutes the tool is used is added to the cumulative tool usage value.
1 : The number of minutes the tool is used is subtracted from the remaining tool life value.

0011

TOOL LIFE ALARM (0: DON'T MAKE/1: MAKE)		Power Off: Not required
Standard Setting: 1	Unit: None	Setting Range: 0 or 1

This setting determines whether or not the tool is handled as an alarm tool when its tool life is reached:

0 : Only calculation is performed by the tool life management function.
1 : An alarm is triggered when that tool is called by a T command the next time after the life is reached.

13.2.2 Display / Control / Printer Settings (0200 – 0399)

Machine parameters 0200 to 0399 are main control panel related parameters.

Flexible Switches (221 – 229)

The main control panel has flexible switches. The desired function can be allocated to the switches on the main control panel by setting the appropriate function number for the parameter. Refer to "Flexible Switch Function Numbers" later in this section for the correspondence between functions and function numbers.

0221

FLEXIBLE SWITCH 01			Power Off: Required
Standard Setting: Refer to table	Unit: None	Setting Range: 0 – 255	

The function number sets which machine function is allocated to the Di switch at the following address on the control panel I/O unit:

V55 : X098 bit 5
V33 : X097 bit 0

0222

FLEXIBLE SWITCH 02			Power Off: Required
Standard Setting: Refer to table	Unit: None	Setting Range: 0 – 255	

The function number sets which machine function is allocated to the Di switch at the following address on the control panel I/O unit:

V55 : X098 bit 6
V33 : X097 bit 1

0223

FLEXIBLE SWITCH 03			Power Off: Required
Standard Setting: Refer to table	Unit: None	Setting Range: 0 – 255	

The function number sets which machine function is allocated to the Di switch at the following address on the control panel I/O unit:

V55 : X098 bit 7
V33 : X097 bit 2

0224

FLEXIBLE SWITCH 04		Power Off: Required
Standard Setting: Refer to table	Unit: None	Setting Range: 0 – 255

The function number sets which machine function is allocated to the Di switch at the following address on the control panel I/O unit:
V55 : X099 bit 0
V33 : X097 bit 3

0225

FLEXIBLE SWITCH 05		Power Off: Required
Standard Setting: Refer to table	Unit: None	Setting Range: 0 – 255

The function number sets which machine function is allocated to the Di switch at the following address on the control panel I/O unit:
V55 : X099 bit 1
V33 : X097 bit 4

0226

FLEXIBLE SWITCH 06		Power Off: Required
Standard Setting: Refer to table	Unit: None	Setting Range: 0 – 255

The function number sets which machine function is allocated to the Di switch at the following address on the control panel I/O unit:
V55 : X099 bit 2
V33 : X097 bit 5

0227

FLEXIBLE SWITCH 07		Power Off: Required
Standard Setting: Refer to table	Unit: None	Setting Range: 0 – 255

The function number sets which machine function is allocated to the Di switch at the following address on the control panel I/O unit:
V55 : X099 bit 3
V33 : X097 bit 6

0228

FLEXIBLE SWITCH 08		Power Off: Required
Standard Setting: Refer to table	Unit: None	Setting Range: 0 – 255

The function number sets which machine function is allocated to the Di switch at the following address on the control panel I/O unit:
V55 : X099 bit 4
V33 : X097 bit 7

0229

FLEXIBLE SWITCH 09		Power Off: Required
Standard Setting: Refer to table	Unit: None	Setting Range: 0 – 255

The function number sets which machine function is allocated to the Di switch at the following address on the control panel I/O unit:
V55 : X099 bit 5
V33 : X099 bit 0

0238

FLEXIBLE SWITCH 11		Power Off: Required
Standard Setting: Refer to table	Unit: None	Setting Range: 0 – 255

The function number sets which machine function is allocated to the Di switch at the following address on the control panel I/O unit:
V55 : X100 bit 6
V33 : X099 bit 2

0240

FLEXIBLE SWITCH 12		Power Off: Required
Standard Setting: Refer to table	Unit: None	Setting Range: 0 – 255

The function number sets which machine function is allocated to the Di switch at the following address on the control panel I/O unit:
V55 : X100 bit 7
V33 : X099 bit 3

0248

ONE TOUCH FUNCTION 01		Power Off: Required
Standard Setting: Refer to table	Unit: None	Setting Range: 0 – 255

The function number sets which one touch function is allocated to the Di switch at the following address on the control panel I/O unit:
V55 : X103 bit 4
V33 : X100 bit 0

0249

ONE TOUCH FUNCTION 02		Power Off: Required
Standard Setting: Refer to table	Unit: None	Setting Range: 0 – 255

The function number sets which one touch function is allocated to the Di switch at the following address on the control panel I/O unit:
V55 : X103 bit 5
V33 : X100 bit 1

0250

ONE TOUCH FUNCTION 03		Power Off: Required
Standard Setting: Refer to table	Unit: None	Setting Range: 0 – 255

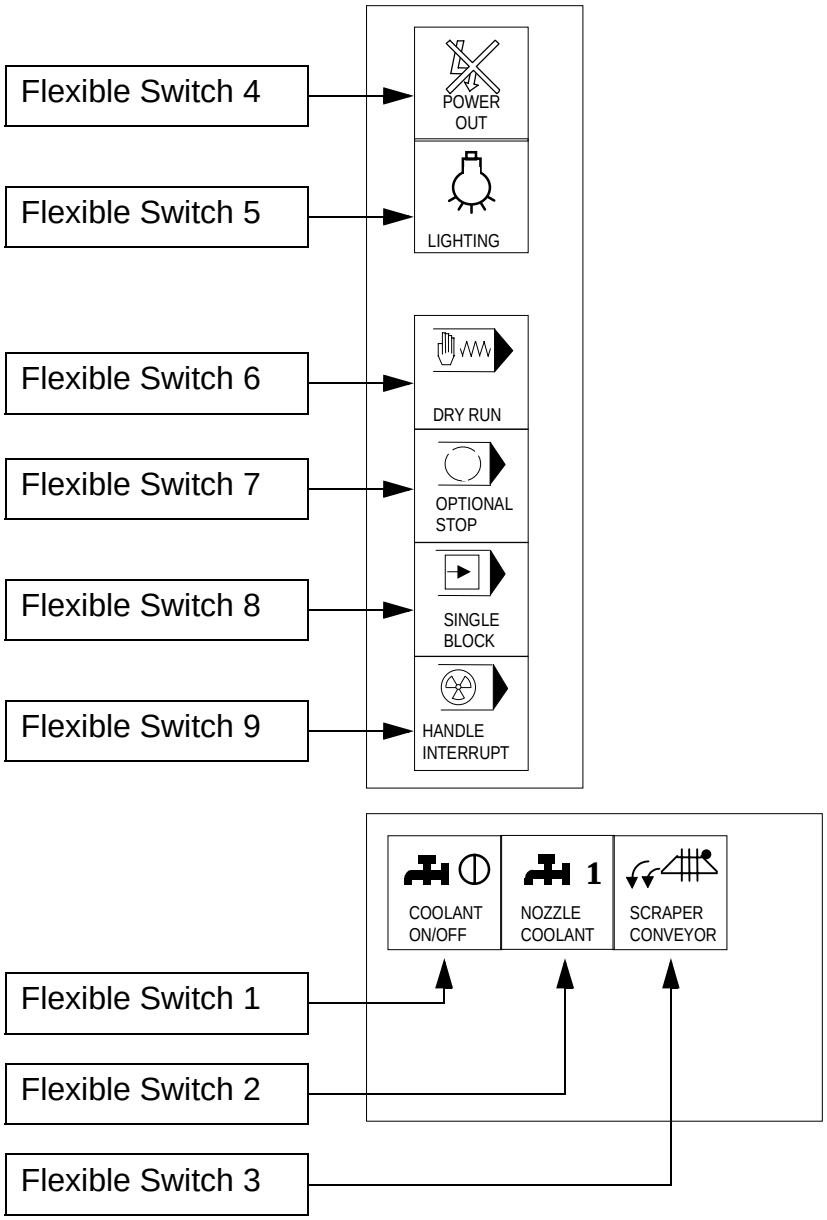
The function number sets which one touch function is allocated to the Di switch at the following address on the control panel I/O unit:
V55 : X103 bit 6
V33 : X100 bit 2

0251

ONE TOUCH FUNCTION 04		Power Off: Required
Standard Setting: Refer to table	Unit: None	Setting Range: 0 – 255

The function number sets which one touch function is allocated to the Di switch at the following address on the control panel I/O unit:
V55 : X103 bit 7
V33 : X100 bit 3

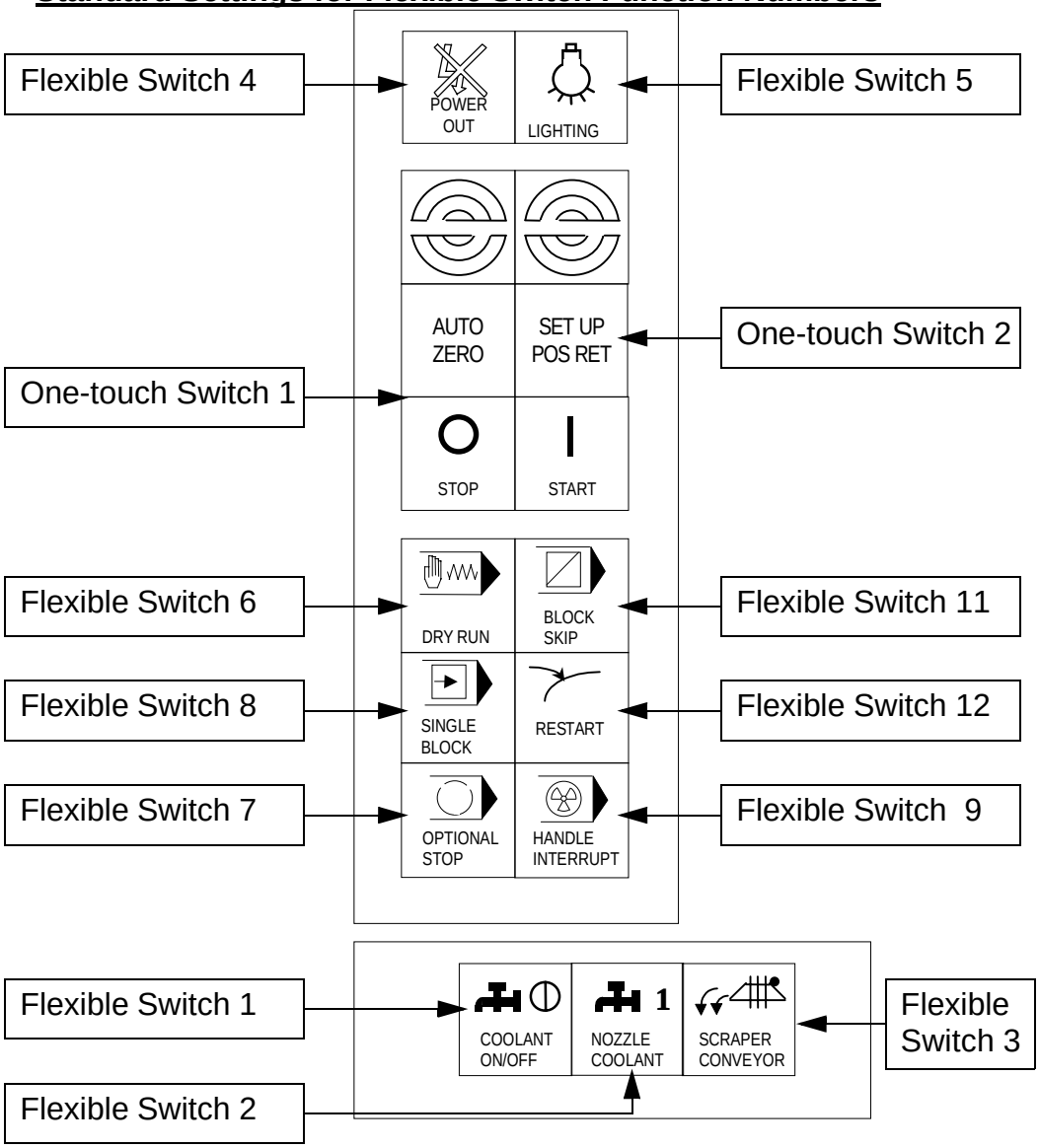
Standard Settings for Flexible Switch Function Numbers



Flexible Switch No.	Machine Parameter No.	Standard Setting	Standard Function Name
1	221	31	COOLANT STOP
2	222	21	NOZZLE COOLANT
3	223	27	SCRAPER CONVEYOR
4	224	24	POWER OUT
5	225	25	LIGHTING
6	226	12	DRY RUN
7	227	14	OPTIONAL STOP
8	228	11	SINGLE BLOCK
9	229	15	HANDLE INTERRUPT (OPTION)

For Main Control Panel (V55: FS16MC)

Standard Settings for Flexible Switch Function Numbers

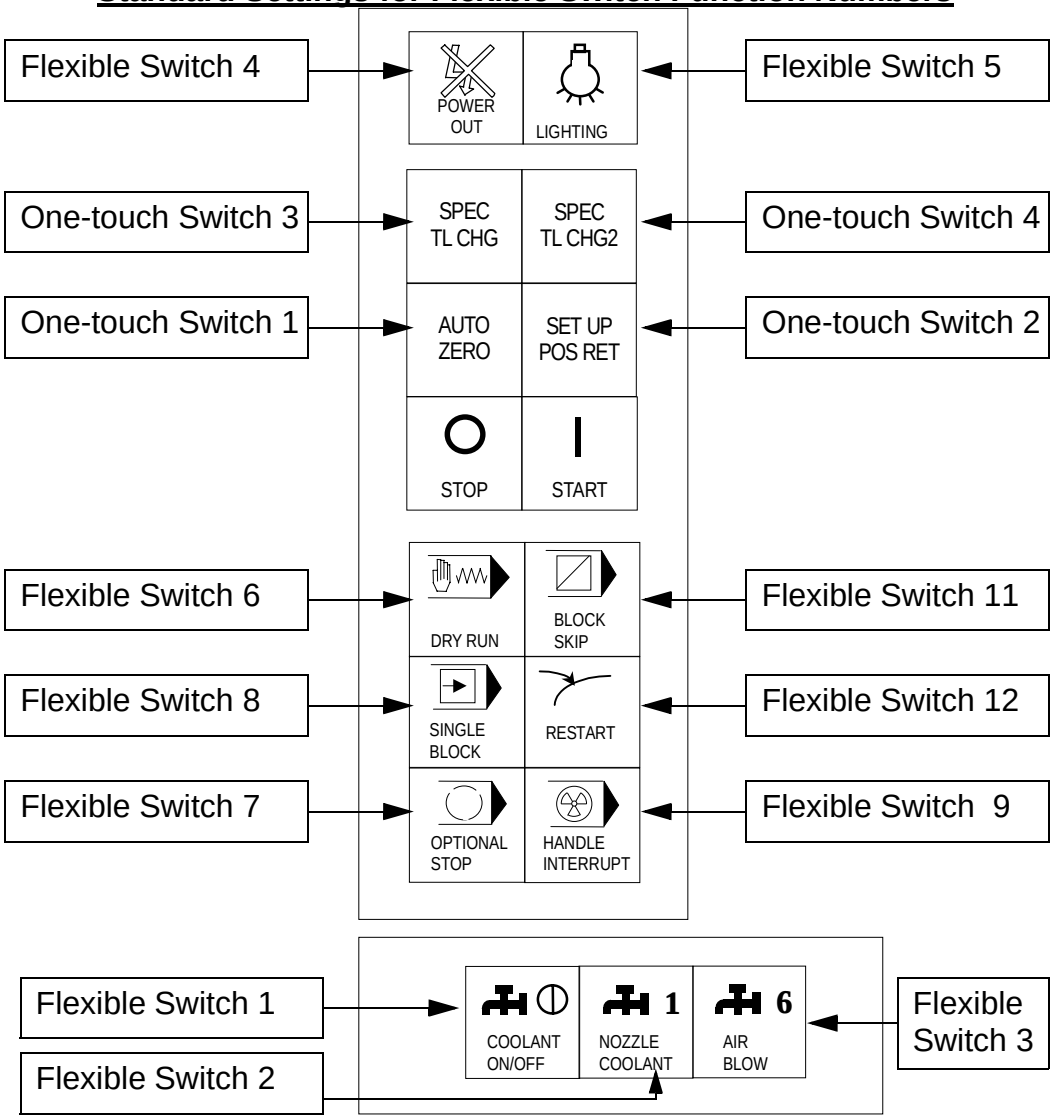


Flexible Switch No.	Machine Parameter No.	Standard Setting	Standard Function Name
1	221	31	COOLANT STOP
2	222	21	NOZZLE COOLANT
3	223	27	SCRAPER CONVEYOR
4	224	24	POWER OUT
5	225	25	LIGHTING
6	226	12	DRY RUN
7	227	14	OPTIONAL STOP
8	228	11	SINGLE BLOCK
9	229	15	HANDLE INTERRUPT (OPTION)
11	238	13	BLOCK SKIP
12	240	16	RESTART

Flexible Switch No.	Machine Parameter No.	Standard Setting	Standard Function Name
1	248	7	AUTO ZERO
2	249	6	SET UP POS RET

For Main Control Panel (V55: FS16i-MA)

Standard Settings for Flexible Switch Function Numbers



Flexible Switch No.	Machine Parameter No.	Standard Setting	Standard Function Name
1	221	31	COOLANT STOP
2	222	21	NOZZLE COOLANT
3	223	59	COOLANT AIR
4	224	24	POWER OUT
5	225	25	LIGHTING
6	226	12	DRY RUN
7	227	14	OPTIONAL STOP
8	228	11	SINGLE BLOCK
9	229	15	HANDLE INTERRUPT (OPTION)
11	238	13	BLOCK SKIP
12	240	16	RESTART

Flexible Switch No.	Machine Parameter No.	Standard Setting	Standard Function Name
1	248	7	AUTO ZERO
2	249	6	SET UP POS RET
3	250	1	AUTO TL CHG
4	251	2	AUTO TL CHG2

For Main Control Panel (V33)

List of Flexible Switch Function Numbers

Function No.	Function
11	Single block
12	Dry run
13	Block skip
14	Optional stop
15	Handle interrupt
16	Program restart
17	Machine lock
18	Manual absolute
19	F1 digit feed
20	Z axis neglect
21	Nozzle coolant
23	Through-tool coolant
24	Power off
25	Light
27	Scraper conveyor
28	Warning light
29	Oil skimmer
30	Through-tool air
31	Coolant stop
40	Spare tool select
41	Block skip 2
42	Block skip 3
43	Block skip 4
44	Block skip 5
45	Block skip 6
46	Block skip 7
47	Block skip 8
48	Block skip 9
49	Playback
50	Auxiliary function lock
51	Unconditional print mode
52	Conditional print mode
54	Random mode
55	Auto unlock
59	Air blow
61	Warning lamp Off
62	Through-spindle coolant

63	Through-spindle air
65	Ceiling shower coolant
67	Random start
69	Mist collector
78	Wet cut mode
82	Tool retract
83	Tool return
85	Lamp check
86	Splash guard wiper
92	Scraper conveyor reverse
99	High-pressure nozzle coolant
106	Custom macro interrupt
108	DNC operation mode
112	Special tool unclamp
113	Operator door open
120	Through-spindle mist
121	Mist blow
122	Dust collector
124	System suspend (HSSB system)
125	Pallet loading prohibit (HSSB system)
130	High-precision machining mode
131	High-efficiency machining mode
132	Pallet unclamp

List of One-Touch Switch Function Numbers

Function No.	Function
01	Special tool change 1
02	Special tool change 2
03	Special tool change 3
04	Special tool change 4
05	Auto tool change
06	Set up position return
07	All axes reference point return
10	Measuring head power Off
11	Measuring head power On

Procedure to Change Flexible Switch Function

1. Check the function number of the new function to be allocated.
2. Determine the machine parameter number for the switch to be changed.

3. Set the function number to the machine parameter.
4. Turn Off the machine power.
5. Remove the cap on the switch, and exchange the symbol sheet.
6. Turn On the machine power (the newly allocated function is activated at this time).

Setting Example

The standard setting for flexible switch 9 is handle interrupt. To change this switch to "Ceiling shower coolant", enter "65" for machine parameter No. 229 (Flexible Switch 09).

0252

SETUP POSITION (X-AXIS)		Power Off: Required
Standard Setting: 0	Unit: mm/inch	Setting Range: ±9999

This parameter sets the X axis coordinate for the set up position return function. The coordinate is set as an absolute position in the machine coordinates.

0253

SETUP POSITION (Y-AXIS)		Power Off: Required
Standard Setting: 0	Unit: mm/inch	Setting Range: ±9999

This parameter sets the Y axis coordinate for the set up position return function. The coordinate is set as an absolute position in the machine coordinates.

0254

REF P RETURN RETRACT POSITION (X-AXIS)		Power Off: Required
Standard Setting: -100	Unit: mm/inch	Setting Range: ±255

This parameter sets the position from which the X axis reference point return operation is performed by the all axis reference point return function. The setting is the distance from the reference point.

0255

REF P RETURN RETRACT POSITION (Y-AXIS)		Power Off: Required
Standard Setting: -100	Unit: mm/inch	Setting Range: ±255

This parameter sets the position from which the Y axis reference point return operation is performed by the all axis reference point return

function. The setting is the distance from the reference point.

0256

REF P RETURN RETRACT POSITION (Z-AXIS)		Power Off: Required
Standard Setting: -100	Unit: mm/inch	Setting Range: ±255

This parameter sets the position from which the Z axis reference point return operation is performed by the all axis reference point return function. The setting is the distance from the reference point.

0257

REF P RETURN RETRACT POSITION (4TH-AXIS)		Power Off: Required
Standard Setting: –20	Unit: °	Setting Range: ±255

This parameter sets the position from which the 4th axis reference point return operation is performed by the all axis reference point return function. The setting is the number of degrees from the reference point.

0258

REF P RETURN RETRACT POSITION (5TH-AXIS)		Power Off: Required
Standard Setting: –20	Unit: mm/inch	Setting Range: ±255

This parameter sets the position from which the 5th axis reference point return operation is performed by the all axis reference point return function. The setting is the number of degrees from the reference point.

0260

SPECIFIC TOOL CHANGE PTN NO. 1		Power Off: Required
Standard Setting: 0	Unit: None	Setting Range: 0 – 9999

This parameter sets the tool number for specific tool 1 which is used when the specific tool change operation is performed.

0261

SPECIFIC TOOL CHANGE PTN NO. 2		Power Off: Required
Standard Setting: 0	Unit: None	Setting Range: 0 – 9999

This parameter sets the tool number for specific tool 2 which is used when the specific tool change operation is performed.

0262

SPECIFIC TOOL CHANGE PTN NO. 3		Power Off: Required
Standard Setting: 0	Unit: None	Setting Range: 0 – 9999

This parameter sets the tool number for specific tool 3 which is used when the specific tool change operation is performed.

0264

SPECIFIC TOOL CHANGE PTN NO. 4		Power Off: Required
Standard Setting: 0	Unit: None	Setting Range: 0 – 9999

This parameter sets the tool number for specific tool 4 which is used when the specific tool change operation is performed.

0266

REGULAR MAINTENANCE DATE SETTING		Power Off: Required
Standard Setting: 0	Unit: None	Setting Range: 0 – 255

When this parameter is set to 1 and the NC power is turned Off and then On, the date/time is read from the Professional 3 NC clock. This date is used to calculate the regular maintenance days (e.g. one month, six month) and is stored in the non-volatile memory. After this information is stored, this parameter is automatically set to 2.
In other words, when the NC power is turned Off and then On when the system is first installed or after the "All Clear" operation is performed for the Professional 3 machine side non-volatile memory, the maintenance items are displayed on the regular maintenance days, based on that date.
Furthermore, the time must have been set for the NC unit before this machine parameter is set to 1 in order to enable the time to be read from the NC unit.

0276

LAMP CHECK TIME AT POWER ON		Power Off: Required
Standard Setting: 0	Unit: sec	Setting Range: 0 – 255

This parameter sets the number of seconds that all LEDs on the main control panel are lit when the power is turned On. Setting this parameter to a value other than 0 enables the lamps to be checked when power is turned On.

0281

TOOL DETAIL SCREEN DISPLAY NUMBER		Power Off: Required
Standard Setting: 0	Unit: Number	Setting Range: 0 – 391

This parameter sets the number of tools which are displayed on the tool data screen. Make sure that this value is a multiple of 17. If this value is set to a number which is not a multiple of 17, 0 or a value exceeding 401, the number of tools displayed will be equal to the ATC capacity + 30.

0324

M483 OUTPUT MACRO NUMBER		Power Off: Required
Standard Setting: 0	Unit: None	Setting Range: 100 – 255

This parameter sets the custom macro common variable for data output when M483 is executed. Output cannot be performed for local variables.

13.2.3 P/C, P/M, S/G Settings (1400 – 1599)

1403

LEAVE PALLET ON TABLE AT RANDOM FINISH		Power Off: Not required
Standard Setting: 0	Unit: None	Setting Range: 0 – 9999

This parameter sets whether the pallet is left on the table when machining is completed in the random operation mode for the last pallet, or the pallet is unloaded.

0 : Pallet unloaded
1 : Pallet left on table

1406

RESTART FUNC OF M60 AT PALLET READY OFF		Power Off: Not required
Standard Setting: 1	Unit: None	Setting Range: 0 or 1

This parameter selects the procedure to be performed in the event there is not a ready pallet when the ready pallet confirm M code (M84, M95) is executed.

0 : Alarm is triggered and operation is stopped if the pallet ready signal is Off when the M84 or M95 code is specified.
1 : Alarm is triggered if pallet ready signal is Off when M84 or M95 is sent, but operation is started when the ready status goes to On subsequent to this.

1407

RESTART METHOD OF M60 AT PALLET READY OFF		Power Off: Not required
Standard Setting: 1	Unit: None	Setting Range: 0 or 1

This parameter is valid when parameter 1406 is set to 1. It selects the method by which operation is started after the ready status goes On.

0 : Operation is immediately started when pallet ready status goes On.

1 : Operation is started when [RETRY] key on alarm screen is pressed after pallet ready status goes On.

1410

X-AXIS POS CHECK MODE AT RANDOM START		Power Off: Not required
Standard Setting: 0	Unit: None	Setting Range: 0 – 3

This parameter is set when you wish to only start random operation when the X axis is at a certain position.

0 : Do not check

1 : Confirm that X axis is at 1st reference point

2 : Confirm that X axis is at 2nd reference point

3 : Confirm that X axis is at 3rd reference point

1411

Y-AXIS POS CHECK MODE AT RANDOM START		Power Off: Not required
Standard Setting: 0	Unit: None	Setting Range: 0 – 3

This parameter is set when you wish to only start random operation when the Y axis is at a certain position.

0 : Do not check

1 : Confirm that Y axis is at 1st reference point

2 : Confirm that Y axis is at 2nd reference point

3 : Confirm that Y axis is at 3rd reference point

1412

Z-AXIS POS CHECK MODE AT RANDOM START		Power Off: Not required
Standard Setting: 0	Unit: None	Setting Range: 0 – 3

This parameter is set when you wish to only start random operation when the Z axis is at a certain position.

0 : Do not check

1 : Confirm that Z axis is at 1st reference point

2 : Confirm that Z axis is at 2nd reference point

3 : Confirm that Z axis is at 3rd reference point

1413

4-AXIS POS CHECK MODE AT RANDOM START		Power Off: Not required
Standard Setting: 0	Unit: None	Setting Range: 0 – 3

This parameter is set when you wish to only start random operation when the 4th axis is at a certain position.

0 : Do not check
1 : Confirm that 4th axis is at 1st reference point
2 : Confirm that 4th axis is at 2nd reference point
3 : Confirm that 4th axis is at 3rd reference point

1414

5-AXIS POS CHECK MODE AT RANDOM START		Power Off: Not required
Standard Setting: 0	Unit: None	Setting Range: 0 – 3

This parameter is set when you wish to only start random operation when the 5th axis is at a certain position.

0 : Do not check
1 : Confirm that 5th axis is at 1st reference point
2 : Confirm that 5th axis is at 2nd reference point
3 : Confirm that 5th axis is at 3rd reference point

1420

CYCLE START ON PALLET READY OFF AT M30		Power Off: Not required
Standard Setting: 0	Unit: None	Setting Range: 0 or 1

This parameter sets whether or not cycle start is automatically performed after the beginning of the machining program is indexed when the pallet is unloaded by O9820 and M30 is executed during the standard operation mode.

0 : Do not perform cycle start
1 : Perform cycle start

1475

NOT CYCLE START PALLET READY ON AT M30		Power Off: Not required
Standard Setting: 0	Unit: None	Setting Range: 0 or 1

This parameter sets whether or not cycle start is automatically performed after the beginning of the machining program is indexed when the pallet is unloaded then loaded by O9820 and M30 is executed during the standard operation mode.

0 : Automatically perform cycle start
1 : Do not perform cycle start

1514

PROGRAM NO. CHECK WHEN PALLET READY ON		Power Off: Not required
Standard Setting: 0	Unit: None	Setting Range: 0 or 1

This parameter sets whether or not the pallet ready On operation is displayed when the random operation mode is On and the machining program number on the work data screen is "0".

0 : Allow On at any time

1 : Prevent ready status from being turned On when random operation mode is On and program number is "0"

Chapter 14 List of M Codes

V33, V55

Professional 3

Chapter 14
List of M Codes

Contents

14.1 List of M Codes

Notes on Viewing List of M Codes

This list of M codes includes all M codes provided for the V33 and V55, including special user specifications.
Therefore, please note that it may not be possible to use some M codes, depending upon the machine specifications and provided options.
Refer to the separate List of M Codes for M code specifications.

14.1.1 List of M Codes for V55

M000	PROGRAM STOP	
M001	OPTIONAL STOP	
M002	END OF PROGRAM	
M003	SPINDLE START IN CW DIRECTION	
M004	SPINDLE START IN CCW DIRECTION	
M005	SPINDLE STOP	
M006	AUTOMATIC TOOL CHANGE	
M007	MIST COOLANT OR AIR BLOW ON	(option)
M008	NOZZLE COOLANT ON	
M009	COOLANT OFF	
M010	4TH-AXIS CLAMP	(option)
M011	4TH-AXIS UNCLAMP	(option)
M012	5TH-AXIS CLAMP	(option)
M013	5TH-AXIS UNCLAMP	(option)
M016	4TH-AXIS MIRROR IMAGE ON	(option)
M019	SPINDLE ORIENTATION	
M020	BTS (BROKEN TOOL DETECTION) CHECK	(option)
M021	X-AXIS MIRROR IMAGE ON	
M022	Y-AXIS MIRROR IMAGE ON	
M023	MIRROR IMAGE OFF	
M026	THROUGH SPINDLE COOLANT ON	(option)
M027	TAP OIL (MIST, JET) ON	
M028	THROUGH TOOL AIR ON	(option)
M029	UNCONDITIONAL POWER OUT	
M030	END OF PROGRAM & REWIND	
M031	WORK AUTOMATIC MEASURING MODE	(option)
M032	TOOL LENGTH AUTO MEASURING MODE	(option)

M033	TOOL LENGTH CIRCUIT CHECK	(option)
M034	AUTO MEASURE & CALL SPARE TOOL	(option)
M035	AUTO MEASURE & PALLET UNLOADING	(option)
M036	PRIOR TOOL CHECK MODE	
M037	TOOL DATA REGISTER MODE OFF	
M038	AC SL VALUE TEMPOR ALTER MODE ON	
M039	AC SL VALUE TEMPORARY ALTERATION	
M040	TL REMAIN DATA REGISTER MODE ON	
M041	SL COEFFICIENT SETTING 125%	
M042	SL COEFFICIENT SETTING 150%	
M043	SL COEFFICIENT SETTING 200%	
M044	SL AC COEFFICIENT 0%	
M046	SL DATA REGISTER MODE ON	
M047	AC DATA REGISTER MODE ON	
M048	M49 MODE CANCEL	
M049	FEEDRATE OVERRIDE CANCEL	
M050	AC COEFFICI 100%, SL COEFFIC 200%	
M051	M52 MODE CANCEL	(option)
M052	AUTO UNLOAD INHIBIT MODE AT ALM	(option)
M053	TOOL OFFSET DATA REGISTER MODE	
M054	TOOL OFFSET MINUS REGIST MODE	
M056	TOOL OFFSET DATA TRANSF COMMAND	
M057	TOOL NUMBER REGISTERING MODE ON	
M058	M59 MODE CANCEL	
M059	SPINDLE SPEED OVERRIDE CANCEL	
M060	PALLET CHANGE	(option)
M061	PALLET CHANGE	(option)
M062	PALLET CHANGE	(option)
M063	PALLET CHANGE	(option)
M064	PALLET CHANGE	(option)
M065	PALLET CHANGE	(option)
M066	PALLET CHANGE	(option)
M067	PALLET CHANGE	(option)
M068	NO. 2M CODE DESIGNATION	
M070	QUANTITY VECTOR INTAKE	
M071	QUANTITY VECTOR PROCESS INCRMNT	
M072	QUANTITY VECTOR NUMBER DECREMENT	
M077	THROUGH SPINDLE AIR ON	
M080	PALLET CHANGE	(option)

M084	PALLET 1 LOAD CHECK	(option)
M085	AUTO MEASURING APPROACH MODE	(option)
M086	AUTO MEASURING FAST FEED MODE	(option)
M088	APC AUTO DOOR OPEN	(option)
M089	APC AUTO DOOR CLOSE	(option)
M093	SPARE TOOL REGISTER MODE ON	
M094	TOOL DATA DELETE MODE ON	
M095	PALLET 2 LOAD CHECK	(option)
M096	THROUGH TOOL COOLANT ON	(option)
M097	HIGH POWER COOLANT ON	(option)
M098	SUB PROGRAM ACCESS	
M099	RETURN MAIN PROGRAM	
M105	DIRECT STS	
M106	DIRECT STS DISABLE	
M107	DIRECT STS ENABLE	
M135	RIGID TAP MODE ON	
M140	AUTOMATIC BLOCK SKIP ON	
M141	AUTOMATIC BLOCK SKIP OFF	
M142	BLOCK SKIP RETURN	
M146	ODEG SURFACE READY CONTROL	
M147	90DEG SURFACE READY CONTROL	
M148	180DEG SURFACE READY CONTROL	
M147	270DEG SURFACE READY CONTROL	
M150	BLOCK SKIP (2 TO 9) OFF	(option)
M152	BLOCK SKIP 2 ON	(option)
M153	BLOCK SKIP 3 ON	(option)
M154	BLOCK SKIP 4 ON	(option)
M155	BLOCK SKIP 5 ON	(option)
M156	BLOCK SKIP 6 ON	(option)
M157	BLOCK SKIP 7 ON	(option)
M158	BLOCK SKIP 8 ON	(option)
M159	BLOCK SKIP 9 ON	(option)
M230	MACHINE PARA REGISTRATION ON	
M231	MACHINE PARAMETER DUMP	
M232	MACHINE PARAMETER PRINT	
M233	TOOL DATA DUMP	
M250	GI S_GI [M250] MODE	

M251	GI S_GI [M251] MODE	
M252	GI S_GI [M252] MODE	
M253	GI S_GI [M253] MODE	
M254	GI S_GI [M254] MODE	
M255	GI S_GI [M255] MODE	
M259	GI S_GI ORIGINAL MODE	
M268	HIGH SPEED CYCLE MACHINING START	
M269	HIGH SPEED CYCLE MACHINING END	
M272	BTS CHECK (MACHINE DOESN'T STOP)	
M300	DISABLE SPINDLE SUCKIN	
M301	ENABLE SPINDLE SUCKIN	
M310	SPINDLE STOP AND STORE	
M311	SPINDLE RECOVER	
M312	COOLANT STOP AND STORE	
M313	COOLANT RECOVER	
M318	EXTERNAL-ORIENTATION	(option)
M319	PRE-ORIENTATION	(option)
M323	SPEC. TOOL CLAMP	
M324	SPEC. TOOL UNCLAMP	
M325	CONTOURING MODE OFF	
M326	CONTOURING MODE ON	
M355	INDEX POSITION-1 OF INDEXER	
M356	INDEX POSITION-2 OF INDEXER	
M357	INDEX POSITION-3 OF INDEXER	
M359	PROCESS-1 WORK	
M380	LOW PRESSURE CLAMP	
M389	HIGH PRESSURE CLAMP	
M390	SPINDLE TOOL CLAMP	
M391	SPINDLE TOOL UNCLAMP	
M392	PREP. FOR SPINDLE TOOL UNCLAMP	
M398	THROUGH SPINDLE MIST ON	
M399	MIST BLOW ON	
M417	CONF PALLET NO 1 ON MACH TBL	(option)
M418	CONF PALLET NO 2 ON MACH TBL	(option)
M419	FIN A CONF OF PALLET ON MACH TBL	(option)

M430	PALLET STICK CHECK	(option)
M433	BTS LS300 OFF CHECK	
M434	TOOL BROKEN CONDITIONAL CHECK	
M436	COMPULSION LIGHTING OF PTL1	
M437	COMPULSION LIGHTING OF PTL2	
M462	SEND OUT PALLET NO	(option)
M463	PRINTOUT MODE OUTPUT REQUIRED	(option)
M464	COMMAND SPDL T-NO. OUTPUT REQUEST	(option)
M465	SPDL NUMBER "0" OUTPUT	(option)
M466	READ MACRO DATA (#100)	(option)
M469	TL ALARM SUSPENSION MODE ON	
M478	RECORD MACHINING FINISH TIME	
M479	RECORD MACHINING START TIME	
M480	MACRO DATA (#100–#149) UPLOAD	(option)
M483	OUTPUT TOOL DETAIL TO MACRO VAL	(option)
M495	WORK CARRYING OUT	
M497	WORK CARRYING IN	
M508	OPERATOR DOOR CLOSE	
M509	OPERATOR DOOR OPEN	
M530	CHUCK CLAMP	
M531	CHUCK UNCLAMP	
M548	ATC SHUTER CLOSE AND WAIT FINISH	
M549	ATC SHUTER OPEN AND WAIT FINISH	
M551	ATC S/G OPEN, ORIENTATIN, CLNT OFF	
M554	CHECK ATC SHUTER OPEN CONDITION	
M559	FOR TOOL CHANGE	
M580	USER I/O M-CODE	(option)
M581	USER I/O M-CODE	(option)
M582	USER I/O M-CODE	(option)
M583	USER I/O M-CODE	(option)
M584	USER I/O M-CODE	(option)
M585	USER I/O M-CODE	(option)
M586	USER I/O M-CODE	(option)
M587	USER I/O M-CODE	(option)

M588	USER I/O M-CODE	(option)
M589	USER I/O M-CODE	(option)
M590	USER I/O M-CODE	(option)
M591	USER I/O M-CODE	(option)
M592	USER I/O M-CODE	(option)
M593	USER I/O M-CODE	(option)
M594	USER I/O M-CODE	(option)
M595	USER I/O M-CODE	(option)
M596	USER I/O M-CODE	(option)
M602	DNC PROG END (ONE-TOUCH FUNCTION)	
M603	FINISH TOOL TAKE SHELTER	
M608	INDEPENDENT CARRIED IN (ONE-TOUCH)	(option)
M609	INDEPENDENT CARRIED OUT (ONE-TOUCH)	(option)
M621	FOR TOOL CHANGE	
M663	FOR TOOL CHANGE	
M709	DON'T WAIT DEN ON COOLANT STOP	
M710	MIST COLLECTOR OFF	
M711	MIST COLLECTOR ON	
M732	COOLANT PRESSURE SETTING 1	
M733	COOLANT PRESSURE SETTING 2	
M734	COOLANT PRESSURE SETTING 3	
M735	COOLANT PRESSURE SETTING 4	
M736	MACHINE LIGHT ON	
M736	MACHINE LIGHT OFF	
M740	SPIRAL CHIP CONVEYOR OFF	
M741	SPIRAL CHIP CONVEYOR ON	
M742	OIL SKIMMER OFF	
M743	OIL SKIMMER ON	
M747	MEASURING HEAD CLEANING AIR ON	(option)
M748	TURN IMM CLEANING AIR ON	(option)
M749	TURN IMM CLEANING AIR OFF	(option)
M750	TURN IMM MODE ON	(option)
M751	TURN IMM MODE OFF	(option)
M756	AIR BLOW ON	(option)

M790	AMOUNT OF OIL IS LITTLE (MQL)	
M791	AMOUNT OF OIL IS STANDARD (MQL)	
M792	AMOUNT OF OIL IS LARGE (MQL)	
M793	MIST PRESSURE IS HIGH (MQL)	
M794	MIST PRESSURE IS STANDARD (MQL)	
M910	WORK AUTO MEASUR M31 MODE CANCEL	(option)
M911	MP7 MEASURING HEAD ALARM CHECK	(option)
M919	TL COUNT	
M920	TOOL LENGTH MEASUR REGISTRATION	(option)
M921	TOOL DIAMETR MEASR REGISTRATION	(option)
M922	M920, M921 ADDITION MODE	(option)
M925	M926 MODE CANCEL	
M926	LC RING SENSOR OBSERVATION MODE	
M927	SET FIRST USED TOOL FLAG	(option)
M928	FIRST USED TOOL FLAG OFF	(option)
M929	BAD RESULT OF 1ST USED TOOL FLAG	(option)
M930	TOOL LIFE DATA REGISTER MODE ON	
M931	TOOL REMAIN DATA REGIST MODE ON	
M932	ITN REGIST MODE ON	
M934	TOOL ALARM DATA REGISTER MODE ON	
M938	RAKURAKU CHECKER: CHANGE JOG MODE	
M939	RAKURAKU CHECKER FINISH	
M940	AUTO FIN AT WORK RESULT ABNORMAL	(option)
M941	MP7 MEASURING HEAD CHECK	(option)
M948	FOR TOOL CHANGE	
M963	MEASURING PROBE POWER OFF & CONF	(option)
M964	MEASURING PROBE POWER ON & CONF	(option)
M965	MEASURING PROBE POWER OFF	(option)
M966	MEASURING PROBE POWER ON	(option)
M967	ATC SPEED REGIST MODE ON	
M968	FF PATH	
M975	TOOL KIND DATA REGIST MODE ON	
M979	THRU SPN AIR TIME REGIST MODE ON	(option)
M994	REV. AXIS CALCULATION	

14.1.2 List of M Codes for V33

M000	PROGRAM STOP	
M001	OPTIONAL STOP	
M002	END OF PROGRAM	
M003	SPINDLE START IN CW DIRECTION	
M004	SPINDLE START IN CCW DIRECTION	
M005	SPINDLE STOP	
M006	AUTOMATIC TOOL CHANGE	
M007	MIST COOLANT OR AIR BLOW ON	(option)
M008	NOZZLE COOLANT ON	
M009	COOLANT OFF	
M010	NC ROTARY TABLE CLAMP	(option)
M011	NC ROTARY TABLE UNCLAMP	(option)
M012	5TH-AXIS CLAMP	(option)
M013	5TH-AXIS UNCLAMP	(option)
M014	BTS ARM ADVANCE	
M015	INDEX TABLE REVERSE	(option)
M016	4TH-AXIS MIRROR IMAGE ON	
M018	BTS ARM RETRACT	
M019	SPINDLE ORIENTATION	
M020	BTS (BROKEN TOOL DETECTION) CHECK	(option)
M021	X-AXIS MIRROR IMAGE ON	
M022	Y-AXIS MIRROR IMAGE ON	
M023	MIRROR IMAGE OFF	
M026	THROUGH SPINDLE COOLANT ON	(option)
M027	TAP OIL (MIST, JET) ON	
M028	THROUGH TOOL AIR ON	(option)
M029	UNCONDITIONAL POWER OUT	
M030	END OF PROGRAM & REWIND	
M031	WORK AUTOMATIC MEASURING MODE	(option)
M032	TOOL LENGTH AUTO MEASURING MODE	(option)
M033	TOOL LENGTH CIRCUIT CHECK	(option)
M034	AUTO MEASURE & CALL SPARE TOOL	(option)
M035	AUTO MEASURE & PALLET UNLOADING	(option)
M036	PRIOR TOOL CHECK MODE	
M037	TOOL DATA REGISTER MODE OFF	
M038	AC SL VALUE TEMPOR ALTER MODE ON	
M039	AC SL VALUE TEMPORARY ALTERATION	

M040	TL REMAIN DATA REGISTER MODE ON	
M041	SL COEFFICIENT SETTING 125%	
M042	SL COEFFICIENT SETTING 150%	
M043	SL COEFFICIENT SETTING 200%	
M044	SL AC COEFFICIENT 0%	
M046	SL DATA REGISTER MODE ON	
M047	AC DATA REGISTER MODE ON	
M048	M49 MODE CANCEL	
M049	FEEDRATE OVERRIDE CANCEL	
M050	AC COEFFICI 100%, SL COEFFIC 200%	
M051	M52 MODE CANCEL	(option)
M052	AUTO UNLOAD INHIBIT MODE AT ALM	(option)
M053	TOOL OFFSET DATA REGISTER MODE	
M054	TOOL OFFSET MINUS REGIST MODE	
M056	TOOL OFFSET DATA TRANSF COMMAND	
M057	TOOL NUMBER REGISTERING MODE ON	
M058	M59 MODE CANCEL	
M059	SPINDLE SPEED OVERRIDE CANCEL	
M068	NO. 2M CODE DESIGNATION	
M070	QUANTITY VECTOR INTAKE	
M071	QUANTITY VECTOR PROCESS INCRMNT	
M072	QUANTITY VECTOR NUMBER DECREMENT	
M077	THROUGH SPINDLE AIR ON	
M085	AUTO MEASURING APPROACH MODE	(option)
M086	AUTO MEASURING FAST FEED MODE	(option)
M093	SPARE TOOL REGISTER MODE ON	
M094	TOOL DATA DELETE MODE ON	
M096	THROUGH TOOL COOLANT ON	(option)
M097	HIGH POWER COOLANT ON	(option)
M098	SUB PROGRAM ACCESS	
M099	RETURN MAIN PROGRAM	
M105	DIRECT STS	
M106	DIRECT STS DISABLE	
M107	DIRECT STS ENABLE	
M135	RIGID TAP MODE ON	

M140	AUTOMATIC BLOCK SKIP ON	
M141	AUTOMATIC BLOCK SKIP OFF	
M142	BLOCK SKIP RETURN	
M145	TABLE PALLET READY OFF	
M146	ODEG SURFACE READY CONTROL	
M147	90DEG SURFACE READY CONTROL	
M148	180DEG SURFACE READY CONTROL	
M147	270DEG SURFACE READY CONTROL	
M150	BLOCK SKIP (2 TO 9) OFF	(option)
M152	BLOCK SKIP 2 ON	(option)
M153	BLOCK SKIP 3 ON	(option)
M154	BLOCK SKIP 4 ON	(option)
M155	BLOCK SKIP 5 ON	(option)
M156	BLOCK SKIP 6 ON	(option)
M157	BLOCK SKIP 7 ON	(option)
M158	BLOCK SKIP 8 ON	(option)
M159	BLOCK SKIP 9 ON	(option)
M230	MACHINE PARA REGISTRATION ON	
M231	MACHINE PARAMETER DUMP	
M232	MACHINE PARAMETER PRINT	
M233	TOOL DATA DUMP	
M235	TL MODE OFF	
M236	TL MODE ON	
M237	SL MODE OFF	
M238	SL MODE ON	
M250	GI S_GI [M250] MODE	
M251	GI S_GI [M251] MODE	
M252	GI S_GI [M252] MODE	
M253	GI S_GI [M253] MODE	
M254	GI S_GI [M254] MODE	
M255	GI S_GI [M255] MODE	
M259	GI S_GI ORIGINAL MODE	
M268	HIGH SPEED CYCLE MACHINING START	
M269	HIGH SPEED CYCLE MACHINING END	
M276	STROKE EXCHANGE SIGNAL OFF	
M277	STROKE EXCHANGE SIGNAL ON	
M302	CONFIRMATION OF M303, M304 OPERATION FINISH	
M303	SPINDLE FORWARD COMMAND RTN ALRDY COMPLETE	

M304	SPINDLE REVERSE COMMAND RTN ALRDY COMPLETE	
M307	COOLANT AND SPINDLE STOP AND STORAGE	
M308	COOLANT AND SPINDLE RESTART	
M312	COOLANT AND STORE	
M313	COOLANT RECOVER	
M314	SPIN PRE MEASURING	(option)
M318	EXTERNAL-ORIENTATION	(option)
M319	PRE-ORIENTATION	
M325	CONTOURING MODE OFF	
M326	CONTOURING MODE ON	
M330	REV ORIENTATION OF EXTERNAL STOP POS	
M390	SPINDLE TOOL CLAMP	
M391	SPINDLE TOOL UNCLAMP	
M392	PREP. FOR SPINDLE TOOL UNCLAMP	
M398	THROUGH SPINDLE MIST ON	
M399	MIST BLOW ON	
M433	BTS LS300 OFF CHECK	
M436	COMPULSION LIGHTING OF PTL1	
M437	COMPULSION LIGHTING OF PTL2	
M463	PRINTOUT MODE OUTPUT REQUIRED	(option)
M464	COMMAND SPDL T-NO. OUTPUT REQUEST	(option)
M465	SPDL NUMBER "0" OUTPUT	(option)
M466	READ MACRO DATA (#100)	(option)
M469	TL ALARM SUSPENSION MODE ON	
M480	MACRO DATA (#100–#149) UPLOAD	(option)
M483	OUTPUT TOOL DETAIL TO MACRO	(option)
M548	TOOL CHANGE M CODE	
M549	TOOL CHANGE M CODE	
M550	TOOL CHANGE M CODE	
M551	TOOL CHANGE M CODE	
M552	TOOL CHANGE M CODE	
M559	TOOL CHANGE M CODE	
M580	USER I/O M-CODE	(option)
M581	USER I/O M-CODE	(option)

M582	USER I/O M-CODE	(option)
M583	USER I/O M-CODE	(option)
M584	USER I/O M-CODE	(option)
M585	USER I/O M-CODE	(option)
M586	USER I/O M-CODE	(option)
M587	USER I/O M-CODE	(option)
M588	USER I/O M-CODE	(option)
M589	USER I/O M-CODE	(option)
M590	USER I/O M-CODE	(option)
M591	USER I/O M-CODE	(option)
M592	USER I/O M-CODE	(option)
M593	USER I/O M-CODE	(option)
M594	USER I/O M-CODE	(option)
M595	USER I/O M-CODE	(option)
M596	USER I/O M-CODE	(option)
M602	DNC PROG END (ONE-TOUCH FUNCTION)	
M603	FINISH TOOL TAKE SHELTER	
M608	INDEPENDENT CARRIED IN FUNCTION	(option)
M609	INDEPENDENT CARRIED OUT FUNCTION	(option)
M620	STROKE LIMIT ENABLE	
M621	STROKE LIMIT DISABLE	
M709	DON'T WAIT DEN ON COOLANT STOP	
M710	MIST COLLECTOR OFF	
M711	MIST COLLECTOR ON	
M732	SPINDLE THROUGH COOLANT PRESSURE 1	
M733	SPINDLE THROUGH COOLANT PRESSURE 2	
M734	SPINDLE THROUGH COOLANT PRESSURE 3	
M735	SPINDLE THROUGH COOLANT PRESSURE 4	
M736	MACHINE LIGHT ON	
M736	MACHINE LIGHT OFF	
M740	SPIRAL CHIP CONVEYOR OFF	
M741	SPIRAL CHIP CONVEYOR ON	
M746	HIGH PRESSURE NOZZLE COOLANT ON	
M747	MEASURING HEAD CLEANING AIR ON	(option)
M748	TURN IMM CLEANING AIR ON	(option)
M749	TURN IMM CLEANING AIR OFF	(option)
M750	TURN IMM MODE ON	(option)
M751	TURN IMM MODE OFF	(option)

M752	MIST COOLANT ON	
M753	WORK CLEAN COOL OR CLEAN AIR ON	
M754	BASE COOLANT ON	
M755	TELSCO COOLANT ON	
M756	AIR BLOW ON	(option)
M757	BASE COOLANT OFF	
M758	WORK CLEAN COOL OR CLEAN AIR OFF	
M790	AMOUNT OF OIL IS LITTLE (MQL)	
M791	AMOUNT OF OIL IS STANDARD (MQL)	
M792	AMOUNT OF OIL IS LARGE (MQL)	
M793	MIST PRESSURE IS HIGH (MQL)	
M794	MIST PRESSURE IS STANARD (MQL)	
M910	WORK AUTO MEASUR M31 MODE CANCEL	(option)
M911	MP7 MEASURING HEAD ALARM CHECK	(option)
M919	TL COUNT	
M920	TOOL LENGTH MEASUR REGISTRATION	(option)
M921	TOOL DIAMETR MEASR REGISTRATION	(option)
M922	M920, M921 ADDITION MODE	(option)
M925	M926 MODE CANCEL	
M926	LC RING SENSOR OBSERVATION MODE	
M927	SET FIRST USED TOOL FLAG	(option)
M928	FIRST USED TOOL FLAG OFF	(option)
M929	BAD RESULT OF 1ST USED TOOL FLAG	(option)
M930	TOOL LIFE DATA REGISTER MODE ON	
M931	TOOL REMAIN DATA REGIST MODE ON	
M932	ITN REGIST MODE ON	
M934	TOOL ALARM DATA REGISTER MODE ON	
M935	TOOL STATUS DATA REGIST MODE ON	
M936	TOOL SIZE DATA REGIST MODE ON	
M940	AUTO FIN AT WORK RESULT ABNORMAL	(option)
M941	MP7 MEASURING HEAD CHECK	(option)
M948	TOOL CHANGE M CODE	
M963	MEASURING PROBE POWER OFF & CONF	(option)
M964	MEASURING PROBE POWER ON & CONF	(option)
M965	MEASURING PROBE POWER OFF	(option)
M966	MEASURING PROBE POWER ON	(option)
M968	FF PATH	

M975	TOOL KIND DATA REGIST MODE ON	
M979	THRU SPN AIR TIME REGIST MODE ON	(option)
M994	REV. AXIS CALCULATION	