OPERATION MANUAL

Applicable Model

MACHINING CENTER (FLAT PANEL TYPE)

MV-40M MV-45, 45/U MV-55, 55/U MV-65, 65/U MH-50, 50/U MH-63, 63/U

Applicable NC Unit

MSC-516 MSC-518 MSD-516

Before operation, maintenance, and programming, read the manuals supplied by Mori Seiki, the NC unit manufacturer, and equipment manufacturers carefully so that the information in the manuals are thoroughly understood.

Keep the manuals carefully so that they will not be lost.

MORI SEIKI

- The contents of this manual are subject to change without notice due to improvements to the machine or in order to improve the manual. Consequently, please bear in mind that there may be slight discrepancies between the contents of the manual and the actual machine. Changes to the instruction manual are made in revised editions which are distinguished from each other by updating the instruction manual number.
- Should you discover any discrepancies between the contents of the manual and the actual machine, or if any part of the manual is unclear, please contact Mori Seiki and clarify these points before using the machine. Mori Seiki will not be liable for any damages occurring as a direct or indirect consequence of using the machine without clarifying these points.
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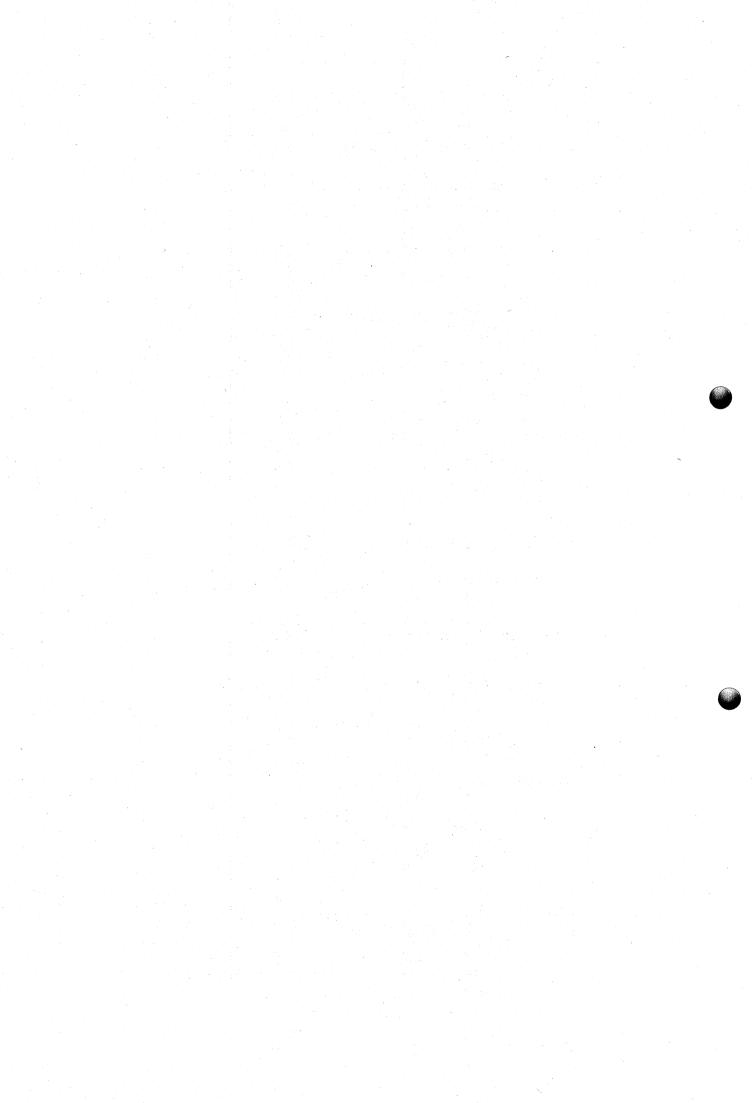
The export of this product is subject to the authorization of the government of the exporting country.

Machine Information

Description of machine : Machining center				
Model name :				
Machine serial No. :				
Manufacturing date :				

Representative :

Business hours : 8 : 30 - 17 : 30



CONTENTS

CRT DISPLAY ON TURNING ON POWER

PREFACE

SIGNAL WORD DEFINITION

SYMBOLS USED IN FLOWCHART

FLOW UNTIL THE PRODUCT IS COMPLETED

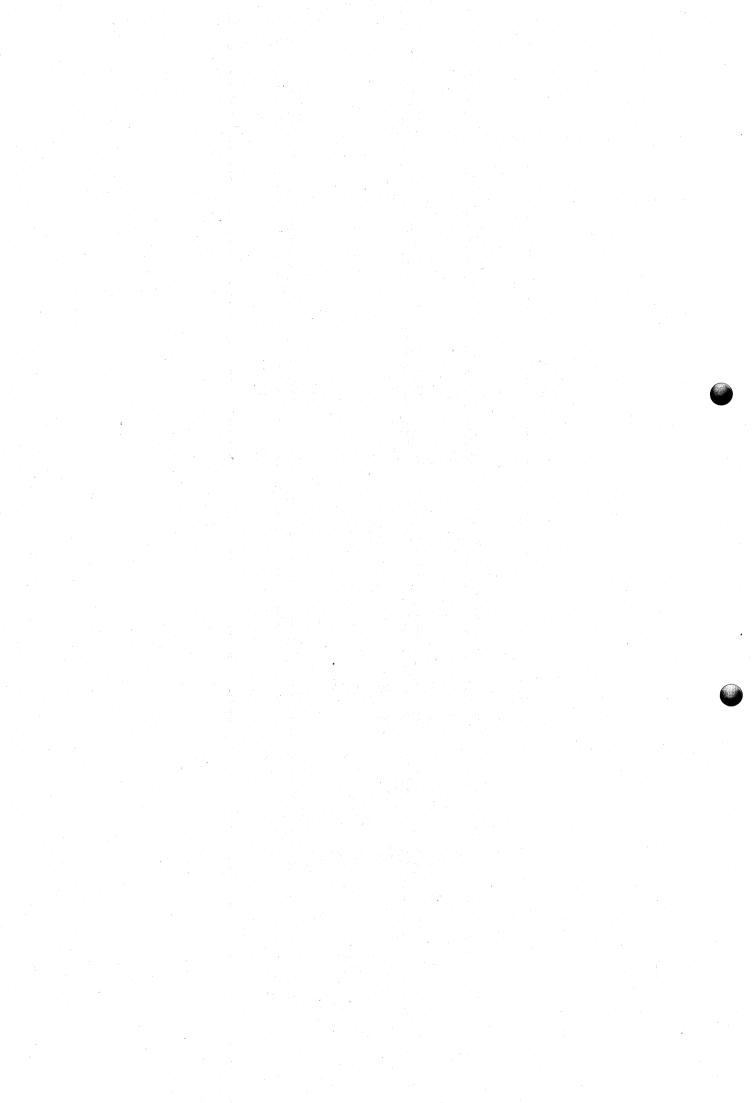
DOOR INTERLOCK FUNCTION

A: OPERATION PANELS AND MANUAL OPERATION

B: PROGRAM EDITING

C: OPERATION PREPARATIONS

INDEX



CRT DISPLAY ON TURNING ON POWER

The cautions to be observed in order to ensure safe machine operation are indicated on the caution labels fixed at appropriate locations on the machine. They are also stated in the Instruction Manual supplied with the machine.

Failure to follow these safety instructions will cause operator injuries and/or damage to the machine. To impress upon the operator that the safety instructions must be strictly observed, a message to this effect is displayed on the CRT when the power is turned on.

The CRT displays the message with the following contents when power is turned on:

(WARNING)

The machine is designed and manufactured for well-trained operators who have a basic knowledge of machine operation. DO NOT operate this machine unless this applies to you. To avoid accidents, you are required to read and understand the information on the caution labels, in the manuals and follow instructions carefully. Failure to follow these instructions may result in injury, or damage to the machine. Being aware of this warning, press [OK] soft-key.



The contents of the displayed message may vary dipending on NC models.

<Operating procedure>



Before pressing the [OK] soft-key, read the message carefully.

Read and understand the contents of the message. After that press the [OK] soft-key.

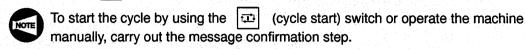
The ACTUAL POSITION (ABSOLUTE) screen or the PCMDI MENU screen is displayed and the machine is ready for operation.



If the message confirmation step is skipped, the machine does not become ready for operation and neither automatic nor manual operation is possible.

<For weekly timer specification>

In the case of machines equipped with the weekly timer, this message confirmation step after turning on the power is not required in order to set the machine in the ready status to allow a cycle start initiated by the weekly timer. In this case, cycle start by using the [12] (cycle start) switch or manual operation is not possible.



PREFACE

This manual provides the information necessary to operate the machine. Information explained in each chapter is briefly described below.

DOOR INTERLOCK FUNCTION:

The door interlock function is provided to ensure the operator's safety.

This chapter deals with the purpose and specifications of the door interlock function.

Before operating the machine, read this manual carefully.

CHAPTER A: OPERATION PANELS AND MANUAL OPERATION

This chapter describes the switches used for turning on/off the power, the functions and operation procedure of the switches and keys on the operation panel, and the screens displayed.

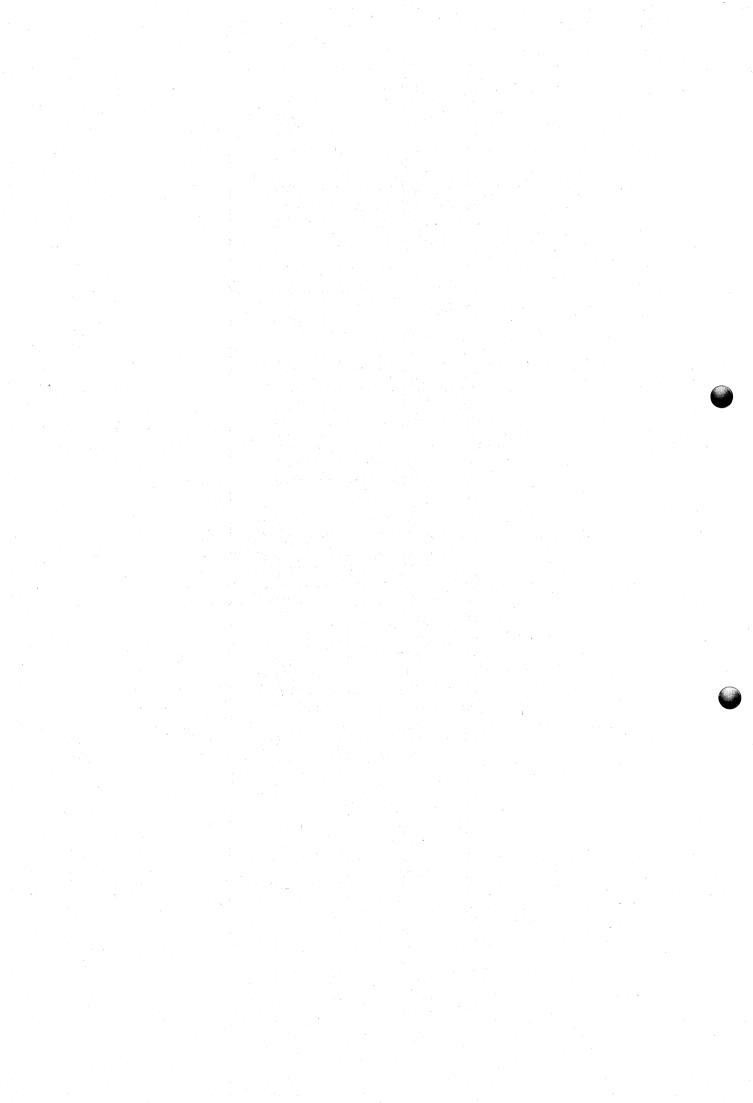
The procedure used for the following operation is also explained – turning on and off the power, stopping the machine in an emergency, and manually feeding an axis or manually starting/stopping the spindle.

CHAPTER B: PROGRAM EDITING

This chapter describes the procedure used to input programs to the NC and to edit the program stored in the NC memory. The procedure for inputting/outputting NC programs using an external I/O device is also described. Note that the programming procedure is not described in this chapter, refer to the programming manual for the programming procedure.

CHAPTER C: OPERATION PREPARATIONS

This chapter describes the preparatory steps necessary before starting mass production. These steps include registration of tool data, mounting/removing tools, and inputting the offset data for setting the workpiece zero.



SIGNAL WORD DEFINITION

A variety of symbols are used to indicate different types of warning information and advice.

Learn the meanings of these symbols and carefully read the explanation to ensure safe operation while using this manual.

<Symbols related with warning>

The warning information is classified into three categories, DANGER, WARNING, and CAUTION.

The following symbols are used to indicate the level of danger.



Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

The information described in the DANGER frame must be strictly observed.



Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

The information described in the WARNING frame must be strictly observed.



Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury damages to the machine.

The information described following the caution symbol must be strictly observed.

<Other symbols>



Indicates the items that must be taken into consideration.



Indicates useful guidance relating to operations.



Indicates the page number or manual to be referred to.

The number in () indicates the section number.

Indicates the results of operation.

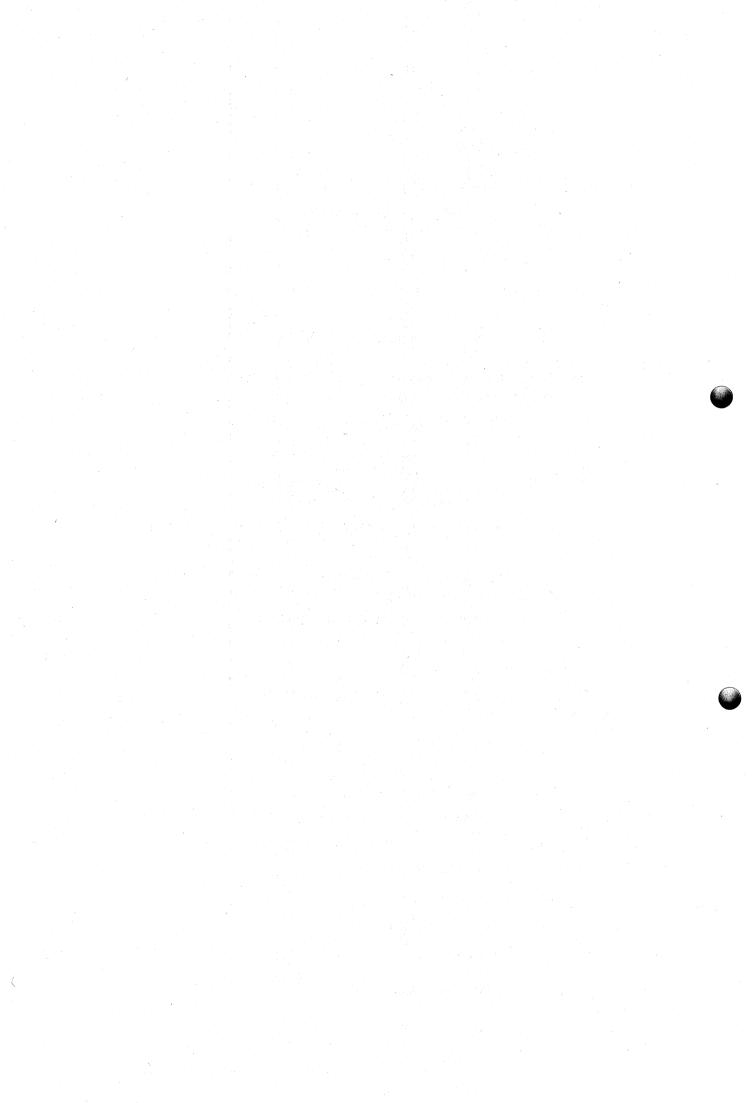
<Lamp indication>



Indicates that the indicator is lit.



Indicates that the indicator is blinking.

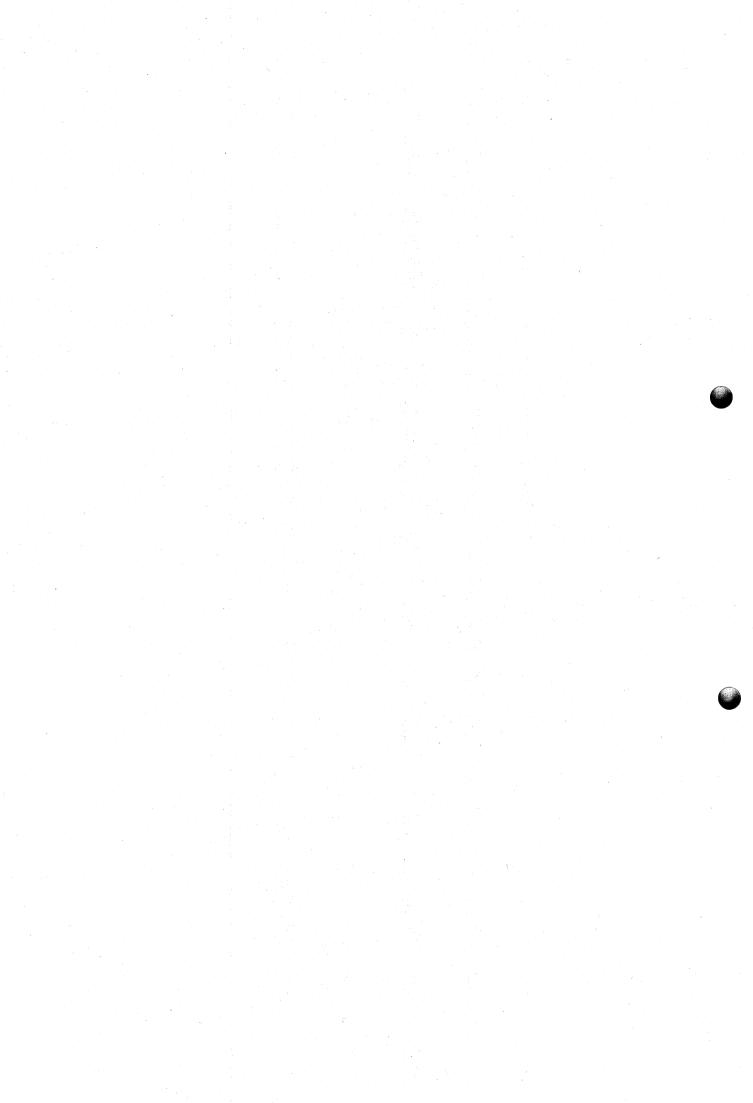


SYMBOLS USED IN FLOWCHART

In this manual, operation procedure is explained using a flowchart.

The symbols used in a flowchart are explained below.

Symbol	Meaning
	Indicates the start and end of operation.
	Indicates an operation of a switch, button, or key on the operation panel.
	Also indicates the operation to refer to the page indicated by \square .
	Indicates the display on the CRT.
	Indicates the entry of address or numeric value using data entry keys.
	Indicates the selection of operation.
	() indicates the operation method to select an operation.



FLOW UNTIL THE PRODUCT IS COMPLETED

sections. Follow and understand the flow so that the operation can be performed smoothly. Describes the instruction manual or item to be referred to. <MSC-516, 518> Examine the drawing to determine the machining required "TOOLING SYSTEM" Determine the tools to be used **Production** in the MAINTENANCE MANUAL planning and programming Examine the workpiece clamping method and the fixtures Create the program PROGRAMMING MANUAL 5) Turn on the power supply TURNING ON THE POWER" in the MAINTENANCE MANUAL "Turning on the Power" in Chapter A Store the program into memory Chapter B "PROGRAM EDITING" "MOUNTING AND Mount the tools and workpiece to the machine **REMOVING TOOLS"** in Chapter C "MEASURING AND SETTING Measure and input the tool length and THE TOOL OFFSET DATA" tool diameter offset value in Chapter C Setup operation "SETTING THE WORK Align the workpiece to set the workpiece zero point COORDINATE SYSTEM" in Chapter C "SETTING THE WORK 10) Set (Input) the workpiece zero point COORDINATE SYSTEM" in Chapter C "PREPARATION 11) Check the program by carrying out dry run operation **BEFORE STARTING** (Correct the program if necessary) MASS PRODUCTION" in Chapter C "PREPARATION 12) Check the machining condition by carrying out test cutting BEFORE (Correct the program if necessary) **STARTING MASS** (Input the tool offset value if necessary) PRODUCTION" in Chapter C 13) Machine the workpiece in automatic operation Mass production Product is completed

General operation flow to finish a product is shown below along with the reference

<MSD-516>

k to	1) Examine the drawing to determine the machining required
Production planning and	2) Determine the tools to be used in the MAINTENANCE MANUAL
programming	3) Examine the workpiece clamping method and the fixtures
	4) Turn on the power supply "TURNING ON THE POWER" in the MAINTENANCE MANUAL
	"Turning on the Power" in Chapter A
	5) Create the program using the conversational programming function Instruction manuals prepared by the NC manufacturer
	6) Check the program using the simulation function (Correct the program if necessary Instruction manuals prepared manufacturer Chapter B
	"PROGRAM EDITING"
	7) Mount the tools and workpiece to the machine TOOLS" in Chapter C
Setup operation	8) Measure and input the tool length and tool ——— "MEASURING AND SETTING THE
	diameter offset value TOOL OFFSET DATA" in Chapter C
	9) Align the workpiece to set the workpiece zero point "SETTING THE
	COORDINATE SYSTEM" in Chapter C
	10) Set (Input) the workpiece zero point "SETTING THE COORDINATE SYSTEM" in Chapter C
	11) Check the program by carrying out dry run operation
	(Correct the program if necessary) BEFORE STARTING MASS PRODUCTION"
· .	in Chapter C
	12) Check the machining condition by carrying out test cutting "PREPARATION BEFORE
	(Correct the program if necessary) STARTING MAS
	(Input the tool wear offset value if necessary) PRODUCTION" in Chapter C
Mass	13) Machine the workpiece in automatic operation
production	14) Product is completed

DOOR INTERLOCK FUNCTION

The door interlock function is provided to ensure the operator's safety.

This chapter deals with the purpose and specifications of the door interlock function.

Before operating the machine, read this chapter carefully.

WARNING



The door interlock function serves only to ensure safety to the machine operator by inhibiting manual operations (spindle rotation, axis feed, etc.) and all automatic operations (including the ATC and APC operations) when and while the door is open; it will not afford protection against hazards that could occur as the result of erroneous operation.

Each customer will machine a variety of workpiece types and use a variety of workpiece holding fixtures and cutting tools. Cutting methods and cutting conditions will also vary widely according to the required machining. Although the door interlock is provided as a safety measure, machine operators are still responsible for ensuring safety against hazards arising from these customer-dependent conditions.

CONTENTS

DOOR INTERLOCK FUNCTION

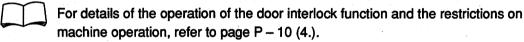
1.	GENERAL (DOOR INTERLOCK FUNCTION)	P-1
2.	DOOR INTERLOCK FUNCTION CONTROLS AND THE FUNCTIONS	P-4
3.	PRECAUTIONS ON USING THE DOOR INTERLOCK FUNCTION	P-9
4.	USING THE DOOR INTERLOCK FUNCTION	P – 10
5.	DOOR LOCK AND UNLOCK	P – 12
	5.1 Door Unlock Switch	D _ 12

1. GENERAL (DOOR INTERLOCK FUNCTION)

The door interlock function is developed to ensure the operator's safety during machine operation.

Before starting the machine operation, make sure that the door interlock function is valid. When the door interlock function is made valid, machine operation is enabled or disabled in response to the closing or opening of the machine door. Spindle rotation, axis feed and other manual and all automatic operations (including the ATC and APC operations) are inhibited when and while the door is opened.

Although it is possible to release the door interlock function unavoidably, the operators must understand that there are potential hazards, which will lead to serious injury or death, in carrying out intended operation while the door is open. For this purpose, the indicator blinks in red and the electronic buzzer beeps while the door interlock function is released. This indicator and buzzer indication is given until the door interlock function is made valid again. The operators must understand that there are various dangers when carrying out maintenance or other work while the door interlock function is released and they must pay sufficient care under such conditions. After completing the intended work with the door interlock function released, make the door interlock function valid. Restart machine operation only after making sure that the door interlock function is valid.



<Examples of accidents occurring with the machine not equipped with the door interlock function>

If the machine is not equipped with the door interlock function, human-caused or unexpected accidents as described below occur since the machine is operable even when the door is open. To prevent occurrence of such accidents and to allow safe operation of the machine, Mori Seiki's NC lathes are equipped with the door interlock function.

Customers are required to operate the machine after thoroughly understanding that the door interlock function is provided to ensure customer's safety.

WARNING



There are a variety of workpiece types to be machined by the customers, and a variety of workpiece holding fixtures, cutting tools are used. Cutting methods and cutting conditions also vary widely according to the required machining. The customers should take proper means to ensure safety against the hazards caused by such customer dependent conditions.

An example of accident which occurs if the machine, not equipped with the door interlock function, is operated while the door is opened.

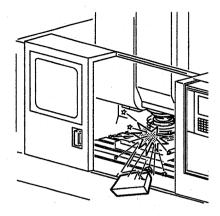


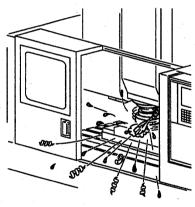
The following cases describe possible accidents occurring in general vertical machining centers. However, similar accidents will occur in horizontal machining center or other type of machining centers.

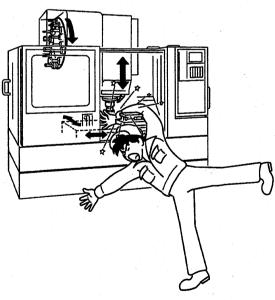


- The operator will become entangled with the spindle if the spindle starts while the operator is touching the cutting tool.
- The operator will become entangled with the spindle if the operator touches the cutting tool while the spindle is rotating.

The accidents described above, in which the operator becomes entangled with the rotating parts of the machine, will result in serious injury or death.







- 3 A workpiece and/or cutting tool will fly out if the cutting tool is hit against the workpiece due to programming error.
- A workpiece will fly out if the machining (automatic operation) is started while the workpiece is not clamped correctly.
- (5) A workpiece will fly out due to excessively heavy cutting force.

The hazards described above can cause accidents in which the operator or a person standing near the machine is struck by a flying workpiece or a cutting tool, resulting in serious injury or death.

- The operator or a person standing near the machine will be splashed with chips and coolant during machining, resulting in injury or health problems (particularly if chips or coolant get into the eyes).
- 7 The operator will be caught by the table or the column during axis feed, resulting in serious injury or death.
- The operator will be injured by touching the cutting tool or tool magazine while the ATC is operating.
- The operator will be entangled with the APC if the APC starts operations during setup operation, such as mounting a workpiece.
- The operator will become entangled with the APC by touching the pallet, fixture, or workpiece while the APC is operating.

The accidents described above, in which the operator is caught by or becomes entangled with the moving parts of the machine, will result in serious injury or death.

2. DOOR INTERLOCK FUNCTION CONTROLS AND THE FUNCTIONS

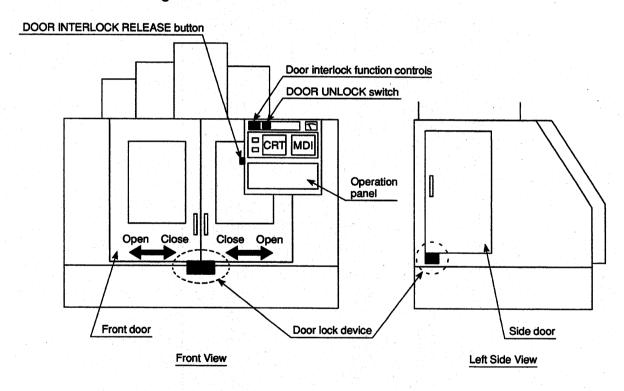
The machine is equipped with the controls, such as the DOOR INTERLOCK key-switch, DOOR INTERLOCK RELEASE button, the status indicator, the electronic buzzer, and the warning label, used to operate the door interlock function, and the door lock device, which locks the door closed during automatic operation and spindle rotation.

This section explains the installation position of the controls related with the door interlock function and the door lock device as well as the functions of the controls.

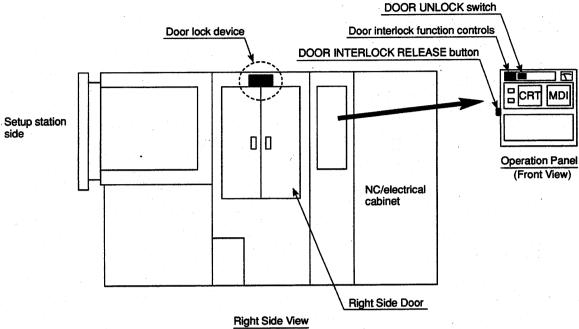
<Installation positions>

The switches and other controls for the door interlock function are mounted on the operation panel and the door lock device is mounted to the door.

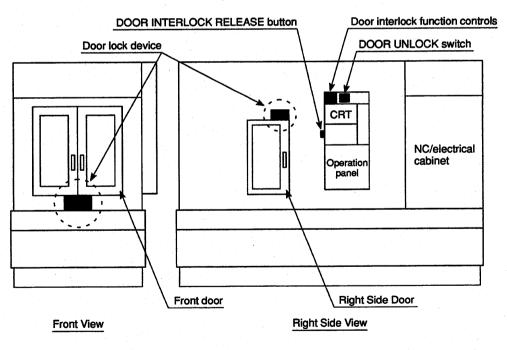
<Vertical machining center>



<Horizontal machining center>



<M-25FV, FH>

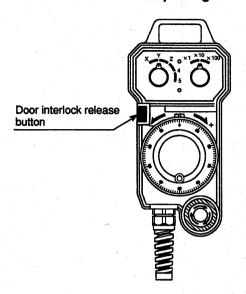


<DOOR INTERLOCK RELEASE button>

<DOOR UNLOCK switch>



<Portable manual pulse generator>



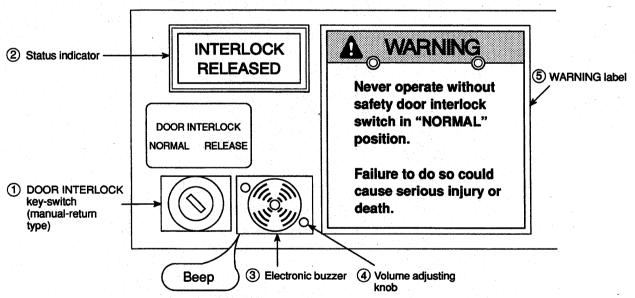
With the portable manual pulse generator specification, a portable manual pulse generator is provided, and the door interlock release button is arranged on the same portable operation panel.

- (1) When the door interlock release button on the portable manual pulse generator panel is pressed, only axis move operation using the manual pulse generator (\times 1, \times 10) is permitted.
- (2) When the portable manual pulse generator panel is detached, only the door interlock release button on this panel is valid. The door interlock release button on the operation panel is invalid.



The specifications and the installation positions of the door interlock function controls and the door lock device will vary according to the machine model and specification. For details, contact Mori Seiki.

<Door interlock function controls>



The arrangement of the controls for the door interlock function will vary according to the machine model and specification.

The functions of the controls are summarized below:

No.	Control	Function
①	DOOR INTERLOCK	Makes the door interlock function valid and invalid.
	key-switch	<normal></normal>
	DOOR INTERLOCK NORMAL RELEASE	When the DOOR INTERLOCK key-switch is placed in the NORMAL position, the door interlock function is made valid. Keep the DOOR INTERLOCK key-switch in the NORMAL position.
		<release></release>
	<part no.=""></part>	When the DOOR INTERLOCK RELEASE button is pressed after placing the DOOR INTERLOCK key-switch in the RELEASE position, the door interlock function is partially made invalid.
	E61286A	Under such condition, there are potential hazards in
	DOOR INTERLOCK RELEASE button	operating the machine. To warn this state, the status indicator [INTERLOCK RELEASED] blinks in red and the electronic buzzer beeps.
	DOOR INTERLOCK RELEASE	Pay sufficient care if it becomes necessary to operate the machine under such condition.
	<part no.=""></part>	If the disconnection of the status indicator or electronic buzzer circuit is detected, the door interlock function cannot be released even if the DOOR INTERLOCK RELEASE button is pressed after placing the DOOR INTERLOCK RELEASE key-switch in the RELEASE
	E61224A	position.
2	Status indicator	The status indicator blinks in red under any of the following conditions to give warning (interlock released, or abnormal state) to the operator.
	INTERLOCK RELEASED	The DOOR INTERLOCK RELEASE button is pressed after placing the DOOR INTERLOCK key-switch in the RELEASE position.
		② The electronic buzzer circuit disconnection is detected.
		3 An abnormal state of the control system of the door interlock function is detected.
	<part no.=""> E36116A</part>	The status indicator [INTERLOCK RELEASED] blinks in red rapidly if the electronic buzzer circuit disconnection or abnormal state of the control system is detected.

No.	Control	Function
3	Electronic buzzer Warning lamp	The electronic buzzer beeps under any of the following conditions to give warning (interlock released, or abnormal state) to the operator.
		The warning lamp also blinks in red while the electronic buzzer is beeping.
		The DOOR INTERLOCK RELEASE button is pressed after placing the DOOR INTERLOCK key-switch in the RELEASE position.
		② The status indicator circuit disconnection is detected.
		3 An abnormal state of the control system of the door interlock function is detected.
	<part no.=""> E36117A</part>	The electronic buzzer beeps rapidly if the status indicator circuit disconnection or abnormal state of the control system is detected.
		The knob adjusts buzzer beep volume. Use a flat head
4	Volume adjusting knob	screwdriver to turn the adjusting knob.
1		CW rotation: Increases volume.
	(IIIO)	CCW rotation: Decreases volume.
	Volume adjusting knob	The knob is set at 40° position in the CW direction from the minimum volume position.
	Volume adjusting knob \	CAUTION Do not decrease volume excessively.
	<part no.=""></part>	If buzzer beeps only faintly, the warning beeps might not be recognized during interlock release or
	E36117A	abnormal state, constituting hazards.
(5)	WARNING label	The warning label gives information related with the door
	<part no.=""></part>	interlock function.
	Japanese H42819A English H42820A	Read and follow the instruction printed on the label.
	English H42820A German H42821A	Never remove or make the label dirty.
	French H42822A	Place an order with Mori Seiki for the label, if the
	Italian H42823A	letters on the label become dirty, or if the label is damaged or lost.
	Spanish H42824A Chinese H42825A	Use the WARNING label in the language
	Dutch H42835A	understandable to the operators.



The <Part No.> indicates the part number of each component parts. Use these numbers to order the controls if they are damaged, or if the label become dirty, damaged, or lost.

3. PRECAUTIONS ON USING THE DOOR INTERLOCK FUNCTION

This section indicates the items to be carefully attended to when using the door interlock function. Please read carefully and understand the cautionary items indicated below.

WARNING



If the DOOR INTERLOCK RELEASE button is pressed after changing the DOOR INTERLOCK key-switch setting to the RELEASE position, the machine is able to operate while the door is open, constituting hazards to the operators. Always keep the key-switch in the NORMAL position when operating the machine.



If disconnection of the status indicator circuit or the electronic buzzer circuit is detected, or if abnormality of the door interlock control system is found, contact Mori Seiki.

Remove the cause of the abnormality, and turn on power supply after pressing the emergency stop button or turning off power supply once, then the error indication will be cleared.



In the Mori Seiki's OPERATION MANUALs, all operation procedures are explained assuming that the door interlock function is valid and the door is closed.

USING THE DOOR INTERLOCK FUNCTION 4.

The specifications of the available door interlock function for the machines equipped with the manual door are explained in details below along with the procedure for using the door interlock function.

NORMAL



If the DOOR INTERLOCK key-switch is placed in the NORMAL position while the door is open, only the following manual operations are permitted.

1) Index operation of the magazine (only when the magazine door is closed)



For the machining centers which have the tool magazine inside the machine, magazine index operation is impossible while the door is opened.

(2) Clamp/unclamp operation of the cutting tool

All manual operations are enabled when the door is closed.

RELEASE



If the DOOR INTERLOCK RELEASE button is pressed with the DOOR INTERLOCK key-switch placed in the RELEASE position while the door is open, automatic operation is completely disabled. Manual operations are possible for axis feed within the restrictions. Independent operation of the ATC is also possible. However, other manual operations are disabled.

The following table shows the permitted and prohibited operations if the DOOR INTERLOCK RELEASE button is pressed with the DOOR INTERLOCK key-switch placed in the RELEASE position while the door is open.

	Status	Door Opened DOOR INTERLOCK key-switch: RELEASE DOOR INTERLOCK RELEASE button: ON (pressed)
Automatic o	operation	Impossible*1
	Rotation of spindle	Impossible
	Jogging of spindle	Possible*2
	Tool change by ATC	Possible (Independent operation only)
NA-m1	Axis feed	Possible under certain conditions*3
Manual operation	Coolant supply	Impossible
	Chip conveyor	Impossible
	APC cycle	Impossible
	Rotation of in-machine magazine	Possible



Automatic operation cannot be started as long as the DOOR INTERLOCK key-switch is in the RELEASE position, independent of the status of the DOOR INTERLOCK RELEASE button.

If the DOOR INTERLOCK key-switch is placed in the RELEASE position while in automatic operation, the machine stops in the feed hold state.



2: The jog speed for the spindle is slower than 800 min-1.

*3: ① Jog feedrate of up to 1260 mm/min is possible.

- 2 Rapid traverse rate and feedrate for zero return operation are clamped at the feedrate available by pressing the (fine feed) switch.
- 3 For axis feed operating with the manual pulse generator, selection is restricted to the setting of $(\times 10)$ or lower.
- Only manual pulse generator is permitted even when the door interlock release button on the portable manual pulse generator panel is pressed. None of jog feed, rapid traverse, and zero return operation is possible.

<Restrictions on operations>

- 1) It is possible to check tool mounted conditions (run out etc.) while the door is opened by jogging the spindle.
- 2) It is possible to carry out manual positioning of each axis in any of the following axis feed modes:

Handle feed, jog feed, rapid traverse, and zero return

Note that rapid traverse rate for rapid traverse and zero return is limited at $| \mbox{\ \ wh} \mbox{\ \ } |$ (fine feed) and feedrate in axis feed operation using the manual pulse generator is restricted to the setting of $| \mbox{\ \ } \mbox{\ \ } |$ (× 10) or lower.



When moving an axis after releasing the door interlock function, if the DOOR INTERLOCK RELEASE button is released while the axis is moved at a rate faster than 500 mm/min, the door interlock function becomes valid and the axis is stopped. In this case, excessive servo error alarm may occur.

This alarm does not occur when the DOOR INTERLOCK RELEASE button is released after axis movement is stopped by releasing the axis feed switch.

3) It is possible to operate the ATC independently while the door is open.



For the independent operation of the ATC, refer to the OPERATION MANUAL (SUPPLEMENT) ATC & APC MANUAL OPERATION.



Independent operation of the ATC must be limited only when a trouble has occurred.

Independent operation of the ATC causes the actual status of the ATC to be different from the status stored in the NC. Therefore, if the ATC is carelessly operated independently, it may cause accidents.

5. DOOR LOCK AND UNLOCK

While the door is closed, the door is always locked and cannot be opened. To open the door, it is necessary to unlock the door by releasing the door lock.



- The machine recognizes that the door is closed when the door is closed and locked. Even if the door is closed, the machine does not recognize it closed unless it is locked. Such status is recognized as the door is open.
 - In the manuals published by Mori Seiki, the expression "door is closed" means that the door is closed and locked.
- When power is turned on, the functions of the door lock device and those of the contactor for SP/SV control are checked.
 - After turning on the power, open the door once and close it again. The machine is not set ready unless the door is opened and closed after turning on power.
- While the door is locked, the door interlock function cannot be released even if the DOOR INTERLOCK RELEASE button is pressed after placing the DOOR INTERLOCK key-switch in the **RELEASE** position. The door interlock function release operation is valid only when it is carried out while the door is open, that is while the door lock is released.

5.1 Door Unlock Switch

DOOR UNLOCK





The DOOR UNLOCK switch, provided on the machine operation panel or the option panel, is used to release the door lock device.



- The door cannot be opened unless the door lock is unlocked.
- With some models, the indicator is provided inside the switch.

Door	Function
Unlock	When the DOOR UNLOCK switch is pressed, the indicator above or in the switch is lit and the door lock is released. The door can be opened in this state.
	The door lock is also released when the M02 or M30 command in a program is read. The indicator above or in the switch is lit and the door can be opened.
	Even if the M02 or M30 command is executed in the MDI mode, the door lock cannot be released.
Lock	When the DOOR UNLOCK switch is pressed while the indicator above or in the switch is lit, the indicator goes off and the door is locked. In this state, the door cannot be opened.
	If the door is closed again after being opened once, the indicator above or in the switch is lit and the door is locked.

<Interlock for door unlock operation>

The door cannot be unlocked even when the DOOR UNLOCK switch is pressed under the following status.

- 1) While the spindle is rotating.
- (2) Orientation command is being executed.
- (3) During automatic operation
- (4) During in-machine magazine rotation
- (5) During APC cycle (for APC specification)

<Releasing the door interlock function>

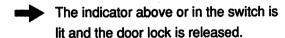
If it becomes necessary to carry out a work with the door opened after releasing the door interlock function, follow the steps indicated below.

DOOR UNLOCK







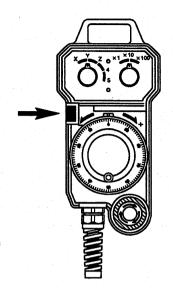


2) Open the door.





3) Place the DOOR INTERLOCK key-switch in the **RELEASE** position.



DOOR INTERLOCK RELEASE



 Carry out necessary work while holding on the door interlock release button on the portable manual pulse generator panel.



When the door interlock release button on the portable manual pulse generator panel is pressed, only axis feed operation using the manual pulse generator (\times 1, \times 10) is permitted.

- After completing the necessary work, set the door interlock function valid.
 - Release the DOOR INTERLOCK
 RELEASE button.
 - 2 Place the DOOR INTERLOCK key-switch in the NORMAL position.
 - (3) Close the door.



The indicator above the DOOR INTERLOCK switch or the indicator in the DOOR INTERLOCK switch goes off and the door is locked.

<Emergency stop and door unlock>

When the machine enters the emergency stop state, the door is placed in the unlocked state.

When the emergency stop state is reset while the door is closed (not locked), the door is locked



If the emergency stop state is reset while the door is open, the following message is displayed.

"EX4002 OPEN THE DOOR THEN CLOSE"

In this case, close the door and press the reset key $\boxed{/\!/}$, and the alarm is reset.

A: OPERATION PANELS AND MANUAL OPERATION

This chapter describes the switches used for turning on/off the power, the functions and operation procedure of the switches and keys on the operation panel, and the screens displayed.

The procedure used for the following operation is also explained – turning on and off the power, stopping the machine in an emergency, and manually feeding an axis or manually starting/stopping the spindle.



The operation mode in which the switch or operation is valid is indicated by illustration of the mode selection switch.

See the example below.



CONTENTS

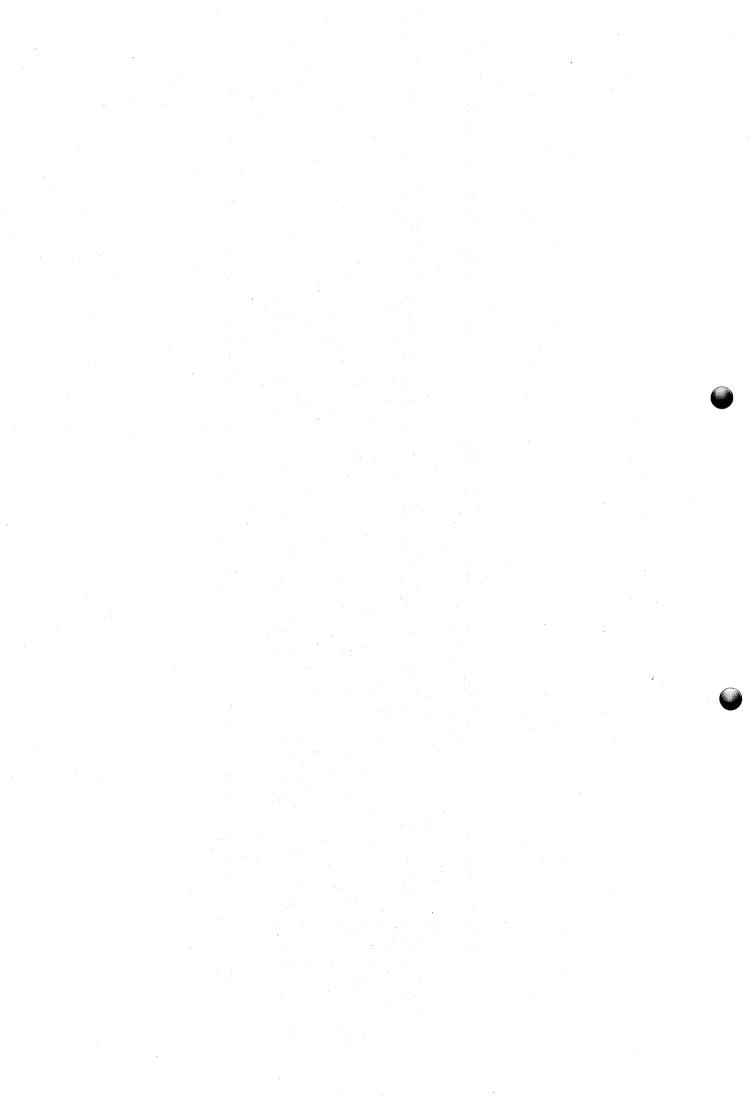
A: OPERATION PANELS AND MANUAL OPERATION

INT	ERLOCI	K FUNCTIO	ONS THAT ENSURE SAFE OPERATION	A -	· 1
MAI	NUALS	SUPPLIED	WITH THE MACHINE	A -	- 2
1.	SWITC	HES FOR	POWER SUPPLY	A -	- 3
	1.1		ent of Power Supply Switches		
	1.2	Functions	of Power Supply Switches	A -	- 4
	,	1.2.1	Main Switch	Α-	- 4
		1.2.2	Electrical Cabinet Door Interlock Key-Switch [CABINET DOOR INTERLOCK]	A -	- 4
		1.2.3	NC Power ON/OFF Switches [1 / O]		
		1.2.4	Emergency Stop Button	Α-	- 6
		1.2.5	2nd O.T. Release Button	A -	- 7
		1.2.6	RS232C Interface Connector	A -	- 7
2.	MACH	INE OPER	ATION PANEL	A -	- 8
	2.1		ent and Names of Switches and Keys ne Operation Panel	A -	- 8
		2.1.1	MV-40M, 45, 55	A -	- 8
		2.1.2	MV-65	Α -	- 9
		2.1.3	MH-50, 63	Α-	- 10
	2.2	Names of	Switches, Keys and Buttons	Α-	- 11
	2.3	Operation	Selection Key-Switch	Α-	- 16
	2.4	Mode Sel	ection Switches	Α-	- 17
	2.5	Automatic	Operation Switches	Α-	- 19
	2.6	Function S	Switches	Α-	- 20
		2.6.1	Single Block Switch	Α-	- 21
		2.6.2	Optional Stop Switch	Α-	- 22
		2.6.3	Block Delete Switch	Α-	- 22
		2.6.4	Dry Run Switch	Α-	- 23
-		2.6.5	Program Restart Switch (Option for MV-40M, Standard for Other Models)	. A -	- 24
		2.6.6	Tool Length Measurement Switch		

		2.6.7	Handle Interruption Switch (Option) A – 24
		2.6.8	F1-Digit Feed Switch (Option) A – 25
	•	2.6.9	Z-Axis Neglect A – 25
		2.6.10	Auxiliary Function Lock
		2.6.11	Machine Lock
	2.7	Status Ind	licators A – 27
	2.8		p/Unclamp Switches A – 30
	2.9	Spindle S	witches A – 31
		2.9.1	Spindle Speed Setting Switches A – 32
		2.9.2	Spindle Load Meter A – 32
		2.9.3	Spindle Override Meter A – 33
	2.10	Spindle G	ear Neutral Switch (Transmission Specification) A - 33
	2.11	Axis Feed	Switches
	2.12	Feedrate	Override Dial A – 34
	2.13	Rapid Tra	verse Rate Override Switches A – 34
	2.14	Handle Sv	witches A – 35
		2.14.1	Axis Selection Switches A – 35
		2.14.2	Axis Feed Amount Selection Switches A – 36
		2.14.3	Manual Pulse Generator A – 36
		2.14.4	Sensor Contact Indicator (Option)
	2.15	Coolant S	witches A – 37
	2.16	Machine l	ight Switch A - 37
	2.17	Automatic	Power Shutoff Switch A – 38
	2.18	Chip Conv	veyor Switches (Chip Conveyor Specification) A – 38
	2.19	Door Unio	ock Switch A – 39
	2.20	Setup But	ton (APC Specification)
	2.21	Magazine	Operation Panel (Excluding MV-40M) A – 40
		2.21.1	Magazine Mode Selection Switch A – 40
		2.21.2	Magazine Indexing Switches A – 40
		2.21.3	Emergency Stop Button A – 41
	2.22	~ .	Start Switch (MV-40M) A – 42
	2.23	Magazine	Tool Unclamp Footswitch (MH Series) A – 42
	2.24	Manual Lu	ubrication Pushbutton
_			
3.			
	3.1		A – 44
•	3.2	Soft-Keys	A – 45
	3.3		ection Keys
	3.4	Cursor Co	ontrol Keys A – 47

	3.5	Program Ed	lit Keys	A – 48
	3.6	Key Input B	uffer Area	A – 48
	3.7	Data Entry	Keys	A - 48
	3.8	Other Keys		A - 49
	3.9	Function Se	election Keys	A – 50
4.	FUNC	TION SELEC	TION KEYS AND DISPLAY SCREENS	A – 51
	4.1	Position Ke	y	A – 51
		4.1.1	Actual Position (ABSOLUTE) Screen	A - 52
		4.1.2	Actual Position (RELATIVE) Screen	A - 52
		4.1.3	Actual Position (Total Position Data) Screen	A – 53
		4.1.4 I	Handle Interruption Screen (Option)	A - 53
		4.1.5	Operating Monitor Screen	A – 53
	4.2	Program Ke	ey	A – 54
		4.2.1	Program Edit Screen	A – 54
		4.2.2	Memory Used Size Screen	A – 55
			Conversational Programming Basic Menu Screen (Conversational Programming Specification)	A 56
		and the second second	Program Screen	
			Program Check Screen	
			Displaying the Present Block Data	
			Displaying the Next Block Data	A-5/
			Program Restart Screen (Option for MV-40M, Standard for Other Models)	A – 57
		4.2.9	MDI Mode Operation Screen	A – 57
	4.3	Offset/Setti	ng Key	A - 58
		4.3.1	Tool Offset Data Setting Screen	A – 58
		4.3.2	Setting (Handy) Screen	A - 58
		4.3.3	Work Coordinates Data Setting Screen	A - 58
		4.3.4	Macro Variable Setting Screen (Option)	A - 59
		4.3.5	Tool Life Management Data Screen (Option)	A - 59
	4.4	Graphic Ke	y(MSD-516)	A - 59
	4.5	Message K	œy	A – 59
		4.5.1	Operator Message Screen	A - 60
		4.5.2	Alarm Message Screen	A - 60
		4.5.3	Alarm History Screen	A - 60
_	4.6	System Ke	y	A - 60
- :		4.6.1	Parameter Setting Screen	A – 61
			CNC Internal State Display Screen	

		4.6.3	PMC Screen	A - 61
		4.6.4	System Configuration Screen	A – 61
		4.6.5	Pitch Error Setting Screen	A – 61
	4.7	Custom K	éy	A - 62
		4.7.1	Operation Panel Screen	A - 62
		4.7.2	Setup Screen	A – 63
		4.7.3	Tool registration Screen	A - 63
		4.7.4	Manual ATC Operation Screen	A – 64
		4.7.5	Work Number Screen	A – 64
	٠	4.7.6	Manual APC Operation Screen	A – 64
		4.7.7	Sensoring Macro Setting Screen	A - 65
		4.7.8	U-axis Tool Offset Data Setting Screen	
	4.8	Help Key		
		4.8.1	Alarm Detail Screen	A - 65
		4.8.2	Operation Method Screen	A - 66
		4.8.3	Parameter Table Screen	A - 66
5.	MANL		ATION	
	5.1	Turning o	n the Power	
		5.1.1	Check Items before Turning on the Power	
		5.1.2	Turning on the Power	
	5.2	and the second	cy Stop	
		5.2.1	Emergency Stop Button	
		5.2.2	Reset Key	
		5.2.3	Feed Hold Switch	
	5.3	. •	ff the Power	
	5.4	Axis Move	ement Operation	
		5.4.1	Manual Axis Feed Operation	
		5.4.2	Releasing the Soft-Overtravel Alarm	A – 79
		5.4.3	Releasing the Hard-Overtravel Alarm	A – 79
	5.5	Spindle O	peration	A – 80
		5.5.1	Conditions for Starting the Spindle Rotation	A – 80
		5.5.2	Checking and Setting the Spindle Speed	A – 81
		5.5.3	Starting and Stopping the Spindle Rotation	A - 82
		5.5.4	Spindle Jog Operation	A – 83
	5.6	Turning o	n Machine Light	A - 83
	5.7	Coolant S	Supply	A - 83
	5.8	Chip Con	veyor (Chip Conveyor Specification)	A – 85
	5.9	Magazine	Indexing Operation	A - 85



INTERLOCK FUNCTIONS THAT ENSURE SAFE OPERATION



This machine features four interlock functions to ensure the operators' safety. Before starting the machine, always make sure these functions are valid. Mori Seiki is not responsible for accidents that occur as a result of the machine being operated without first validating these interlock functions.

<Door interlock>

The door interlock function prevents the spindle rotation or the cycle from starting while the front door and the side door are open.

The function protects operators from operation errors such as starting the spindle rotation while touching the spindle or a workpiece, and dangers such as being caught by the table or the column if an operator has to carry out operation inside the machine.



DOOR INTERLOCK FUNCTION

<Electrical cabinet door interlock>

When the electrical cabinet door interlock key-switch is valid, power cannot be turned ON while the electrical cabinet door is open.

The electrical cabinet door interlock function protects the operator from receiving an electrical shock caused by touching a live device inside the electrical cabinet. Operators' safety is ensured by cutting the power when the door is opened.



Page A - 4 (1.2.2)

<Magazine door interlock (excluding MV-40M)>

The magazine door interlock function prevents magazine rotation by a T command or by manual operation while the magazine door is open.

The function ensures safety by protecting operators from danger to become entangled with the rotating magazine while the door is open.

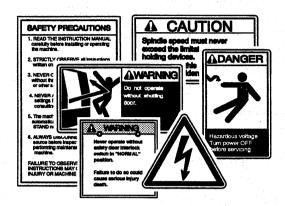
<Setup station door interlock>

The setup station door interlock function prevents APC operation by an M command or by manual operation while the setup station door is open because the pallet is not set in the setup completed state if the setup station door is open.

The function ensures safety by protecting operators from danger to become entangled with the pallet changer while the setup station door is open.

MANUALS SUPPLIED WITH THE MACHINE

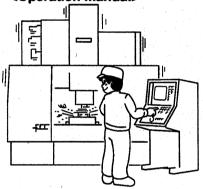
<Safety guidelines>



Contains the safety related information that provides basic rules to follow so that an operator can operate the machine safely.

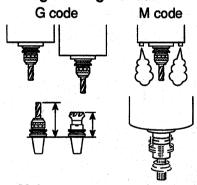
Read this manual carefully and strictly observe the instructions in it before operating the machine.





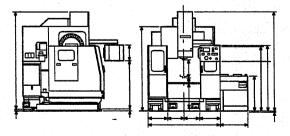
Contains operation procedures, setup methods, and the functions of the switches and keys used for machine operation. (this manual)

<Programming manual>



Contains NC language and coding rules for creating programs.

<Maintenance manual>



Contains information about machine dimensions and specification, as well as descriptions of adjustment procedures for major machine units.

<NC operation and maintenance manual (prepared by NC manufacturer)>

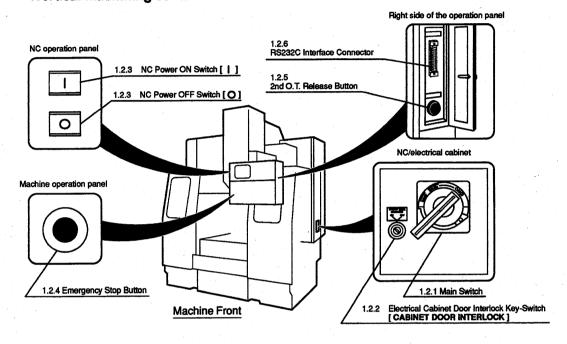
Contains detailed information on programming and NC unit maintenance.

1. SWITCHES FOR POWER SUPPLY

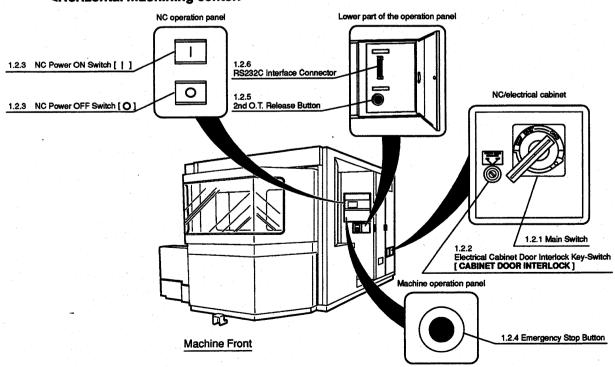
1.1 Arrangement of Power Supply Switches

The numbers indicate the subsection numbers where explanations of switches are given.

<Vertical machining center>



<Horizontal machining center>

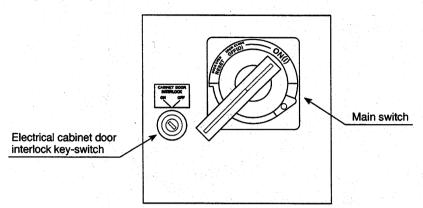




The positions and shapes of switches are subject to change with the machine models or specifications.

1.2 Functions of Power Supply Switches

This section explains the switches that supply power to the machine: Main switch, power source lamp, electrical cabinet door interlock key-switch, power ON/OFF switch, emergency stop button.



1.2.1 Main Switch

The main switch, located on the electrical cabinet door, is used to turn the machine power supply on and off. It also works as a non-fused circuit breaker.



The positions and shapes of switches are subject to change with the machine models or specifications.

Switch Position	Function		
ON (1)	Power is supplied to the machine when the main switch is placed in this position.		
OFF (O)	Power to the machine is turned off when the main switch is placed in this position.		
OFF(0) 1 ON(1)	The switch functions as the non-fused circuit breaker in the following cases and the switch returns to the center position between ON (\P) and OFF (\bigcirc).		
	 Power supply is automatically turned off due to overcurrent. Power supply is turned off by the automatic power supply shutoff function. 		
	To turn on the machine power supply again, place the main switch in the OFF (O) position, and then place it in the ON () position.		
DOOR OPEN RESET	When opening the electrical cabinet door, place the main switch in the DOOR OPEN RESET position.		

1.2.2 Electrical Cabinet Door Interlock Key-Switch [CABINET DOOR INTERLOCK]

This key-switch is located on the electrical cabinet door.

This key-switch is provided to protect an operator from electrical shock if he/she touches an energized part inside the electrical cabinet when power is turned ON while the electrical cabinet door is opened.



For daily operations, set the key-switch in the **ON** position and keep the key removed.

(2) This key-switch is for the electrical cabinet door.

For the front door and side door interlock functions, refer to "DOOR INTERLOCK FUNCTION".

3 Switch configuration and switch name may vary depending on machine models.

Interlock	Switch Position	Function
Valid	CABINET DOOR INTERLOCK ON OFF	The electrical cabinet door interlock function is valid when this key-switch is placed in this position. Power supply cannot be turned on while the electrical cabinet door is open. Usually, the CABINET DOOR INTERLOCK key-switch should be placed in the ON position for operating or maintaining the machine.
Invalid	CABINET DOOR INTERLOCK ON OFF	The electrical cabinet door interlock function is invalid when this key-switch is placed in this position. Power supply can be turned on while the electrical cabinet door is open.



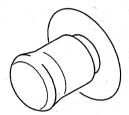
Always switch off the power before carrying out inspection or maintenance work in the electrical cabinet. If work has to be done while the power is switched on, it must be carried out by a qualified electrical engineer, taking the proper precautions; there is a danger of electric shock.

1.2.3 NC Power ON/OFF Switches [1 / O]

The NC power ON and OFF switches are used to turn on and off the power to the NC system, respectively.

Power Supply to NC	Switch	Function
On		Power is supplied to the NC when this switch is pressed. This switch is also used as the second power ON switch for
		turning on the machine ready signal after resetting the emergency stop button.
Off	0	Power to the NC is turned off when this switch is pressed.

1.2.4 Emergency Stop Button



The emergency stop button is used to stop the machine immediately if an emergency requiring immediate machine stop occurs.

This button is also used to turn off the power supply at the end of the operation.

WARNING



Memorize the locations of the emergency stop buttons so that you can press one immediately from any location and at any time while operating the machine. The emergency stop buttons are used to stop all operations in the event of an emergency. If there is an obstacle in front of an emergency stop button it will not be possible to press it immediately when an emergency occurs and this could cause accidents involving serious injuries or damage to the machine.

Pressing the emergency stop button on the machine operation panel turns off the NC servo system power supply, turning off the ready signal and stopping the machine.

To reset the emergency stop state, pull out the emergency stop button from the pushed and locked position then press the NC power switch [] (on).



On some models, the emergency stop button is arranged at more than one place. In this case, all of these emergency stop buttons have the same function and pressing any one of them can stop the machine. To reset the emergency stop state, it is necessary to pull out all the emergency stop buttons from the pushed and locked position.

1.2.5 2nd O.T. Release Button



The 2nd O.T. RELEASE button is used to clear the hard-overtravel alarm state.

Hold down this button while moving an axis from the overtravel zone.



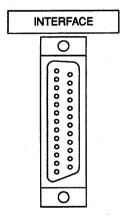
<Hard-overtravel>

If an axis moves exceeding the travel range of the machine, it will cause breakage to the machine. To avoid this, the machine has the limit switch which is actuated if an axis reaches the mechanical travel limit to place the machine in the emergency stop state. Under this state, the axis cannot move beyond this limit position.

<In hard-overtravel state>

- 1) The axis stops moving.
- (2) The status indicator ((machine ready) goes off.
- 3 The message "EMG" blinks on the CRT screen.

1.2.6 RS232C Interface Connector



The INTERFACE connector is used to connect an external I/O device that has the RS232C interface.

An external I/O device is used in the following cases:

- 1 To input the data from the external I/O device to the NC memory
- ② To output the data from the NC memory to the external I/O device





An external I/O device that has other type of interface connector cannot be connected using the RS232C interface connector.

2. MACHINE OPERATION PANEL

In this section, the functions of the switches and keys arranged on the machine operation panel are explained.

2.1 Arrangement and Names of Switches and Keys on Machine Operation Panel

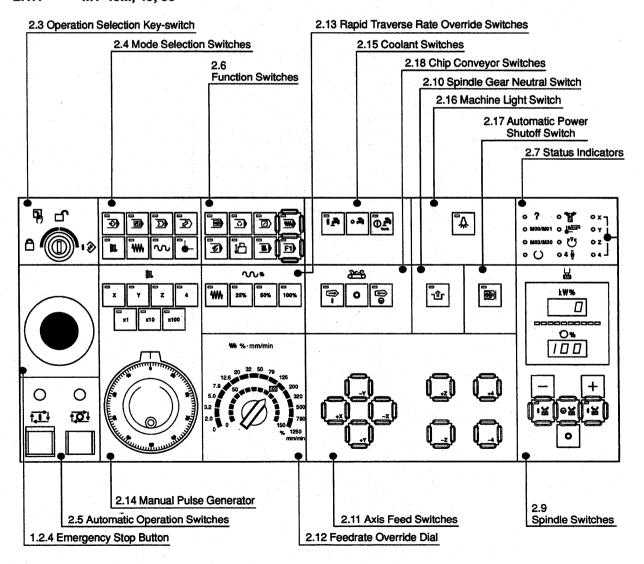
The arrangement of switches and keys on the machine operation panel and their names are indicated below.

The numbers heading the names of the switches and the keys in the following illustrations indicate the subsection numbers where corresponding explanation is given.



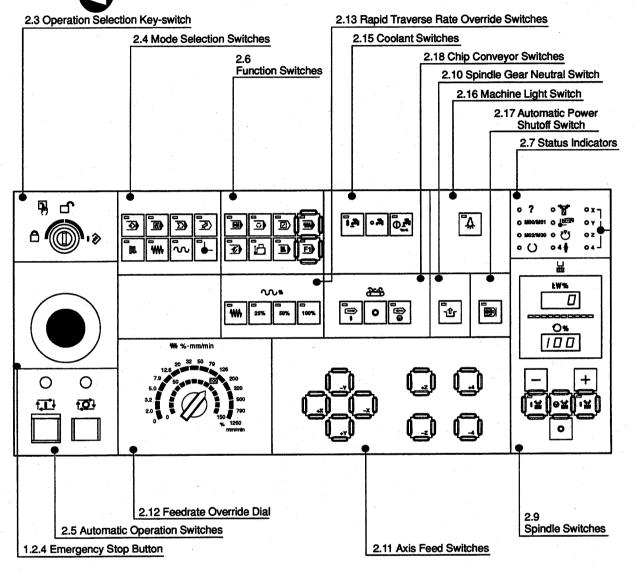
The arrangement and shapes of the switches and keys vary according to the machine models and specifications.

2.1.1 MV-40M, 45, 55

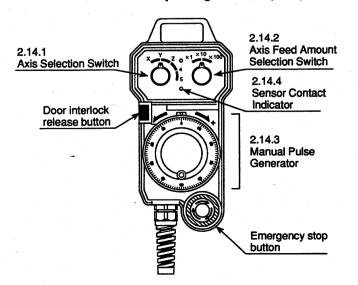


2.1.2 MV-65

With the MV-65, a portable manual pulse generator is provided.



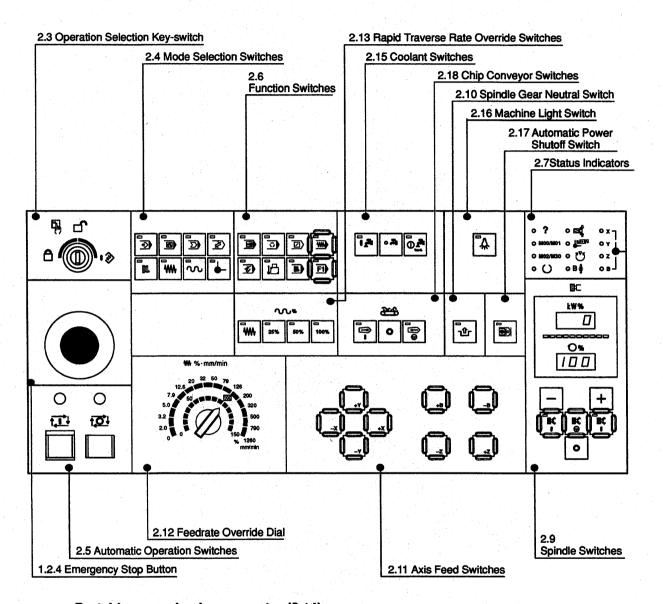
<Portable manual pulse generator (2.14)>



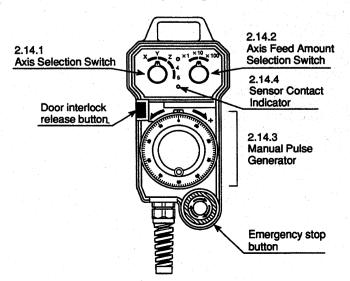
2.1.3 MH-50, 63

NOTE

With the MH-50 and 63, a portable manual pulse generator is provided.



<Portable manual pulse generator (2.14)>



2.2 Names of Switches, Keys and Buttons

The names of switches, keys, and buttons on the operation panel are summarized below. In this manual, the names indicated below are used for the explanation.

<Machine operation panel>

Switch	Name	Switch	Name
	Emergency stop button		Mode selection switch (rapid traverse)
			Mode selection switch (zero return)
	Operation selection key-switch (operation disable)	↑_1	Automatic operation switch (cycle start)
	Operation selection key-switch (operation enable)	↑ O ↓	Automatic operation switch (feed hold)
1 🕏	Operation selection key-switch (operation & edit enable)		Single block switch
	Mode selection switch (edit)	o	Optional stop switch
	Mode selection switch (memory)		Block delete switch
	Mode selection switch (MDI)		Dry run switch
	Mode selection switch (tape)		Program restart switch * For MV-40M, option
	Mode selection switch (handle)		Tool length measurement switch * Function not supported
w	Mode selection switch (jog)		Handle interruption switch * Option

Switch	Name	Swi	itch	Name
	F1-digit feed switch * Option	*1 =3:6=	*2	Tool clamp switch *1 MV series (excluding MV-40M) *2 MH series
0 ?	Status indicator (error)	*1 *3E> \[\overline{D}\]	*2 C	Tool unclamp switch *1 MV series *2 MH series
O M00/M01	Status indicator (M00/M01)			Spindle switch (normal rotation) * MV series
O M02/M30	Status indicator (M02/M30)	<u>—</u>		Spindle switch (reverse rotation) * MV series
° ()	Status indicator (machine ready)			Spindle switch (jog) * MV series
	Status indicator (tool clamp) *1 MV series *2 MH series			Spindle switch (normal rotation) * MH series
০ কিন্দ্ৰ	Status indicator (ATC home position)	K		Spindle switch (reverse rotation) * MH series
০ 🖖	Status indicator (spindle orientation)			Spindle switch (jog) * MH series
○ 4 🖁	Status indicator (4-axis clamp) * MV series, option	, /	0	Spindle switch (stop)
ОВ∦	Status indicator (B-axis clamp) * MH series		[+]	Spindle speed setting switch (increase)
$ \begin{bmatrix} 0 \times 7 & *1 & 0 \times 7 & *2 \\ 0 \times 7 & 0 \times 7 & 0 \end{bmatrix} $	Status indicator (zero return completion) *1 MV series *2 MH series			Spindle speed setting switch (decrease)
OZ OZ OB		kW	1 %	Spindle load meter

Switch	Name	Switch	Name
0%	Spindle override meter	x1	Axis feed amount selection switch (×1) * MV series (excluding MV-65)
TÛr	Spindle gear neutral switch * Transmission specification	x 10	Axis feed amount selection switch (×10) * MV series (excluding MV-65)
	Axis feed switch (–X/+X)	×100	Axis feed amount selection switch (×100) * MV series (excluding MV-65)
	Axis feed switch (-Y/+Y)	×1 ×10 ×100	Axis feed amount selection switch (×1/×10/×100) * MH series, MV-65
	Axis feed switch		
	Axis feed switch (-4/+4) * MV series, option	x	Axis selection switch (X) * MV series (excluding MV-65)
	Axis feed switch (-B/+B) * MH series		Axis selection switch (Y) * MV series (excluding MV-65)
WW % · mm/min 20 32 50 79 12.6 7.9 50 200 200	Feedrate override dial	z	Axis selection switch (Z) * MV series (excluding MV-65)
	0 10 10 10 11	4	Axis selection switch (4) * MV series (excluding MV-65), option
w	Rapid traverse rate override switch (fine feed)	X Y Z	Axis selection switch (X/Y/Z/4/5) * MH series, MV-65
25%	Rapid traverse rate override switch (25%)	5	
50%	Rapid traverse rate override switch (50%)		Manual pulse generator
100%	Rapid traverse rate override switch (100%)		

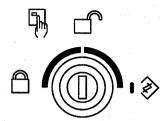
Switch	Name	Switch	Name
I A	Coolant switch (on)		Automatic power shutoff switch
o #4	Coolant switch (off)	C @	Setup button * APC specification
(1) A	Coolant switch (chip removal) * Option		Magazine mode selection switch (auto) * Excluding MV-40M
D-	Chip conveyor switch (forward)	(m)	Magazine mode selection switch (manual) * Excluding MV-40M
9cc	Chip conveyor switch (stop)		Magazine indexing switch (normal rotation) * Excluding MV-40M
□ ⊕	Chip conveyor switch (backward)	O	Magazine indexing switch (reverse rotation) * Excluding MV-40M
	Machine light switch	000	Magazine start switch * MV-40M

<NC operation panel>

\bigcap	The functions of the keys on the NC operation panel are explained in page $A - 44$ (3.).
	A – 44 (3.).

Switch	Name	Switch	Name
	NC power switch (on)	//	Cancel key
0	NC power switch (off)	+	Position key
	Page selection key (return)	\bigcirc	Program key
[라	Page selection key (advance)		Offset/setting key
\$	Alteration key	\triangleright	System key
	Insertion key	?	Message key
>	Deletion key		Graphic key
•>	Input key		Custom key
	Reset key		Help key
Û	Shift key		

2.3 Operation Selection Key-Switch



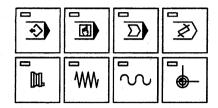
The operation selection key-switch is used to select the operation range of the switches on the machine operation panel.

After turning on the power supply, first check the setting of the key-switch.

The key-switch is used to protect the stored program from being inadvertently changed. It also prevents an operation error caused by erroneous switch operation during automatic operation.

Switch Position	Machine Operation, Program Editing	Function
	Operation: Disabled	When this position is selected, the switches on the machine operation panel are invalid.
	Edit:	Therefore, programs stored in memory cannot be edited.
	Disabled	Select this position so that the switches on the machine operation panel will not be used carelessly during automatic operation.
		The key can be removed when the operation selection key-switch is placed in this position.
		When this position is selected, the following switches remain valid:
		emergency stop button, automatic operation switches, machine light switch, chip conveyor switches, and coolant switches
	Operation: Enabled	When this position is selected, the switches on the machine operation panel are valid.
	Edit: Disabled	However, programs stored in memory cannot be edited. The key can be removed when the operation selection key-switch is placed in this position.
1 🕏	Operation: Enabled	When this position is selected, the switches on the machine operation panel are valid.
	Edit: Enabled	In addition, programs stored in memory can be edited. Cycle start is impossible in the memory mode. The key cannot be removed when the operation selection
	Enabled -	

2.4 Mode Selection Switches



Eight mode selection switches are used to select the machine operation mode.

Operation of the machine begins with the selection of the operation mode.



When the power is turned on, the memory mode is set as the initial mode.

Operation modes are generally classified into the following three groups:

	Operation Mode Group	S
Automatic operation	Program edit	Manual operation
Memory operation mode	Edit mode	Handle mode
MDI operation mode		Jog mode
Tape operation mode		Rapid traverse mode
		Zero return mode

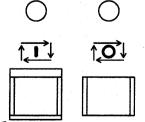


To carry out the operation using tape, an optional I/O device such as a tape reader used for inputting punched program is required.

Switch	Function
	When this switch is pressed, the indicator in the switch is lit and the edit mode is selected.
	In the edit mode, the following operations are possible:
	Inputting and storing programs to NC memory
	② Changing or deleting a program
	3 Outputting a program stored in the NC memory
	As above three operations, editing a program in the edit mode is called foreground editing.
	Usually, the term "program editing" means the foreground program editing.
	Using the search function (program number search, sequence number search, etc.)
	The above operations are impossible with the operation selection key-switch placed in the [%] (operation enable) or
	disable) position.

Switch	Function
□ •>•	When this switch is pressed, the indicator in the switch is lit and the memory mode is selected.
	In the memory mode, the following operations are possible:
	① Calling and executing a program stored in the NC memory
	Before starting operation in the memory mode, close the front door and the side door.
	② Searching for a sequence number, etc. of a program stored in the NC memory
	③ Editing a program in a background mode
	When the operation selection key-switch is placed in the (operation disable) position during memory operation, background editing is not possible.
	Background editing
	A program that is not currently being executed can be edited by displaying it on the screen while executing another program in the automatic mode.
	When this switch is pressed, the indicator in the switch is lit and the MDI mode is selected.
	In the MDI mode, the following operations are possible:
	① Operating the machine in the MDI mode.
	The MDI mode is often used to start the spindle and change the tools.
	A program created in the MDI mode is cleared in the following cases:
	After the program is executed
	When the power is turned off
	When the reset key is pressed
	Before starting operation in the MDI mode, close the front door and the side door.
	② Setting parameters and other data
	When this switch is pressed, the indicator in the switch is lit and the tape mode is selected.
	In the tape mode, running a program using an external I/O device (tape reader or personal computer) is possible.
	① An external I/O device (such as a tape reader) is optional.
	② Before starting operation in the tape mode, close the front door and the side door.

2.5 Automatic Operation Switches 3



The automatic operation switches are used to start an automatic operation and stop the program execution temporarily.



<u>a</u>

D

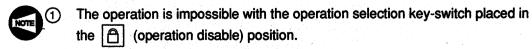
The operation is impossible with the operation selection key-switch placed in the operation & edit enable) position.

Close the front door and the side door before pressing the automatic operation switch (cycle start) switch.

Switch	Function
0	This switch is used to start an automatic operation in the memory, MDI or tape mode.
<u>↑</u> • ↓	The indicator above this switch is lit during automatic operation.
	The cycle start signal is output when this switch is released (after being pressed).
	Therefore, machine operation will not start if this switch is held down.
	Be aware that the machine will start automatic operation if the automatic operation switch (cycle start) is pressed by mistake while the conditions required to start automatic operation are satisfied and an automatic mode is selected. If this switch is pressed carelessly, automatic operation will start unexpectedly, and this could cause damage to the machine.
	<side view=""></side>
	To avoid such a situation, caused by erroneous operation, the switch cover is placed.
	Operation panel To ensure safety, close the cover unless the switch should be pressed.
	Open the cover to press the switch.
	Switch For the condition for starting automatic operation, refer to page C – 31 (6.1).
0	This switch is used to temporarily stop program execution during automatic operation.
↑ ○	The indicator above the switch is lit while the axis movement is stopped.
1,0 ↓	When a test cutting or program check is carried out, the operator must be ready to press this switch immediately if a problem arises.
	To restart the automatic operation, press the automatic operation switch (cycle start) again.

2.6 Function Switches

The function switches are usually used to carry out test cutting and to check programs in the automatic mode, or to intervene manual operation during automatic operation.



- ② The single block switch ③ , the optional stop switch ⑤ , and the block delete switch ⑥ remain set even if the power is turned off.
- 3 Depending on the machine model and NC specification, the NC functions are set valid/invalid by either switches or using the OPERATION PANEL screen.

Carry out program check or test cutting after thoroughly understanding the NC functions explained below.

2.6.1 Single Block Switch 3





D



When this switch is pressed, the indicator in the switch is lit and the single block function becomes valid.

When this switch is pressed again, the indicator in the switch goes off and the single block function becomes invalid.

<Single block function>

The single block function executes a program block by block in the automatic mode.

This function is used to check a program block by block in test cutting, etc.



A "block" refers to one line of the program, ending with the EOB code (;), displayed on the screen.



Before starting mass production, always check the program and perform test cutting in the single block mode. If you fail to do this the workpiece could collide with the cutting tool during machining, damaging the machine. Machining defects could also be caused.

<When the single block function is valid>

When the automatic operation switch | 교 | (cycle start) is pressed after pressing the single block switch | machine stops after the execution of one block of commands.

To execute the next block of commands, press the automatic operation switch [43] start) again.

<When the single block function is invalid>

The program is executed continuously when the automatic operation switch 🗗 start) is pressed.



If the single block function is made valid during automatic operation, the next block is stored in the buffer register.

To stop the process currently being executed in order to execute another process in this condition (i.e., with the data for the next block stored in the buffer register), clear the data in the buffer register by pressing the reset key // . If you attempt to execute another process while the data is still stored in the buffer memory, the machine will operate in an unexpected manner, and this could cause damage to the machine.

2.6.2 Optional Stop Switch 3









When this switch is pressed, the indicator in the switch is lit and the optional stop function becomes valid.

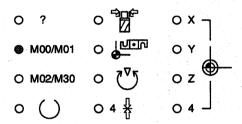
When this switch is pressed again, the indicator in the switch goes off and the optional stop function becomes invalid.

<Optional stop function>

The optional stop function makes the M01 (optional stop) command written in a program valid.

This function is used to check the conditions of the cutting tool or to remove chips from the machine during automatic operation and to check a program at each process of test cutting.

<When the optional stop function is valid>



In the optional stop mode, spindle rotation, coolant supply, and axis feed stop after the execution of an M01 block.

The status indicator (M00/M01) is lit.

To continue the interrupted operation, press the automatic operation switch [12] (cycle start).



Specify the M01 command in an independent block.

<When the optional stop mode is invalid>

Any M01 command is ignored and the program is executed continuously.

2.6.3 Block Delete Switch →







When this switch is pressed, the indicator in the switch is lit and the block delete function becomes valid.

When this switch is pressed again, the indicator in the switch goes off and the block delete function becomes invalid.



The block delete functions (/2 - /9) are optional and whether each of the block delete functions is valid or invalid is set on the OPERATION PANEL screen.

<Block delete function>

The block delete function ignores the commands preceded by a slash [/ (/2 to /9)] in a block to the end of the EOB code (;) in the same block, and makes the program skip to the next block.

<When the block delete function is valid>

The commands preceded by a slash [/ (/2 to /9)] in a block to the end of the EOB code (;) in the same block are ignored and the program skips to the next block.

<When the block delete function is invalid>

All blocks (even those preceded by a slash [/ (/2 to /9)]) are executed.

D

2.6.4 Dry Run Switch →



When this switch is pressed, the indicator in the switch is lit and the dry run function becomes valid.

When this switch is pressed again, the indicator in the switch goes off and the dry run function becomes invalid.

<Dry run function>

The cutting feedrate specified in a program is ignored and all axis feed commands are executed at a feedrate set using the feedrate override dial.

This function is used to shorten program check time.



Be aware that the program will be executed at an unexpected feedrate if the dry run function is made valid mistakenly during automatic operation, and this could cause accidents involving damage to the machine.

<When the dry run function is valid>

In the dry run mode, the cutting feedrates specified in the program are adjusted by the feedrate set with the feedrate override dial.

The feedrate override dial setting can be changed in 15 steps.

Setting range: 0 to 1260 mm/min



The dry run function is invalid during tapping and thread cutting (option).

<When the dry run function is invalid>

All feedrates (cutting feedrates and rapid traverse rate) are executed at the programmed feedrates. The percent setting (0 to 150%) of the feedrate override dial becomes valid when the dry run function is canceled. Therefore, be careful when making the dry run function valid and invalid.



If the dry run function valid/invalid state is changed by pressing the dry run switch during automatic operation, the machine stops in the feed hold state to ensure safety to the machine and the operator. The automatic operation can be restarted by pressing the automatic operation switch to (cycle start).

2.6.5 Program Restart Switch (Option for MV-40M, Standard for Other Models)





When this switch is pressed, the indicator in the switch is lit and the program restart function becomes valid.

When this switch is pressed again, the indicator in the switch goes off and the program restart function becomes invalid.

<Program restart function>

The program restart function is used to restart the program from the required block if execution of the program is interrupted due to tool breakage, the power supply being turned off or any other reason, or to restart the interrupted program or recommencing after a vacation.



For details, refer to the instruction manuals prepared by the NC manufacturer.

<When the program restart function is valid>

After the interruption of a program, specify the sequence number of the block where the program should be restarted, and the program restarts from the specified block.

<When the program restart function is invalid>

After the interruption of a program, program restart is not possible.

2.6.6 Tool Length Measurement Switch





The tool length measurement function is not provided now.

2.6.7 Handle Interruption Switch (Option)



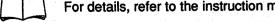


When this switch is pressed, the indicator in the switch is lit and the handle interruption function becomes valid.

When this switch is pressed again, the indicator in the switch goes off and the handle interruption function becomes invalid.

<Handle interruption function>

The handle interruption function allows shifting of the workpiece zero point to offset the tool paths by turning the pulse handle during automatic operation.



For details, refer to the instruction manuals prepared by the NC manufacturer.

<When the handle interruption function is valid>

Select the axis to move with the axis selection switch and rotate the manual pulse generator during automatic operation.



Be aware that, while the handle interrupt function is valid, the coordinate shift value will be applied to the coordinate systems of all programs unless it is cancelled. If automatic operation is executed without canceling this value, machining will be carried out with an incorrect depth of cut and this could damage the cutting tool and the machine.

<When the handle interruption function is invalid>

The axis movement by turning the manual pulse generator is not possible during automatic operation.

2.6.8 F1-Digit Feed Switch (Option)

F1





When this switch is pressed, the indicator in the switch is lit and the F1-digit feed function becomes valid.

When this switch is pressed again, the indicator in the switch goes off and the F1-digit feed function becomes invalid.



Actual feedrate is set as parametric data corresponding to each 1-digit number.

<When the F1-digit feed function is valid>

When a 1-digit number (1 to 9) is specified following address F, the parameter set feedrate corresponding to the specified number becomes valid.

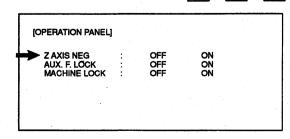
For details, refer to the instruction manuals prepared by the NC manufacturer.

ωζ (1) Specification of F0 calls the rapid feedrate.

<When the F1-digit feed function is invalid>

The programmed axis movement commands are executed at a feedrate designated following address F.

2.6.9 Z-Axis Neglect D D L W



The Z-axis neglect function is made valid or invalid on the OPERATION PANEL screen, which is displayed by pressing the custom key 📵 .



<Z-axis neglect function>

Manual Z-axis movement operation and programmed Z-axis movement commands are ignored and the Z-axis is not fed. Only position data is updated according to the execution of an axis movement command.

The axis movement commands of other than Z-axis command are all executed as programmed.

This function is used to check a program without Z-axis movement operation.

<When the Z-axis neglect function is valid>

Manual Z-axis movement operation and programmed Z-axis movement commands are ignored and the Z-axis is not fed.

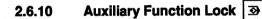


When checking the program using the Z-axis neglect function, return the Z-axis to the zero point (second zero point in the case of MH series) in advance.

The axes other than the Z-axis are moved as programmed.

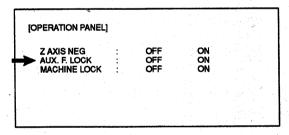
<When the Z-axis neglect function is invalid>

Axis movement is carried out normally.









The auxiliary function lock function is made valid or invalid on the OPERATION PANEL screen, which is displayed by pressing the custom key



Page A – 62 (4.7.1)

<Auxiliary function lock function>

The auxiliary function lock function is used to select whether or not executing the M, S, and T (auxiliary function) commands in a program during automatic operation. It is used to check the program in combination with the Z-axis neglect function, machine lock function, etc.

<When the auxiliary function lock is valid>

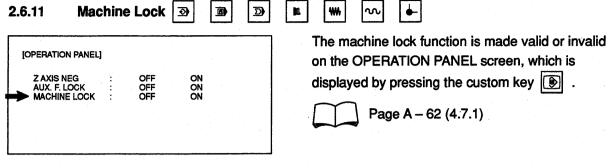
In the auxiliary function lock mode, the M, S, and T codes specified in a program are ignored.

Note that the following M commands are executed:

M00, M01, M02, M30, M98, M99

<When the auxiliary function lock is invalid>

All the programmed commands and codes are executed as specified.



<Machine lock function>

Manual axis movement operation and programmed axis movement commands are ignored. Only position data is updated according to the operation of an axis feed switch or the execution of an axis movement command.

This function is used to check a program without axis movement operation.

<When the machine lock function is valid>

Manual axis movement operation and programmed axis movement commands are ignored.

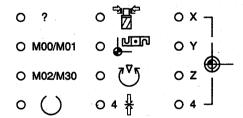
<When the machine lock function is invalid>

Axis movement is carried out normally.



Before switching the machine lock function from "valid" to "invalid", wait until one program operation cycle has been completed. After switching from "valid" to "invalid", always execute a zero return operation. Switching between "valid" and "invalid" during program execution will create a discrepancy between the position designated in the program and the actual machine position, which could cause damage to the machine.





The status indicator is lit in the following cases:

- (1) When the machine is at the reference position for an intended operation.
- When the machine has stopped during an automatic operation.
- (3) When an alarm has occurred.



These status indicators are for the MV series machining centers. With the MH series, some of the indicators differ from the illustration shown in the left.

Status Indicator	Contents of Indication
O ?	The status indicator (error) is lit if an alarm state is detected.
	If an alarm occurs, the corresponding alarm message is displayed on the screen.
○ M00/M01	The status indicator (M00/M01) is lit and the machine stops in the following cases:
	① When an M00 command (program stop) is read.
	② When an M01 command (optional stop) is read while the optional stop function is valid.
	The M01 command in a program is ignored when the optional stop function is invalid, and the program proceeds to the next block without halting.
	In a program specify the M00/M01 command in an independent block.
○ M02/M30	The status indicator (M02/M30) is lit and the machine stops in the following cases:
	① When an M02 command (program end) is read.
	② When an M30 command (program end and rewind) is read.
	In a program, specify the M02/M30 command in an independent block.
0()	The status indicator (machine ready) is lit after the power has been turned on and when the machine is ready for operation.
	Machine operation is impossible unless this indicator is lit.
	The fact that this indicator is lit means that the electrical system is operating correctly.
	Start the machine operation only after making sure that the operation can be started safely by checking the machine conditions, cutting tool(s), workpiece, working environment and program.
<mv series=""></mv>	The status indicator (tool clamp) is lit when a tool is clamped in the spindle.
<mh series=""></mh>	The indicator is lit when tool clamp operation is carried out if a tool is not set in the spindle.
	The spindle cannot be rotated unless the indicator is lit.
	Check whether this indicator is lit or not if the automatic operation does not start even when the automatic operation switch [12] (cycle start) is pressed.

Status Indicator	Contents of Indication
O Trien	The status indicator (ATC home position) is lit when the ATC is at the home position.
	If this indicator is not lit, automatic tool change cycle using the ATC is impossible because the ATC is off the home position.
	(1) Check whether this indicator is lit or not if the automatic operation does not start even when the automatic operation switch (cycle start) is pressed.
	② The home position of the ATC varies depending on the machine model. For details, refer to the OPERATION MANUAL (SUPPLEMENT) ATC & APC MANUAL OPERATION.
0 ₹	The status indicator [7] (spindle orientation) is lit when spindle is stopped at the spindle orientation position.
<mv series=""> ○ 4 ∯</mv>	The status indicator [4#] (4-axis clamp) is lit when an optional 4-axis equipment, such as index table, is used and when the 4-axis is clamped.
<mh series=""></mh>	The status indicator [B] (B-axis clamp) is lit when the B-axis is clamped.
<mv series=""></mv>	These indicators are lit when zero return of the corresponding axis (X-, Y,- Z-, and 4-axes (option)) is completed. They are used to make sure that the individual axes have returned to the zero point correctly.
0 Y 0 Z 0 4	In the 2nd or 3rd zero point return operation, the home position indicators for the 2nd zero and 3rd zero point arranged on the option panel are lit corresponding to the axis which has returned to the 2nd or 3rd zero point.
	② For the machining center which has the U-axis specification, the status indicator (zero return completion) is lit.
<mh series=""> O X TO Y</mh>	These indicators are lit when zero return of the corresponding axis (X-, Y,- Z-, and B-axes) is completed. They are used to make sure that the individual axes have returned to the zero point correctly. In the 2nd or 3rd zero point return operation, the home position
0 z 0 0 B	indicators for the 2nd zero and 3rd zero point arranged on the option panel are lit corresponding to the axis which has returned to the 2nd or 3rd zero point.

Status Indicator	Contents of Indication
<mh (u-axis="" series="" type)=""></mh>	This indicator located on the option panel is lit when the zero return of the U-axis is completed.
	It is used to make sure that the U-axis has returned to the zero point correctly.
+U	

2.8 Tool Clamp/Unclamp Switches



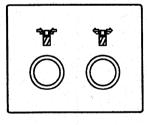


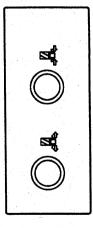
- (1) When holding a cutting tool with hands, pay sufficient care so that fingers and hands will no be injured due to sharp cutting edge.
- When removing a cutting tool from the spindle manually, make sure that it is properly supported before unclamping it. Also be careful not to drop the cutting tool inside the machine; this could damage the machine.
- Tool unclamp operation is not possible while the spindle is rotating.
 - ② For the machine with the U-axis control function, tools are positioned using the tapered portion and securely torqued down by the spindle drive motor rotation. Therefore, it is not possible to mount or remove a tool directly at the spindle.

These switches are used to manually clamp and unclamp a tool in the spindle.

<MV series>







When the tool clamp switch is pressed, the status indicator (tool clamp) is lit and the tool is clamped.

When the tool unclamp switch is pressed, the status indicator (tool clamp) goes off and the tool is unclamped.



2.9 Spindle Switches

The spindle switches are used to start and stop the spindle manually.

The spindle is manually rotated for cutting the rough surface of a workpiece or centering.

WARNING



- ① Before starting the spindle, carefully check the tool mounted conditions and the spindle speed. If spindle rotation is started when the tool is mounted unstably or when the spindle speed inappropriate, the tool could fly out, causing serious injuries or damage to the machine.
- 2 Be aware that the spindle will start rotating if the spindle switch ((normal rotation), ((reverse rotation), or ((jog) is pressed by mistake while a manual mode is selected and the conditions for spindle rotation are satisfied. If these switches are pressed carelessly the spindle will start rotating unexpectedly and this could cause accidents involving serious injuries or damage to the machine.



For the condition for spindle starting, refer to page A - 80 (5.5.1).



The operation is impossible with the operation selection key-switch placed in the (operation disable) position.

Close the front door and the side door before pressing these switches.

<Valid mode>







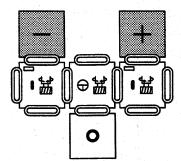
Switch	Function
	The spindle rotates in the clockwise direction (viewing a workpiece from the spindle) when this switch is pressed.
	The spindle start signal is output when the switch is released. Therefore, the spindle will not start if this switch is held down.
	② If spindle speed data (S code) is not set, the spindle does not start even when this switch is pressed.
	Spindle speed is adjustable from the specified spindle speed data (S code) by setting the override value with the spindle speed setting switches + (increase) and - (decrease).
	The spindle rotates in the counterclockwise direction (viewing a workpiece from the spindle) when this switch is pressed.
	The spindle start signal is output when the switch is released. Therefore, the spindle will not start if this switch is held down.
	② If spindle speed data (S code) is not set, the spindle does not start even when this switch is pressed.
	③ Spindle speed is adjustable from the specified spindle speed data (S code) by setting the override value with the spindle speed

setting switches | + | (increase) and |

(decrease).

Switch	Function
0	The spindle stops when this switch is pressed.
	The spindle rotates at jog speed in the clockwise direction (viewing a workpiece from the spindle) while this switch is held down; it stops when this switch is released.

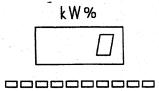
2.9.1 Spindle Speed Setting Switches 3



The spindle speed setting switches are used to set a spindle speed in the range of 50% to 120% at an increments of 10% in reference to the following spindle speed.

- In the manual mode, the spindle speed set on the PROGRAM (MDI) screen is taken as the reference.
- In the automatic mode, the programmed spindle speed (100%) is taken as the reference.
- ① When the spindle speed setting switch + (increase) is pressed and released, the override value is increased by 10%.
- (2) When the spindle speed setting switch + (increase) is held down, the override value is continuously increased in units of 10%.
- (3) When the spindle speed setting switch (decrease) is pressed and released, the override value is decreased by 10%.
- When the spindle speed setting switch __ (decrease) is held down, the override value is continuously decreased in units of 10%.
- (5) When the spindle speed setting switches + (increase) and (decrease) are pressed simultaneously, the override value is set to 100%.
- When the power is turned on, the override value is automatically set to 100%. The spindle speed does not exceed the maximum allowable spindle speed.

2.9.2 Spindle Load Meter 🗗 🖫 🕥 👪 ₩ 🕟 👆



The spindle load meter indicates the load applied to the spindle drive motor in percent.

100% corresponds to the continuous output rating of the motor.

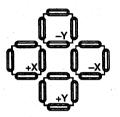
	Carry out machining while observing the spindle load.
	For details, refer to the MAINTENANCE MANUAL separately provided.
2.9.3	Spindle Override Meter 🚳 🔞 🕦 🖈 🖟
	The spindle override meter indicates the spindle speed override data set using the spindle speed setting switches + (increase) and - (decrease).
	When the power is turned on, 100% is displayed.
2.10	Spindle Gear Neutral Switch (Transmission Specification)
	The spindle gear neutral switch is used to manually select the neutral position of the spindle
	The operation is impossible with the operation selection key-switch placed in the (operation disable) position.
	2 This switch is valid when the machine is equipped with a transmission.
	Pressing this switch while the spindle is stopped puts the spindle in neutral. This switch is valid in any operation mode.
2.11	Axis Feed Switches
	The axis feed switches are used to manually move the axis.
	The operation is impossible with the operation selection key-switch placed in the (operation disable) position.
	② Close the front door and the side door before moving the axis.
	These switches are used for the following axis feed operations:
	① Jog feed
	② Rapid traverse
	③ Zero return
	Select the axis to be moved and the feed direction and initiate axis feed with these switches.
	With MV series, the axis feed switches (+4) and (-4) can be used only when the 4-axis is selected optionally.
	2 For the MV series of U-axis type, the axis feed switches (-4) and (-4) are used to feed the U-axis.

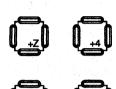


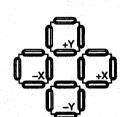
With MH series, the axis feed switches (+B) and (-B) can be used only when arbitrary angle index specification is selected optionally. These switches are used only for zero return operation of the B-axis.

For the MH series of U-axis type, axis feed switches are arranged on the **(4)** option panel.

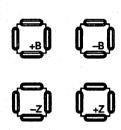
<MV series>







<MH series>



Feedrate Override Dial 3 2.12



The feedrate override dial is used to adjust the axis feedrate.

<In the automatic mode>

In the automatic mode operation, the values at the inner graduations are used to set the override value.

The programmed feedrate (F code) is adjusted in the range of 0 to 150% in increments of 10%.

An axis will be moved at the programmed feedrate when the setting is 100%.

When the dial is set at the 0% position, all axis movement stops; this has the same effect as the feed hold function.

<in the manual mode>

In the manual mode operation, the values at the outer graduations are used to set the override value.

In manual operation, the axis feedrate can be set in the range of 0 to 1260 mm/min (15 steps) if the jog mode is selected.

2.13 Rapid Traverse Rate Override Switches 3

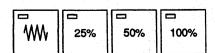








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The rapid traverse rate override switches are used to adjust rapid traverse rate.



The operation is impossible with the operation selection key-switch placed in the (operation disable) position.

The rapid traverse rate is adjusted in four steps;

(fine feed), 25%, 50% and 100% (set rapid traverse rate).



- 1) When the power is turned on, the [(fine feed) is selected to ensure safety.
- ② For manual operation, the maximum allowable override value is 50%.
 Therefore, if the rapid traverse rate override switch [x100] (100%) is pressed, the override is 50%.
- 3 The rapid traverse override function is valid in the dry run mode.
- (4) For automatic operation, set 100% for the override value.
- (5) When the operation mode is changed from automatic to manual, the [***] (fine feed) is selected to ensure safety.

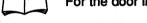
2.14 Handle Switches

The handle switches are used to carry out the handle feed operation.

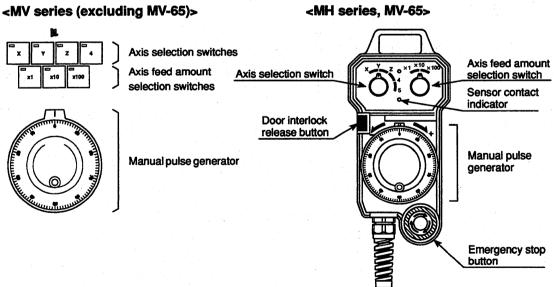


- Close the front door and the side door before carrying out the handle feed operation.
- (2) The emergency stop button on the portable manual pulse generator panel has the same function as the one provided on the machine operation panel.

However, the button should be turned clockwise to reset the emergency stop state.



For the door interlock release button, refer to page P-4 (2.).



2.14.1 Axis Selection Switches

The axis selection switches are used to select the axis (X, Y, Z, 4, B or U) to be moved in the handle mode.

With the MV series (excluding MV-65), when the axis selection switch corresponding to the selected axis is pressed, the indicator in the switch is lit.



- With the MH series, select the 4th-axis by placing the axis selection switch in the 4 position to feed the B-axis with the manual pulse generator.
- With the MV series (U-axis type), select the 4th-axis by pressing manual pulse generator axis selection switch 4 (4) to feed the U-axis with the manual pulse generator.
- With the MH series (U-axis type), select the 5th-axis by placing the axis selection switch in the 5 position to feed the U-axis with the manual pulse generator.

2.14.2 Axis Feed Amount Selection Switches

The axis feed amount selection switches are used to determine the axis feed amount per pulse when an axis is moved with the manual pulse generator.

With the MV series (excluding MV-65), when the axis feed amount selection switch is pressed, the indicator in the switch is lit.

<Axis feed amount per pulse>

Setting	X-, Y-, Z-, 4-, and, U-axes	B-axis
×1	0.001 mm	0.001°
×10	0.01 mm	0.01°
×100	0.1 mm	0.1°



With the MV series (excluding MV-65), $[\times 1]$ ($\times 1$) is selected when the power is turned on to ensure safety.

2.14.3 Manual Pulse Generator

The manual pulse generator is used to move an axis in the handle mode.

The amount of axis feed per pulse is set with the axis feed amount selection switches $[\times 1]$ ($\times 1$), $[\times 10]$ ($\times 10$), and $[\times 100]$ ($\times 100$) when using the manual pulse generator.

<Relationship between the axis feed direction and the dial rotation direction>

Dial rotation direction	Clockwise	Counterclockwise
Axis feed direction	+ (positive)	- (negative)

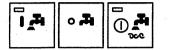


Do not turn the manual pulse generator any faster than 5 rotations per second. If you do, the axis will not stop immediately when the manual pulse generator is stopped and the actual amount of axis feed will not coincide with the number of pulses generated. This could damage the machine.

2.14.4 Sensor Contact Indicator (Option)

The sensor contact indicator is available for the machine equipped with optional contact sensor function. It is lit when the contact of the contact sensor with an object is detected.





The coolant switches are used to manually operate the coolant.



Close the front door and the side before supplying the coolant so that the coolant will not splash out.

Switch	Function		
٦ _A	When this switch is pressed, the indicator in the switch is lit and coolant is supplied through the nozzles.		
	When the coolant ON M code is read during automatic operation (MDI, memory, or tape mode), the indicator in the coolant switch (on) is lit and coolant is automatically supplied.		
o.#4	When this switch is pressed while coolant is being supplied, the coolant supply stops and the indicator in the coolant switch (on) goes off.		
	Pressing this switch for 1 second or more while coolant is not being supplied causes the indicator in the coolant switch (on) to blink.		
	In this state, the coolant is not supplied even if an M08 command is executed.		
	<to blink="" cancel="" state="" the=""></to>		
	① Press the coolant switch (on).		
	The coolant is supplied.		
	② Press the coolant switch off).		
	The coolant is not supplied.		
6 [This switch is used to flush away chips with coolant.		
When this switch is pressed, chip flush coolant is supplied and the inditthe switch is lit.			
When this switch is pressed while chip flush coolant is being supplied, supply stops and the indicator in the switch goes off.			
	For MV series, this switch is optional.		

2.16 Machine Light Switch 3 3 2 1 1 1 1 1 1



The machine light switch is used to turn the machine light on/off.

Machine Light	Function
On	Pressing this switch turns on the machine light. At the same time, the indicator in the switch is lit.
Off	Pressing this switch while the machine light is lit turns off the machine light. The indicator in the switch also goes off.



A halogen lamp, an incandescent lamp, or a fluorescent lamp is used as a machine light.



For the procedure to change the fluorescent lamp or the halogen lamp, refer to the MAINTENANCE MANUAL.

2.17 **Automatic Power Shutoff Switch**





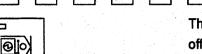












The automatic power shutoff switch is used to shut off the power automatically after the completion of machining.

Automatic Power Shutoff	Function
Valid	When this switch is pressed, the indicator in the switch is lit.
	The power supply circuit is opened to shut off the power supply to the machine if M02 (program end) or M30 (program end & rewind) command, specified in the program, is read under this setting during the automatic operation.
	For the machine equipped with the APC, the power supply circuit is automatically opened if the indicator in the setup button is off.
Invalid	When this switch is pressed again, the indicator in the switch goes off and the automatic power shutoff function becomes invalid.
	The power supply is not shut off even if M02 (program end) or M30 (program end & rewind) command, specified in the program, is read under this setting.



The main switch is placed in the position between ON () and OFF () after the power supply is automatically shut off using the automatic power shutoff function.

Place the main switch in the OFF () position first and then place it in the ON () position to turn on the power supply again.

- (2) The M20 (automatic power shutoff) command, when executed, turns off the power supply regardless of the setting of the automatic power shutoff switch.
- (3) A PC parameter is provided to save the "automatic power shutoff function ON" state.

Chip Conveyor Switches (Chip Conveyor Specification) 2.18









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The chip conveyor switches are used to manually operate the chip conveyor.



Close the front door and the side door before operating the chip conveyor.

Switch	Function
□ →	When this switch is pressed, the indicator in the switch is lit and the chip conveyor moves forward to discharge chips. This switch is valid until the chip conveyor switch (stop) is pressed.
0	When this switch is pressed, the chip conveyor stops.
□ ⊕	When this switch is pressed, the indicator in the switch is lit and the chip conveyor moves backward. The chip conveyor moves backward only while this switch is held down. If the chip conveyor is blocked by chips, press this switch to remove the chips from the chip conveyor.

2.19 Door Unlock Switch 3



B

















The DOOR UNLOCK switch, provided on the machine operation panel or the option panel, is used to release the front door and the side door lock devices.



- The front door and the side door cannot be opened unless the door lock is unlocked.
- ② With some models, the indicator is provided inside the switch.



For details, refer to page P – 12 (5.) in Chapter "DOOR INTERLOCK FUNCTION".

Door	Function
Unlock	When the DOOR UNLOCK switch is pressed, the indicator above or in the switch is lit and the door lock is released. The front door and the side door can be opened in this state.
Lock	When the DOOR UNLOCK switch is pressed while the indicator above or in the switch is lit, the indicator goes off and the door is locked. In this state, the front door and the side door cannot be opened.

2.20 Setup Button (APC Specification)



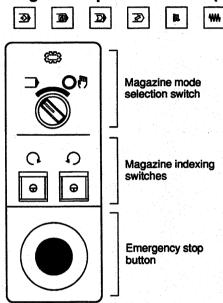


The setup button is located on the APC operation panel.

The button should be pressed, when workpiece setting up at the setup position of the pallet changer is completed, to send the setup complete signal to the NC.

When the setup button is pressed, the APC enters the setup completed state, the indicator in the setup button is lit, and the setup station door is locked. Pressing the setup button again cancels the setup completed state and the indicator in the switch goes off.

2.21 Magazine Operation Panel (Excluding MV-40M)



The magazine operation panel is mounted at the left side of the machine.

The switches on the magazine operation panel is used for mounting and removing tools to and from the magazine.

2.21.1 Magazine Mode Selection Switch

The magazine mode selection switch selects whether the magazine is rotated according to a T command (automatic operation) or by manual operation.

Switch Position	Function
	When the switch is placed in this position, the magazine rotates according to the T command (automatic operation).
	When the switch is placed in this position, the manual magazine operation indicator is lit and the magazine can be rotated manually.
	If the switch is placed in this position while the magazine is rotating according to the execution of a T command, the indicator is not lit. It is lit only after the completion of present T command execution.

2.21.2 Magazine Indexing Switches

The magazine indexing switches are used to manually rotate the magazine in the clockwise/counterclockwise direction.

Manual magazine operation is possible independent of the setting of the operation selection switch and the selected operation mode as long as the magazine mode selection switch is placed in the (manual) position and the manual magazine operation indicator is lit.

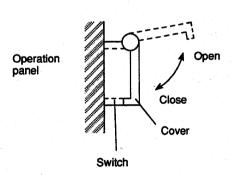
Switch	Function
C	The magazine keeps rotating in the clockwise direction while this switch is held down.
Θ	CW: Movement of the pallets from the right to the left, viewing the magazine from the magazine door.
0	The magazine keeps rotating in the counterclockwise direction while this switch is held down.
0	CCW: Movement of the pallets from the left to the right, viewing the magazine from the magazine door.



- Close the magazine door before rotating the magazine manually.
- 2 Although the magazine door may be opened while in automatic operation, automatic operation is suspended by the magazine door interlock function when a T command is read while the magazine door is open.
- The magazine may not rotate unless the magazine indexing switch is pressed positively.

Therefore, when indexing the magazine by 1 pot, hold the switch pressed until the magazine begins rotating.

<Side view>





rotating if the magazine indexing switch (normal rotation) or (reverse rotation) is pressed by mistake while the magazine mode selection switch is placed in the (manual) position and the manual magazine operation indicator is lit. If these switches are pressed carelessly the magazine will start rotating unexpectedly and this could cause damage to the machine.

Be aware that the magazine will start

To avoid such a situation, caused by erroneous operation, the switch cover is placed.

To ensure safety, close the cover unless the switch should be pressed.

Open the cover to press the switch.

2.21.3 Emergency Stop Button

The emergency stop button has the same function as that available with the emergency stop button on the machine operation panel.

Pressing the emergency stop button on the magazine operation panel turns off the power supply to the NC servo system, stopping the machine as well as the magazine operation.

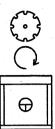
The operator must be able to press this button any time at any place while operating the machine.

2.22 Magazine Start Switch (MV-40M)









The magazine start switch is provided on the option panel.

It is used during setup, such as removing tools from the magazine.

The magazine keeps rotating while the magazine start switch is held down. It stops at the next pot position when the switch is released.



Close the front door and the side door before rotating the magazine manually.

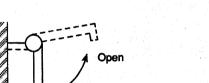
The magazine may not rotate unless the magazine start switch is pressed positively.

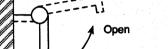
Therefore, when indexing the magazine by 1 pot, hold the switch pressed until the magazine begins rotating.

<Side view>

Operation

panel





Close

Cover

Switch



Be aware that the magazine will start rotating if the magazine start switch

is pressed by mistake while the magazine mode selection switch is placed in the | (manual) position and the manual magazine operation indicator is lit. If this switch is pressed carelessly the magazine will start rotating unexpectedly and this could cause damage to the machine.

To avoid such a situation, caused by erroneous operation, the switch cover is placed.

To ensure safety, close the cover unless the switch should be pressed.

Open the cover to press the switch.

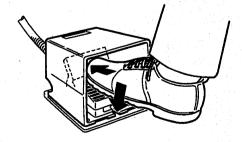
2.23 Magazine Tool Unclamp Footswitch (MH Series)





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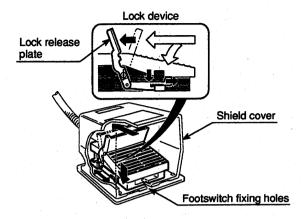
The magazine tool unclamp footswitch is used to remove a cutting tool from a magazine pot.

To unclamp a cutting tool in the machine, use the magazine tool unclamp footswitch; step on the pedal while pushing the lock release plate.

When the footswitch pedal is stepped on, the cutting tool in the tool removal position in the magazine is unclamped.

<Footswitch construction>

The footswitch has the shield cover and lock device so that the cutting tool in the tool removal position in the magazine will not be unclamped due to careless stepping or falling of object onto it.



By pushing the lock release plate forward, the lock is released and the footswitch pedal can be stepped on.

At the center of the footswitch base plate, holes are provided at the front and the rear. Use these two holes when fixing the footswitch in place.



1 Never operate the machine without the shield cover and the lock device of the magazine tool unclamp footswitch in place.

If the footswitch is stepped mistakenly or something falls onto the footswitch, the tool in the tool removable position is unclamped and falls from the pot to damage the machine.

- When removing a tool from the magazine, be sure to hold it by hand before unclamping it. If you should hold the tool by bare hands, pay sufficient care so that fingers and hands will not be injured due to sharp cutting edge.
- (3) Take care not to stumble over the footswitch since you may be injured.

2.24 Manual Lubrication Pushbutton













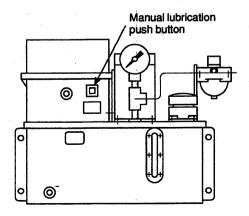


The manual lubrication pushbutton is used to supply lubricating oil to the slideways manually after the machine has been stopped for a long period or when manual lubricating oil feed is necessary at an occurrence of a problem.



If the machine is stopped for a day or longer, the oil film on the slideways may be lost. If the machine is started in this condition the machine will be damaged such as wear or seizure of slideways and ball screws.

<Lubrication unit>



Hold down the pushbutton, and lubricating oil is supplied to the slideways.



Type and installation position of the lubrication unit will vary depending on the machine models.

For details, refer to the MAINTENANCE MANUAL.

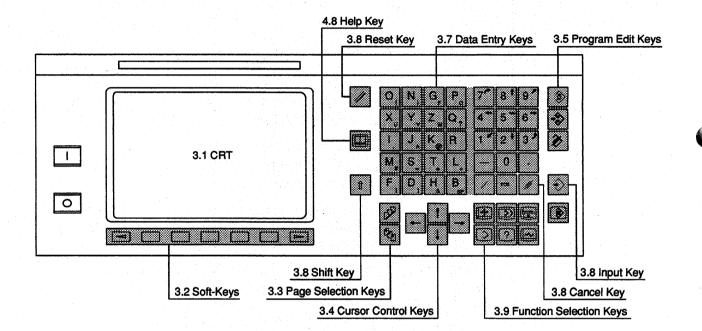


In order to protect the lubrication pump motor, do not hold down the manual lubrication pushbutton for longer than one minute when supplying lubricating oil to the slideways manually. If the pushbutton is held down for longer than a minute, the lubrication pump motor may fail.

3. NC UNIT

This section describes the NC operation panel.

Explanations of keys and function can be found in the sections indicated by the illustration given below.



- 1 Arrangement of the keys varies depending on machine models.
 - ② For the conversational programming specification (MSD-516), 12 soft-keys are provided.

3.1 CRT

CRT is an abbreviation for Cathode Ray Tube. For NC machine tools, the CRT is used as a device to display characters and function as the man-machine interface for machine operation.

3.2 Soft-Keys

Below the CRT are seven (or twelve) keys.

These keys are called soft-keys and they are assigned variety of function depending on the operation step currently being executed. The functions currently available for each of the individual soft-keys are displayed on the bottom line on the CRT.

<Conversational programming specification> <Standard> General General information information Soft-keys Soft-keys assingned assingned 11 11 11 11 functions functions ① Chapter selection keys Chapter selection keys ② Operation selection keys ② Operation selection keys 3 Return menu key ④ Continuous menu key 3 Return menu key Continuous menu key

Chapter selection keys

These keys are displayed when the screen is changed by pressing the function selection key, to provide a chapter option for the function selection key.

If there is another chapter option in the chapter, the additional chapter selection keys are displayed.

The key that corresponds to a selected chapter is displayed in a reversed display.

(2) Operation selection keys

These keys are displayed when the chapter selection key [(OPRT)] is pressed or data is input from the NC operation panel.

The [(OPRT)] soft-key is not displayed on the screen that has no operation selection key.

(3) Return menu key

This key is used to return to the chapter selection key, from either the operation selection key or the chapter selection key.

(4) Continuous menu key

This key is used to display any keys to follow the chapter selection key or operation selection key.

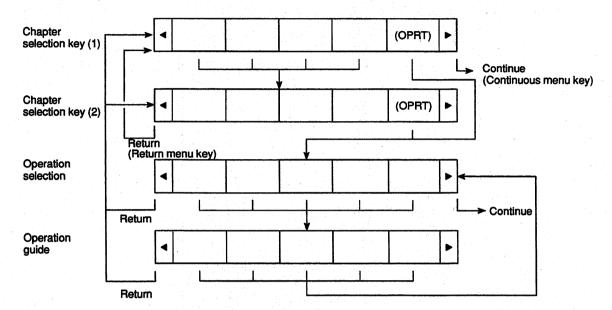
This key is valid for the following function selection keys:

position key 🕒 , offset/setting key 🔚 , system key 🕥

<Soft-key configuration>

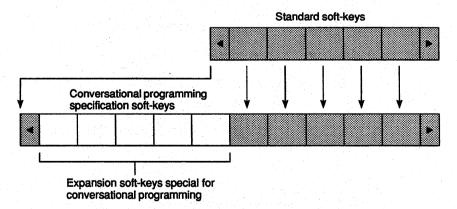


The soft-keys shown below are for the standard. For the conversational programming specification, 12 soft-keys are provided.



<Soft-keys used for the conversational programming specification>

For the conversational programming specification, 12 soft-keys are provided. As indicated in the illustration below, the five soft-keys at the right and left end positions are the used in the same manner as standard soft-keys. The five soft-keys at the left side are used as the soft-keys for conversational programming.



When the actual position data (absolute, relative, all) is displayed at the left half screen with a function selection key other than the position key pressed, the soft-keys specially used for conversational programming are displayed as shown below.

		14 T			
4	ABS	REL	ALL	HNDL	
<u> </u>	<u> </u>	4 1 1 A			<u> </u>



The [HNDL] soft-key is displayed only when the optional handle interruption function is selected.

3.3 Page Selection Keys

The page selection keys are used to change the display pages.

Each of the display pages provide the information related with the called function. If the function has the information to be displayed on two or more pages, use these keys to change the display page.

There are two page selection keys.

Page	Key	Function
Return		This key is used to return the display page to the previous page.
Advance		This key is used to advance the display page to the next page.

3.4 Cursor Control Keys

The cursor control keys are used to move the cursor on the screen.

There are four cursor control keys.

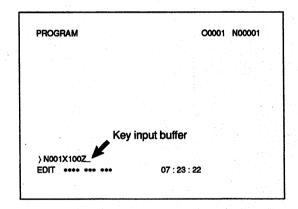
Cursor	Key	Function
Forward (small unit)		This key moves the cursor to the right by the small unit (forward).
Reverse (small unit)	-	This key moves the cursor to the left by the small unit (reverse).
Forward (large unit)		This key moves the cursor down by the large unit (forward).
Reverse (large unit)	1	This key moves the cursor up by the large unit (reverse).

3.5 Program Edit Keys

The program edit keys allow words and blocks of data in a program to be altered, inserted, or deleted.

Program Edit	Key	Function		
Alteration	\$	This key is used to alter words (addresses and data). In other words, the key is used to replace an existing word with a new word.		
Insertion		This key is used to insert a new word between two existing words. It is also used to write a program to the NC memory.		
Deletion	⊘	This key is used to delete words, blocks and programs. Before pressing the key, ensure the words, blocks, or programs to be deleted. Once the key is pressed and the words, blocks, or programs are deleted, there are no ways to restore them.		

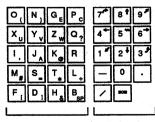
3.6 Key Input Buffer Area



The data entered using the data entry keys are first entered to the buffer area, called the key input buffer. The data in the buffer area is displayed at the lower area of the screen.

The " > " symbol is displayed at the head of the data to identify that the data is entered using the keys. At the end of the data, the underline cursor is displayed to indicate the next data entry position.

3.7 Data Entry Keys



Alphabetic characters

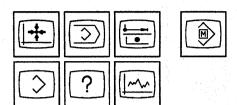
Numeric characters

The data entry keys are the letter keys and number keys used to input alphabetic and numeric characters.

3.8 Other Keys

Name	Key	Function
Input key	→	When data entry keys are pressed, the corresponding data is entered to the key input buffer and displayed on the CRT.
		When the input key is pressed, the information entered to the key input buffer is set to a memory area, such as the offset register.
Reset key		The reset key is used to clear an alarm state and to reset the NC. Modal information already executed is not cleared
		when this key is pressed to reset the NC.
Shift key	Û	Each key on the NC operation panel contains two characters; the shift key is used to input the character located in the lower right hand corner of the keys.
		Example> To key in "A" 1) Press the shift key 1.
		"A" is displayed on the key input buffer (on the second line but one from the bottom).
		2) Press the J key.
		"A" is not displayed when the JA key is pressed while holding the shift key 1.
Cancel key		The cancel key is used to delete the data entered to the key input buffer (displayed on the second line but one from the bottom) character by character to the left.
		<example></example>
		If the cancel key is pressed while the key input buffer data currently displayed is "N001X100Z", the last
		character "Z" is deleted and the display changes to "N001X100".
		The program data already stored in the NC memory cannot be deleted using the cancel key

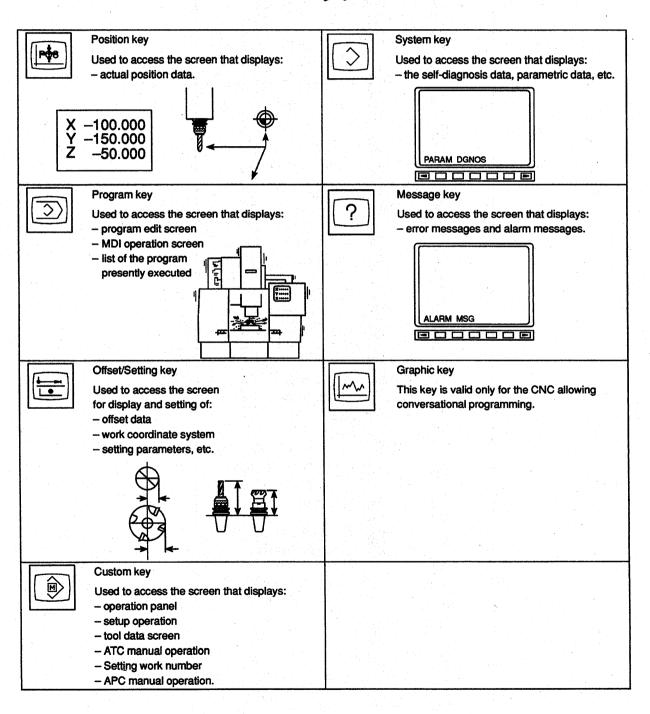
3.9 Function Selection Keys



The function selection keys allow the operator to access the required function quickly.

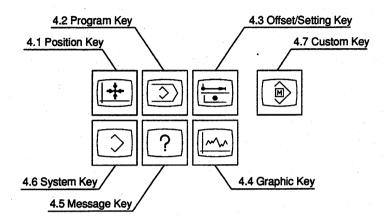
Using these keys, seven functions are accessible.



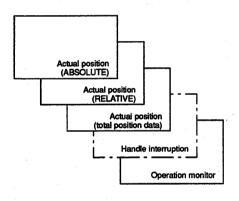


4. FUNCTION SELECTION KEYS AND DISPLAY SCREENS

This section deals with the screens which are displayed when the function selection keys on the NC operation panel are pressed.



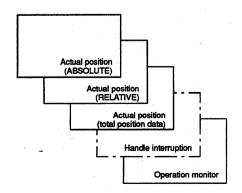
<Example>



- ② Soft-keys are expressed as [KEY-NAME].

4.1 Position Key

The position key is used to display position data on any of the following the position data screens.



To change the display screen, press the soft-key corresponding to the screen to be accessed.

To display the operating monitor screen, press the continuous menu key [], and then the [MONI] soft-key.



Position data display screens are switched in order among the absolute position data, relative position data and total position data by pressing the position key



- The HANDLE INTERRUPTION screen is displayed only when the optional handle interruption function is selected.
- With MV-40M, the following display and soft-keys are available when the optional part count display and run time display functions are equipped:
 - PART COUNT, RUN TIME, and CYCLE TIME
 - [PTSPRE] and [RUNPRE] soft-keys on the ACTUAL POSITION (RELATIVE) and ACTUAL POSITION (total position data) screens
- 3 B-axis position data is displayed only for MH series.

4.1.1 Actual Position (ABSOLUTE) Screen

This screen displays the actual position data in absolute values in the work coordinate system set by G54 to G59 (work coordinate system selection).

4.1.2 Actual Position (RELATIVE) Screen

This screen is displays the actual position data in incremental values referenced to the arbitrary position where the operator has set the data to "0".

<Procedure to reset the actual position data>

1) Press the address key (X, Y, Z, or B) corresponding to the axis for which the actual position data is to be reset to "0".

The display of the pressed address key will blink.

- 2) Press the [ORIGIN] soft-key.
 - The actual (relative) position data is reset to "0".

<Resetting the actual position data for all the axes at the same time>

Follow the steps below to simultaneously reset all the axes (X, Y, Z, or B).

- 1) Press the [(OPRT)] soft-key.
- 2) Press the [ORIGIN] soft-key.
- 3) Press the [ALLEXE] soft-key.
 - This resets the actual (relative) coordinate position data (X, Y, Z, or B).

<Procedure to preset the actual position data>

- 1) Press the address key (X, Y, Z, or B) of the axis to be preset.
- 2) Input the numerical data to be set using the data entry keys.
- 3) Press the [PRESET] soft-key.
 - The input numerical data is set for the relative coordinate values.

<Procedure to clear the run time data and the part count data>

- 1) Press the [PTSPRE] or [RUNPRE] soft-key.
- 2) Press the [EXEC] soft-key.

The RUN TIME data or the PART COUNT data is reset to "0".

4.1.3 Actual Position (Total Position Data) Screen

The following position data is displayed on one screen.

- Position in the relative coordinate system (RELATIVE)
 Position data in reference to the zero reset point
- Position in the work coordinate system (ABSOLUTE)
 Position data in reference to the work zero point
- ③ Position in the machine coordinate system (MACHINE)
 Position data in reference to the machine zero point
- 4 Remaining distance (DISTANCE TO GO)
 The distance an axis will move to the programmed end point from the presently located point

The remaining distance is only displayed when the machine is operating in the memory, MDI, or tape mode.

4.1.4 Handle Interruption Screen (Option)

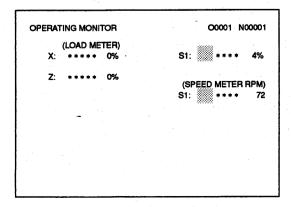
This screen displays the axis movement distance moved by rotating the manual pulse generator when the optional handle interruption function is selected.

4.1.5 Operating Monitor Screen

How to display: Position key

[►] — [MONI]

This screen displays the load and the rotation speed of the spindle drive motor and servo motor.



(LOAD METER)

X: X-axis servo motor

Y: Y-axis servo motor

Z: Z-axis servo motor

S1: Spindle drive motor

(SPEED METER RPM)

S1: Spindle drive motor

4.2 Program Key 🕥

The program key is used to display the program list and directory of the programs in the memory, the program command presently executed, the MDI program screen, etc.

The accessible screens vary depending on the selected mode.

Mode	Screen	Refer to
Edit	Program edit screen	4.2.1
	Memory used size screen	4.2.2
	Conversational programming basic menu screen (only for MSD-516)	4.2.3
Memory	Program screen (display only)	4.2.4
Tape	Program check screen	4.2.5
	Present block data	4.2.6
	Next block data	4.2.7
	Program restart screen	4.2.8
	Background program edit screen	4.2.1 to 4.2.3
MDI	Program screen (display only)	4.2.4
	MDI program	4.2.9
	Present block data	4.2.6
	Next block data	4.2.7
	Background program edit screen	4.2.1 to 4.2.3
Handle	Program screen (display only)	4.2.4
Jog	Present block data	4.2.6
Rapid traverse	Next block data	4.2.7
Zero return	Background program edit screen	4.2.1 to 4.2.3

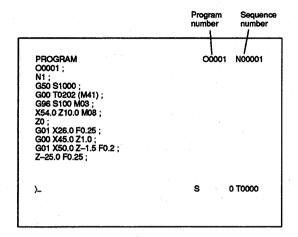
<When the mode selection switch <a> ② (edit) or background program edit is selected (4.2.1 to 4.2.3)>

4.2.1 Program Edit Screen

How to display:

This screen is used to edit the program. Program editing is possible only when the edit mode background program edit is selected.

The background program edit screen is accessible in any mode other than the edit mode. Usually, background program edit function is used for input/output of a program or edit a program while in automatic operation in the memory mode.

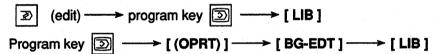


<Information displayed at upper right area>

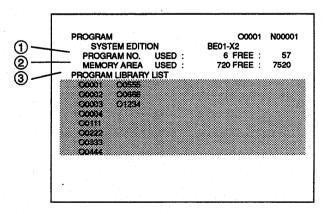
- During program editing in the edit mode:
 - Program number of the program presently edited
 - Sequence number of the program block just preceding the cursor
- Other than program editing in the edit mode:
 - Program number and sequence number of the program block edited last
- Right after search (program number, sequence number) operation:
 - Searched program or sequence number

4.2.2 Memory Used Size Screen

How to display:



The directory of registered programs and memory used size are displayed. This screen is used to check the programs registered to the memory, the number of registered programs, and the free memory size.



The display items are explained below:

- (1) PROGRAM NO. USED
 - PROGRAM NO. USED

The total number of programs, including sub-programs, stored in memory

FREE

Allowable number of programs that can be additionally stored in memory



Creation of a new program or editing a program to add commands are not allowed if there is no free area in memory even when the number of registered programs is smaller than the maximum storable number of programs.

- (2) MEMORY AREA USED
 - MEMORY AREA USED

Memory size already used (expressed in the number of characters)

FREE

Available memory size (expressed in the number of characters)

(3) PROGRAM LIBRARY LIST

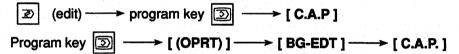
The list of the program numbers of the programs stored in memory



When creating a new program, refer to the program numbers in the PROGRAM LIBRARY LIST and determine a number not used for the existing programs.

4.2.3 Conversational Programming Basic Menu Screen (Conversational Programming Specification)

How to display:



This screen is used to create a program using the conversational programming function.

	-	_	_	٦
1	ŀ			١
	L	_	-	

For details of conversational programming procedure, refer to the instruction manuals prepared by the NC manufacturer.

<When the mode selection switch <a> ■ (memory) or <a> ■ (tape) is selected (4.2.4 to 4.2.8)>

4.2.4 Program Screen

The list of the program presently executed is displayed. This screen is used to check the contents of the program.



On this screen, it is not possible to edit a program.

M

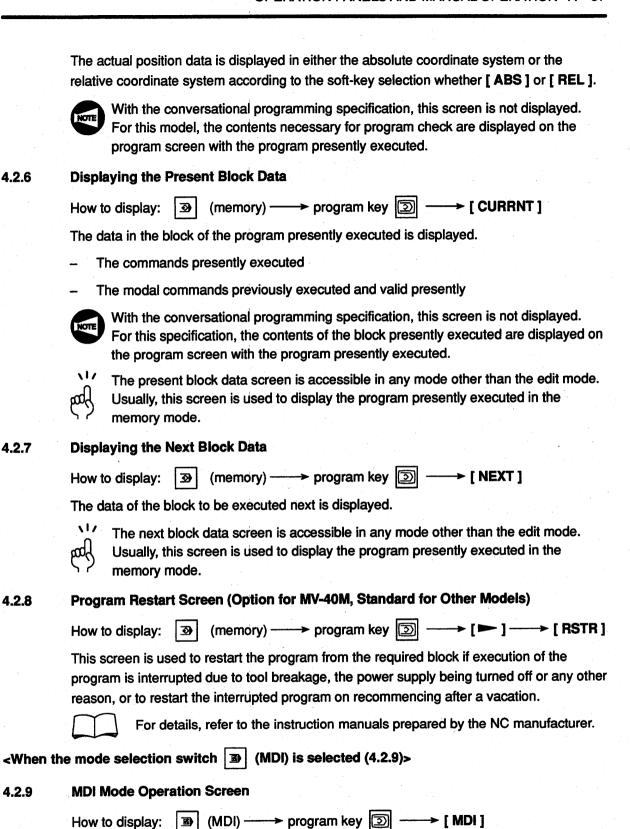
The program screen is accessible in any mode other than the edit mode. Usually, this screen is used to display the program presently executed in the memory mode.

4.2.5 Program Check Screen

How to display:



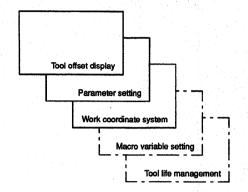
The program presently executed, the remaining distance for each axis to move, actual position, and model commands previously executed are displayed.



This screen is used to input the MDI commands.

4.3 Offset/Setting Key

The offset/setting key is used for setting the tool geometry/wear offset data and the work coordinate system, and for checking the contents of the setting parameters.



To change the display screen, press the soft-key corresponding to the screen to be accessed.

To display the macro variable setting screen or the tool life management data screen, press the [MACRO] or [TOOLLF] soft-key after pressing the continuous menu key [].



The tool offset data display screens and the parameter setting display are switched in order by pressing the offset/setting key



The macro variable setting screen and the tool life management screen are optional.

4.3.1 Tool Offset Data Setting Screen

How to display: Offset/setting key
☐ ──── [OFFSET]

This screen is used to directly input the tool position offset data that is set when a tool is mounted to the turret head.

Move the cursor to the geometry offset number to be set, using the page selection keys and the cursor control keys.



The screen used for setting the tool offset data varies depending on the type of NC. For details, refer to page C-25 (5.3).

4.3.2 Setting (Handy) Screen

How to display: Offset/setting key ☐ → [SETING]

This screen displays the some parameters that are frequently changed.

To display the required item, change the page using the page selection keys [4] (advance) and [5] (return).

4.3.3 Work Coordinates Data Setting Screen

How to display: Offset/setting key
☐ ── [WORK]

The shift data of the work coordinate systems is displayed. This function is used to select the work coordinate system using the codes G54 to G59.

The function is also used to shift the coordinate system which is already set in the following cases:

- The coordinate system set using the work coordinate system setting function (G54 to G59) or the automatic coordinate system setting function (G92) does not agree with the coordinate system assumed when programming.
- To execute program check

Move the cursor to the work coordinate system number (NO.) to be set, using the page selection keys and the cursor control keys.

4.3.4 Macro Variable Setting Screen (Option)

How to display: Offset/setting key

[►]

[MACRO]

This screen is used to display and set the variables used in the macro program.

4.3.5 Tool Life Management Data Screen (Option)

How to display: Offset/setting key

[►]

[TOOLLF]

This screen is used to display and set the tool life data of the tools mounted to the turrets. The screen displays the tool group, set tool life, and total tool-use data.

The tool-use data (COUNT) may be displayed in either used time (minutes) or used frequency (number of times). This selection is made by setting a proper parameter data.

For details of the procedure used for setting the tool life data, etc., refer to the instruction manuals prepared by the NC manufacturer.

4.4 Graphic Key (MSD-516)

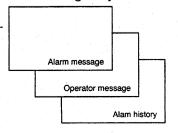
The graphic key is used to draw the program created using the automatic conversational programming function.

The graphic function is supported only for the conversational programming specification models (MSD-516). If the graphic key is pressed for the standard (MSC-516, 518), no corresponding function is supported.

For details for the drawing function, refer to the instruction manuals prepared by the NC manufacturer.

4.5 Message Key 📵

The message key is used to display the NC alarms, operator messages, etc.



To change the screen, press the soft-key corresponding to the screen to be accessed.

4.5.1 Operator Message Screen

How to display: Message key [?] → [MSG]

If an error occurs, the screen automatically changes to the OPERATOR MESSAGE screen where the error number and the message are displayed.

a

The OPERATOR MESSAGE screen is also displayed by pressing the soft-key as indicated above.

4.5.2 Alarm Message Screen

How to display: Message key [?] → [ALARM]

If an alarm occurs, the screen automatically changes to the ALARM MESSAGE screen where the alarm number and the message are displayed.

圆

The ALARM MESSAGE screen is also displayed by pressing the soft-key as indicated above.

4.5.3 Alarm History Screen

This screen displays the maximum of 25 alarms that have occurred in the past.

The following three types of alarm information are displayed.

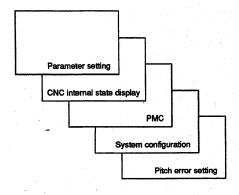
- (1) Occurrence time and date
- (2) Alarm No.
- (3) Alarm message

To clear the data, press the soft-keys as indicated below.

Message key [?] → [HISTRY] → [(OPRT)] → [CLEAR]

4.6 System Key 🕥

The system key is used to display the system data of the NC unit and its optional devices (servo motor, PMC).



To change the screen, press the soft-key corresponding to the screen to be accessed.

To display the pitch error setting screen, press the [PITCH] soft-key after pressing the continuous menu key [].



The system parameter setting screen and the CNC internal state display screen are switched each time the system key is pressed.

4.6.1 Parameter Setting Screen

How to display: System key
☐ — [PARAM]

The system parameters of the CNC can be set and displayed. This screen is used to check the setting of the system parameters by displaying them.

WARNING



The parameters are set on shipment in accordance with the machine specifications; do not change them without first consulting Mori Seiki. If the parameters are changed without consultation, the machine may operate in an unexpected manner, causing accidents involving serious injuries or damage to the machine.

4.6.2 CNC Internal State Display Screen

This screen is used to check the internal state of the NC unit.

4.6.3 PMC Screen

This screen is used to check the PMC status, and to change its parameters.

WARNING



The parameters are set on shipment in accordance with the machine specifications; do not change them without first consulting Mori Seiki. If the parameters are changed without consultation, the machine may operate in an unexpected manner, causing accidents involving serious injuries or damage to the machine.

[PMCLAD] soft-key

The PMC ladder diagram is displayed.

[PMCDGN] soft-key

The PMC self-diagnosis screen is displayed.

[PMCPRM] soft-key

The setting screen for the timer, counter, keep relay, and data table for the PMC is displayed.

4.6.4 System Configuration Screen

How to display: System key

[SYSTEM]

This screen is used to check the NC unit system configuration.

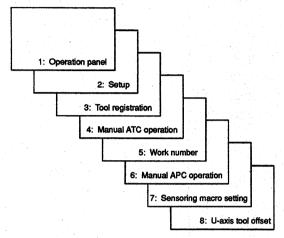
4.6.5 Pitch Error Setting Screen

How to display: System key \bigcirc \longrightarrow [PITCH]

This screen is used to compensate the pitch error when the error occurs to machine feed.

4.7 Custom Key 📵

The custom key is used to display the operation panel screen, setup screen, tool registration screen, manual ATC operation screen, work number screen, manual APC operation screen, sensoring macro setting screen, etc.



To change the screen, press the soft-key corresponding to the screen to be accessed.

To display the manual APC operation screen or the sensoring macro setting screen, press the [APC], [SENSOR], or [U-AXIS] soft-key after pressing the continuous menu key [].



It is possible to access the required screen directly by using the data entry key. For this, input the menu number of the required screen and press the input key $| \diamondsuit |$.



The menus displayed on the screen vary depending on the machine models and specifications.

No.	Model	Menu	Soft-key	Refer to
1	For all models	OPERATION PANEL	[OPPANL]	4.7.1
2	For all models	SET UP	[SETUP]	4.7.2
3	For all models	TOOL ENTRY	[TOOL]	4.7.3
4	For all models	ATC MANUAL OPERATION	[ATC]	4.7.4
5	APC specification Weekly timer specification	WORK NUMBER	[WORK]	4.7.5
6	APC specification	APC MANUAL OPERATION	[APC]	4.7.6
7	MH series	SENSOR SETTING	[SENSOR]	4.7.7
8	U-axis specification	U-AXIS TOOL OFFSET	[U-AXIS]	4.7.8

4.7.1 Operation Panel Screen

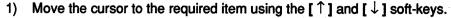
How to display: Custom key

[OPPANL] → [NEXT] (option)

This screen is used to set the following NC functions. For the details of the NC functions, refer to the reference pages indicated in the table.

NC Function	Soft-key	Refer to
Z AXIS NEG	[OPPANL]	A – 25
AUX. F. LOCK	[OPPANL]	A – 26
MACHINE LOCK	[OPPANL]	A – 27
BLOCK DELETE 2 to 9 (option)	[OPPANL] → [NEXT]	A – 22

<Setting procedure>



It is also possible to move the cursor using the cursor control keys and .

2) Select and set the required status using the [\leftarrow] and [\rightarrow] soft-keys.

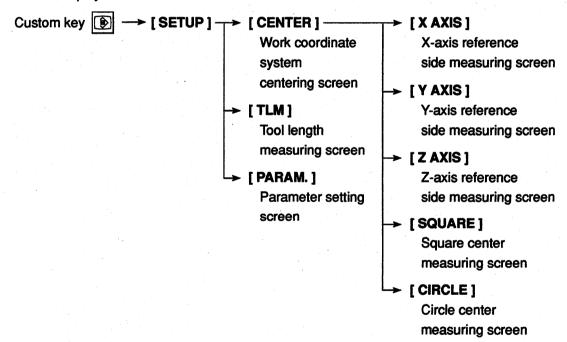
It is also possible to move the cursor using the cursor control keys — and

4.7.2 Setup Screen

The setup function is used to center the workpiece coordinate system and perform tool length measurement using simple operations.

For the procedure used for setting the work coordinate system using the setup function, refer to page C - 17 (4.2).

How to display:

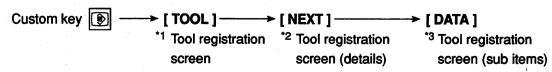


4.7.3 Tool registration Screen

This screen is used to register all of the spindle tool, next tool, empty pot, sensor tool, and the magazine tools.

For details of tool registration procedure, refer to page C-1 (1.).

How to display:



*1: The screen is used to register the spindle tool, next tool, empty pot, and the sensor tools.



When sensor tools are used, set the tool number of these tools to "SENSOR TOOL 1" and "SENSOR TOOL 2". With this setting, the sensor tool interlock function becomes valid when a sensor tool is mounted to the spindle to disable automatic and manual spindle rotation.

- *2: The screen is used to register the tools in the magazine.
- *3: ① For the MH series (NT tool specification), set whether or not the registered tool is a light tool (less than 20 kg).
 - 2 For the MH series (U-axis tool specification), set whether or not the registered tool is "U-axis tool" and also whether or not it is "FMT tool".



The tool registration (sub item) screen is displayed only for the MH series.

4.7.4 Manual ATC Operation Screen

This screen is used to check the ATC status as well as to operate the ATC manually.



Independent operation of the ATC must be limited only when a trouble has occurred.

Independent operation of the ATC causes the actual status of the ATC to be different from the status stored in the NC. Therefore, if the ATC is carelessly operated independently, it may cause accidents.



For the independent operation of the ATC, refer to the OPERATION MANUAL (SUPPLEMENT) ATC & APC MANUAL OPERATION.

4.7.5 Work Number Screen

How to display: Custom key

→ [WORK]

This screen is used to set the work number for the workpiece mounted to the fixture at the setup station.

For the timer specification machine, set the program number of the program which is executed in response to the operation of the weekly timer.



The work number screen is displayed only for APC or weekly timer specification models.

4.7.6 Manual APC Operation Screen

This screen is used to check the APC status as well as to operate the APC manually.



Independent operation of the APC must be limited only when a trouble has occurred.

Independent operation of the APC causes the actual status of the APC to be different from the status stored in the NC. Therefore, if the APC is carelessly operated independently, it may cause accidents.



The manual APC operation screen is displayed only for APC specification models.



For the independent operation of the APC, refer to the OPERATION MANUAL (SUPPLEMENT) ATC & APC MANUAL OPERATION.

4.7.7 Sensoring Macro Setting Screen

How to display: Custom key

[▶] → [SENSOR]

This screen is used to check and/or set the data for the spindle-mounted sensor and the table-mounted sensor.



The sensoring macro setting screen is displayed only for the MH series.

4.7.8 U-axis Tool Offset Data Setting Screen

How to display: Custom key \bigcirc \longrightarrow [\longrightarrow] \longrightarrow [\cup -AXIS]

This screen is used to set the U-axis tool offset and other related U-axis data. Move the cursor to the required data setting item and set the data.

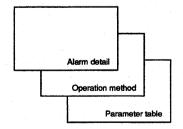


This screen is displayed only for the machine equipped with the U-axis specification.

4.8 Help Key

This section describes the displaying procedure and the content of the HELP screens.

The HELP screens are displayed by pressing the help key .



To change the screen, press the soft-key corresponding to the screen to be accessed.



If the help key is pressed while this screen is displayed, the previous CNC screen before pressing the help key will be displayed.

The help key is invalid if the PCMDI MENU screen is displayed by pressing the custom key .

4.8.1 Alarm Detail Screen

How to display: Help key □ → [1 ALARM]

This screen is used to display the alarm number (NUMBER), message (M'SAGE), function (FUNCTION), and alarm detail (ALARM) of the alarms. It is used to check the information related with the present alarm.

<Displaying the alarm information>

- 1) Input the detail-required alarm number using the data entry keys.
- 2) Press the [SELECT] soft-key.

4.8.2 Operation Method Screen

How to display: Help key ☐ → [2 OPR]

The OPERATION METHOD screen is used to display the available mode, screen and procedure of the following operations.

PROGRAM EDIT (4 pages)
 SEARCH (3 pages)

3. RESET (2 pages)

4. INPUT WITH MDI (2 pages)

5. INPUT WITH TAPE (2 pages)

6. OUTPUT (2 pages)

7. INPUT WITH FANUC CASSETTE (2 pages)

8. OUTPUT WITH FANUC CASSETTE (2 pages)

9. MEMORY CLEAR (2 pages)

The numbers in () indicate the total number of display pages of each operation method.



If it becomes necessary to perform a memory clear operation, contact Mori Seiki first. If a memory clear operation is performed without due care, the entire memory contents may be deleted, making the machine inoperable.

<Displaying the operation procedure>

- 1) Input the required operation method number using the data entry keys (1 to 9).
- 2) Press the [SELECT] soft-key.
- 3) Use the page selection keys to change the display screen if the information is given in more than 1 page.

4.8.3 Parameter Table Screen

How to display: Help key ☐ → [3 PARA]

This screen is used to display the classification and number of the NC unit parameters.

For the detail of parameters, refer to the instruction manuals prepared by the NC manufacturer.

5. MANUAL OPERATION

This section describes the procedure used for the following operation – turning on and off the power, stopping the machine in an emergency, and manually moving an axis or manually starting/stopping the spindle.

WARNING



Before using a switch, button, or key, check visually that it is the one you intend to use, and then press or set it decisively. Pressing the wrong switch, button, or key by mistake can cause accidents involving serious injuries or damage to the machine.

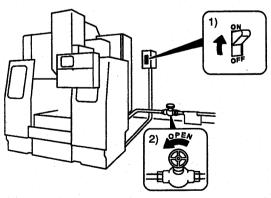
5.1 Turning on the Power

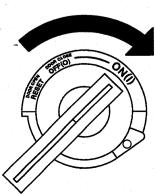
This section describes the procedure for turning on the power to the NC lathe.

5.1.1 Check Items before Turning on the Power

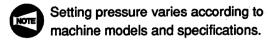
- Make sure that all of the doors to the NC unit and the electrical cabinet are closed.
 If any door is opened, find out why.
 - Close the doors after making sure that closing them will not create any problems.
- 2) Make sure that all of the covers are correctly placed.
 - If any cover is not correctly placed, find out why.
 - Replace the covers after making sure that replacing them will not create any problems.
- Make sure that the floor around the machine is clean. There should be no oil or coolant on the floor.

5.1.2 Turning on the Power



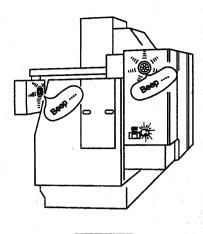


- Turn on the main breaker on the shop power distribution board.
- 2) Turn on the compressed air.
- 3) Check the pressure of the compressed air.





4) Turn on the main switch.







(WARNING)

The machine is designed and manufactured for well-trained operators who have a basic knowledge of machine operation. DO NOT operate this machine unless this applies to you. To avoid accidents, you are required to read and understand the information on the caution labels, in the manuals and follow instructions carefully. Failure to follow these instructions may result in injury, or damage to the machine. Being aware of this warning, press [OK] soft-key.

MEM **** ***

13 : 17 : 33

- 5) Make sure that the cooling fans in the operation panel, the NC unit, and the electrical cabinet are operating properly.
- Pull out all the emergency stop buttons to reset the emergency stop state.



The emergency stop button on the portable manual pulse generator panel should be turned clockwise to reset the emergency stop state.

7) Press the NC power switch [] (on).



Some of the keys on the NC operation panel are used for maintenance purposes or for special operations with the NC power switch (on).

Pressing these keys may cause the machine to operate unexpectedly.

- Never touch any operation-related keys on the NC operation panel when pressing the NC power switch (on).
- Never touch other switches and keys on the NC operation panel until warning message is displayed on the screen.
- The WARNING message is displayed on the screen.



Before pressing the [OK] soft-key, read the message carefully.

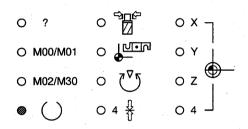


For details of the WARNING message, refer to "CRT DISPLAY ON TURNING ON POWER".

 Read and understand the contents of the message. After that press the [OK] soft-key.



If the message confirmation step is skipped, the machine does not become ready for operation and neither automatic nor manual operation is possible. EX4002 OPEN THE DOOR THEN CLOSE



- The instruction message is displayed on the screen.
- 9) Open the door once and then close it following the displayed instruction.



If the front door and the side door are already open when power is turned ON, simply close them.



The machine ready state is not established until the front door and the side door are opened and then closed, making neither automatic nor manual operation possible.

- The front door and the side door are locked, and the status indicator (machine ready) is lit.
- The ACTUAL POSITION
 (ABSOLUTE) screen is displayed.



The ALARM MESSAGE screen is displayed if the NC is in an alarm state when the power is turned on.

In this case, remove the cause of the alarm before starting any operation.

5.2 Emergency Stop

To immediately stop machine operation during manual or automatic operation, use one of the following three methods. The status of the machine after stopping will differ depending on which method you used. Therefore, understand the differences between the three methods.

<Pre><Pre>s the emergency stop button>

All machine operation stops immediately.

Press this button in case of emergency.

WARNING



Because of the inertia of the moving parts of the machine, they may not be stopped immediately when the emergency stop button is pressed. Always confirm that all operations have stopped before going near these parts. If you approach the moving parts of the machine without due care you may be entangled in them and seriously injured.



- The power to the servo system that controls the axis movement and spindle rotation is turned off.
- 2 On some models, emergency stop button is located at more than one position.

<Press the reset key // >

All machine operation stops.



The power is not turned off.

<Press the automatic operation switch | আ (feed hold)>

The axis movement stops. But the spindle keeps on rotating if this switch is pressed while the spindle is rotating.



The power is not turned off.

5.2.1 Emergency Stop Button

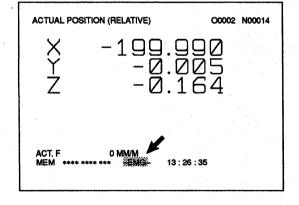


- 1) Press the emergency stop button.
 - Regardless of the operation mode (manual or automatic), all machine operation, including axis feed and spindle rotation, stops when the emergency stop button is pressed.



If the machine has more than one emergency stop button, it is necessary to pull out all the emergency stop buttons from the pushed and locked position to reset the emergency state.

- The screen displays the information that the machine has been stopped in the emergency stop state.
- The message "EMG" blinks.





When the emergency stop button has been pressed to stop the machine during a hole machining operation, especially a tapping operation and thread cutting operation (option), carefully move the axes after checking the workpiece and cutting tool carefully for damage. If you move the axes without due care, the workpiece and cutting tool may collide or interfere with each other, and this could damage the machine.

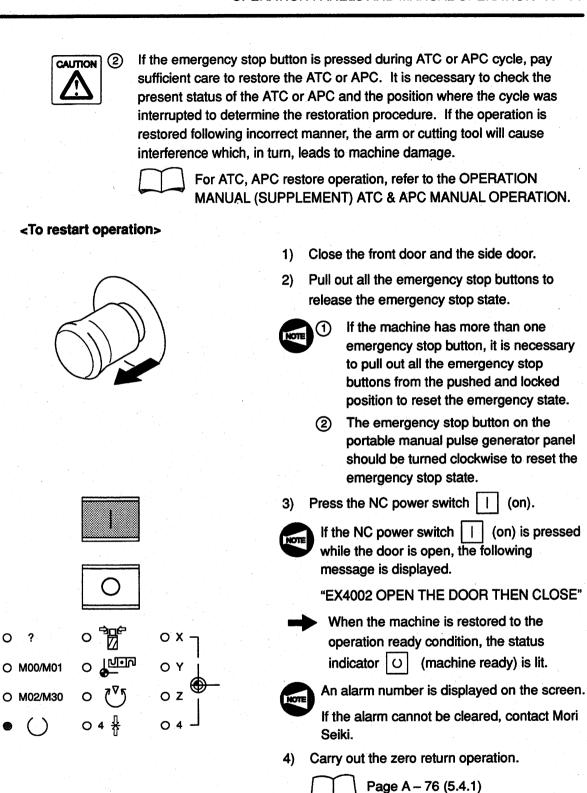
Make sure that the ATC or the APC is at the

the OPERATION MANUAL (SUPPLEMENT) ATC & APC MANUAL OPERATION.

The home position of the ATC and APC varies depending on the

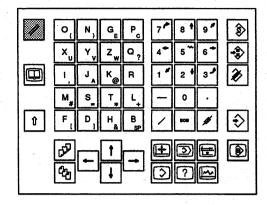
machine model. For details, refer to

home position.



0

5.2.2 Reset Key

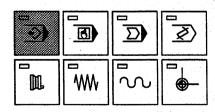


- 1) Press the reset key.
- When the reset key // is pressed during automatic operation, the spindle rotation and axis movement stop.
- At the same time, the NC is placed in the reset status.

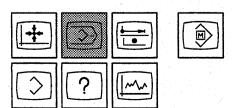


- When the reset key // has been pressed to stop the machine during a hole machining operation, especially a tapping operation and thread cutting operation (option), carefully move the axes after checking the workpiece and cutting tool carefully for damage. If you move the axes without due care, the workpiece and cutting tool may collide or interfere with each other, and this could damage the machine.
- ② If the reset key / is pressed during ATC or APC cycle, pay sufficient care to restore the ATC or APC. It is necessary to check the present status of the ATC or APC and the position where the cycle was interrupted to determine the restoration procedure. If the operation is restored following incorrect manner, the arm or cutting tool will cause interference which, in turn, leads to machine damage.
 - The home position of the ATC and APC varies depending on the machine model. For details, refer to the OPERATION MANUAL (SUPPLEMENT) ATC & APC MANUAL OPERATION.
- To restart the program from a required block after resetting the NC, first check the modal data if the data necessary for operation restart is all satisfied.

<To restart operation>



1) Select the memory mode () with the mode selection switch.



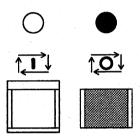
- 2) Press the program key 📵
- 3) Press the [(OPRT)] soft-key.
- Press the [REWIND] soft-key and locate the head of the program.

PROGRAM	O0001 N00001
C0001 :	
N1 ;	
G90 G00 G54 X90.0 Y-25.0	;
G43 Z30.0 H01 S440 T2 ;	
M03 ;	
G01 Z0 F1000 ;	
X-165.0 F210 ;	
G00 Z10.0 ;	
X90.0. Y25.0 ;	
Z 0 ;	
G01 X-165.0 ;	
	· .
<u>}_</u>	
MEM **** *** ***	14:52:37

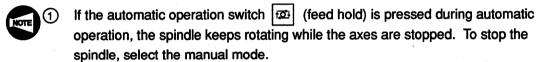
- 5) Close the front door and the side door.
 - The cursor moves to the head of the program.
- 6) Carry out the zero return operation.

Page	A –	76	(5.4.	1)
rage	A –	70	(5.4.	ı

5.2.3 Feed Hold Switch

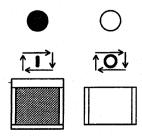


- 1) Press the automatic operation switch [12] (feed hold).
 - The indicator above the switch is lit and axis feed stops.

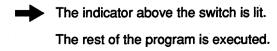


- (2) When the automatic operation switch (feed hold) is pressed in the tapping cycle, the cycle is interrupted at the position where a single block stop is valid in the cycle.
- (3) In the G33 thread cutting mode, if the automatic operation switch (feed hold) is pressed while a thread is being cut, the machine stops after executing the first block following the thread cutting mode blocks.
- 4 The ATC cycle stops after completing the ATC cycle if the automatic operation switch অ (feed hold) is pressed during the ATC operation.

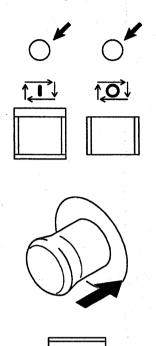
<To restart operation>

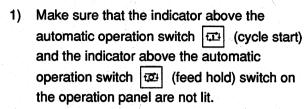


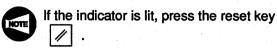
- 1) Close the front door and the side door.
- 2) Press the automatic operation switch (cycle start).

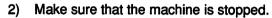


5.3 Turning off the Power

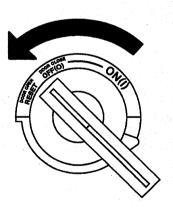




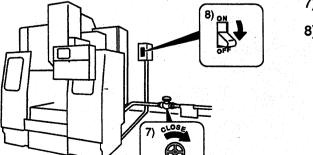




- If an external I/O device is connected to the NC, turn off the power to the external I/O device.
- 4) Press the emergency stop button.
- 5) Press the NC power switch O (off).



6) Turn off the main switch.



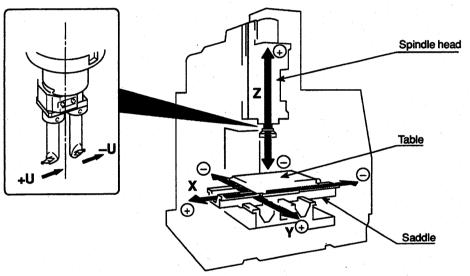
- 7) Turn off the compressed air supply.
- 8) Turn off the main breaker on the shop power distribution board.

5.4 Axis Movement Operation

The directions of the controlled axes of this machine are determined as follows.

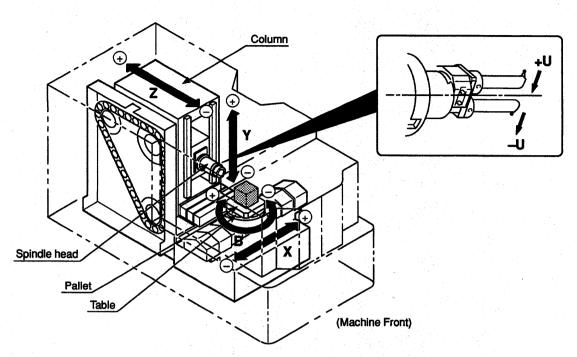
<MV series>

Axis	Unit	+and - Direction
X	Table	+ direction: left, viewing from machine front
Υ	Table (saddle)	+ direction: forward, viewing from machine front
Z	Spindle head	+ direction: up, viewing from machine front
U (U-axis specification)	U-axis tool holder	direction: The direction in which the bore of the hole being machined increases.



<MH series>

Axis	Unit	+and - Direction
X	Table	+direction: right, viewing from machine front
Υ	Spindle head	+direction: up, viewing from machine front
Z	Column	+direction: away from the operator, viewing from machine front
В	Pallet	+direction: CW rotation, viewing from machine top
U (U-axis specification)	U-axis tool holder	direction: The direction in which the bore of the hole being machined increases.



5.4.1 Manual Axis Feed Operation

This section describes the procedure used for manually moving an axis for the following four types of operation.

- (1) Zero return
- (2) Rapid traverse
- (3) Jog feed
- (4) Handle feed

WARNING



1 During zero return or rapid traverse operation, each axis moves at the rapid traverse rate.

Before starting a zero return operation or rapid traverse operation, always make sure that no one is standing near the moving parts and that the moving parts can be fed to the zero point (or fed) without interference.

Failure to observe these warnings could result in accidents involving serious injuries or damage to the machine: personnel could be crushed by the moving parts of the machine, and the moving parts could strike obstacles.

2 During jog feed operation, the selected axis moves at the feedrate set with the jog feedrate override dial.

Before starting jog feed operation, always make sure that no one is standing near the moving parts and that the moving parts can be fed without interference.

Failure to observe these warnings could result in accidents involving serious injuries or damage to the machine: personnel could be crushed by the moving parts of the machine, or the moving parts could strike obstacles.



In the zero return mode, if the axis feed switch, which moves the axis away from the zero point, is pressed, the axis is moved in the direction opposite to the zero point at the set rapid traverse rate while the switch is held pressed; make sure that you move the axis in the correct direction.

Also make sure that you move the axis in the correct direction whenever you use an axis feed switch to move an axis at a rapid traverse rate or jog feedrate.

Moving an axis in the wrong direction could cause damage to the machine: personnel could be crushed by the moving parts of the machine, or the moving parts could strike obstacles.

<Zero return operation>

In the manual operation, each axis is returned to the machine zero point at the set rapid traverse rate.



The machine zero point varies depending on the machine model.

Zero return operation must be carried out in the following cases:

- (1) After the power is turned on
- 2 Before setting the tool offset data for newly mounted tools
- 3 After the machine ready signal has been turned off due to the emergency stop button being pressed, etc.
- (4) After changing the machine lock function setting from "valid" to "invalid".

<Rapid traverse operation>

In manual operation, each axis is moved at the set rapid traverse rate.

Rapid traverse operation is used to position each axis approximately.

<Jog feed operation>

In manual operation, each axis is moved at the set jog feedrate.

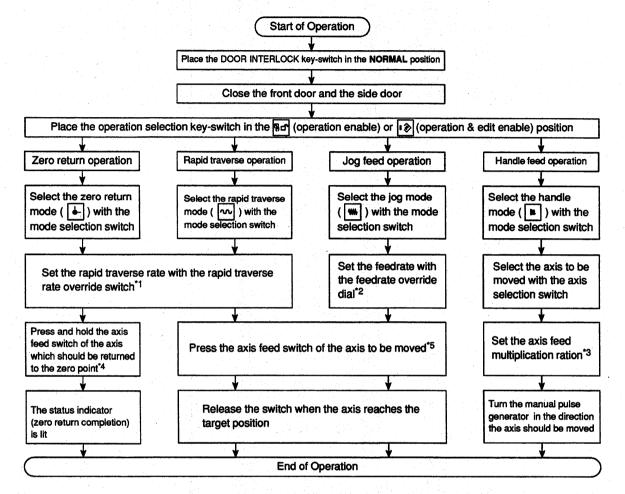
Jog feed operation is used when removing the rough surface of a workpiece or centering.

<Handle feed operation>

In manual operation, each axis is moved at the set feedrate using the manual pulse generator.

Handle feed operation is used when removing the rough surface of a workpiece, centering, or performing a fine positioning adjustment.

<Manual axis feed operation procedure>





- For manual operation, even if the rapid traverse rate override switch (100%) is pressed, the actual override value is fixed at 50%.
- *2: The values on the outside graduation ring indicate the jog feedrate (0 to 1260 mm/min).

When the feedrate override dial is placed in the **0** position, the axis is not moved even when an axis feed switch is pressed.

- ^{*3:} The numbers indicate the multiplication number to the smallest increment (0.001 mm).
- *4: As the axis approaches the zero point, it decelerates automatically and is positioned at the zero point.

If the axis is located near the machine zero point, first move the axis away from the machine zero point slightly by pressing the axis feed switch which moves the axis in the direction opposite to the machine zero point.

If the axis feed switch which moves the axis in the machine zero point is pressed to execute zero return while the axis is located near the machine zero point, it may cause soft-overtravel alarm.

*5: The axis is moved at the set feedrate while the switch is held down.

5.4.2 Releasing the Soft-Overtravel Alarm

Software limit positions are set with parameters. If an axis is moved beyond its limit, an alarm occurs, stopping axis feed. Mori Seiki refers to this alarm as the "soft-overtravel" alarm.

If an axis is moved beyond the software limit position (set individually for each axis), an alarm number (500, 501) is displayed.

<How to release the alarm state>

- 1) Read the alarm number and message displayed on the screen.
- 2) Place the DOOR INTERLOCK key-switch in the NORMAL position.
- 3) Close the front door and the side door.
- 4) Select any of the following modes with the mode selection switch:

8	(rapid traverse),	₩	(jog),		(handle
---	-------------------	---	--------	--	---------

- 5) Move the axis that caused the soft-overtravel alarm in the opposite direction, away from its limit.
- 6) Press the reset key //

—	he :	alarm	state	is	cleared	d.
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5.4.3 Releasing the Hard-Overtravel Alarm

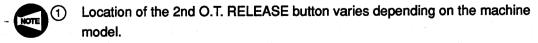
Usually, axis feed operation is checked by the stored soft limit and will stop at the limit if an attempt is made to move beyond it. However, there may be cases when the axis exceeds the limit without being stopped. In these cases, the hard-overtravel function stops axis feed.

In such a case, the status indicator O (machine ready) goes off, the message "EMG" blinks on the screen and axis movement stops.

Use the procedure indicated below to release the alarm state.

<How to release the hard-overtravel alarm>

- 1) Place the DOOR INTERLOCK key-switch in the NORMAL position.
- 2) Close the front door and the side door.
- Open the right side cover of the operation panel. (MV series)
 Open the cover under the operation panel. (MH series)
- 4) Press the 2nd O.T. RELEASE button.



(2) Hold down the 2nd O.T. RELEASE button until steps 4) to 8) are completed. If the button is released during these steps, the ready signal is turned off and it becomes necessary to repeat the operation from step 4) again.

7 The machine is not in the reset state.

(8) The machine is not in the M00 or M01 state.

5.5

5.5.1

	5)	Press the NC power switch [] (on).
		The status indicator (machine ready) is lit.
	NOT	The mode selection switch is automatically set to the handle mode (
		To ensure safety, do not select other modes until the hard-overtravel alarm state is cleared.
	6)	Select ×1 with the axis feed amount selection switch.
	NOT	To ensure safety, do not select other multiplication ratio until the hard-overtravel alarm state is cleared.
	7)	Select the axis to be moved with the axis selection switch.
	8)	Move the axis that caused the hard-overtravel alarm in the opposite direction by the manual pulse generator, away from its limit.
	CAI	When a hard-overtravel alarm has occurred, the interlock axis movement interlock can be released by pressing the 2nd O.T. RELEASE button. Be very careful not to move the axis in the wrong direction after pressing this button. If the axis is moved further in the direction in which hard overtravel occurred, the spindle and table may collide with the covers, damaging the machine.
	9)	After the axis has been returned to within its limits, release the 2nd O.T. RELEASE button.
	Sp	indle Operation
	Thi	s section describes the spindle related operation – spindle start and stop.
	Co	nditions for Starting the Spindle Rotation
	If th	rotate the spindle manually, the conditions that allow spindle rotation must be satisfied. ne spindle does not start although correct operation sequence is followed, check if the owing conditions are all satisfied.
<c< th=""><th>ondi</th><th>tions></th></c<>	ondi	tions>
	1	The front door and the side door are closed.
		For details, refer to DOOR INTERLOCK FUNCTION.
	2	The operation selection key-switch is placed in either the (operation enable) or (operation & edit enable) position.
	3	A manual mode (handle, jog, rapid traverse, zero return) is selected.
	4	The status indicator (machine ready) is lit.
	(5)	The status indicator (M02/M30) is not lit.
	6	The tool is clamped. (The status indicator (tool clamp) is lit.)

- (9) The spindle is not rotating.
- (10) The spindle is not jogging.
- 1 The spindle switch (stop) is not pressed.
- 12 There is no spindle related alarm.
- External spindle interlock signal (the signal which disables spindle rotation) is not input.
- (14) The ATC main arm is at the home position.
- (5) The spindle is not rotating for orientation.
- (6) A spindle speed (S code) is specified.
- (17) A sensor tool is not called to the spindle.
- (8) The machine is not in the rigid tapping operation.
- (19) The APC is at the home position. (APC specification)

5.5.2 Checking and Setting the Spindle Speed

When the spindle is manually started, the spindle rotates at the speed which was used last in the MDI or memory mode operation. Therefore, to start the spindle manually, it is necessary to check the presently set spindle speed first and change the presently set spindle speed if it is not adequate.

The procedure for checking and setting the spindle speed is explained.

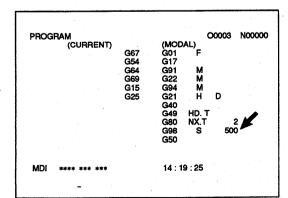


- 1) Once set, the spindle speed remains valid until a new spindle speed is set.
- (2) If the spindle speed data is blank, the spindle does not rotate even if spindle start operation is carried out.

<Checking the spindle speed>



When rotating the spindle manually, check the presently set spindle speed first. If it is not adequate for intended operation, change it to the required speed.



Display the data in the block of the program presently executed.

The S value displayed on the screen is the spindle speed to be used.

Spindle speed is not set if S data is blank.

<Setting the Spindle Speed>

To set the spindle speed used for the manual operation, follow the steps indicated below.

1) Place the DOOR INTERLOCK key-switch in the NORMAL position.

spindle is rotating.

5.5.3

2)	Close the front door and the side door.
3)	Display the PROGRAM (MDI) screen.
	Page A – 57 (4.2.9)
4)	Press the s key and key in the required spindle speed.
	<example> To input 800 min⁻¹</example>
	Press the following keys in order:
	S 8 [†] 0 0 (EOB)
5)	Press the insertion key 🔹 .
6)	Press the automatic operation switch [(cycle start).
	The required spindle speed is set.
7)	Press the [CURRNT] soft-key.
8)	Make sure that the set spindle speed is displayed on the screen.
Sta	rting and Stopping the Spindle Rotation
1)	Place the DOOR INTERLOCK key-switch in the NORMAL position.
2)	Close the front door and the side door.
3)	Make sure that the status indicators (tool clamp) and (ATC home position) are lit.
4)	Select any of the following modes with the mode selection switch:
	(handle), (jog), (rapid traverse), (zero return)
5)	Change the spindle speed as required with the spindle speed setting switches + (increase) and - (decrease).
	1) When the spindle speed setting switch + (increase) is pressed, the override value increases in units of 10%.
	② When the spindle speed setting switch — (decrease) is pressed, the override value decreases in units of 10%.
Non	Spindle speed command by an S code is the spindle speed at 100% override.
6)	Start the spindle.
	<normal direction=""></normal>
	Press the spindle switch (normal rotation).
	<reverse direction=""></reverse>
	Press the spindle switch (reverse rotation).
New	Use the spindle speed setting switches to change the spindle speed while the

7) To stop the spindle, press the spindle switch o (stop).



Stop the spindle rotation before changing the spindle rotation direction.

5.5.4 Spindle Jog Operation

In the manual mode, it is possible to rotate the spindle at a jog feedrate.

Spindle jog operation is possible regardless of the selected operation mode.

Spindle jog operation is used to check tool mounted conditions (run out, etc.).

- 1) Place the DOOR INTERLOCK key-switch in the NORMAL position.
- 2) Close the front door and the side door.
- 3) Place the operation selection key-switch in the [明日] (operation enable) or 「② (operation & edit enable) position.
- 4) Press the spindle switch (jog).

The spindle starts in the normal direction at a jog feedrate.

5) Release the spindle switch (jog) to stop the spindle.

5.6 Turning on Machine Light

A halogen lamp, an incandescent lamp, or a fluorescent lamp is used as a machine light.



- Keep the machine light on during setup to ensure safety. If this light is off it will not be possible to check conditions inside the machine or test cutting properly, and this may lead to machine damage or machining defects. In addition, operators could be injured while working inside the machine.
- ② Do not touch the halogen lamp or the incandescent lamp that illuminates the interior of the machine since it becomes hot and will burn you. Do not switch the lamp back on immediately after switching it off.



The lamp is consumable and is not covered under warranty.



For the procedure to change the lamp, refer to the MAINTENANCE MANUAL.

Any position of the operation selection key-switch and any mode can be selected.

- 1) Press the machine light switch .

 The lamp is lit; the indicator in the switch also is lit.
- 2) Press this switch again while the lamp is lit.

The lamp goes off; the indicator in the switch also goes off.

5.7 Coolant Supply



- Close the front door and the side door before supplying the coolant so that the coolant will not splash out.
- (2) For MV series, chip flush coolant is optional.

Any position of the operation selection key-switch and any mode can be selected.

Manual mode	(1) A	Press the coolant switch (chip removal).	The indicator in the coolant switch (chip removal) is lit and chip flush coolant is supplied.
	(1) A	Press the coolant switch (chip removal) while chip flush coolant is supplied.	The indicator in the coolant switch (chip removal) goes off and chip flush coolant is stopped.
	[A	Press the coolant switch (on).	The indicator in the coolant switch (on) is lit and coolant supply starts.
	· A	Press the coolant switch (off) while coolant is being supplied.	The indicator in the coolant switch (on) goes off and the coolant supply is stopped.
Automatic mode		Chip flush coolant supply starts when M80 (chip flush coolant ON) command is read.	The indicator in the coolant switch of chip removal) is lit.
	(1) A	Press the coolant switch (chip removal) to stop chip flush coolant supply during automatic operation.	The indicator in the coolant switch of (chip removal) goes off.
	M08-	Coolant supply starts when M08 (coolant ON) command is read.	The indicator in the coolant switch (on) is lit.
	.2	Press the coolant switch (off) to stop the coolant supply during automatic operation.	The indicator in the coolant switch (on) goes off.
	17.	Press and hold the coolant switch of more to make the indicator in the coolant switch on)	The coolant is not supplied even when M08 command is read.
-	ĪÆ	Press the coolant switch (on), and the indicator in the switch is lit and the coolant supply starts.	The indicator in the coolant switch (on) remains blinking.

5.8 Chip Conveyor (Chip Conveyor Specification)



Keep the chip conveyor operating all the time during automatic operation. If chips accumulate on the conveyor it will not be possible to expel them and the chip conveyor could be damaged.



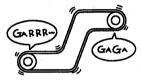
Close the front door and the side door before operating the chip conveyor.

Any position of the operation selection key-switch and any mode can be selected.





② Too many chips



3 Abnormal noise



When operating the chip conveyor, always pay careful attention to the following three points.

- ① Check if there is any foreign matter on the chip conveyor belt.
- ② Check if too many chips have accumulated on the chip conveyor belt.
- 3 Check if there is any abnormal noise during the operation.
- 1) Press the chip conveyor switch (forward) and the chip conveyor operates in the forward direction.

The indicator in the switch is lit.

- 2) Press the chip conveyor switch o (stop) while the chip conveyor is operating and the chip conveyor stops operating.
- 3) Press the chip conveyor switch [(backward) and the chip conveyor operates in the reverse direction.



The chip conveyor operates in the reverse direction only while the switch is held down.

The indicator in the switch is lit.

5.9 Magazine Indexing Operation

To mount or remove a tool in the magazine, the magazine can be rotated manually.

<MV series (excluding MV-40M), MH series>



Although magazine indexing operation is possible independent of the setting of the operation selection switch and the selected operation mode, magazine indexing is not possible while a T command is being executed in automatic mode.

- 1) Close the magazine door.
- 2) Place the magazine mode selection switch in the [7] (manual) position.
 - The manual magazine operation indicator is lit.

OF 1	_1 1/	THORY AREES AND MARIOAE OF ERATION
1.		
	NOT	If the switch is placed in the (manual) position while the magazine is rotating according to the programmed T command, the manual magazine operation indicator is not lit.
		It is lit after the completion of magazine rotation in the automatic mode.
;	3)	<cw direction=""></cw>
		Press the magazine indexing switch (normal rotation).
•		The pots move from the right to the left when viewing the magazine from the magazine door.
		<ccw direction=""></ccw>
		Press the magazine indexing switch [O] (reverse rotation).
		The pots move from the left to the right when viewing the magazine from the magazine door.
	4)	The magazine stops at the next pot position when the magazine indexing switch is released.
	NOT	1) If the manual magazine operation indicator is not lit, the magazine door is locked when it is closed.
		② Magazine index is not allowed while the magazine door is opened. If the magazine is indexed while the magazine door is closed, the magazine door is locked.
		When indexing the magazine for the first time after turning on power or after the restoration from an error, index the target pot after passing the zero point dog.
<mv< td=""><td>-40</td><td></td></mv<>	-40	
	1)	Place the DOOR INTERLOCK key-switch in the NORMAL position.
	2)	Close the front door and the side door.
	3)	Place the operation selection key-switch in the (speration enable) or (operation & edit enable) position.
	4)	Select any of the following modes with the mode selection switch:
		(handle), (jog), (rapid traverse), (zero return)
	5)	Press the magazine start switch [] .
		The magazine rotates while the switch is held down.
	6)	The magazine stops at the next pot when the magazine start switch [is released.
	NO	When indexing the magazine for the first time after turning on power or after the

B: PROGRAM EDITING

This chapter describes the following procedure:

- ① Storing a program to the NC memory
- ② Editing a program stored in the NC memory
- 3 Inputting/outputting a program to or from the NC memory using an external I/O device
- For the extended program editing function, refer to the instructin manuals prepared by the NC manufacturer.

CONTENTS

B : PROGRAM EDITING

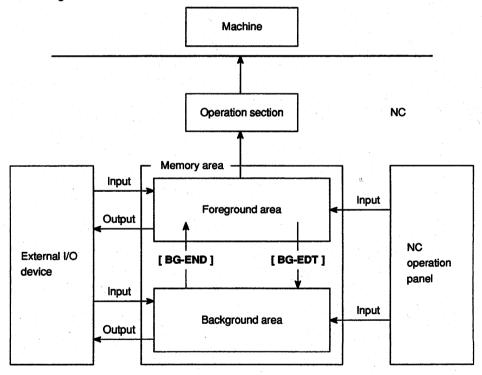
1.	FORE	EGROUND AND BACKGROUND	B-1
	1.1	Foreground Editing	B – 1
	1.2	Background Editing	B-2
2.	STO	RING A PROGRAM TO NO MEMORY	B-3
3.	SEAF	RCH FUNCTION	
	3.1	Program Number Search	B-5
	3.2	Sequence Number Search	
	3.3	Word Search	B-7
	3.4	Program Head Search	B-9
4.	PRO	GRAM EDITING	B – 10
5.		ITTING AND OUTPUTTING A PROGRAM USING	5
		ERNAL I/O DEVICE	B – 14
	5.1	Preparation	
	5.2	Inputting/Outputting a Program	B – 15

1. FOREGROUND AND BACKGROUND

The NC has memory area to store programs.

The memory area is basically divided into two areas: the foreground area, for programs that will directly operate the machine, and the background area, where the stored data cannot be used to directly control the machine.

- 1 Register programs used for machining in the foreground area. A program stored in this area cannot be edited during automatic operation.
- 2 A program stored in the foreground area must be transferred to the background area so it can be edited during automatic operation.
- Program editing and program input/output to/from the background area are possible regardless of the selected operation mode.
- 3 A program input to or edited in the background area must be transferred to the foreground area to be run.



1.1 Foreground Editing

Foreground editing is an operation to edit a program in the foreground area when the edit mode ($\boxed{2}$) is selected with the mode selection switch.

When a program is being edited in the foreground area, the automatic operation cannot be done.

1.2 Background Editing

Background editing is an operation to edit a program displayed on the screen while executing another program in the automatic mode.

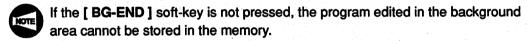
Regardless of the current NC operation mode, whether it is in the automatic mode or not, or of the setting of the mode selection switches, background editing is possible. Any alarms generated during background editing will not influence foreground machine operation and any alarms generated in foreground machine operation will not influence background editing.

Usually, program input or edit operation is executed in background if such an operation is required during automatic operation.

<Cautions on background operation>

1	Do no	ot press the reset key // during background editing.
	If the	reset key // is pressed, the NC will be reset.
CA	MITION	Do not press the reset key / during background editing since automatic operation will be reset and the machine will stop suddenly; this could damage the machine.

(2) When finishing background editing, always press the [BG-END] soft-key.



3 Background editing is only possible for a program which is not used in the foreground operation.

An attempt to edit the program selected for foreground operation will generate a BP/S alarm (140 BP/S ALARM).

If the program selected for the background editing is selected for foreground operation, a P/S alarm (alarm code: 059, 078) will be generated in the foreground operation.

The P/S alarm, which can occur in background editing, is the same as the P/S alarm that occurs in foreground editing. To distinguish this alarm from the foreground alarm, check the data input line for the background editing screen.

The BP/S alarm is cleared when any edit operation (pressing a key) is carried out.

(5) All programs delete operations are not possible during background editing.

2. STORING A PROGRAM TO NC MEMORY

Programs created by a programmer should be input to the NC memory area.

Two different methods are available: To use data entry keys on the operation panel

To use an external I/O device

- (1) Using data entry keys (Foreground)
- (2) Using data entry keys (Background)
- (3) Using an external I/O device (Foreground)
- 4 Using an external I/O device (Background)

This section gives an operational procedure to store a program into the NC memory area using the data entry keys.



For the procedure to input a program using an external I/O device, refer to page B-14 (5.).

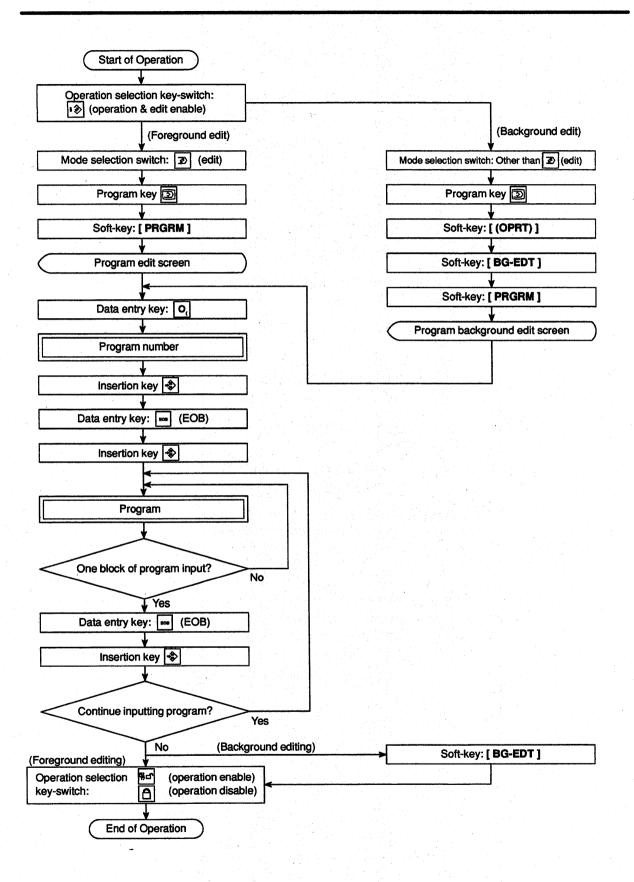


- Only when the operation selection key-switch is placed in the (operation & edit enable) position, storing a program can be done.
- ② When inputting a program number, the ";" (EOB) code cannot be input following a program number.
- When a program is input in the background edit mode, press the [BG-END] soft-key to end the background edit mode.

If the [BG-END] soft-key is not pressed, the program input in the background area cannot be registered to the foreground area.



When using the flat panel type, always place the operation selection key-switch in the [4d] (operation enable) or [6] (operation disable) position after completing program entry. Be aware that the program will be updated if program editing operations are carried out with the operation selection key-switch at the [13] (operation & edit enable) position. If the program is executed after being accidentally updated in this way the machine could operate unexpectedly, causing damage to the machine.



3. SEARCH FUNCTION

To edit a program or start a program from a block, locate the program block or word with the search function.

Three different search functions are available:

- Program number search
- Sequence number search
- Word search

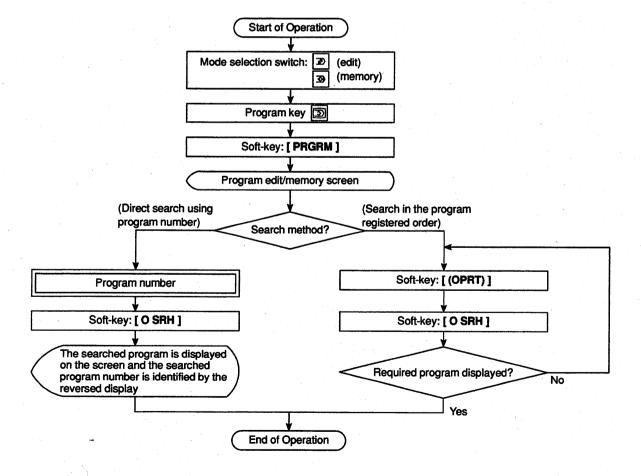
3.1 Program Number Search

The procedure to locate the required program in the NC memory is explained below.

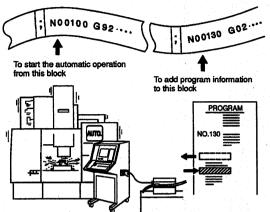
The program search function can be used in the edit mode or the memory mode.

This function is used to locate the program to be edited in the edit mode and the program to be executed during automatic operation in the memory mode.

This function is also used to search the head of a program.



3.2 Sequence Number Search



The sequence number search function is used to search for a sequence number in a program in the edit or memory mode.

This function is used to locate a specific block in a program to be edited in the edit mode, or start automatic operation from in the memory mode.

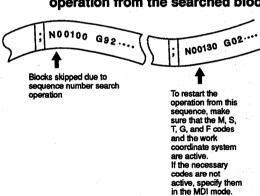
1

Enter the sequence number to be searched for exactly as it appears in the program.

For example, when searching for "N00007", "N7" cannot be used to search for "N00007".

2 Press the [SRH †] soft-key to search for a sequence number located before the current cursor position.

< Cautions for using the sequence number search function for starting automatic operation from the searched block>



Coordinate values and M, S, T, G, and F codes in the blocks skipped during sequence number search operation do not change the coordinate values or modal M, S, T, G, and F codes in the NC.

Usually, a block chosen as the target of a sequence number search operation is the first block of a machining process.

However, if machining is to be restarted from a block in the middle of a machining processes, specify the M, S, T, G, and F codes, and the work coordinate system selection command, etc. into the starting block in the MDI mode after checking the status of the NC unit.

<Sequence number search in a sub-program>

To search for a sequence number in a sub-program, search for the sub-program before attempting the sequence number search.

If the sequence number is searched for directly without searching for a sub-program number first, the enabled operation is the same as a sequence number search of the program.



If the specified sequence number is found in the main program, that block is searched for.

If the specified sequence number is not found in the main program, an alarm occurs.

Start of Operation (Edit mode) (Memory mode) Mode selection Mode selection switch: ☑ (edit) (memory) Program key 3 Program key 3 Soft-key: [PRGRM] Soft-key: [PRGRM] Program search Page B - 6 Program search Page B - 6 Data entry key: N. Sequence number Sequence number Soft-key: [N SRH] Soft-key: [SRH ↓] or [SRH ↑] The searched sequence number is displayed at the upper right area and the sequence number in the program is identified by the reversed display End of Operation

<Sequence number search operation procedure>

3.3 Word Search

A word search operation is required when editing a program. First, the program to be edited is called by the program number search operation and, then, the word to be edited is located by the word search operation.

The following three methods are used for the word search operation:

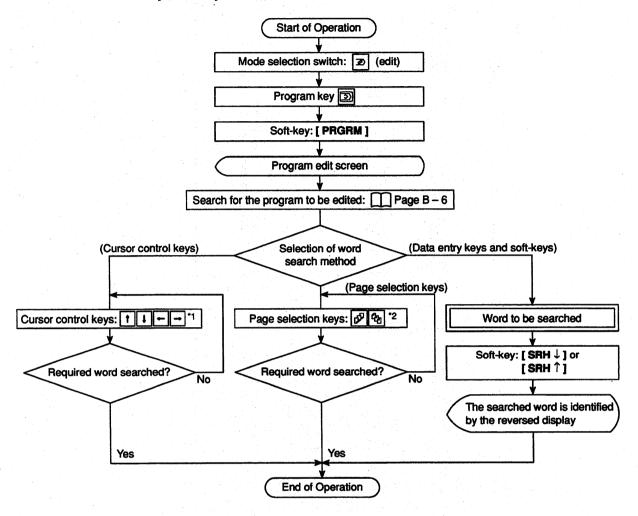
- Searching for a word with the cursor control keys
- Searching for a word with the page selection keys
- Searching for a word with the data entry keys and the soft-keys

<Cautions on word search using data entry keys and soft-keys>



- If the searched word appears more than once in the program, the first occurrence of the word located after the current cursor position is searched for.
- Enter the word to be searched for exactly as it appears in the program.
 For example, when searching for "M03", "M3" cannot be used to search for "M03".
- ③ Press the [SRH †] soft-key to search for a word located before the current cursor position.

<Word search operation procedure>



*1: Hold down the cursor control key and the cursor moves continuously word by word.

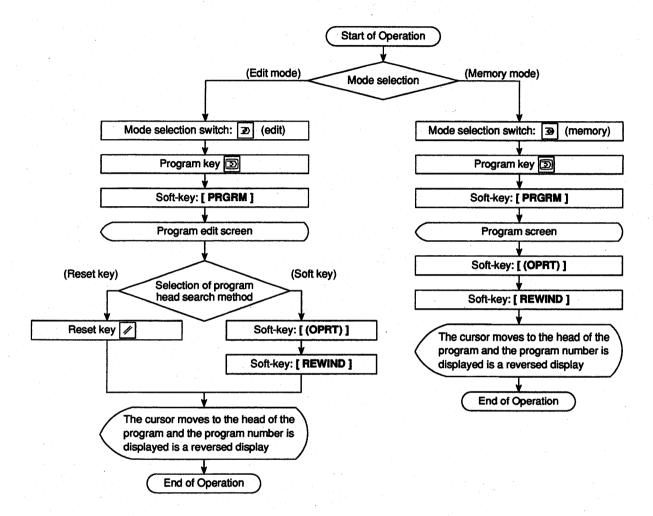
1	The cursor will be located on the first word of the next block.
1	The cursor will be located on the first word of the previous block.
-	The cursor moves to the right, word by word.
-	The cursor moves to the left, word by word.

*2: Hold down the page selection key and the pages change continuously.

ඇ	The next page is displayed. The cursor will be located on the first word of the page.		
_ 📆	The previous page is displayed. The cursor will be located on the first word of the page.		

3.4 Program Head Search

The program head search function is used to locate the head of a program when editing a program or after the NC is reset during automatic operation.



4. PROGRAM EDITING

Editing a program means the procedure to change a part of the program, already stored in memory, into the most appropriate one to meet the intended operation, using the data entry keys and program edit keys,

<Alteration>

This operation is used when changing the word in the program for a new word or block.

<Insertion>

This operation is used when inserting a new word or block between the words in the program.

<Deletion>

This operation is used when deleting a block or word in the program.



Before deleting the data, make sure that the words, blocks, or programs going to be deleted are those that may be deleted. Once the deletion key $\boxed{\geqslant}$ is pressed and the words, blocks, or programs are deleted, there are no ways to restore them.



Before editing	a program	, select foreg	round or bac	kground editing.

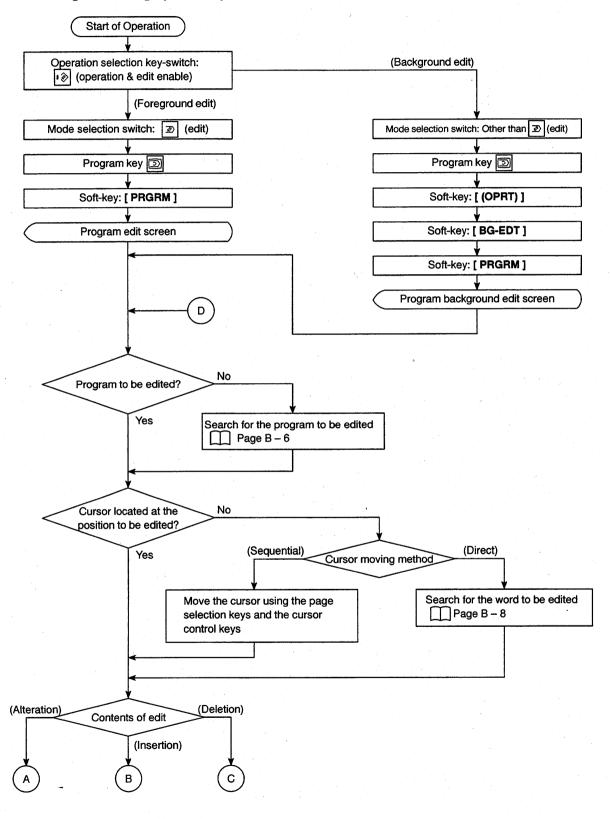
Page B $-$ 1 (1.1) for foreground editing
Page B - 2 (1.2) for background editing

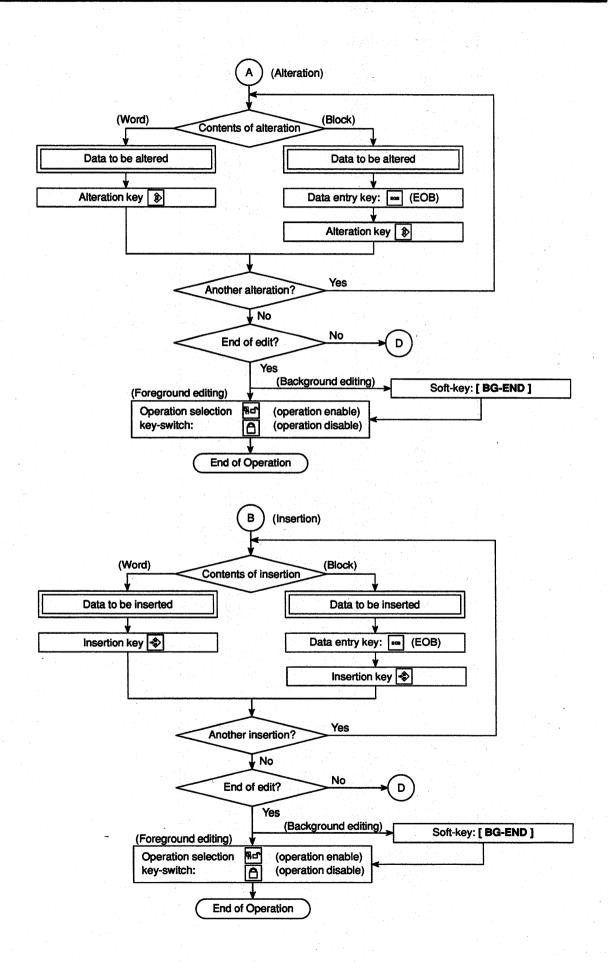
- ② Only when the operation selection key-switch is placed in the (operation & edit enable) position, program editing can be done.
- When a program is input in the background edit mode, press the [BG-END] soft-key to end the background edit mode. If the [BG-END] soft-key is not pressed, the program input in the background area cannot be registered to the foreground area.
- 4 Press the cancel key / if an error is found in the keyed word or block before pressing the alteration key so or insertion key .
- To alter or insert a block of data, move the cursor to position where the block is to be altered or inserted. Key in the new block and press the EDB) key. Then press the alteration key or insertion key.

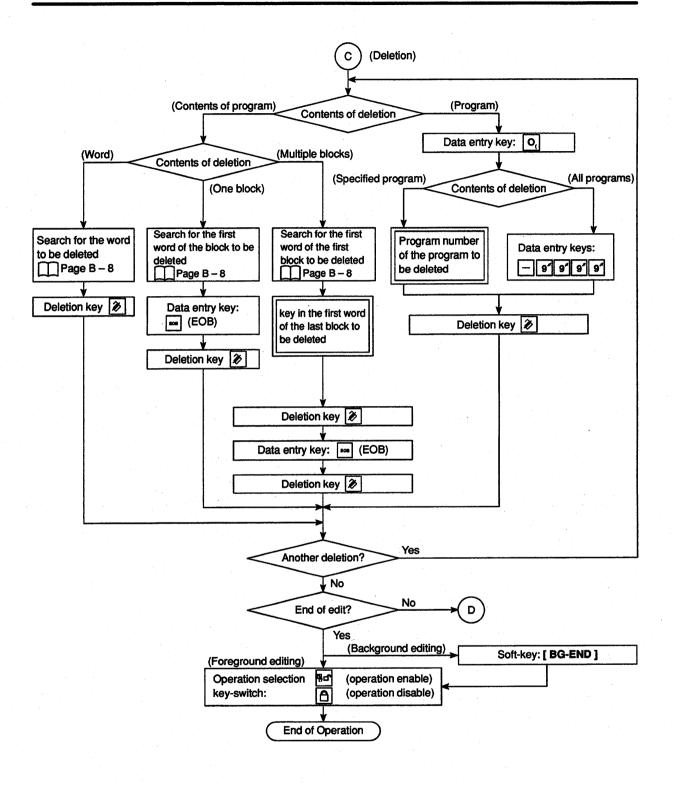


When using the flat panel type, always place the operation selection key-switch in the (operation enable) or (operation disable) position after completing program entry. Be aware that the program will be updated if program editing operations are carried out with the operation selection key-switch at the (operation & edit enable) position. If the program is executed after being accidentally updated in this way the machine could operate unexpectedly, causing damage to the machine.

<Program editing operation procedure>







5. INPUTTING AND OUTPUTTING A PROGRAM USING EXTERNAL I/O DEVICE

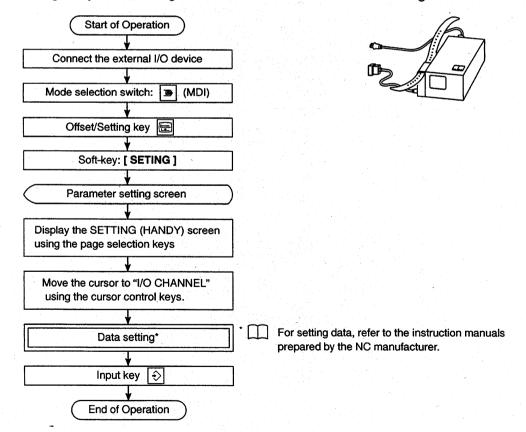
The programs stored in the NC memory can be output to an external I/O device or programs can be input to the NC memory from an external I/O device. The procedure to input or output a program using an external I/O device is explained in this section.

For program input/output operation, the I/O device to be used must be set first. This I/O device setting procedure is explained in 5.1, "Preparation". After that, program input procedure and program output procedure are explained in the following order:

- (1) Inputting a program (foreground)
- (2) Inputting a program (background)
- (3) Outputting a program (foreground)
- (4) Outputting a program (background)

5.1 Preparation

Set the parameters to meet the external I/O device to be used. Once set, the parameter settings may not be changed unless the external I/O device is changed.



5.2 Inputting/Outputting a Program

<Cautions on program input/output operation>



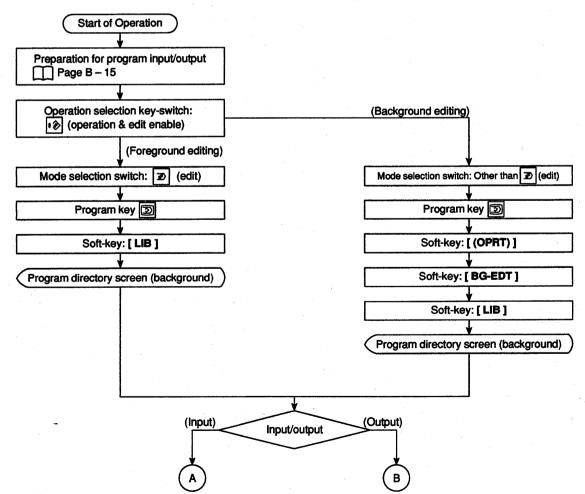
When using the flat panel type, always place the operation selection key-switch in the (pd) (operation enable) or (operation disable) position after completing program entry. Be aware that the program will be updated if program editing operations are carried out with the operation selection key-switch at the (operation & edit enable) position. If the program is executed after being accidentally updated in this way the machine could operate unexpectedly, causing damage to the machine.

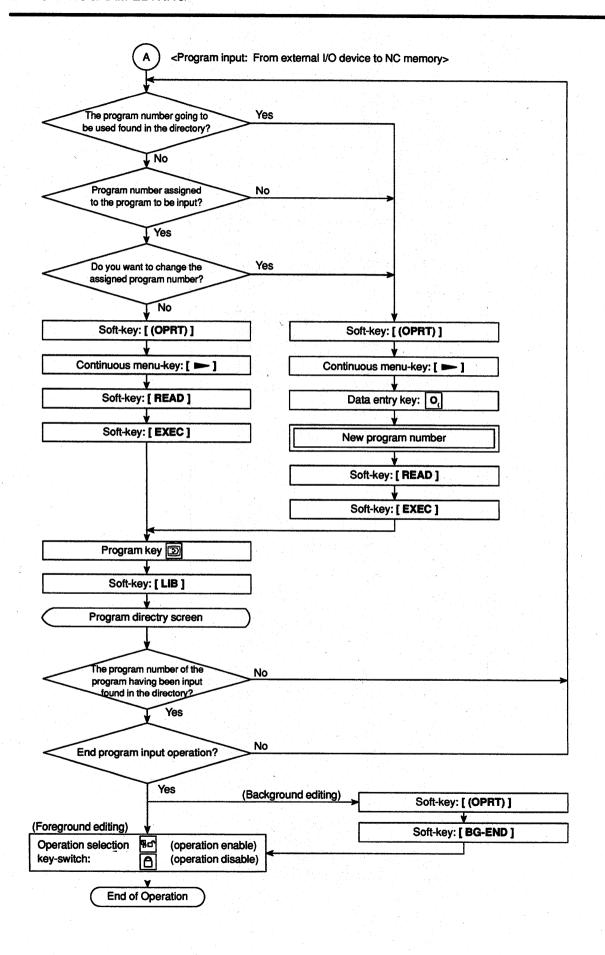


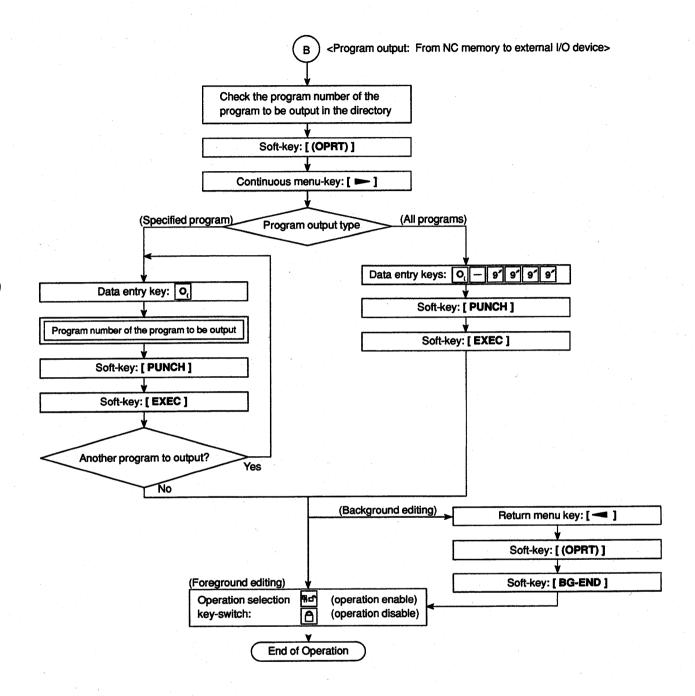
- If an existing program number is used when inputting a new program, an alarm is generated.
- ② Program input/output stops when the [STOP] soft-key is pressed.

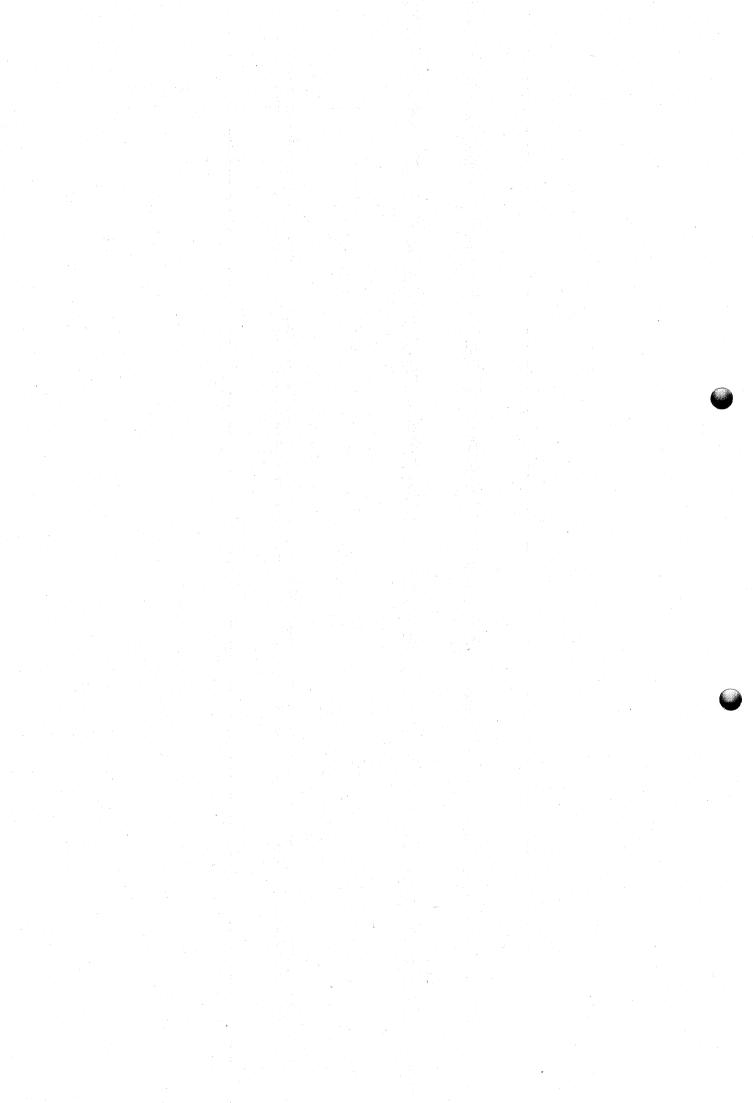
 Pressing the reset key // also stops program input/output.
- The input program is appended to the specified program in the NC memory when the [CHAIN] soft-key is pressed.

<Program input/output operation procedure>









C: OPERATION PREPARATIONS

This chapter describes the preparatory steps necessary before starting mass production. These steps include registration of tool data, mounting/removing tools, and inputting the offset data for setting the workpiece zero.



Since the workpiece material, shape, and machining methods differ largely among the customers, this manual cannot cover all kinds of workpieces.

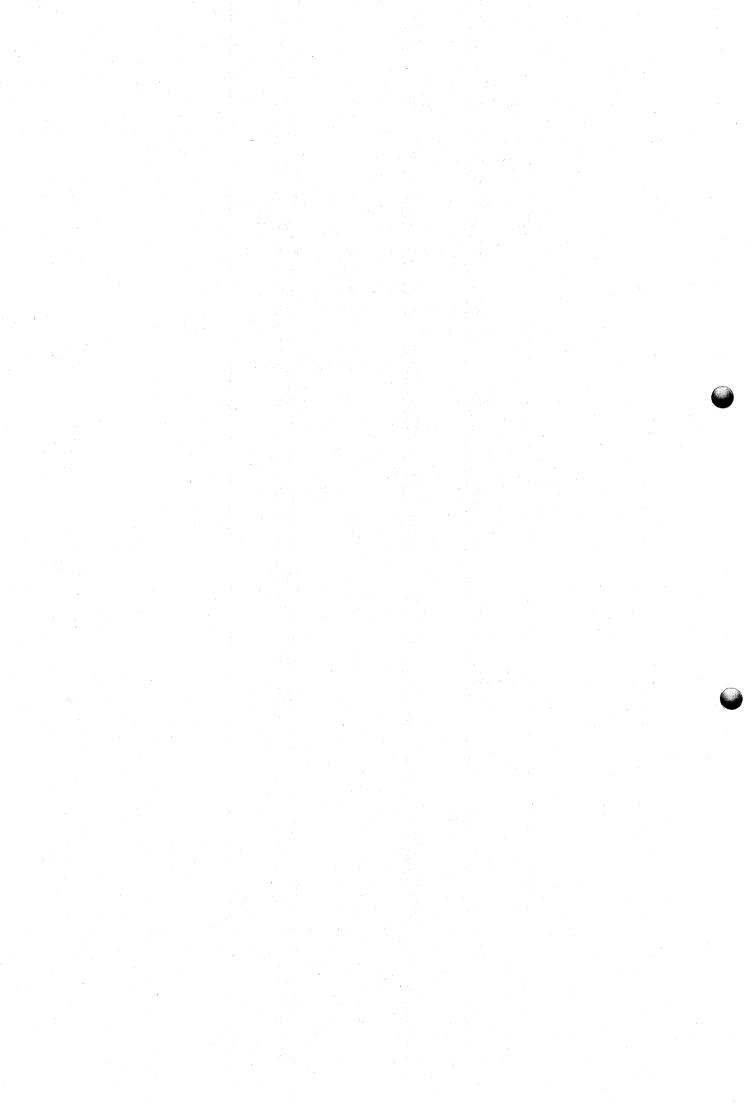
Since the procedure and the numerical values explained in this chapter may not be the most proper for customer's specific workpiece, take the explanation in this chapter for the reference and find the more proper method for your specific work.

CONTENTS

C: OPERATION PREPARATIONS

1.	TOOL	REGISTRATION C-1	
2.	MOU	NTING AND REMOVING TOOLS	i
	2.1	Check Items When Mounting Tools	
	2.2	Mounting Tools in the Magazine	
	2.3	Removing Tools from the Magazine C – 9	
	2.4	Mounting a Tool in the Spindle	
	2.5	Removing the Tool from the Spindle	
3.	SETT	ING UP FOR APC OPERATION (MH SERIES) C - 1	3
	3.1	Mounting and Removing a Workpiece (at Setup Station) C − 1	3
	3.2	Pallet Setup Operation	4
	3.3	Setting a Program Number	4
	3.4	Programming for APC	4
		3.4.1 Execution of APC Cycle by M02/M30	4
		3.4.2 Execution of APC Cycle by M60/M61	5
	3.5	Automatic Power Shut-off Function and APC C - 1	5
4.	SETT	ING THE WORK COORDINATE SYSTEM C - 1	6
	4.1	Setting the Parameter Required in Work Coordinate System and Tool Length Measurement	6
	4.2	Setting the Work Coordinate Systems	
		Using the Setup Function C – 1	7
5.	MEAS	SURING AND SETTING THE TOOL OFFSET DATA C-2	23
	5.1	Check Items When Measuring and Inputting Tool Offset Values	23
	5.2	Measuring the Tool Length Offset Data	23
		5.2.1 Measuring the Tool Length Offset Data (When the Setup Function is not Used.)	24
-		5.2.2 Measuring the Tool Length Offset Data (When the Setup Function is Used.)	
	5.3	Setting the Tool Length Offset and Cutter Radius	
		Offset Data C – 2	27

6.	PREI	PARATION BEFORE STARTING MASS PRODUCTION	C – 31
	6.1	Condition for Starting Automatic Operation	C – 31
	6.2	Check Items when Executing Dry Run, Test Cutting, Measurement, and Mass Production	C – 32
	6.3	Checkups before Starting Mass Production	C – 33
	6.4	Preparations for Checking a Program	
	6.5	Test Cutting	C – 39
7.	SETT	FING THE INHIBITED TOOL ENTRY ZONE	C – 43
8.	REM	OVING CHIPS ENTANGLING CUTTING TOOL	
	AND	WORKPIECE	C – 44
9.		TIONS ON USE OF U-AXIS TOOL	
	(U-A	XIS SPECIFICATION)	C – 45
	9.1	MV Series (U-axis Specification)	C – 45
	92	MH Series (U-axis Specification)	C - 46



1. TOOL REGISTRATION

This section describes the tool registration procedure for the following six types of registration operation.

- (1) Registering the tool number
- (2) Registering the light tool (MH series: NT tool specification)
- (3) Registering the FMT tool (MH series: U-axis specification)
- (4) Registering the U-axis tool (MH series: U-axis specification)
- (5) Registering the spindle tool
- (6) Registering the empty pot (MV series)
- (7) Registering the next tool (MH series)
- (8) Registering the sensor tool



When registering a cutting tool, make sure that the correct tool is registered correctly.

If a wrong cutting tool is registered or if wrong data is set, the spindle speed may become faster than the allowable limit of the cutting tool mounted to the spindle. If this occurs, the cutting tool may be broken or it may come off the spindle, causing damage to the machine.



- When registering the cutting tools, register the cutting tools in the pots first.

 Registration of the spindle tool should be made after that.
- Tool registration is not allowed during the ATC cycle or while the magazine is rotating.

The correspondence between the tool number and the pot number where the tool is stored should be registered.

Set the tool number of the tools which are mounted in the magazine pots.

<Registering the light tool (MH series: NT tool specification)> Tool registration screen (sub items)

Set the tool number and whether or not the tool is light tool (less than 20 kg) for the cutting tool mounted in the magazine pot.

The maim arm rotation speed during ATC cycle is changed according to the tool weight.

Registering the FMT tool (MH series: U-axis specification)> Tool registration screen (sub items)

Set the tool number and whether or not the tool is FMT tool for the cutting tool mounted in the magazine pot.

<Registering the U-axis tool (MH series: U-axis specification)> Tool registration screen (sub items)

Set the tool number and whether or not the tool is U-axis tool for the cutting tool mounted in the magazine pot.

< Registering the spindle tool> ---> Tool registration screen

If a tool is manually mounted to the spindle, the tool number of the tool mounted in the spindle should be set.

If the tool number of the spindle tool is not correct at an occurrent of a trouble, the tool number should be changed.

Registering the empty pot (MV series)>→ Tool registration screen

If the pot number of an empty pot is not correct at an occurrent of a trouble, the pot number should be changed.

Usually, this operation is not used.

< Registering the next tool (MH series)> ---> Tool registration screen

If the tool number of the next tool is not correct at an occurrent of a trouble, the next tool number should be changed.

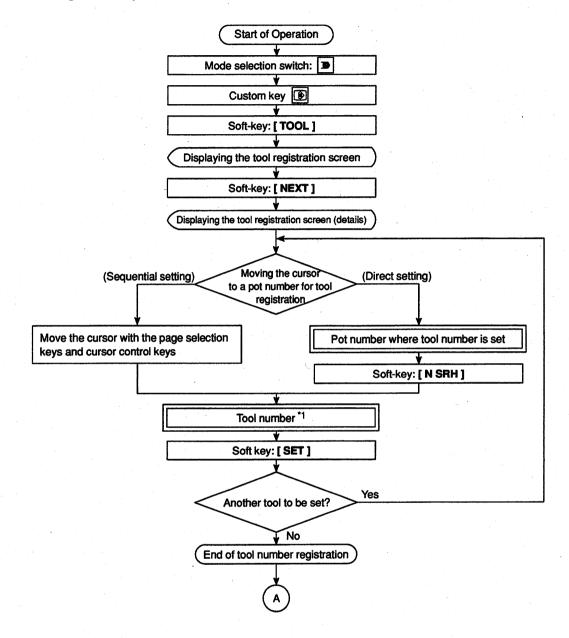
Usually, this operation is not used.

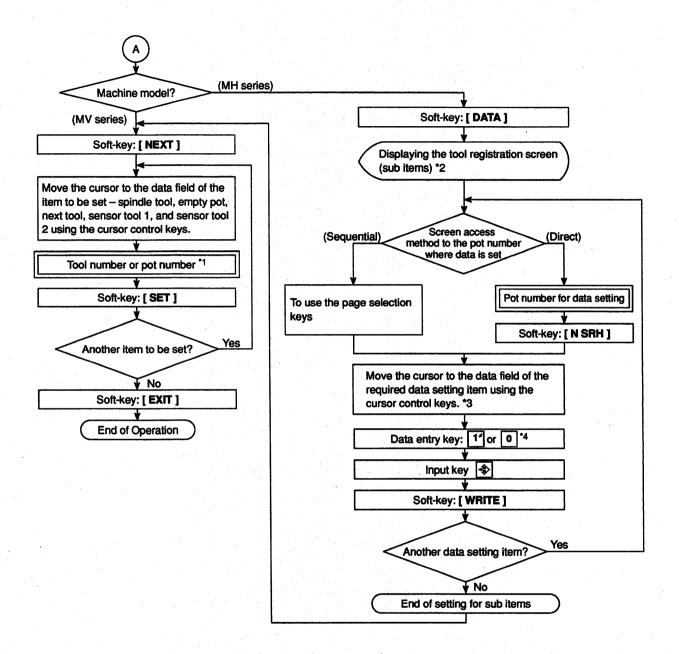
< Registering the sensor tool> ----> Tool registration screen

When using the sensor tool, the tool number of the sensor tool should be set to "SENSOR TOOL 1" and "SENSOR TOOL 2".

With this setting, the sensor tool interlock function becomes valid when a sensor tool is mounted to the spindle to disable automatic and manual spindle rotation.

<Tool registration procedure>





*1: ① A tool number is input in a number up to four digits.

The first digit indicates the tool diameter classification as follows:

Large diameter tools 9

Medium diameter tools ... 1 to 8 to 8 (example: 1002)

Small diameter tools 0

For details, refer to the PROGRAMMING MANUAL.

- ② A tool number already registered cannot be set. If it is set, an error message is displayed.
- *2: Tool number registration is also possible at the tool registration (sub item) screen.



*3: ① MH series (NT tool specification): Move the cursor to the data field of light

tool.

② MH series (U-axis specification): Move the cursor to the data field of

U-axis tool and FMT tool.

*4:

Setting Item	Setting	
Light tool (NT tool specification)	Less than 20 kg	[1]
	20 kg or more	[0]
U-axis tool (U-axis tool specification)	U-axis tool	[1]
	Other than U-axis tools	[0]
FMT tool (U-axis tool specification)	FMT tool	[1]
	Other than FMT tools	[0]

2. MOUNTING AND REMOVING TOOLS

This section describes the procedure used for mounting and removing tools at the magazine and the spindle.



- 1 Before mounting a tool in the spindle and/or magazine, clean the tapered hole in the spindle, the tool shank of the tool holder, and the magazine pot with clean cloth. If a tool is mounted in the spindle without removing foreign matter or chips from the tool holder taper shank, it will cause run out of the tool mounted in the spindle when the spindle is rotated and also damage the tapered hole in the spindle due to scratching.
- When mounting tools in the magazine, arrange them so that they are evenly balanced in the magazine. If the tools are mounted only in a specific area, magazine operations will be restricted to the area where the pots with tools mounted in them are located and this will adversely affect the machine.
- When mounting and removing tools, be very careful not to drop the tools. Never touch the tools with your bare hands.

2.1 Check Items When Mounting Tools

The items that must be carefully checked when mounting tools are indicated in the table below. Use this table when carrying out the work to ensure correct operation.

		Check Items	Check Column
	1	Are the tool holders and the retention knobs cleaned before mounting a cutting tool?	
	2	Are cutting tools free of abnormal wear and/or breakage?	
Mounting the Tools	3	Are tool shape and material proper for intended operation?	
	4	Are cutting tools mounted to the tool holders correctly?	
	5	Is the tool overhang appropriate?	
	6	When mounting a boring bar in the spindle, is the tool tip set in the direction opposite to the tool shift direction?	
	7	Are all cutting tools registered?	
	8	Is tool size code entered correctly?	
	9	Are tool numbers allocated correctly for different size of cutting tools?	
	10	Are cutting tools mounted taking the maximum diameter of the adjacent tools into consideration?	
	11	Are pots adjacent to a large diameter tool assigned for small diameter tools or left empty?	

2.2 Mounting Tools in the Magazine

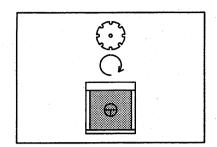
<MV-40M>

[TOOL E	NTRY] OOL: 0001	NEXT POT: 002 EMPTY POT: 005		
POT	TOOL	POT	TOOL	
01	0001	11	0011	
02	0002	12	0012	
03	0003	13	0013	
04	0004	14	0014	
05	0000	15	0015	
06	0006	16	0016	
07	0007	17	0017	
08	0008	18	0018	

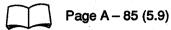
1) Display the TOOL ENTRY screen.



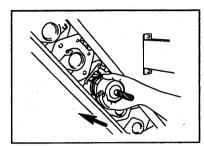
Check the information of the tool to be set in each pot of the magazine.



3) Rotate the magazine to bring the desired pot into the tool setting position.



4) Press the [**DOOR UNLOCK**] switch to unlock the side door. Then open the side door.



5) Align the key slot in the tool holder with the key in the pot and insert the tool securely into the pot.



Cutting tool edge is sharp and dangerous. Pay sufficient care when holding a tool by bare hands.

You may be injured due to sharp edge.

- 6) Close the side door.
- 7) To mount another tool in the magazine, repeat steps 2) through 6) above.



Mount only the tools which are within the limits. The tools must be arranged so that they are evenly balanced in the magazine.



For the restrictions on the tools, refer to the MAINTENANCE MANUAL.

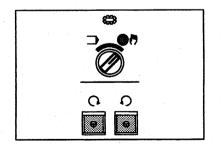
<MV series (excluding MV-40M)>

TOOL E	NTRY] OOL:0001	NEXT POT: 002 EMPTY POT: 005		
POT	TOOL	POT	TOOL	
01	0001	11	0011	
02	0002	12	0012	
03	0003	13	0013	
04	0004	14	0014	
05	0000	15	0015	
06	0006	16	0016	
07	0007	17	0017	
08	0008	18	0018	

1) Display the TOOL ENTRY screen.



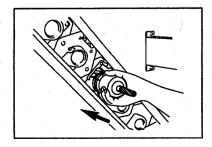
2) Check the information of the tool to be set in each pot of the magazine.



 Rotate the magazine to bring the desired pot into the tool setting position.



4) Open the magazine door.



5) Align the key slot in the tool holder with the key in the pot and insert the tool securely into the pot.



Cutting tool edge is sharp and dangerous. Pay sufficient care when holding a tool by bare hands.

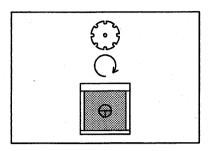
You may be injured due to sharp edge.

6) Close the magazine door.

7) To mount another	r tool in the magazine, repeat steps 2) through 6) above.
Mount only the	tools which are within the limits. The tools must be arranged so that by balanced in the magazine.
For	the restrictions on the tools, refer to the MAINTENANCE MANUAL.
8) After setting all de (auto) position.	esired tools, place the magazine mode selection switch in the
<mh series=""></mh>	
[TOOL ENTRY] NEXT POT : 002	1) Display the TOOL ENTRY screen.
SP. TOOL: 0001 NEXT TOOL: 0002 POT TOOL POT TOOL 01 0001 11 0011	Page A – 63 (4.7.3)
02 0002 12 0012 03 0003 13 0013 04 0004 14 0014 05 0005 15 0015 06 0006 16 0016 07 0007 17 0017 08 0008 18 0018	Check the information of the tool to be set in each pot of the magazine.
	Rotate the magazine to bring the desired pot into the tool setting position.
	Page A – 85 (5.9)
	4) Open the magazine door.
	5) Align the key slot in the tool holder with the key in the pot and insert the tool securely into the pot.
	Cutting tool edge is sharp and dangerous. Pay sufficient care when holding a tool by bare hands.
THOM I	You may be injured due to sharp edge.
7) To mount another	6) Close the magazine door.
grand and <u>L</u> earning the first	r tool in the magazine, repeat steps 2) through 6) above.
1 NOIE	e tools which are within the limits. The tools must be arranged so that y balanced in the magazine.
For	the restrictions on the tools, refer to the MAINTENANCE MANUAL.
8) After setting all d (auto) position.	esired tools, place the magazine mode selection switch in the

2.3 Removing Tools from the Magazine

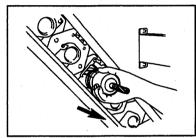
<MV-40M>



1) Rotate the magazine to bring the pot which stores the tool to be removed into the tool setting position.

Page A - 85 (5.9)

Press the [DOOR UNLOCK] switch to unlock the side door.



3) Pull out the tool from the magazine.

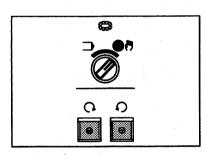


Cutting tool edge is sharp and dangerous. Pay sufficient care when holding a tool by bare hands.

You may be injured due to sharp edge.

- 4) Close the side door.
- 5) To remove another tool from the magazine, repeat steps 1) through 4) above.

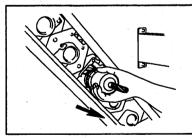
<MV series (excluding MV-40M)>



1) Rotate the magazine to bring the pot which stores the tool to be removed into the tool setting position.



2) Open the magazine door.



3) Pull out the tool from the magazine.

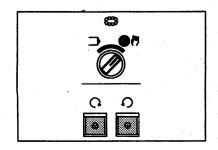


Cutting tool edge is sharp and dangerous. Pay sufficient care when holding a tool by bare hands.

You may be injured due to sharp edge.

- 4) Close the magazine door.
- 5) To remove another tool from the magazine, repeat steps 1) through 4) above.
- 6) Place the magazine mode selection switch in the $| \Rightarrow |$ (auto) position.

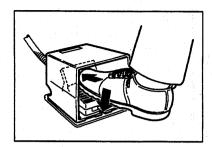
<MH series>



1) Rotate the magazine to bring the pot which stores the tool to be removed into the tool setting position.



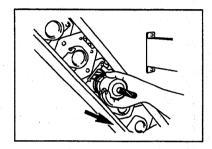
2) Open the magazine door.



While holding the tool by hand, step on the pedal of the magazine tool unclamp footswitch while pushing the lock release plate forward.



Page A - 42 (2.23)



Pull out the tool from the magazine.



Cutting tool edge is sharp and dangerous. Pay sufficient care when holding a tool by bare hands.

You may be injured due to sharp edge.

- 5) Close the magazine door.
- 6) To remove another tool from the magazine, repeat steps 1) through 4) above.
- Place the magazine mode selection switch in the $| \supset |$ (auto) position.

2.4 Mounting a Tool in the Spindle

<MV-40M>

- Place the operation selection key-switch in the | 4 cr | (operation enable) or | 2 (operation & edit enable) position.
- Select any of the following modes with the mode selection switch:

(handle), ₩ (jog), w (rapid traverse), - (zero return)

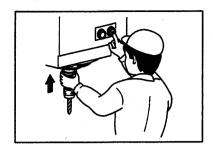
Press and hold the tool unclamp switch



- Align the key slot in the tool shank with the drive key in the spindle and insert the tool into the spindle hole.
- 5) Release the tool unclamp switch
- 6) After making sure that the tool is clamped, release the tool.
 - The tool is clamped in the spindle and the status indicator | (tool clamp) is lit.

<MV series (excluding MV-40M)>

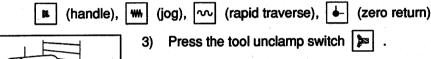
- Place the operation selection key-switch in the [90] (operation enable) or (operation & edit enable) position.
- 2) Select any of the following modes with the mode selection switch:

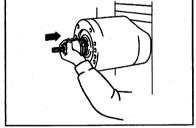


- 3) Press the tool unclamp switch
- 4) Align the key slot in the tool shank with the drive key in the spindle and insert the tool into the spindle hole.
- 5) Press the tool clamp switch
- 6) After making sure that the tool is clamped, release the tool.
 - The tool is clamped in the spindle and the status indicator (tool clamp) is lit.

<MH series>

- 1) Place the operation selection key-switch in the [%] (operation enable) or (operation & edit enable) position.
- 2) Select any of the following modes with the mode selection switch:





- 4) Align the key slot in the tool shank with the drive key in the spindle and insert the tool into the spindle hole.
- 5) Press the tool clamp switch [...]
- 6) After making sure that the tool is clamped, release the tool.
 - The tool is clamped in the spindle and the status indicator [tool clamp) is lit.

2.5 Removing the Tool from the Spindle

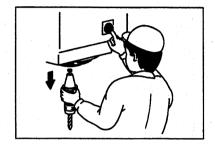
<Conditions required to unclamp a tool>

- ① A manual mode (handle, jog, rapid traverse, zero return) is selected at the machining center.
- ② An ATC cycle is not being executed.
- _(3) The spindle has been stopped.
- (4) Air pressure is proper.
- (5) The ATC main arm is at the home position.
- (6) The ATC MANUAL screen is not displayed.

<MV-40M>

- 1) Place the operation selection key-switch in the 事命 (operation enable) or 「② (operation & edit enable) position.
- 2) Select any of the following modes with the mode selection switch:

(handle), (jog), (rapid traverse), (zero return)

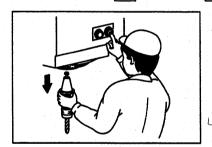


- Hold the tool with your hand.
- 4) Press and hold the tool unclamp switch
 - The tool is removed from the spindle.

<MV series (excluding MV-40M)>

- 1) Place the operation selection key-switch in the 等中 (operation enable) or 🕪 (operation & edit enable) position.
- 2) Select any of the following modes with the mode selection switch:

(handle), (jog), (rapid traverse), (zero return)

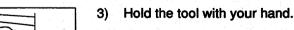


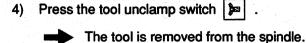
- Hold the tool with your hand.
- 4) Press the tool unclamp switch
 - The tool is removed from the spindle.

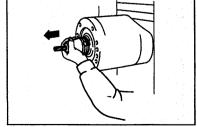
<MH series>

- 1) Place the operation selection key-switch in the 隔点 (operation enable) or 🕪 (operation & edit enable) position.
- 2) Select any of the following modes with the mode selection switch:

(handle), (jog), (rapid traverse), (zero return)





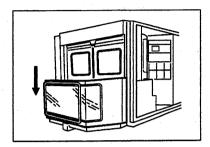


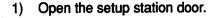
3. SETTING UP FOR APC OPERATION (MH SERIES)

This section describes the setup operation for the APC.

3.1 Mounting and Removing a Workpiece (at Setup Station)

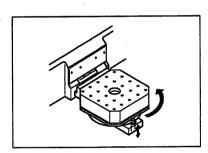
To mount/remove a workpiece, follow the steps indicated below.







- 1) While the indicator in the setup button is lit, or during APC cycle, the setup station door is locked and cannot be opened.
- ② With MH-63, the setup station doors open and close right and left.

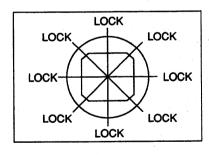


- 2) Step on the footswitch for pallet rotation, at the setup station.
 - The pallet location pin is extracted from the pallet.
- 3) Rotate the pallet manually to index it to the required position.
 - The pallet can be indexed in intervals of 45°.



Take due care to avoid being injured by the workpiece or fixture when rotating the pallet.

- 4) After positioning the pallet to the required position, step on the footswitch again.
- 5) Repeat steps 2), 3) and 4) to mount or remove a workpiece or fixture.



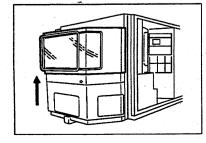
WARNING



When mounting or removing workpieces or workpiece holding device at the setup station, do not exert force in the direction the pallet will be lifted or tilted.

Because the pallet is not clamped at the setup station, if excessive force is applied to the pallet, it may fall from the setup station, causing serious injuries or damage to the machine.

- 6) After setting a workpiece and fixture on the pallet, return the pallet to the initial position.
- 7) Close the setup station door.

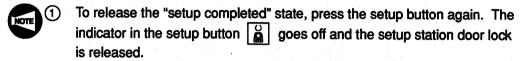


3.2 Pallet Setup Operation

1)	Position th	e APC	setup	station	at the	home	position.
	\sim	100					•

Page C - 13 (3.1)

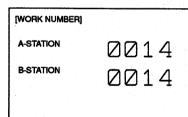
- 2) Close the setup station door.
- 3) Press the setup button on the APC operation panel.
 - The indicator in the setup button is lit and the lock pin is fitted into the setup station door.
 - The pallet is placed in the "setup completed" state.



② During the APC cycle, the setup station door is locked even if the indicator in the setup button is off.

3.3 Setting a Program Number

By setting a program number on the WORK NUMBER screen, the machining program is automatically called for the individual pallets and machining starts using the called program.



1) Display the WORK NUMBER screen.

Page A - 64 (4.7.5)

- 3) Input the program number using the data entry keys.
- 4) Press the [SET] soft-key.

The input program number is set.

- 5) Press the [EXIT] soft-key.
 - The screen returns to the PCMDI MENU screen.

3.4 Programming for APC

The APC cycle is executed by specifying a proper M code. The APC cycle is executed in different manner according to the specified M code.

- (1) M02 or M30
- ② M60 or M61

3.4.1 Execution of APC Cycle by M02/M30

If the M02 or M30 command in the program is read while the X-axis is at the 3rd zero point and the Z- and B-axes are at the zero point, the pallet change cycle is automatically executed.

After changing the pallet, the program used for machining the next workpiece is automatically searched, and the automatic operation is continuously executed.

<Program example>

O1234;

G91 G28 Z0; Z-axis zero return

G30 P3 X0 : X-axis 3rd zero return

G28 B0 : B-axis zero return

M02 (M30); Pallet change, work number search

3.4.2 Execution of APC Cycle by M60/M61

In addition to the pallet change cycle called by the M02/M30 command, it is also possible to call the pallet change cycle by executing the M60 or M61 command. If either of these commands is executed during machining, the pallet is forcibly ejected from the machining center. After setting up the workpiece at the setup station, the pallet is loaded to the machining center and the operation is continuously executed.

<Program example>

M60 (M61); Ejection of A pallet → After setting up at the setup station, press the setup button

M61 (M60); Loading of A pallet Machining program

M02; Loading of B pallet, work number search



- If the M60 or M61 command is read during automatic operation, the pallet change cycle is executed in response to the lighting of the indicator in the setup button
- 2 In the MDI mode operation, pallet change cycle is executed when the M60 or M61 command is executed independent of the status of the indicator in the setup button
- In the pallet change cycle called by the M60 or M61 command, work number search is not executed after the completion of pallet change cycle.

3.5 Automatic Power Shut-off Function and APC

When the automatic power shut-off function is valid, if the M02 or M30 command specified in the program is read while the indicator in the setup button is not lit, power supply is automatically shut off.



If the indicator in the setup button is lit when the M02 or M30 command is read, power supply is not shut off but the operation is continuously executed by changing the pallet.

4. SETTING THE WORK COORDINATE SYSTEM

Up to six work coordinate systems can be set.

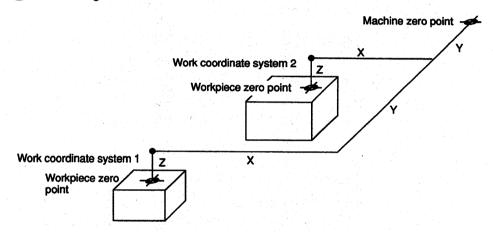
These work coordinate systems are set by setting the distance between the workpiece zero point of each work coordinate system and the machine zero point.

They are registered using the G codes (G54 to G59).

When setting a work coordinate system, set 0 for the Z-axis offset because the tool length offset function is used.



In case of measuring the tool length offset on the top of the table (angle plate), input work height to Z.



4.1 Setting the Parameter Required in Work Coordinate System and Tool Length Measurement

When setting the work coordinate system and the tool length measurement using the setup function, be sure to set the parameter.

[SET UP] (PARAMTER SETTING)	
TLW DISPLAY CURSOR	MANUAL
TLM TYPE	TYPE 2
BOTTOM LEVEL	0.000
HEIGHT OF BLOCK H-CODE OF MEASURENT TOOL	0.000
RADIUS OF MEASURENT TOOL	
CENTER DEVIATION AMOUNT X	0.000
Y	0.000
DISTANCE BETWEEN POINTS	5.000

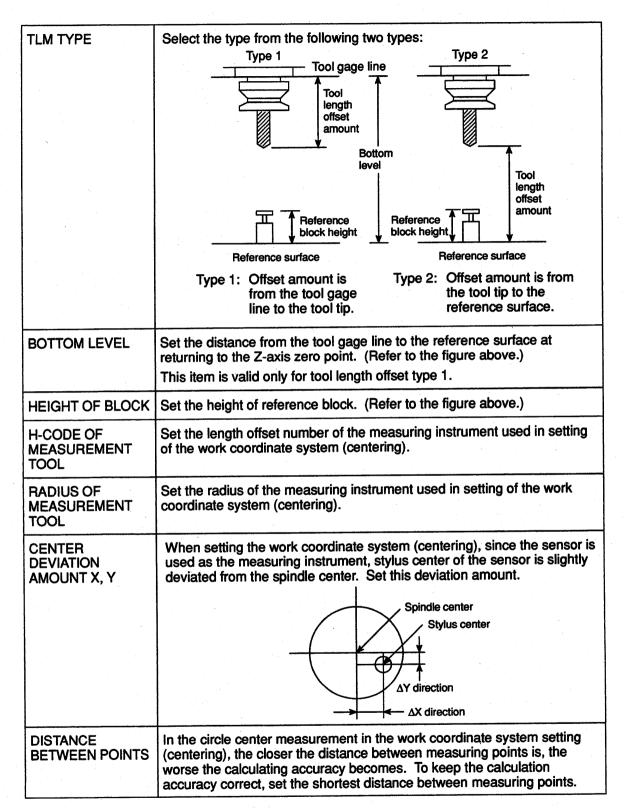
1) Display the PARAMETER SETTING screen.

2) Set the parameter as required.

The contents of the parameters are described below.

TLW DISPLAY CURSOR

When the TOOL LENGTH MEASURE. screen is displayed, select whether the cursor is automatically moved to the same length offset number (H-OFFSET) as the lower three digit of spindle tool number (SP. TOOL). However, when the same numerical value is not in the length offset number, the cursor does not move. Also, the spindle tool is changed when the TOOL LENGTH MEASURE. screen is displayed, the cursor does not move.



4.2 Setting the Work Coordinate Systems Using the Setup Function

For setting the zero point of a work coordinate system using the setup function, the following five functions can be used. Before setting the work coordinate system zero point, set the data for the setup parameters.



Page C - 16 (4.1)

<X-axis reference face measurement>

The workpiece zero point in the X-axis is measured and set.

<Y-axis reference face measurement>

The workpiece zero point in the Y-axis is measured and set.

<Z-axis reference face measurement>

The workpiece zero point in the Z-axis is measured and set.

<Square center measurement>

This measurement cycle is used when the workpiece zero point lies at the center of a rectangle.



This function is used for a rectangular workpiece. The workpiece must be set so that the sides are parallel to the X- and Y-axis.

The center of the rectangle is measured and set.

<Circle center measurement>

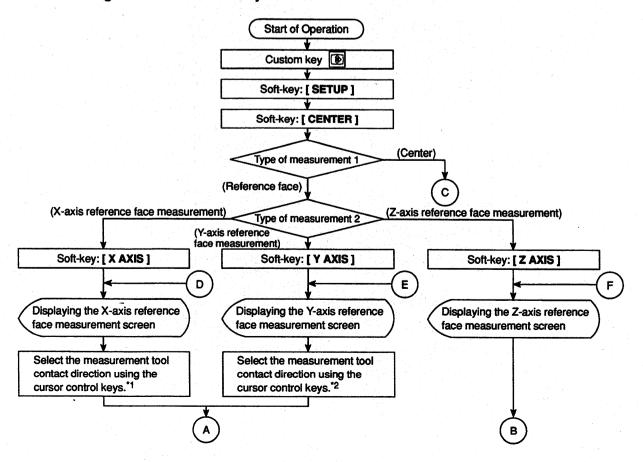
This measurement cycle is used when the workpiece zero point lies at the center of a circle.

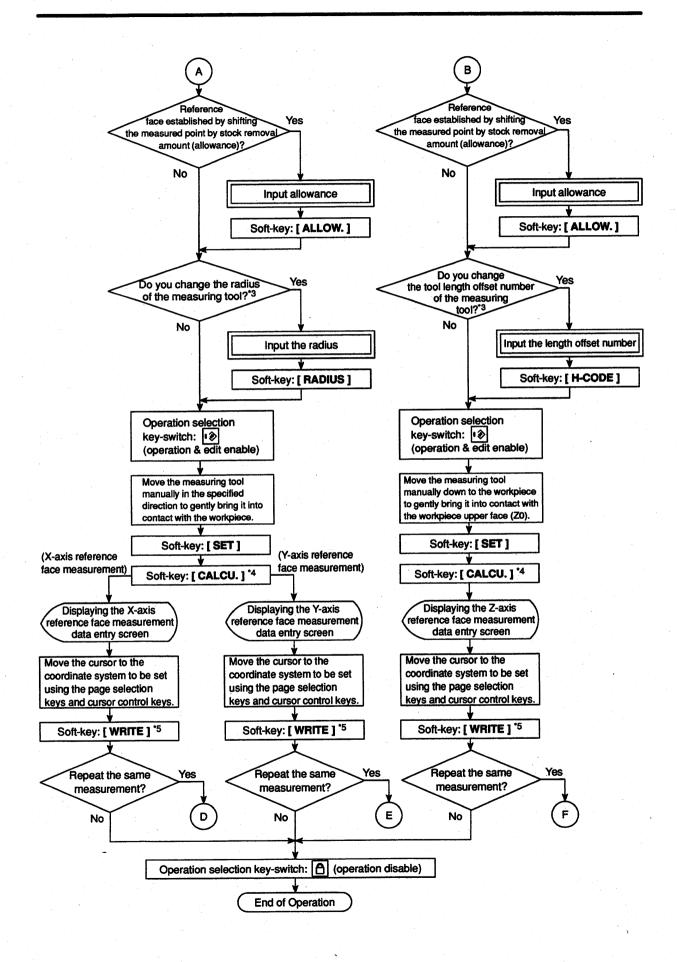


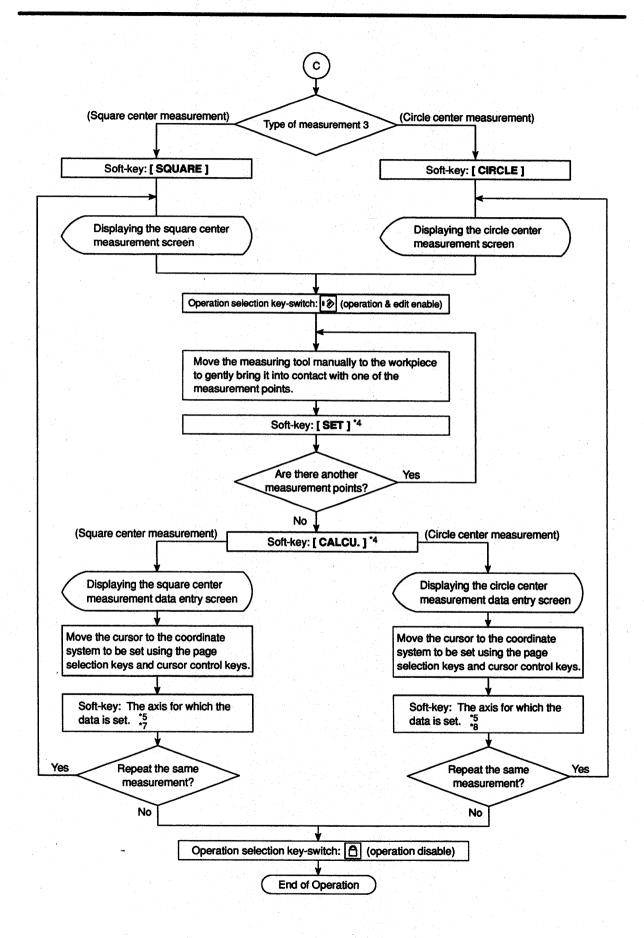
This function is used for a circular workpiece.

The center of the circle is measured and set.

<Setting the work coordinate system>



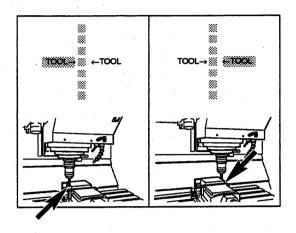




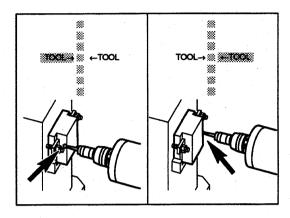


11: The measuring tool is brought into contact with the workpiece from the directions illustrated below.

<MV series>



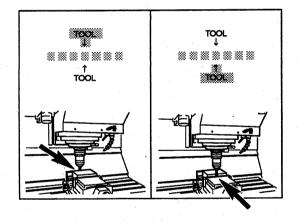
<MH series>



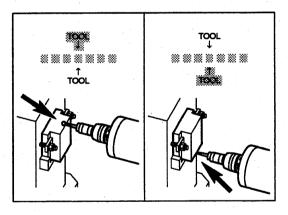


2: The measuring tool is brought into contact with the workpiece from the directions illustrated below.

<MV series>



<MH series>





- *3: Radius value of the measuring tool in 4.1, "Setting the Parameter Required in Work Coordinate System and Tool Length Measurement" is not changed.
- *4: To carry out measurement again, press the [CANCEL] soft-key.
- *5: If memory or tape mode is selected, the data cannot be set if the [WRITE] soft-key is pressed.

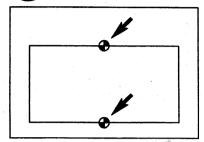
Select the mode other than the memory and tape modes.

- *6: ① With the square center measurement function, there are four measurement points.

 Bring the measuring tool into contact with the four sides of the rectangle.
 - With the circle center measurement function, there are three measurement points. Bring the measuring tool into contact with the circumference at three points. To ensure high accuracy, select equally spaced three points for the contact points.
 - The measuring tool can be brought into contact with the measurement points in any order.



^{*7:} The relationship between the measuring point(s) and the soft-key to be used is indicated below.



① When the measurement points are located as in the illustration shown at the left, press the [X AXIS] soft-key.

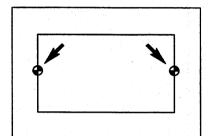
X-axis:

Square center point

Y-axis:

Point obtained by Y-axis reference face

measurement



② When the measurement points are located as in the illustration shown at the left, press the [YAXIS] soft-key.

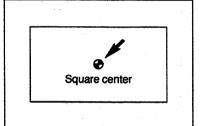
X-axis:

Point obtained by X-axis reference face

measurement

Y-axis:

Square center point



When the measuring point is located as in the illustration shown at the left, press the [X-Y AXIS] soft-key.

X-axis:

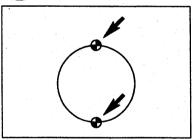
Square center point

Y-axis:

Square center point



^{*7:} The relationship between the measuring point(s) and the soft-key to be used is indicated below.



(1) When the measurement points are located as in the illustration shown at the left, press the [X AXIS] soft-key.

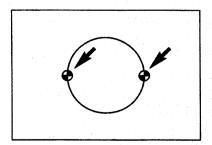
X-axis:

Circle center point

Y-axis:

Point obtained by Y-axis reference face

measurement



When the measurement points are located as in the illustration shown at the left, press the [YAXIS] soft-key.

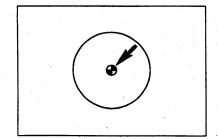
X-axis:

Point obtained by X-axis reference face

measurement

Y-axis:

Circle center point



When the measuring point is located as in the illustration shown at the left, press the [X-Y AXIS] soft-key.

X-axis:

Circle center point

Y-axis:

Circle center point

5. MEASURING AND SETTING THE TOOL OFFSET DATA

This section describes the tool offset data measuring and setting procedure.

To measure the tool offset data, first set all tools necessary for cutting to the magazine.

5.1 Check Items When Measuring and Inputting Tool Offset Values

The items that must be carefully checked when measuring and inputting the tool offset data are indicated in the table below.

Use this table when carrying out the work to ensure correct operation.

		Check Items	Check Column
	1	Is due consideration given to possible interference during measurement of tool offset data?	
T10#	2	Is centering tool speed proper?	
Tool Offset	3	Are the workpiece zero point coordinate values set for the work coordinate system?	
	4	Is the workpiece zero point determined taking the diameter of the centering tool into consideration?	
	5	When measuring the tool length offset data, is the relative coordinate value set "0" with the Z-axis positioned at the machine zero point?	
	6	Is the offset direction correct?	
	7	Is the tool offset number correct?	
	8	Are the tool geometry offset data, tool wear offset data, and coordinate system used for offset identified correctly?	
	9	Are the cutter radius offset data and tool length offset data used for offset identified correctly?	

5.2 Measuring the Tool Length Offset Data

The tool length offset data setting procedure is explained below for the following two cases.

- (1) When the setup function is not used.
- (2) When the setup function is used.

5.2.1 Measuring the Tool Length Offset Data (When the Setup Function is not Used.)

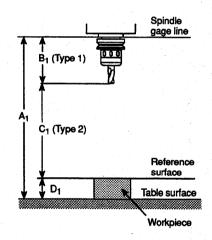
<MV series>

For offsetting the tool length, either the tool length from the spindle gage line to the tool nose (type 1) or the distance from the tool nose to the reference surface (type 2) is treated as the tool length offset data.

Usually, the tool offset data is measured using a tool presetter or similar instrument. If the tool length measurement instrument is not available, use the following procedure to find the tool offset data.

1) Return the Z-axis to the machine zero point.

2) Gently bring the tools to be used for machining into contact with the reference face one by one, and record the distance (movement distance) between the contact point and the machine zero point.



A1: Distance from the table surface to the spindle gage line

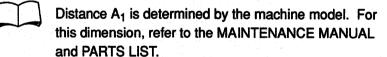
B₁: Tool length (type 1 offset data)

C₁: Movement distance (type 2 offset data)

D₁: Distance from the table surface to the reference surface (must be measured)

Type 1 offset data =
$$A_1 - (C_1 + D_1)$$

Type 2 offset data =
$$C_1$$



- 3) Calculate the length of the tools using the formula indicated above.
- 4) Input the calculated tool length to the corresponding tool offset number.

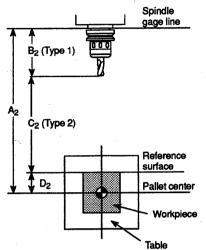
<MH series>

For offsetting the tool length, either the tool length from the spindle gage line to the tool nose (type 1) or the distance from the tool nose to the reference surface (type 2) is treated as the tool length offset data.

Usually, the tool offset data is measured using a tool presetter or similar instrument. If the tool length measurement instrument is not available, use the following procedure to find the tool offset data.

1) Return the Z-axis to the machine zero point.

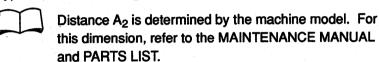
2) Gently bring the tools to be used for machining into contact with the reference face one by one, and record the distance (movement distance) between the contact point and the machine zero point.



- A2: Distance from the pallet center to the spindle gage line
- B₂: Tool length (type 1 offset data)
- C2: Movement distance (type 2 offset data)
- D₂: Distance from the pallet center to the reference face (must be measured)

Type 1 offset data =
$$A_2 - (C_2 + D_2)$$

Type 2 offset data =
$$C_2$$



- 3) Calculate the length of the tools using the formula indicated above.
- 4) Input the calculated tool length to the corresponding tool offset number.

5.2.2 Measuring the Tool Length Offset Data (When the Setup Function is Used.)

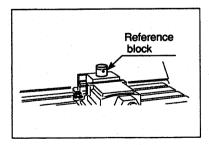
If the tool length offset data is measured using the setup function, the measured data is automatically input to GEOM (H: length) on the OFFSET screen.



In the case of MSC-518, there is no distinction between geometry and wear, and between H (length) and D (radius). The measured offset data is input to the same offset number as the one set on the tool length measurement screen.

Before measuring the tool length offset data, set the setup parameters.





- Use a vise or fixture to securely mount the workpiece on the pallet.
- 2) Place the reference block on the workpiece.
- 3) Place the operation selection key-switch in the propertion & edit enable).
- 4) Display the PROGRAM (MDI) screen.

② Method 2

Press and hold the cursor control key.

5)	Return the axes to the tool change position.
	MV series: Z-axis Zero return
	MH series: X-axis Zero return
	Y/Z-axis Second zero return
	① Press the following keys in order:
	<mv series=""></mv>
	G _E 9" 1" G _E 2 [†] 8 [†] Z _w 0 soo (EOB)
	<mh series=""></mh>
	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$
	② Press the insertion key 🔹 .
	3 Close the front door and the side door.
	4 Press the automatic operation switch (cycle start).
•	
6)	Set the tool for which the tool offset data is to be measured into the spindle.
	1 Press the following keys in order:
	T _* [tool number] [500] (EOB) [M] [6"] [500] (EOB)
	② Press the insertion key 🔹 .
	③ Press the automatic operation switch [(cycle start).
	The ATC cycle is executed and the specified tool is set in the spindle.
[SET-UP] (TOOL LEN	
H-OFFSET 0.000 002 0.000 003 0.000 004 0.000 005 0.000	D-OFFSET 0.000 0.000 0.000 0.000 0.000
8)	Move the cursor to the offset number of the tool for which the tool length is to be measured.
	① Method 1
	After inputting the offset number using the data entry key, press the [SEARCH] soft-key.

_		
(a)	Method	•
(3)	INETHOR	J

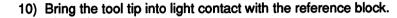
The cursor can be moved automatically by the parameter to the same number of lower three digits of the spindle tool number.

Page C - 16 (4.1)

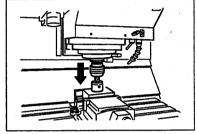
9) Select any of the following modes with the mode selection switch:

With MSC-518, the D-OFFSET column is not displayed.

(handle), (jog), (rapid traverse)



- 11) Press the [SET] soft-key.
- 12) Press the [WRITE] soft-key.
 - The tool length offset data is calculated and the calculated data is input to H-OFFSET.



- 1) To carry out measurement again, press the [CANCEL] soft-key.
- ② If memory or tape mode is selected, the data cannot be set if the [WRITE] soft-key is pressed. Select the mode other than the memory and tape modes.
- 13) Press the return menu key.
 - The SET-UP screen is displayed.
- 14) Press the [EXIT] soft-key.
 - The PCMDI MENU screen is displayed.
- 15) Repeat steps 4) through 14) above to measure the tool length successively.

5.3 Setting the Tool Length Offset and Cutter Radius Offset Data

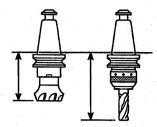
In a program, the tool length offset data is called using the H code and the cutter radius offset data using the D code. The offset data is set using the OFFSET screens, independently.

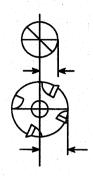
For details of H and D code command, refer to the PROGRAMMING MANUAL.

<To set the tool offset data>

Tool offset data is set in two modes, one in incremental data and the other in absolute data.

<Tool length offset data> <Cutter radius offset data>





<Tool offset data setting screen (MSC-516)>

OFFSET				O0001	N00001
NO.	GEOM (H)	WEAR (H)	GEOM (D)	WEAR (D)	
001	0.000	0.000	0.000	0.000	
002	0.000	0.000	0.000	0.000	
003	0.000	0.000	0.000	0.000	
004	0.000	0.000	0.000	0.000	
005	0.000	0.000	0.000	0.000	
006	0.000	0.000	0.000	0.000	
007	0.000	0.000	0.000	0.000	
800	0.000	0.000	0.000	0.000	1
ACTUAL	POSITION	N (RELATIVE)		
X	0.000		Y	0.000	
Z	0.000				

The following types of tool offset data should be set:

- ① GEOM (H)
 Set the tool length offset (geometry) data.
- ② WEAR (H) Set the tool length offset (wear) data.
- ③ GEOM (D)
 Set the cutter radius offset (geometry) data.
- WEAR (D)
 Set the cutter radius offset (wear) data.

For each tool number, set the above indicated four types of offset data in the corresponding columns.

<Tool offset data setting screen (MSC-518)>

OFFSET			O0001	N0000
NO.	DATA	NO.	DATA	
001	0.000	009	0.000	
002	0.000	010	0.000	
003	0.000	011	0.000	
004	0.000	012	0.000	
005	0.000	013	0.000	
006	0.000	014	0.000	
007	0.000	015	0.000	
800	0.000	016	0.000	
ACTUAL I	POSITION (RELA	TIVE)		
X	0.000	Υ	0.000	
Z	0.000			

When setting the offset data, there is no distinction between the tool length offset (geometry/wear) and the tool diameter offset (geometry/wear). Set the data as indicated below.

- The tool length offset data and tool diameter offset data for a single tool should be set for individual tool offset numbers.
- ② The tool length offset data (geometry) and the tool length offset data (wear) for a single tool should be set in the same data setting column.
- The tool diameter offset data (geometry) and the tool diameter offset data (wear) for a single tool should be set in the same data setting column.

<Tool offset data setting screen (MSD-516)>

			_			
	(LENG			ADIUS)		
No.	GEOMETRY	WEAR	GEOMETRY	WEAR	ACTUAL	. POSITIO
001	0.000	0.000	0.000	0.000	(A	ELATIVE
002	0.000	0.000	0.000	0.000	X.	0.000
003	0.000	0.000	0.000	0.000	Y	0.000
004	0.000	0.000	0.000	0.000	· Z	0.000
005	0.000	0.000	0.000	0.000		
006	0.000	0.000	0.000	0.000		
007	0.000	0.000	0.000	0.000		
800	0.000	0.000	0.000	0.000		
009	0.000	0.000	0.000	0.000		
010	0.000	0.000	0.000	0.000		
011	0.000	0.000	0.000	0.000		
012	0.000	0.000	0.000	0.000		
013	0.000	0.000	0.000	0.000		
014	0.000	0.000	0.000	0.000		
015	0.000	0.000	0.000	0.000		
016	0.000	0.000	0.000	0.000		
•						
		_				

The following types of tool offset data should be set:

- GEOMETRY (LENGTH)

 Set the tool length offset (geometry) data.
- WEAR (LENGTH)Set the tool length offset (wear) data.
- ③ GEOMETRY (RADIUS)Set the cutter radius offset (geometry) data.
- WEAR (RADIUS)Set the cutter radius offset (wear) data.

For each tool number, set the above indicated four types of offset data in the corresponding columns.

<Setting the tool length offset data>

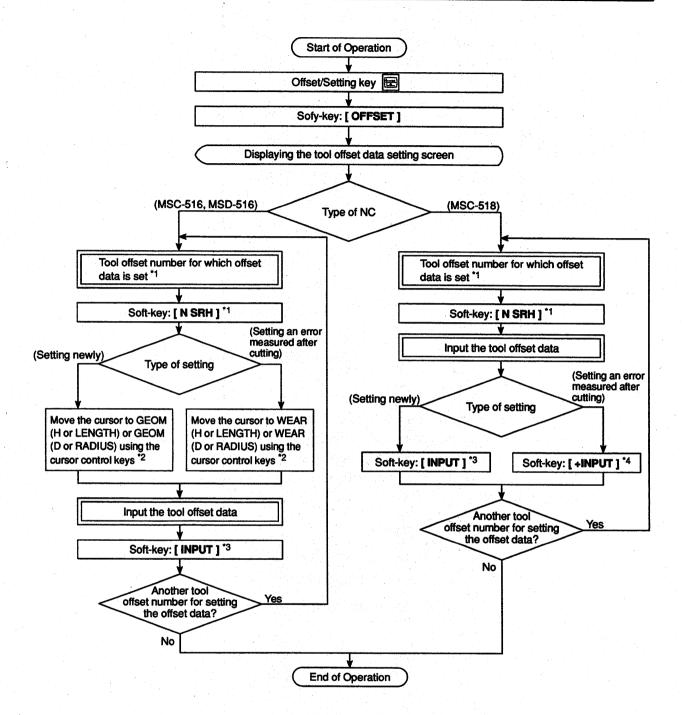
The program command point is the tool tip. Basically, you have to measure the length of each tool and take it into account when creating a program. However, when machining involves a large number of tools, it is a great deal of trouble to measure all the tools used when creating a program. Tool length offset correctly offsets the tools used to the positions indicated in a program.

<Setting the cutter radius offset data>

When using an end mill, etc. to precisely machine a workpiece to the programmed shape, it is necessary to register the cutter radius in advance as the cutter radius offset data.

By using this feature, the same program can be used to machine a workpiece when a different tool is used.

The tool moves along the tool path offset from the programmed path by the set offset data.





- 1: It is possible to move the cursor to the offset number using the page selection keys and cursor control keys.
- *2: Move the cursor to GEOM (H or LENGTH) or WEAR (H or LENGTH) when setting the tool length offset data and move it to GEOM (D or RADIUS) or WEAR (D or RADIUS) when setting the cutter radius offset data.
- *3: If the [+INPUT] soft-key is pressed, the numerical value is input in incremental mode. Therefore, make sure to press the [INPUT] soft-key.
 - *4: If the [INPUT] soft-key is pressed, the value having been input with the data entry keys is regarded as the tool offset data. Therefore, make sure to press the [+INPUT] soft-key.

6. PREPARATION BEFORE STARTING MASS PRODUCTION

This section describes the program check and test cut procedure to be carried out before starting mass production and the items to be checked before checking the program or starting test cut.

6.1 Condition for Starting Automatic Operation

For carrying out memory (tape) mode operation to check the program, to execute test cutting, or to run the program for mass production, or for carrying out MDI mode operation, the conditions required for automatic operation must be satisfied.

If the automatic operation does not start even if the automatic operation switch [] (cycle start) is pressed, check the following items if they are satisfied.



The conditions indicated below are the conditions to turn on the automatic operation start circuit in the NC unit. Workpiece mounted conditions, pressure setting, tool offset setting, etc. must be checked by the customer according to the customer's operation needs.

<Conditions>

1	The front door and the side door are closed.				
		For details, refer to DOOR INTERLOCK FUNCTION.			

- ② An automatic operation mode (memory, tape, MDI) is selected.
- (3) The tool is clamped.

 (The status indicator (tool clamp) is lit.)
- The NC and the machine are free of program error and machine error. (The status indicator (error) is not lit.)
- (5) If the spindle is rotating, the spindle speed arrived signal has been turned on.
- 6 Restart of spindle rotation is not valid when the automatic operation is temporarily suspended.
- (7) External start interlock signal (the signal which disables spindle rotation) is not input.
- 8 After the reading of M02 or M30, the front door and the side door were opened at least once.
- (9) The ATC main arm is at the home position.
- 10) The pot is moved up (MV series).
- (1) The ATC shutter is closed (MH series).
- (12) The sub-arm is at the home position (MH series).
- 13) The APC is at the home position (APC specification).
- (14) The pallet is clamped (APC specification).

6.2 Check Items when Executing Dry Run, Test Cutting, Measurement, and Mass Production

The items that must be carefully checked when checking the program, offset data, and possible interference by executing dry run operation and test cutting for starting mass production are indicated in the table below. Use this table when carrying out the work to ensure correct operation.



For the items to be checked, also refer to "Checkups before Starting Mass Production".

		Check Items	Check Column
	1	Is the door interlock function made valid?	
	2	Are the front door and the side door closed?	<u></u>
Dry Run	3	Is the single block function turned on?	
Operation	4	Are the feedrate and spindle speed appropriate for operation?	
	5	Are the feed modes (rapid traverse and cutting feed) used correctly?	
	6	Is the tool retraction direction after cutting correct?	
	7	Is tool movement smooth in the calculated area?	
	8	Are the tools free of interference with the workpiece and fixtures?	· · · · · · · · · · · · · · · · · · ·
	9	Can the machine be stopped immediately when necessary?	
	10	Are the completion of dry run mode operation, are switches on the operation panel (dry run, feed override, etc.) set to the proper positions?	
TEST	Check Items		Check Column
180 E. O	1	Is the door interlock function made valid?	
	2	Are the front door and the side door closed?	
Test Cutting	3	Is the single block function turned on?	
	4	Are cutting conditions (depth of cut, width of cut, feedrate, and spindle speed) set properly?	
	5	Are the order of machining and machining processes determined in accordance with the shape and material of the workpiece blank?	
	6	Are cutting tools selected properly?	
	7	Is the selection of fixture correct?	
	8	Is the workpiece clamping method correct?	
	9	Is the progress of cutting been observed?	
	10	Are coolant supply volume and direction correct?	
	11	Are the cutting tools free of interference with the workpiece and fixtures?	
	12	Are the dimensions measured after the rough cutting process?	
	13	Are the settings for feed override and rapid traverse override correct?	
	14	Can the machine stopped immediately when necessary?	

		Check Items	Check Column
11111111111	1	Is the measuring instrument functioning correctly?	7
\p\	2	Is the choice of measuring instrument correct?	
Measuring	3	Is the measuring order correct?	
Moasumg	4	Is the measuring method appropriate?	
y to the second	5	Is the area to be measured indicated clearly?	
	6	Is the area to be measured free of chips and coolant?	
	7	Are the dimensions measured after the rough cutting process?	
	8	Is the workpiece cool when the dimensions are measured?	
		Check Items	Check Column
	1	Is the door interlock function made valid?	
	2	Are the front door and the side door closed?	-
Mass Production	3	Are all NC functions such as single block functions used to check the program turned off?	
1 TOGGCUOTI	4	Is a target work time established on the basis of the machining time for one workpiece?	
	5	Is tool wear observed?	· ·
	6	Are the dimensions measured after the rough cutting process?	

6.3 Checkups before Starting Mass Production

This section lists the minimum items which must be checked before starting mass production. Always check these items in addition to the working environment before starting automatic operation.

Items to Check					
1) Check the interlock setting	Operation-panel-side front door interlock valid				
	Electrical cabinet door interlock valid				
	Operation selection key-switch (operation disable)				
2) Check the clamped conditions	Tool				
	Workpiece				
	Fixture				
3) Check the pressure	Air pressure proper				
	Hydraulic pressure proper				
4) Check the override switch settings	Rapid traverse rate override (100%)				
	Feedrate override (100%)				
	Spindle speed override (100%)				

	Items to C	Check	Check
5)	Check the functions	Single block invalid	
		Optional stop invalid	
		Dry run invalid	
		Machine lock invalid	
		Z-axis neglect invalid	
		Auxiliary function lock invalid	
6)	Check the status indicators	(machine ready) lit	
		x • , z • (zero return completion) lit	
		(tool clamp) lit	
•		(ATC home position) lit	
7)	Check the tool offset data Record the work shift data before ending	Tool geometry offset data	
	operation for the day. Check the data	Tool wear offset data	
	before starting mass production for the day.	Work shift data	
8)	Check the program	Program No.	
		Program contents	

6.4 Preparations for Checking a Program

After creating a program, it is necessary to check it for debugging (to find program errors, wrong tool offset data, interference, etc.).

This section describes the preparatory steps for checking a program.

Program check can be executed in the following methods:

- 1 To use the machine lock function. The program is checked without actually moving the axes.
- ② To use the Z-axis neglect function. The program is checked without moving the Z-axis.
- To use the dry run function. The program is checked by actually executing it but without a workpiece in the fixture or on the table.
- 4 To run the program without a cutting tool in the spindle. The program is checked by actually executing it, but without a cutting tool in the spindle.
- (5) To shift the coordinate system (Z-axis direction). The program is checked by actually executing it using the dry run function.

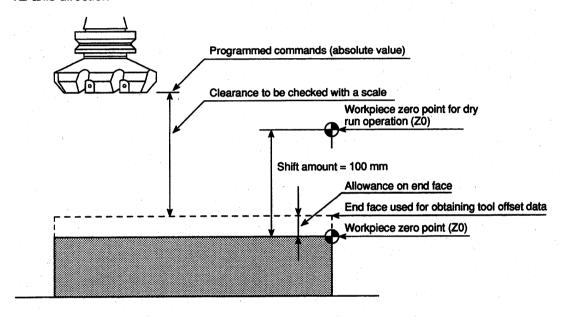
In this section, the procedure used to check the program by shifting the coordinate system and by using the dry run function is described.



There are variety of types of workpieces which are machined by the customer. Clamping methods will vary according to the workpiece type as well. Therefore, to check the program with a workpiece clamped, pay sufficient care for interference taking the workpiece shape and clamping method into consideration.

<Example>

To carry out dry run operation by shifting the work coordinate system 100 mm in the +Z-axis direction



The clearance between the tool nose and the end face used for obtaining the tool offset data is:

[Shift amount (100 mm)] + [Z-coordinate specified in the program] - [allowance on end face]



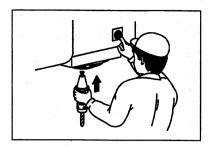
When shifting the coordinate system, determine proper shift amount taking into consideration the workpiece shape and conditions. When a blank workpiece is used for program check, for example, the cutting tool may be hit against the workpiece, the fixture, etc. if shift amount is insufficient.



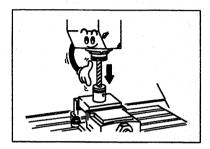
- Depending on workpiece shapes etc., there may be cases that dry run operation is executed after removing a workpiece or a cutting tool instead of entering the work coordinate system shift data.
- (2) When checking the program by shifting the coordinate system in the Z-axis direction, input the shift amount with a plus sign.
- 3 Correct the program after program check if necessary.

4 After finishing the program check, always reset the shift amount to its original value.

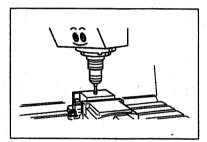
The procedure to check the program by shifting the coordinate system 100 mm in the Z-axis direction is explained below:



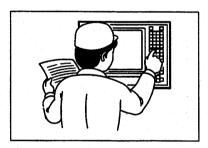
1) Mount the tools and the workpiece in the machine by moving the axes manually.



 Measure and input the tool length and tool diameter. Make sure that the offset direction and offset number are correct.



3) Align the workpiece.



4) Input the created program to the NC memory using the keyboard on the operation panel or the external I/O device.



When executing the program check, set ON the NC functions such as single block, dry run, optional stop, machine lock, and Z-axis neglect as necessary. For details of the NC functions, refer to page A - 20 (2.6).

- 5) Place the DOOR INTERLOCK key-switch in the NORMAL position.
- 6) Close the front door and the side door.
- 7) Carry out the zero return operation.

Page A – 76 (5.4.1)

8) Place the operation selection key-switch in the 🖫🗗 (operation enable) position.

WORK	COOR	DINATES	-	O0001	N00001
NO. 00 (EXT)	X Y Z	DATA 0.000 0.000	NO. 02 (G55)	X Y Z	DATA 0.000 0.000 0.000
01 (G54)	X Y Z	0.000 0.000 0.000	03 (G56)	X Y Z	0.000 0.000 0.000

9) Display the WORK COORDINATES screen.

Page A – 58 (4.3.3)

10) Move the cursor to "NO. 00(EXT)Z" using the cursor control keys.

	Press the following keys in order:
	1 0 0 0
	Make sure the sign for the entered value is correct.
* *	12) Press the [+INPUT] soft-key.
	If the [INPUT] soft-key is pressed, the value having been input with data entry keys is input for the work shift offset data (Z-axis). Therefore, make sure to press the [+INPUT] soft-key.
	13) Check the setting of switches on the operation panel or function.
	Make sure that the rapid override switch is set correctly.
	② Make sure that the feedrate override dial is set correctly.
	3 Make sure that the dry run switch is set correctly.
	Make sure that the machine lock function setting is set correctly.
	Make sure that the Z-axis neglect function is set correctly.
	14) Press the single block switch 📵 to make the single block function valid.
	15) Press the optional stop switch (3) to make the optional stop function valid.
	16) If there is an M08 (coolant ON) command in the program, press the coolant switch of 1 second or more to make the coolant OFF mode valid.
	17) Place the operation selection key-switch in the (operaion disable) position.
	18) Select the memory mode () with the mode selection switch.
PROGRAM CH	19) Display the PROGRAM CHECK screen.
O0001; N1; G90 G00 G54 X G43 Z30.0 H01 (ABSOLUTE) X 0.000 Y 0.000 Z 0.000	20) Press the [ABS] soft-key.
	Make sure that you can press the emergency stop button or the automatic operation switch [32] (feed hold) immediately if an abnormality occurs.
	21) Check the tool motion on the PROGRAM CHECK screen by pressing the automatic operation switches [crit] (cycle start) and [crit] (feed hold) alternately. Check the interference between the tool and the workpiece or the fixture.
	(1) While the dry run function is valid, programmed feedrates are ignored and the

axes move at the feedrate set by the feedrate override dial.

Because the machine lock function is valid, the axes do not move even if the

program is executed. Only the position data on the screen is updated.

11) Set the Z-axis shift amount of 100 mm.

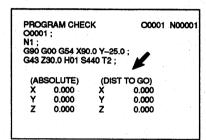


Because the Z-axis neglect function is valid, the Z-axis does not move even if the program is executed. Only the position data on the screen is updated.

The X- and Y-axes are moved as programmed.

- The program stops at each block as the single block function is valid.

 However, press the automatic operation switch [[(feed hold) if the X- or Z-axis starts moving.
- (5) If the coolant OFF mode is currently valid, coolant will not be supplied even if an M08 (coolant ON) command in the program is carried out.



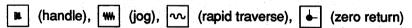
22) Check the clearance between the cutting tool and the chuck in comparison with the data for "DIST TO GO" which is displayed on the screen.

The cutting tool to chuck clearance should be checked through the window in the front door and the side door.



If the cutting tool will be hit against the chuck when the program is continuously executed, stop dry run operation and correct the program. Then, check the program again.

23) After the completion of the first axis movement block, select any of the following modes with the mode selection switch:



The spindle stops rotating when any of these modes is selected.

- 24) Press the [DOOR UNLOCK] switch to unlock the front door and the side door. Then open the front door and the side door.
- 25) Measure the distance between the tool and the workpiece. Also measure the distance between the fixture and the tool.



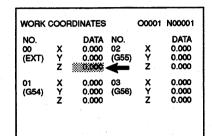
Measure the distance for all the tools to check for possible interference.



When checking possible interference by measuring the distance, never move an axis or change a tool manually. If it is necessary to move an axis or change a tool manually, return the axis and/or the tool to the previous state before restarting the dry run operation. If the dry run operation is restarted with a different tool set in the spindle or from a different position, a tool may be hit against the workpiece or the fixture, causing damage to the machine.

- 26) If the measured clearance is proper and there are no possibilities of interference, close the front door and the side door.
- 27) Select the memory mode () with the mode selection switch.
- 28) Press the automatic operation switch [(cycle start).
 - The spindle starts rotating at a speed selected before stopping the dry run operation.

- 29) Press the automatic operation switch [cycle start) again.
 - The dry run operation restarts.
- 30) If there are no problems found in dry run operation, reset the shift data to its original value after the completion of the dry run operation.



(1) Display the WORK COORDINATES screen.



- 2 Move the cursor to "NO. 00(EXT)Z" using the cursor control keys.
- (3) Press the following keys in order:





Make sure the sign for the entered value is correct.

- (4) Press the [+INPUT] soft-key.
 - If the [INPUT] soft-key is pressed, the value having been input with data entry keys is input for the work shift offset data (Z-axis). Therefore, make sure to press the [+INPUT] soft-key.

6.5 Test Cutting

When the cutting tool moves along the programmed tool path, there may be cases when the workpiece cannot be finished within the required accuracy due to cutting resistance, tool deflection, tool nose shape, and worn tool tip.

In this case, the programmed path should be shifted in parallel along the X-, Y-, and Z-axes to finish the workpiece within the specified tolerance.

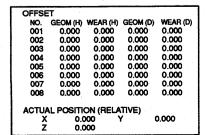


When machining the first workpiece in test cutting, pay sufficient care to ensure safety.

- 1) Place the DOOR INTERLOCK key-switch in the NORMAL position.
- 2) Close the front door and the side door.
- 3) Carry out the zero return operation.



4) Place the operation selection key-switch in the 🖫 🗗 (operation enable) position.



5) Display the OFFSET screen.

6) Move the cursor to the tool wear offset number of the tool to be used using the cursor control keys.

7) Input the tool wear offset amount.



Only when machining a workpiece for the first time, shift the tool path following the procedure below.

<Example>

To carry out test cutting by shifting the tool path 1 mm both in the Z-axis direction and the radial direction.

1 <MSC-516, MSD-516>

Move the cursor to WEAR (H or LENGTH) of the tool offset number of one of the tools to be used.

<MSC-518>

Move the cursor to the tool offset number of one of the tools to be used.

Shift the tool path 1 mm in the +Z direction.

Press the following keys in order:

ı	11	14.2		[+INPUT] soft-key
	•	•	٥	[+IIIPO I] SOIL-KEY

For the tools used for such as back boring which carries out cutting from the -Z direction, it is necessary to shift the tool path 1 mm in the -Z direction.

Press the following keys in order:

		1 - 1	[+INPUT] so	£
-	 1 7 1	 101	I TIMPLIE I SO	π-κρν
1		1 - 1	I THE OIL TOO	



When shifting the tool path 1 mm in the –Z direction for such as a back boring tool by changing the wear offset data, it is necessary to determine the offset data so that the tool will not be hit against the workpiece upper face in the approach movement.

- When the cutter radius offset function is used, for an end mill for example, follow the steps indicated below.
- (5) <MSC-516, MSD-516>

Move the cursor to WEAR (D or RADIUS) of the tool offset number of one of the tools to be used.

<MSC-518>

Move the cursor to the tool offset number of one of the tools to be used.

6 Shift the tool path 1 mm in the radial direction.

Press the following keys in order:



Do not input the shift data for the tools used for hole machining operation.



Repeat the steps 6) and 7) for all the tools used for cutting.

8) Select the memory mode () with the mode selection switch.
9) Display the PROGRAM CHECK screen.
PROGRAM CHECK
(ABSOLUTE) (DIST TO GO)
11) Press the single block switch to make the single block function valid.
12) Press the optional stop switch (3) to make the optional stop function valid.
13) Make the coolant OFF mode invalid.
Page A – 83 (5.7)
14) Set the rapid traverse rate override, spindle speed override, and feedrate override as needed.
Make sure that you can press the emergency stop button or the automatic operation switch with the switch sw
15) Place the operation selection key-switch in the (operation disable) position.
16) Press the automatic operation switch [12] (cycle start).
Proceed machining by observing vibration of the machine, cutting sound, chip discharge condition, and coolant supply condition.
17) When the program stops after executing the M01 (optional stop) command, press the [DOOR UNLOCK] switch to unlock the front door and the side door. Then open the front door and the side door. Then measure and record the dimension of the workpiece.
Before opening the front door and the side door, change the operation mode to manual with the mode selection switch.
The machine does not stop if an M01 command is not entered at the end of the program.
There may be cases that M01 is not entered in a program to shorten machinin time.
18) Close the front door and the side door.
19) Select the memory mode () with the mode selection switch.
20) Display the OFFSET screen.
Page A – 58 (4.3.1)
21) <msc-516, msd-516=""></msc-516,>

Move the cursor to WEAR (H or LENGTH) or WEAR (D or RADIUS) of the offset

number of the tool for which the dimension was measured.

<MSC-518>

Move the cursor to the offset number of the tool for which the dimension was measured.

- 22) Enter the difference between the measured dimension on step 17) and the dimension specified on the drawing.
 - (1) Key in difference of the measured dimension.
 - 2 Press the [+INPUT] soft-key.

<Example>

If the measured workpiece height is 51.05 mm although the program is written to machine it to 50 mm using offset number H01, follow the steps indicated below.

(1) <MSC-516, MSD-516>

Move the cursor to WEAR (H or LENGTH) of OFFSET NO. 001.

<MSC-518>

Move the cursor to offset number 001.

(2) Calculate the wear offset data.

Programmed height - measured height = offset data

$$50.0 - 51.05 = -1.05$$

Since the actual workpiece height is 1.05 mm larger than the programmed height, offset data should be set so that a workpiece is cut at a level 1.05 mm lower than the present level.

Press the following keys in order:

If the [INPUT] soft-key is pressed, the value having been input with data entry keys is input for the tool wear offset data. Therefore, make sure to press the [+INPUT] soft-key.

- (2) Make sure that the decimal point and the plus or minus sign are input correctly.
- 23) Display the PROGRAM CHECK screen.

Page A – 56 (4.2.5)

24) Execute the sequence number search in the memory mode to search the sequence number where the offset was made.

For a part program which uses the cutter radius offset, cancel the cutter radius offset data by the MDI operation. For details, refer to the PROGRAMMING MANUAL.

25) Press the automatic operation switch [(cycle start) to finish the workpiece.



If offset is made for a tapping process, threads may be distorted.

- 26) After finishing the workpiece, measure the workpiece dimensions again and input the tool wear offset data.
- 27) Repeat steps 16) to 26) until the program end command M30 is executed to measure the offset data of all tools.
- 28) Start automatic continuous operation after obtaining the tool offset data precisely for all the tools.

Before staring the automatic operation,

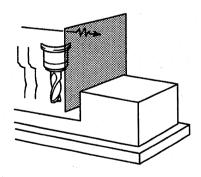
- 1) Turn off the single block function,
- (2) Turn off the optional stop function, and
- (3) Turn off the coolant OFF mode.



After starting the automatic operation, check the dimensions of several finished workpieces. The dimensions will slightly vary due to initial tool wear, cutting resistance, deflection of cutting tools, and other reasons.

7. SETTING THE INHIBITED TOOL ENTRY ZONE

To avoid interference of a cutting tool with the workpiece or fixture, set the inhibited tool entry zone using the optional G22 command (stored stroke limit function ON).



Inhibit the entry of a cutting tool into the zone defined using the stored stroke limit function.

If the cutting tool is going to be moved in the zone, the related alarm message is displayed on the screen and the axes stop moving.



If the axes are stopped due to an alarm, axis feed is possible only in the direction opposite to the direction the axis has been moved.



For details of the procedure to set the inhibited tool entry zone, refer to the PROGRAMMING MANUAL.

8. REMOVING CHIPS ENTANGLING CUTTING TOOL AND **WORKPIECE**

	e procedure to follow to remove chips entangling a cutting tool and a workpiece during chining is explained below.				
1)	Press the automatic operation switch [122] (feed hold) to suspend program execution at a position where chips will be removed from the workpiece easily.				
2)	Select any of the following modes with the mode selection switch:				
	(handle), (jog), (rapid traverse), (zero return)				
	The spindle stops rotating when any of these modes is selected.				
3)	Make sure that the DOOR INTERLOCK key-switch is placed in the NORMAL position.				
4)	Press the [DOOR UNLOCK] switch to unlock the door. Then open the door.				
5)	Remove chips from the workpiece using a proper hand tool.				
C/	Never touch chips or the cutting edges of tools with your bare hands since you may be injured.				
	2 Never move the axes or change the cutting tools manually. If it becomes necessary to do these manually, always return the axes or the tools to the previously located position before restarting the program.				
	If the program is restarted from a position, different from the previously located position, an interference will occur between the tool and the workpiece or between the tool and the fixture causing damage to the machine.				
6)	Close the front door and the side door.				
7)	Select the memory mode () with the mode selection switch.				
8)	Press the automatic operation switch [(cycle start).				
	The spindle restarts rotating at the speed it was rotating before stopped.				
9)	Press the automatic operation switch [1] (cycle start) again.				
	The program is restarted.				

9. CAUTIONS ON USE OF U-AXIS TOOL (U-AXIS SPECIFICATION)

This section describes the basic items to be attended to for using U-axis tools.



For the machine with the U-axis control function, tools are positioned using the tapered portion and securely torqued down by the spindle drive motor rotation. Therefore, tool mounting/removing operation and ATC cycle operation are different from the operation used for models without featuring the U-axis control.



For details of the U-axis operation, refer to the OPERATION MANUAL (SUPPLEMENT) "U-AXIS OPERATION".

9.1 MV Series (U-axis Specification)

- When U-axis tool is selected, the maximum spindle speed is clamped at 1500 min-1.
 For other tools, the spindle can be rotated up to the maximum speed specified in the machine specifications.
- When registering U-axis tools, the tool numbers are restricted to the numbers indicated below.

Tool	U-axis tool (large diameter)	Large diameter	Medium diameter	Small diameter
Tool Numbers	9000 to 9099	9100 to 9999	1000 to 8999	0001 to 0999



Medium diameter U-axis tools can be registered to tool numbers 8900 to 8999 by changing the setting for parameter K6.3. For details, contact Mori Seiki.

3 U-axis control is possible only when a U-axis tool is mounted in the spindle. However, after turning on the power, U-axis movement in the zero point direction is allowed with an ordinary tool only within a very short distance.

<Axis movement command>

G00 G91 G28 U0;

4 Tool clamped state is determined by tool clamping torque. Accordingly, if the tool clamp command is executed while there is no tool mounted in the spindle, tool clamp will not be completed. For this reason, do not specify the following commands.

<Forbidden commands>

	М33; 7	Tool return command → C	ompletion signal is n	ot returne
or				
	T0; M06;	Tool change command (without a new tool)	→ An alarm is gene	erated.

(5) The U-axis drive mechanism such as the U-axis holder slide and the connection between a tool and the machine has backlash.

Therefore, positioning of the U-axis must be made only in one direction to ensure high accuracy machining.

6 For mounting/removing a cutting tool, do so at the magazine pot by using the special tool.

When fitting a cutting tool to the arm of the special tool, find the key-way (2 key-ways) in the tool which is aligned with the notch (3 notches) in the flange, then insert the tool into the arm of the special tool while aligning the found key-way with the groove in the arm grip.

7 The following M codes are used for the U-axis specification models.

M Code	Command
M44	Sensor DOWN
M45	Sensor UP

9.2 MH Series (U-axis Specification)

- When U-axis tool is selected, the maximum spindle speed is clamped at 1500 min-1.
 For other tools, the spindle can be rotated up to the maximum speed specified in the machine specifications.
- ② U-axis control is possible only when a U-axis tool is mounted in the spindle. However, after turning on the power, U-axis movement in the zero point direction is allowed with an ordinary tool only within a very short distance.

<Axis movement command>

G00 G91 G28 U0;

3 The No. 1 pot is used specially for a spindle protection tool.

If the M33 command (tool return command) is executed while a tool is set in the spindle, the tool in the spindle is returned to the magazine and the spindle protection tool is mounted to the spindle.

Therefore, never set a tool other than the spindle protection tool in the No. 1 pot.

Tool clamped state is determined by tool clamping torque. Accordingly, if the tool clamp command is executed while there is no tool mounted in the spindle, tool clamp will not be completed. For this reason, do not clamp a tool manually or do not specify the following commands.

<Forbidden commands>

(5) The U-axis drive mechanism such as the U-axis holder slide and the connection between a tool and the machine has backlash.

Therefore, positioning of the U-axis must be made only in one direction to ensure high accuracy machining.

INDEX (TITLES)

		Page
A		-
	Actual Position (ABSOLUTE) Screen	A - 52
	Actual Position (RELATIVE) Screen	
	Actual Position (Total Position Data) Screen	
	Alarm Detail Screen	
	Alarm History Screen	A - 60
	Alarm Message Screen	A - 60
	Arrangement and Names of Switches and Keys on Machine	
	Operation Panel	
	Arrangement of Power Supply Switches	
	Automatic Operation Switches	
	Automatic Power Shut-off Function and APC	
	Automatic Power Shutoff Switch	
	Auxiliary Function Lock	A – 26
	Axis Feed Amount Selection Switches	A – 36
	Axis Feed Switches	
	Axis Movement Operation	A – 75
	Axis Selection Switches	A – 35
В		
	Background Editing	B-2
	Block Delete Switch	
C		
Ĭ	CAUTIONS ON USE OF U-AXIS TOOL (U-AXIS SPECIFICATION)	C - 45
	Check Items before Turning on the Power	
	Check Items when Executing Dry Run, Test Cutting, Measurement,	
	and Mass Production	C-32
	Check Items When Measuring and Inputting Tool Offset Values	C - 23
	Check Items When Mounting Tools	C-6
	Checking and Setting the Spindle Speed	A - 81
	Checkups before Starting Mass Production	C-33
	Chip Conveyor (Chip Conveyor Specification)	A – 85
	Chip Conveyor Switches (Chip Conveyor Specification)	A – 38
	CNC Internal State Display Screen	A-61

	Condition for Starting Automatic Operation	C-31
	Conditions for Starting the Spindle Rotation	A - 80
	Conversational Programming Basic Menu Screen	
	(Conversational Programming Specification)	
	Coolant Supply	
	Coolant Switches	A - 37
	CRT	A – 44
	Cursor Control Keys	A – 47
	Custom Key	A - 62
D		
_	Data Entry Keys	Δ _ 48
	Displaying the Next Block Data	
	Displaying the Present Block Data	
	DOOR INTERLOCK FUNCTION CONTROLS AND THE FUNCTIONS	
	DOOR LOCK AND UNLOCK	
	Door Unlock Switch, DOOR LOCK AND UNLOCK	
	Door Unlock Switch, MACHINE OPERATION PANEL	
	Dry Run Switch	
E		
-	Floatwicel Cohinet Deer Interlegis Kov. Switch DOOD INTERLOOK	
	Electrical Cabinet Door Interlock Key-Switch [DOOR INTERLOCK]	
	Emergency Stop	
	Emergency Stop Button, Emergency Stop	
	Emergency Stop Button, Functions of Power Supply Switches	
	Emergency Stop Button, Magazine Operation Panel	
	Execution of APC Cycle by M02/M30	
	Execution of APC Cycle by M60/M61	C – 15
F		
	F1-Digit Feed Switch (Option)	A – 25
	Feed Hold Switch	A – 73
	Feedrate Override Dial	A - 34
	FOREGROUND AND BACKGROUND	B - 1
	Foreground Editing	B-1
	Function Selection Keys	A - 50
	FUNCTION SELECTION KEYS AND DISPLAY SCREENS	A – 51
	FUNCTION SELECTION KEYS AND DISPLAY SCREENS	

G			
	GENERAL (DOOR INTERLOCK FUNCTION)	P-1	
	Graphic Key (MSD-516)	A - 59	
Н			
	Handle Interruption Screen (Option)	A – 53	,
	Handle Interruption Switch (Option)		
	Handle Switches		
	Help Key		
ı	WINDLESTING AND CUTTOUTTING A DECORAN LIGHT		
	INPUTTING AND OUTPUTTING A PROGRAM USING EXTERNAL I/O DEVICE	B – 14	
	Inputting/Outputting a Program		
	INTERLOCK FUNCTIONS THAT ENSURE SAFE OPERATION		
	INTERLOOK FONCTIONS THAT ENGOTIE OAI E OF ENVIRON		
K			
	Key Input Buffer Area	A – 48	,
M			
	Machine Light Switch		
	Machine Lock		
	MACHINE OPERATION PANEL		
	Macro Variable Setting Screen (Option)		
	Magazine Indexing Operation		
	Magazine Indexing Switches		
	Magazine Mode Selection Switch		
	Magazine Operation Panel (Excluding MV-40M)		
	Magazine Start Switch (MV-40M)		
	Magazine Tool Unclamp Footswitch (MH Series)		
	Main Switch		
	Manual APC Operation Screen		
	Manual ATC Operation Screen		
	Manual Axis Feed Operation		
	Manual Lubrication Pushbutton		
	MANUAL OPERATION		
	Manual Pulse Generator		
	MANUALS SUPPLIED WITH THE MACHINE		
	MULIMODE UDERSTION Screen	~ - J	

	MEASURING AND SETTING THE TOOL OFFSET DATA	C - 23
	Measuring the Tool Length Offset Data	C - 23
	Measuring the Tool Length Offset Data	
	(When the Setup Function is not Used.)	C - 24
	Measuring the Tool Length Offset Data	
	(When the Setup Function is Used.)	
	Memory Used Size Screen	
	Message Key	
	MH Series (U-axis Specification)	C - 46
	MH-50, 63 (Arrangement and Names of Switches and Keys	
	on Machine Operation Panel)	A – 10
	Mode Selection Switches	
	Mounting a Tool in the Spindle	C-10
	Mounting and Removing a Workpiece (at Setup Station)	C - 13
	MOUNTING AND REMOVING TOOLS	C-6
	Mounting Tools in the Magazine	C-6
	MV Series (U-axis Specification)	C -45
	MV-40M, 45, 55 (Arrangement and Names of Switches and Keys	A 0
	on Machine Operation Panel)	A – 8
	MV-65 (Arrangement and Names of Switches and Keys on Machine Operation Panel)	A-9
N		
	Names of Switches, Keys and Buttons	A – 11
	NC Power ON/OFF Switches [1 / O]	
	NC UNIT	
0		
J		
	Offset/Setting Key	
	Operating Monitor Screen	
	Operation Method Screen	
	Operation Panel Screen	
	Operation Selection Key-Switch	
	Operator Message Screen	A - 60
	Optional Stop Switch	A - 22
	Other Keys	A – 49
P		
	Page Selection Keys	A - 47
	Pallet Setup Operation	
		• • •

	Parameter Setting Screen	A - 61
	Parameter Table Screen	A - 66
	Pitch Error Setting Screen	A - 61
	PMC Screen	
	Position Key	
	PRECAUTIONS ON USING THE DOOR INTERLOCK FUNCTION	P-9
	Preparation, INPUTTING AND OUTPUTTING A PROGRAM USING	
	EXTERNAL I/O DEVICE	
	PREPARATION BEFORE STARTING MASS PRODUCTION	
	Preparations for Checking a Program	
	Program Check Screen	
	Program Edit Keys	
	Program Edit Screen	
	PROGRAM EDITING	
	Program Head Search	
	Program Key	
	Program Number Search	B-5
	Program Restart Screen (Option for MV-40M, Standard for Other Models)	A – 57
	Program Restart Switch (Option for MV-40M, Standard for Other Models)	A – 24
	Program Screen	
	Programming for APC	C-14
R		
	Rapid Traverse Rate Override Switches	A – 34
	Releasing the Hard-Overtravel Alarm	
	Releasing the Soft-Overtravel Alarm	
	REMOVING CHIPS ENTANGLING CUTTING TOOL	
	AND WORKPIECE	C - 42
	Removing Tools from the Magazine	
	Removing the Tool from the Spindle	
	Reset Key	
	RS232C Interface Connector	A-7
S		
	SEARCH FUNCTION	B-5
•	2nd O.T. Release Button	
	Sensor Contact Indicator (Option)	

	Sensoring Macro Setting Screen	A - 65
	Sequence Number Search	B-6
	Setting a Program Number	C-14
	Setting (Handy) Screen	A – 58
	SETTING THE INHIBITED TOOL ENTRY ZONE	C - 41
	Setting the Parameter Required in Work Coordinate System and	
	Tool Length Measurement	C-16
	Setting the Tool Length Offset and Cutter Radius Offset Data	C - 27
	SETTING THE WORK COORDINATE SYSTEM	C-16
	Setting the Work Coordinate Systems Using the Setup Function	C-17
	SETTING UP FOR APC OPERATION (MH SERIES)	C - 13
	Setup Button (APC Specification)	A - 39
	Setup Screen	A - 63
	Single Block Switch	
	Soft-Keys	A – 45
	Spindle Gear Neutral Switch (Transmission Specification)	A - 33
	Spindle Jog Operation	
	Spindle Load Meter	
	Spindle Operation	
	Spindle Override Meter	A - 33
	Spindle Speed Setting Switches	
	Spindle Switches	
	Starting and Stopping the Spindle Rotation	
•	Status Indicators	
	STORING A PROGRAM TO NC MEMORY	
	SWITCHES FOR POWER SUPPLY	A-3
	System Configuration Screen	
	System Key	A - 60
T		
	Test Cutting	C - 39
	Tool Clamp/Unclamp Switches	
	Tool Length Measurement Switch	
	Tool Life Management Data Screen (Option)	
	Tool Offset Data Setting Screen	
	TOOL REGISTRATION	
	Tool registration Screen	
	Turning off the Power	

	Turning on Machine Light	A – 83
	Turning on the Power	
	Turning on the Power	
U		
	U-axis Tool offset Data Setting Screen	A – 65
	USING THE DOOR INTERLOCK FUNCTION	P – 10
W		
	Word Search	B-7
	Work Coordinates Data Setting Screen	
	Work Number Screen	A – 64
Z		
	Z-Axis Neglect	A – 25

INDEX (KEYS AND SWITCHES)

		Page
A		
	ATC home position (Status indicator)	A - 29
	Alteration Key 🚯	A – 48
	Arrangement of Power Supply Switches	A-3
	Automatic Operation Switches	A – 19
	Automatic operation switch [(cycle start)	A - 20
	Automatic operation switch [52] (feed hold)	A – 20
	Automatic Power Shutoff Switch	
	Auxiliary Function Lock	A – 26
	Axis Feed Amount Selection Switches	A – 36
	Axis Feed Switches	A - 33
	Axis Selection Switches	A - 35
В		
	B-axis clamp B# (Status indicator)	A - 29
	Backward (Chip conveyor switch)	A - 39
	Block Delete Switch	A – 22
C		
	Cancel Key //	A _ 49
	Chip Conveyor Switches (Chip Conveyor Specification)	
	Chip conveyor switch (backward)	
	Chip conveyor switch (forward)	
	Chip conveyor switch (stop)	
	Chip removal (Coolant switch)	
	Coolant Switches	
	Coolant switch of (Chip removal)	
	Coolant switch on (off)	
	Coolant switch (on)	
	Cursor Control Keys	

		Page
	Cycle start	A - 20
D		
	[DOOR INTERLOCK] Electrical Cabinet Door Interlock Key-Switch	A-4
	Data Entry Keys	A – 48
	Deletion Key 🔊	A – 48
	DOOR INTERLOCK key-switch (DOOR INTERLOCK FUNCTION)	P-7
	DOOR INTERLOCK RELEASE button (DOOR INTERLOCK FUNCTION)	
	Door Unlock Switch (DOOR INTERLOCK FUNCTION)	
	Door Unlock Switch (MACHINE OPERATION PANEL)	
	Dry Run Switch	A – 23
Ε		
	Edit 😰 (Mode selection switch)	A – 17
	Electronic buzzer (DOOR INTERLOCK FUNCTION)	P-8
	Electrical Cabinet Door Interlock Key-Switch [DOOR INTERLOCK]	
	Emergency Stop Button (Functions of Power Supply Switches)	A-6
	Emergency Stop Button (Magazine Operation Panel	
	Emergency Stop Button (Magazine Operation Panel (Excluding MV-40M))	A – 41
	Error [?] (Status indicator)	A – 28
F		
	F1-Digit Feed Switch (Option)	
,	Feed hold [22] (Automatic operation switch)	
	Feedrate Override Dial	
	Forward (Chip conveyor switch)	
	4-axis clamp (Status indicator)	
	Function Selection Keys	
	FUNCTION SELECTION KEYS AND DISPLAY SCREENS	
	Function Switches	A – 20
G		
	Graphic Key (MSD-516)	A - 59
Н		
	Handle (Mode selection switch)	A – 19
	Handle Interruption Switch (Option)	
	Handle Switches	
	Help Key 🔲	

		Page
	[INTERLOCK RELEASED] Status indicator (DOOR INTERLOCK FUNCTION)	P - 7
	Input Key ♦	
	Insertion Key 💠	
J		
	Jog (Mode selection switch)	A 40
	Jog [] (Spindle switch)	
	Jog [jest] (Spindle switch)	A - 32
M		
	M00/M01 (Status indicator)	
	M02/M30 (Status indicator)	
	Machine Light Switch	
	Machine Lock	
	Machine ready O (Status indicator)	
	Magazine Mode Selection Switch	
	Magazine Start Switch (MV-40M)	
	Magazine Tool Unclamp Footswitch (MH Series)	
	Main Switch	
	Manual Lubrication Pushbutton	
	Manual Pulse Generator	A – 36
	MDI (Mode selection switch)	A – 18
	Memory (Mode selection switch)	A – 18
	Message Key	A – 59
	Mode Selection Switches	A – 17
	Mode selection switch (edit)	A-17
	Mode selection switch (handle)	A – 19
	Mode selection switch (jog)	A – 19
	Mode selection switch (MDI)	A - 18
	Mode selection switch ③ (memory)	A – 18
	Mode selection switch	
	Mode selection switch (tape)	
	Mode selection switch	A – 19
N	하는 경험 보고됐는 같은 이 속 됐다. 그리는 그리는 그 그 그 그 그 그 그 그 그 그 그 그 그 그 그 그	
	[1 / O] NC Power ON/OFF Switches	A-6

		Page
	Normal rotation (Spindle switch)	A - 31
0		
	Off Coolant switch)	A - 37
	Offset/Setting Key	A – 58
	On Coolant switch)	
	Operation Selection Key-Switch	
	Optional Stop Switch	
	Other Keys	
P		
۲	Page Selection Keys	Δ _//7
	Position Key 🖭	
	Program Edit Keys	
	Program Key	A _ 5/
	Program Restart Switch (Option for MV-40M, Standard Other Models)	
_	Program Restart Switch (Option for MV-40M, Standard Other Models)	7-24
R		
	Rapid traverse (Mode selection switch)	
	Rapid Traverse Rate Override Switches	
	Reset Key //	
	Reverse rotation (Spindle switch)	
	RS232C Interface Connector	A – 7
S		
	2nd O.T. Release Button	A-7
	Sensor Contact Indicator (Option)	A – 36
	Setup Button (APC Specification)	A – 39
	Shift Key 1	A – 49
	Single Block Switch	
	Soft-Keys	
	Spindle Gear Neutral Switch (Transmission Specification)	
	Spindle Load Meter	
	Spindle orientation [
	Spindle Override Meter	A – 33
	Spindle Speed Setting Switches	A – 32
	Spindle Switches	
	Spindle switch (jog)	
	Spindle switch ((normal rotation)	. A – 31

		Page
	Spindle switch (reverse rotation)	A-31
	Spindle switch (stop)	A – 32
	Status Indicators	A – 27
	Status indicator (ATC home position)	A - 29
	Status indicator B# (B-axis clamp)	A – 29
	Status indicator (error)	A – 28
	Status indicator 4 (4-axis clamp)	A – 29
	Status indicator (M00/M01)	A – 28
	Status indicator (M02/M30)	A – 28
	Status indicator O (machine ready)	A – 28
	Status indicator	A – 29
	Status indicator T (tool clamp)	A – 28
	Status indicator (zero return completion)	A – 29
	Stop (Chip conveyor switch)	A - 39
	Stop	A - 32
	System Key 🖸	A - 60
T		
	Tape (Mode selection switch)	A – 18
	Tool clamp T (Status indicator)	
	Tool Clamp/Unclamp Switches	
	Tool Length Measurement Switch	
٧		
	Volume adjusting knob (DOOR INTERLOCK FUNCTION)	P-8
W		
	WARNING label (DOOR INTERLOCK FUNCTION)	D_Ω
Z	The deficiency of the first state of the first stat	г-0
~	7 Avia Naglact	
	Z-Axis Neglect	
	Zero return completion (Status indicator)	
	Cotatus indicator)	A – 29
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To improve this manual, we invite you to make comments on any insufficient description or errors in this manual. We want to know how you think we can make this manual better. Please restrict your comments to those concerning this manual only.

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