CNC SYSTEMS

OSP-U100M
OSP-U10M

OPERATION MANUAL

(1st Edition)

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OKUMA

SAFETY PRECAUTIONS

The machine is equipped with safety devices which serve to protect personnel and the machine itself from hazards arising from unforeseen accidents. However, operators must not rely exclusively on these safety devices: they must also become fully familiar with the safety guidelines presented below to ensure accident-free operation.

This instruction manual and the warning signs attached to the machine cover only those hazards which Okuma can predict. Be aware that they do not cover all possible hazards.

1. Precautions Relating to Machine Installation

(1) Install the machine at a site where the following conditions (the conditions for achievement of the guaranteed accuracy) apply.

- Ambient temperature: 17 to 25°C
- Ambient humidity: 40% to 75% at 20°C (no condensation)
- Site not subject to direct sunlight or excessive vibration; environment as free of dust, acid, corrosive gases, and salt spray as possible.

(2) Prepare a primary power supply that complies with the following requirements.

- Voltage: 200 V
- Voltage fluctuation: ±10% max.
- Power supply frequency: 50/60 Hz
- Do not draw the primary power supply from a distribution panel that also supplies a major noise source (for example an electric welder or electric discharge machine) since this could cause malfunction of the CNC unit.
- If possible connect the machine to a ground not used by any other equipment. If there is no choice but to use a common ground, the other equipment must not generate a large amount of noise (such as an electric welder or electric discharge machine).

(3) Installation Environment

Observe the following points when installing the control enclosure.

- Make sure that the CNC unit will not be subject to direct sunlight.
- Make sure that the control enclosure will not be splashed with chips, water, or oil.
- Make sure that the control enclosure and operation panel are not subject to excessive vibrations or shock.
- The permissible ambient temperature range for the control enclosure is 0 to 40°C.
- The permissible ambient humidity range for the control enclosure is 30 to 95% (no condensation).
- The maximum altitude at which the control enclosure can be used is 1000 m (3281 ft.).

2. Points to Check before Turning on the Power

(1) Close all the doors of the control enclosure and operation panel to prevent the entry of water, chips, and dust.

(2) Make absolutely sure that there is nobody near the moving parts of the machine, and that there are no obstacles around the machine, before starting machine operation.

(3) When turning on the power, turn on the main power disconnect switch first, then the CONTROL ON switch on the operation panel.

3. Precautions Relating to Operation

(1) After turning on the power, carry out inspection and adjustment in accordance with the daily inspection procedure described in this instruction manual.

(2) Use tools whose dimensions and type are appropriate for the work undertaken and the machine specifications. Do not use badly worn tools since they can cause accidents.

(3) Do not for any reason touch the spindle or tool while spindle indexing is in progress since the spindle could rotate: this is dangerous.

(4) Check that the workpiece and tool are properly secured.

(5) Never touch a workpiece or tool while it is rotating: this is extremely dangerous.

(6) Do not remove chips by hand while machining is in progress since this is dangerous. Always stop the machine first, then remove the chips with a brush or broom.

(7) Do not operate the machine with any of the safety devices removed. Do not operate the machine with any of the covers removed unless it is necessary to do so.

(8) Always stop the machine before mounting or removing a tool.

(9) Do not approach or touch any moving part of the machine while it is operating.

(10) Do not touch any switch or button with wet hands. This is extremely dangerous.

(11) Before using any switch or button on the operation panel, check that it is the one intended.

4. Precautions Relating to the ATC

(1) The tool clamps of the magazine, spindle, etc., are designed for reliability, but it is possible that a tool could be released and fall in the event of an unforeseen accident, exposing you to danger: do not touch or approach the ATC mechanism during ATC operation.

(2) Always inspect and change tools in the magazine in the manual magazine interrupt mode.

(3) Remove chips adhering to the magazine at appropriate intervals since they can cause misoperation.

Do not use compressed air to remove these chips since it will only push the chips further in.

(4) If the ATC stops during operation for some reason and it has to be inspected without turning the power off, do not touch the ATC since it may start moving suddenly.

5. On Finishing Work

(1) On finishing work, clean the vicinity of the machine.

(2) Return the ATC, APC and other equipment to the predetermined retraction position.

(3) Always turn off the power to the machine before leaving it.

(4) To turn off the power, turn off the CONTROL ON switch on the operation panel first, then the main power disconnect switch.

6. Precautions during Maintenance Inspection and When Trouble Occurs

In order to prevent unforeseen accidents, damage to the machine, etc., it is essential to observe the following points when performing maintenance inspections or during checking when trouble has occurred.

(1) When trouble occurs, press the emergency stop button on the operation panel to stop the machine.

(2) Consult the person responsible for maintenance to determine what corrective measures need to be taken.

(3) If two or more persons must work together, establish signals so that they can communicate to confirm safety before proceeding to each new step.

(4) Use only the specified replacement parts and fuses.

(5) Always turn the power off before starting inspection or changing parts.

(6) When parts are removed during inspection or repair work, always replace them as they were and secure them properly with their screws, etc.

(7) When carrying out inspections in which measuring instruments are used – for example voltage checks – make sure the instrument is properly calibrated.

(8) Do not keep combustible materials or metals inside the control enclosure or terminal box.

(9) Check that cables and wires are free of damage: damaged cables and wires will cause current leakage and electric shocks.

(10) Maintenance inside the Control Enclosure

a) Switch the main power disconnect switch OFF before opening the control enclosure door.

b) Even when the main power disconnect switch is OFF, there may some residual charge in the servo amplifier and spindle drive unit, and for this reason only service personnel are permitted to perform any work on these units. Even then, they must observe the following precautions.

- Servo amplifier

  Discharge the residual voltage one minute after turning off the breaker inside the unit.

- Spindle drive unit

  Discharge the residual voltage one minute after turning off the main power disconnect switch.

c) The control enclosure contains the NC unit, and the NC unit has a printed circuit board whose memory stores the machining programs, parameters, etc. In order to ensure that the contents of this memory will be retained even when the power is switched off, the memory is supplied with power by a battery. Depending on how the printed circuit boards are handled, the contents of the memory may be destroyed and for this reason only service personnel should handle these boards.

(11) Periodic Inspection of the Control Enclosure

a) Cleaning the cooling unit

The cooling unit in the door of the control enclosure serves to prevent excessive temperature rise inside the control enclosure and increase the reliability of the NC unit. Inspect the following points every three months.

- Is the fan motor inside the cooling unit working?

  The motor is normal if there is a strong draft from the unit.

- Is the external air inlet blocked?

  If it is blocked, clean it with compressed air.

7. General Precautions

(1) Keep the vicinity of the machine clean and tidy.

(2) Wear appropriate clothing while working, and follow the instructions of someone with sufficient training.

(3) Make sure that your clothes and hair cannot become entangled in the machine. Machine operators must wear safety equipment such as safety shoes and safety goggles.

(4) Machine operators must read the instruction manual carefully and make sure of the correct procedure before operating the machine.

(5) Memorize the position of the emergency stop button so that you can press it immediately at any time and from any position.

(6) Do not access the inside of the control panel, transformer, motor, etc., since they contain high-voltage terminals and other components which are extremely dangerous.

(7) If two or more persons must work together, establish signals so that they can communicate to confirm safety before proceeding to each new step.

8. Symbols Used in This Manual

The following warning indications are used in this manual to draw attention to information of particular importance. Read the instructions marked with these symbols carefully and follow them.

⚠DANGER : Indicates an imminent hazard which, if not avoided, will result in death or serious injury.

⚠WARNING : Indicates hazards which, if not avoided, could result in death or serious injury.

⚠CAUTION : Indicates hazards which, if not avoided, could result in minor injuries or damage to devices or equipment.

NOTICE : Indicates precautions relating to operation or use.

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I. SPECIFICATIONS

SECTION 1 FOREWORD

Before reading this manual, please read this Foreword which describes the features of the NC, configuration of the manual and the items to be attended to for reading the manual.

[FEATURES OF NC]

(1) Multiple Main CPU System Permits CNC Growth

This NC adopts the multi-main CPU system in which up to 7 engines (main CPU's) can be installed.

(a) High level functions and high cost performance NC which can cope with ever advancing machine tools for faster speed and higher accuracy.

(b) The ever-growing CNC which can cope with any machine model and specifications by the configuration of the main CPU's.

(c) A built-in PLC is used for machine control.

(2) Reliable and Compact Package

By the innovation in hardware – adoption of UCMB (universal compact main board), I/O link, and servo link, high reliability is realized in compact package.

One of the technological philosophy of OSP, "variable software", is realized by the flash memory. After the installation at the user's production field, the OSP can be upgraded meeting user's new requirements.

(3) NC Operation Panel

For the NC operation panel, the following three types of panels are available.

- 14-inch color CRT operation panel
- Compact and thin monochrome display operation panel
- Compact and thin color display operation panel

Depending on the NC specifications, some types of operation panel are not selectable.

(4) Machining Management Function (MacMan)

The powerful management function comes with the NC to allow the effective use of the NC functions. The main objective of the management function is to yield profits in small lot production with wide variety of workpiece kinds and also in variable lot production with variable kinds of workpieces.

(a) Reduction of setup time

- As the production style changes to small lot production, machining data must be changed more frequently. To cope with this time consuming and error-prone work, Okuma makes quick set up change possible by introducing the same operation procedure independent of floppy disk format and file name selection from directory.
- Information such as job instruction which is needed in set up change work can be displayed on the NC unit screen.

(b) Grasping the real production state

Machining state and machine operating status can be displayed on the NC unit screen real time.

(c) Reduction of troubleshooting time

The information necessary for troubleshooting can be output accurately and quickly in the usable form. Here, the usable form means the print out or file output to the floppy disk.

For more details of this management function, refer to "MacMan INSTRUCTION MANUAL".

(5) Help Function

At the occurrence of an alarm, details of the alarm are displayed on the screen by pressing the help key.

The help key is also used to display the history of alarms when it is pressed while there are no alarms occurring. It is also possible to display the details of the specified alarm number.

[CONTENTS OF THE MANUAL]

The manual consists of the following chapters.

I SPECIFICATIONS

This Chapter describes the table of specifications and the operation flow block diagrams of OSP.

II OPERATION

This Chapter gives explanation on the following items.

Functions of NC operation panel, machine information display, machine operation methods in manual, MDI, and automatic modes, and other operation functions

III DATA OPERATION

This Chapter gives explanation on the following items.

Program operation method, setting methods of zero offset data and tool offset data, data input/output method, and file editing method

IV PARAMETER

This Chapter describes the contents and setting procedure of the parameters used by the NC.

V APPENDIX

This Chapter gives external views showing the arrangement of switches and indicating lamps of NC operation panels.

1. OSP Specifications

(1) Basic Functions

● : Standard
○ : Optional
× : Selection impossible

Item	Description		OSP U10M	OSP U100M
Number of controlled axes	Controlled axes (machine) X-, Y-, and Z-axis (simultaneous 3 axes)	Max. number of simultaneously controllable axes	4 axes	6 axes
		Max. number of controllable axes	6 axes	24 axes
Position encoder	OSP absolute position encoder (no reference zero return required) OSP absolute position encoder (no reference zero return required)		●	●
Minimum input increment	Metric system: 1 μm Inch system: 0.0001 in.		●	●
Maximum input increment	±99999.999 mm (8-digit decimal number)		●	●
Input unit setting	0.001 mm, 0.01 mm, 1 mm		●	●
Feed function	Direct F code command	Feedrate range: Specified in the machine specification table Override: 0 to 200% Dwell: 0.01 to 99999.99 sec	●	●
	F1-digit feed	4 sets, 8 sets, parameter type	○	○
	Feedrate unit: Mixed use of "mm/rev" and "mm/min" is possible.		●	●
Display function (13 languages (English, German, French, Chinese, etc.) and the required language can be selected from these.)	14-inch color CRT operation panel		×	●
	Compact and thin monochrome display operation panel		●	●
	Compact and thin color display operation panel		○	○
Help function	Displays the alarm information (description, history).		●	●

(2) Operation Functions

● : Standard
○ : Optional
× : Selection impossible

Item	Description	OSP U10M	OSP U100M
Program selection	Selects one of the stored programs.	●	●
Schedule program	Scheduled sequential running of stored multiple programs	●	●
	Automatic schedule program update function	○	○
Sequence number search	Starts machining from the specified sequence number.	●	●
Sequence stop	Allows a program to stop at the specified sequence number.	○	○
Mid block sequence restart	Allows sequence restart from a command in a block is possible.	○	○
Mid-auto manual mode & auto restart	Allows manual operation intervention during automatic operation. After the completion of manual operation, restart of automatic operation is possible from the operation interrupted position.	●	●
Multi task processing	Creation/editing of a program and interactive programming operation are possible during machining.	●	●
Program operation	Permits program editing by a screen editor, verify during tape read, and list output.	●	●
Manual operation	Axis feed: Rapid traverse (10 steps), Manual cutting feed (256 steps) Pulse handle (1 pc.)	●	●
Switch operation	Dry run, Z-axis command cancel, Machine lock, Block skip, Optional stop, Single block, Override (spindle, feed axis)	●	●

(3) Programming Functions

● : Standard
○ : Optional
× : Selection impossible

Item	Description	OSP U10M	OSP U100M
Program format	Automatic ISO/EIA code recognition N5, G3, X+53, Y+53, Z+53, F+53, S4, T3, M3	●	●
Basic interpolation	Positioning, Linear interpolation, Circular interpolation	●	●
3-dimensional circular interpolation	3-dimensional circular interpolation is possible.	×	○
Helical cutting	Large-diameter thread cutting using an angular cutter is possible.	○	○
Synchronized tapping	High-speed and high-accuracy tapping is possible by synchronizing spindle rotation angular position and feed axis position.	○	○
Cylinder side-face machining function	Programming for machining the side face of a cylindrical workpiece is simplified.	○	○
Slanted-face machining function	Programming for machining on the slanted face of a workpiece is simplified.	×	○
Work coordinate system selection Standard: 20 pairs	Selection of a work coordinate system is possible by a program command.	●	●
	Addition of offset compensation data pairs - 200 pairs - 300 pairs	○	○
Tool compensation function Standard: 100 pairs	Tool length offset: 100 pairs Cutter radius compensation: 100 pairs Max. offset amount: ±99999.999 mm	●	●
	Addition of offset compensation data pairs - 200 pairs - 300 pairs	○	○
3-dimensional tool offset	Direction of offset is specified by I, J, and K	○	○
Attachment compensation function	- Extension attachment pcs. - Universal attachment pcs. - Angular attachment pcs. Angle deg.	×	○
Graphic conversion	Programmable mirror image: G62	○	○
	Enlarge/contraction: G50, G51	○	○
On-line automatic programming MAP	Coordinate calculation function: Line at angle, Arc, Grid, Double-grid, Square, Bolt hole circle, Omit, Restart Area machining: Facemill, Pocket mill, Round mill	○	○
	Coordinate conversion: Allows the shift, rotation, and copy of a coordinate system.	○	○
inch/mm setting unit selection	Allows the selection of inch system or mm system for programming by the setting for a parameter.	○	○
Automatic any-angle chamfering	Allows chamfering (C, R) in required angle by a simple program.	○	○

Item	Description	OSP U10M	OSP U100M
Fixed cycle	G73, G74, G76, G81 to G87, G89: 11 kinds Upper limit return, Specified point return, R-point return	●	●
User task 1	Use of GOTO and IF statements and arithmetic operations is possible. Use of subprogram function, common variables, local variables, and system variables, (and variables related to machine operation) is possible.	●	●
	Common variable: 1000 variables (standard: 200)	○	○
User task 2			
Function operation function	Subprogram function, function operation function, and logical operation function can be used.	○	○
Input/output variable function	Input/output control of I/O is possible using a program. (16 points)	○	○
Programmable message function	Allows a message to be displayed on the screen by specifying it in a part program.	○	○
Program branch function	Allows part program branching to be turned on and off by the corresponding switch.	○	○
Programmable stroke limit	Allows stroke limit setting to be changed by G22 and G23.	○	○
Axis name designation function	Allows an axis name to be changed by a G code.	○	○
Skip function	G31 (program skip is controlled by the input of a sensor signal.)	○	○

(4) Interactive Programming Function (automatic programming function for machining center)

● : Standard
○ : Optional
× : Selection impossible

Item	Description	OSP U10M	OSP U100M
IGF-M			
Standard	Allows an operator to make a program easily by inputting the data according to the guide messages displayed on the screen. No special NC language is used.	○	○
5-face machining	Programming for 5-face machining is simplified.	×	○
I-MAP	Part program can be edited by following guide drawings. With the graphic calculation function	○	○

(5) Program Capacity

● : Standard
○ : Optional
× : Selection impossible

*: Selection not possible for OSP-U10

Item	Description	OSP U10M	OSP U100M
Program storage capacity	- 320 m - 640 m - 1280 m - 2560 m* - 5120 m* - 10240 m*	Standard: 160 m	Standard: 320 m
Operation buffer capacity	- 320 m - 640 m - 1280 m	Standard: 160 m	Standard: 320 m

(6) Gauging Function

Item	Description	OSP U10M	OSP U100M
Automatic gauging function	Checks the workpiece dimensions and offsets the zero point automatically.	○	○
Automatic tool length offset/Automatic tool breakage detection function	Executes tool length offset and tool breakage detection automatically for tools such as drills, taps, reamers, and boring bars.	○	○
Manual gauging	Simplifies zero-point setting and tool length offset by displaying the operation guide on the screen.	○	○
Interactive gauging	Simplifies zero-point setting and tool length offset by pressing a button according to the operation guide displayed on the screen.	○	○
Gauging data printout	Outputs the gauging data to a printer (connected to RS232C IF).	○	○

(7) Machining Management Function (MacMan)

● : Standard
○ : Optional
× : Selection impossible

Item	Description	OSP U10M	OSP U100M
Collection and display of machining management information			
Machining report	Collects and displays the operation progress state for the selected main programs.	●	●
Operation report	Collects and displays the machine operating state (power on time, cutting time, etc.) of the machine.		
Operation history	Collects and displays the machine operation state in time chart in intervals of 10 minutes.		
Trouble information	Collects and displays the status of CNC and operation history at the occurrence of an alarm.		
Output of machining management information	Outputs the machining management information (machining report, operation report, operation history, and trouble information) to floppy disk or printer. For OSP-U10, floppy disk input/output function must be selected separately.	●	●
Network function * Detailed technical consultation is necessary.	Allows input/output of the machining management information (machining report, operation report, operation history, and trouble information) through the network (DNC-P1/P2/P3/T1/T2/T3). The DNC connection function must be selected separately.	○	○

(8) Monitoring Function

● : Standard
○ : Optional
× : Selection impossible

Item	Description	OSP U10M	OSP U100M
Animated simulation with cycle time calculation function	Provides the means to check a program using animated simulation so that an operator can start actual production without worry. The function simulates the program quickly and calculates the estimated cycle time.	○	○
Simple load monitor function	The CNC monitors the spindle load.	○	○
Tool life management	Counts the number of machine workpieces or cutting time and changes the tool to a spare tool if the count data reaches the preset life value.	○	○
MOP-TOOL	Executes overload monitor and adaptive control (built-in type).	×	○
NC operation monitor	Timers counting the cutting time, run time, spindle rotating time, and external input time, and four work counters are provided. It is possible to generate an alarm when the count value reaches the preset value.	○	○
Operation end buzzer	Sounds a buzzer at the execution of M02, M00 or M01 to indicate the end of operation.	○	○
Work counter installation	It is possible to select cycle stop, cycle start disable for the processing at the full-count of a work counter.	○	○
NC operation meter installation	Calculates the length of time of power ON, spindle rotating, CNC running, etc.	○	○
Synchronized tapping torque monitoring function	Monitors spindle load torque during synchronized tapping.	○	○
Operation end lamp (yellow)	Lights at the execution of M02, M00, or M01 to indicate the end of operation.	○	○
Alarm lamp (red)	Lights at the occurrence of an alarm to indicate that a trouble has occurred with the machine.	○	○
Status indicating lamp (3 tiers)	The lamp consists of three lamps – operation end lamp, alarm lamp, and machining running lamp.	○	○

(9) External Input/Output and Communication Function

● : Standard
○ : Optional
× : Selection impossible

Item	Description	OSP U10M	OSP U100M
Reader/Punch interface	Serial interface (RS232C), 1 channel	●	●
	Addition of RS232C interface, addition of __ channels	○	○
Built-in floppy disk drive (3.5")	Allows data exchange between OSP format FD data and MS-DOS format FD data. Format: 2DD/2HD/2HC	○	●
DNC connection * Detailed technical consultation is necessary.	- DNC-A	○	○
	- DNC-B	○	○
	- DNC-C1 - DNC-C2 - DNC-C3	×	○
	- DNC-P1 - DNC-P2 - DNC-P3	○	○
	- DNC-T1 - DNC-T2 - DNC-T3	○	○
	- DNC-DT	×	○

(10) Automation and Unmanned Operation Function

Item	Description	OSP U10M	OSP U100M
Spindle orientation	The spindle is indexed to the predetermined angular position by an M command. (multi-point indexing using an RS command is possible)	○	○
External program selection	A: Pushbutton method B: Rotary switch method (8 steps) C: External input method (BCD 4-digit)	○	○
Automatic power shutoff function	The function shuts off the power automatically when the machine stops by the execution of M02 or due to the occurrence of an alarm.	○	○
Warm-up function	The function automatically turns on the power at the preset time and starts warm-up operation.	○	○
Cycle time reduction function * Detailed technical consultation is necessary.	Proceeds program execution without waiting for answer signals; called by an M command.	○	○

(11) High-speed, High-accuracy Function

● : Standard
○ : Optional
× : Selection impossible

*: Selection not possible for OSP-U10

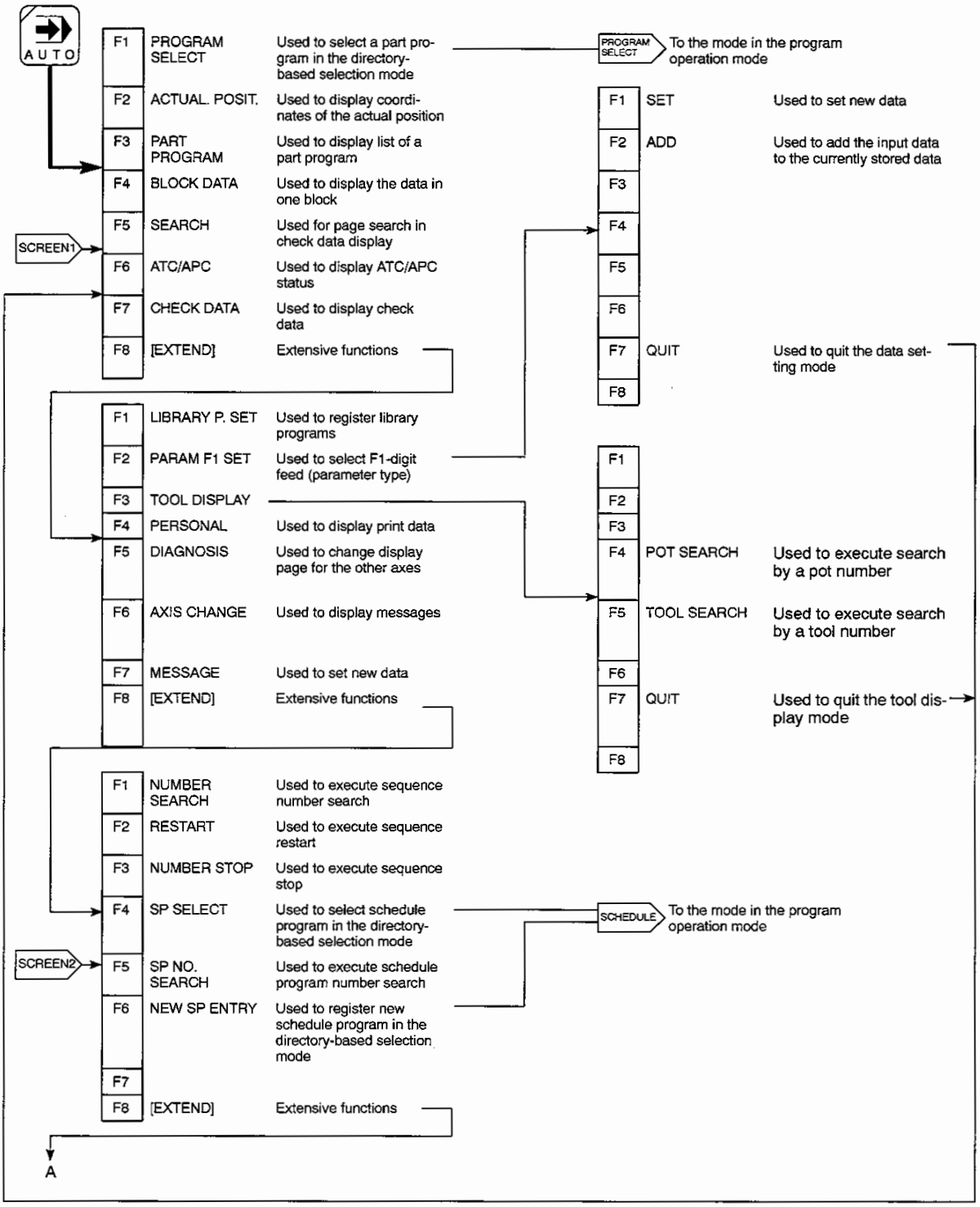
Item	Description	OSP U10M	OSP U100M
Super Hi-NC	Adaptive velocity control for NURBS curve.	×	○
NURBS command	Allows the use of NURBS commands in a part program.	○	○
Hi^2-NC	FF tolerance control	×	○
Absolute scale detection	- X-axis - Y-axis - Z-axis - W-axis	○	○
Inductosyn scale detection	- A-axis - B-axis - C-axis	○	○

(12) Others

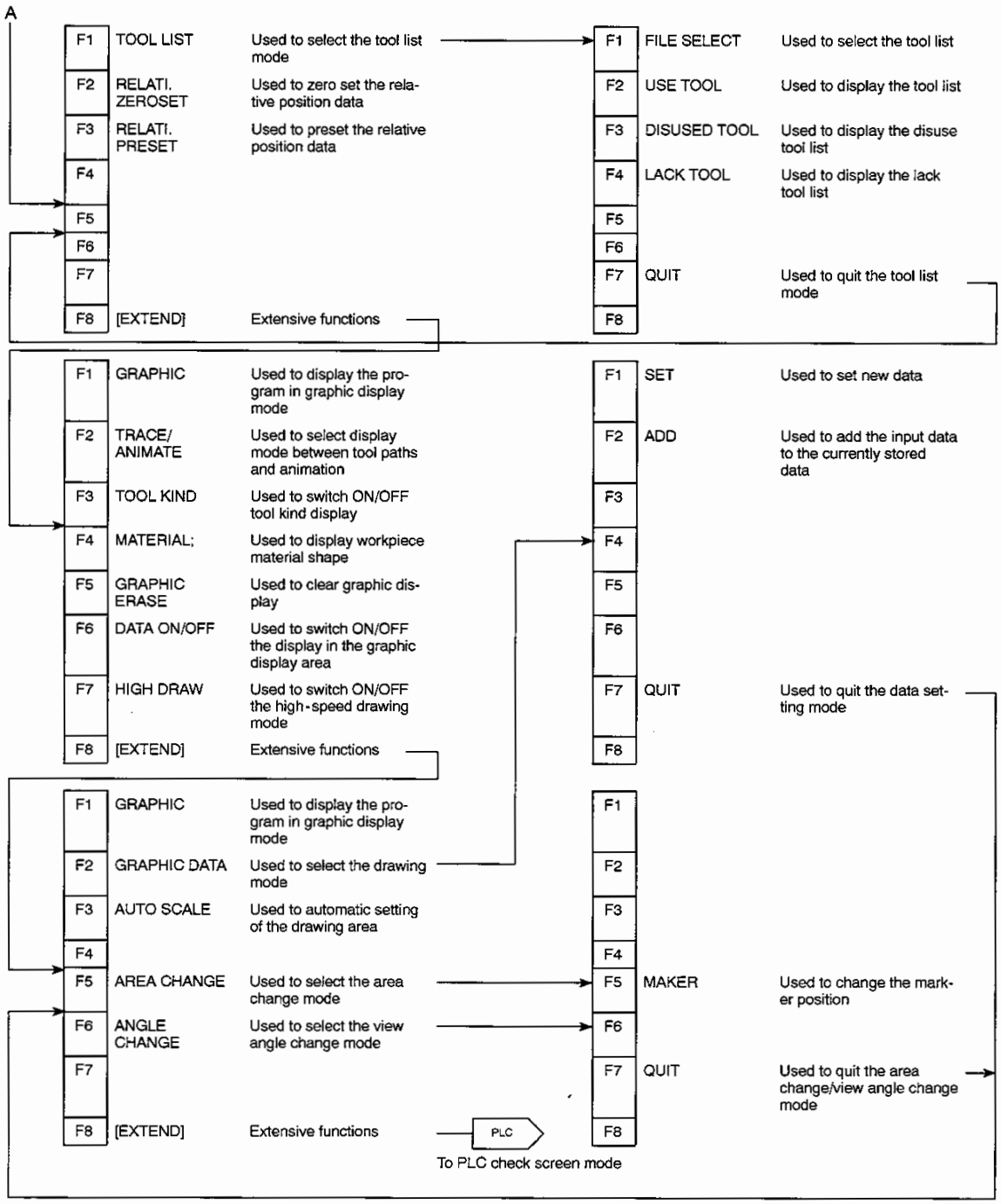
Item	Description	OSP U10M	OSP U100M
External M signal	- 4-position index table (includes emergency stop) - 4 sets - 8 sets	○	○
Addition of pulse handles	Number of added pulse handles: 1 pcs. (2 pcs. in total), 2 pcs. (3 pcs. in total) Pulse handle installation position: Saddle, Pendant	○	○
Additional axis	- A-axis - B-axis - C-axis - U-axis - W-axis Rotary table installation: - Specification for rotary table installation - Rotary table installation Rotary table manufacturer	○	○
Ground-fault power shut off function	Prevents accidents caused by ground-fault using the earth leakage breaker.	○	○
Control cabinet lighting	Installs a lamp in the control cabinet.	○	○

2. Operation Transfer Chart

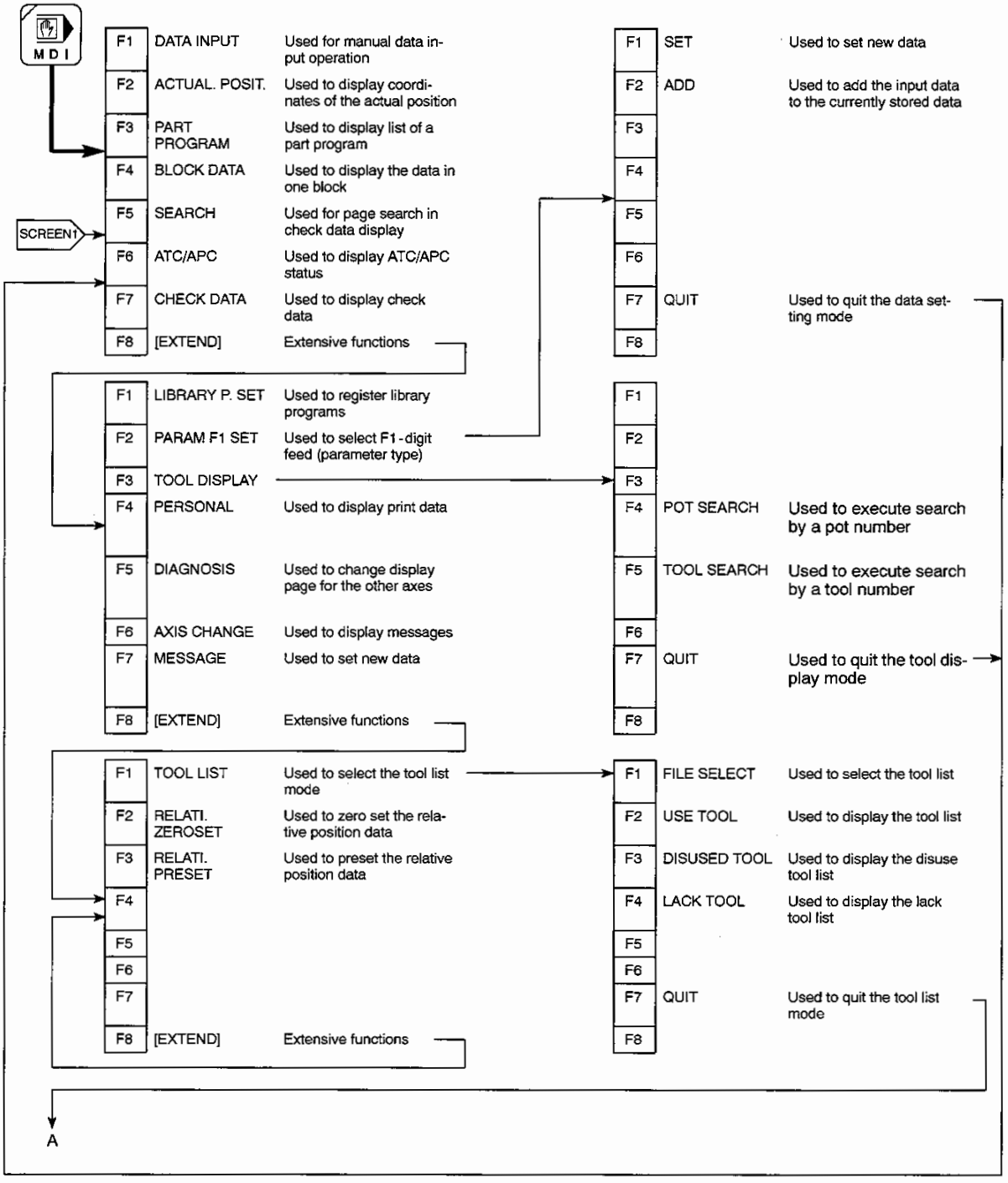
(1) Automatic Operation Mode (1/2)



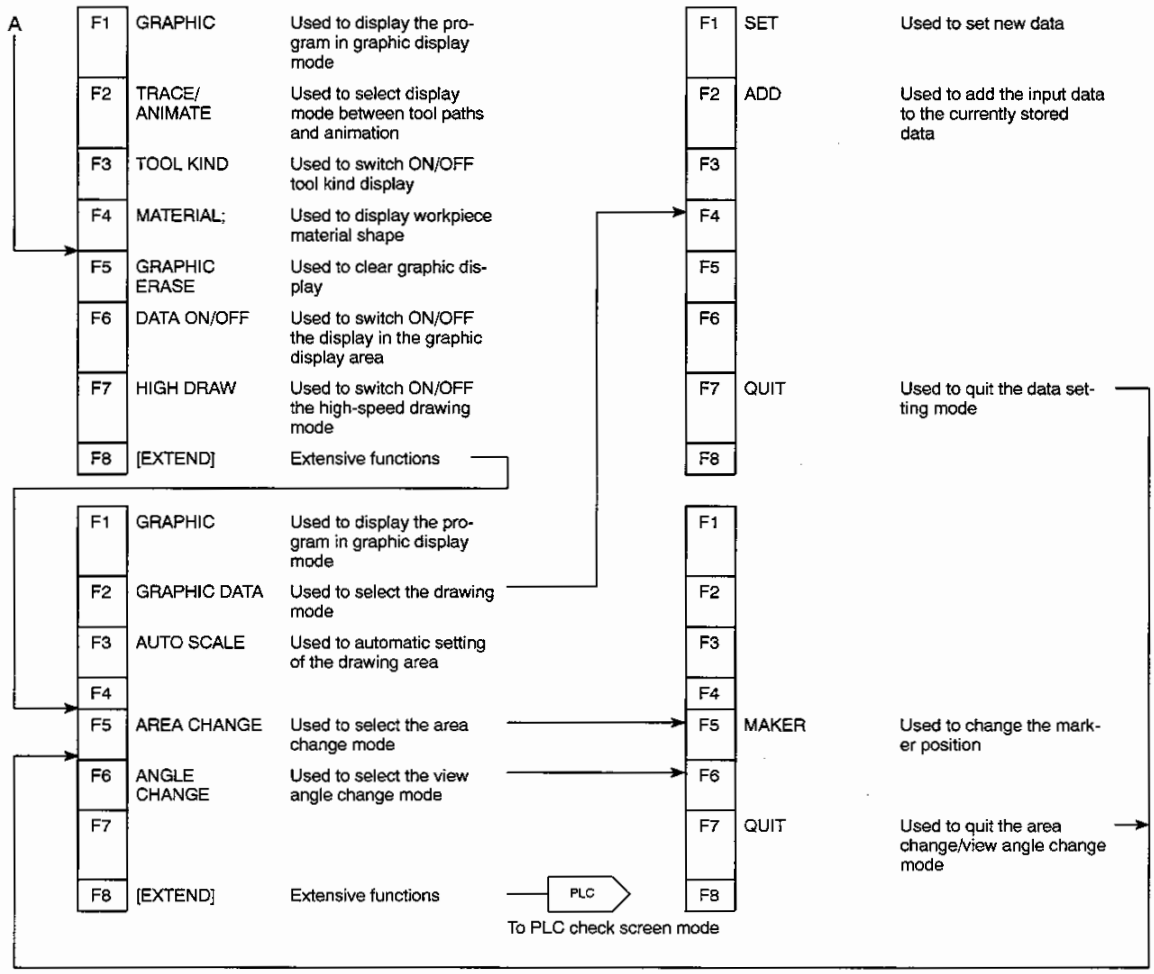
Automatic Operation Mode (2/2)



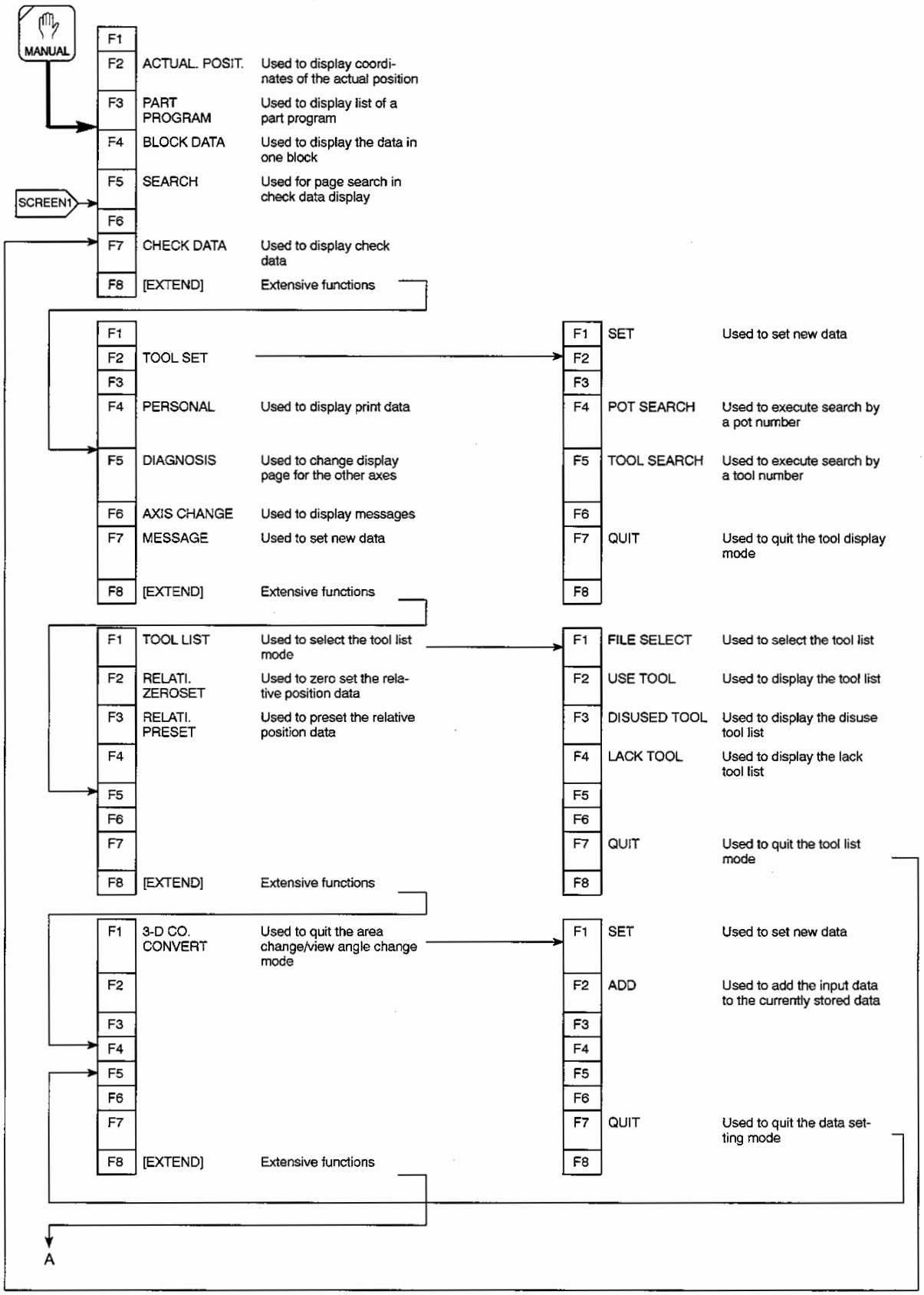
(2) MDI Operation Mode (1/2)



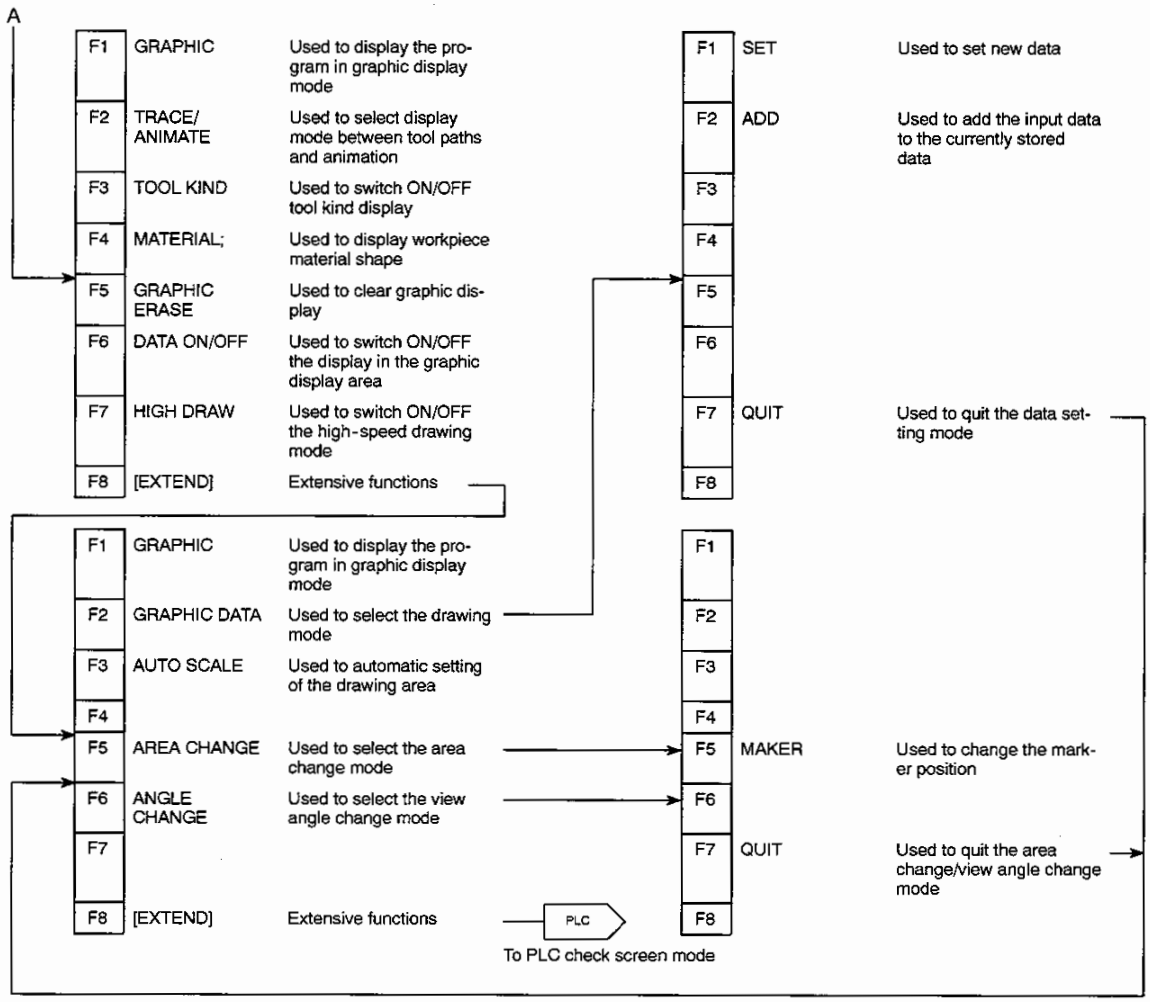
MDI Operation Mode (2/2)



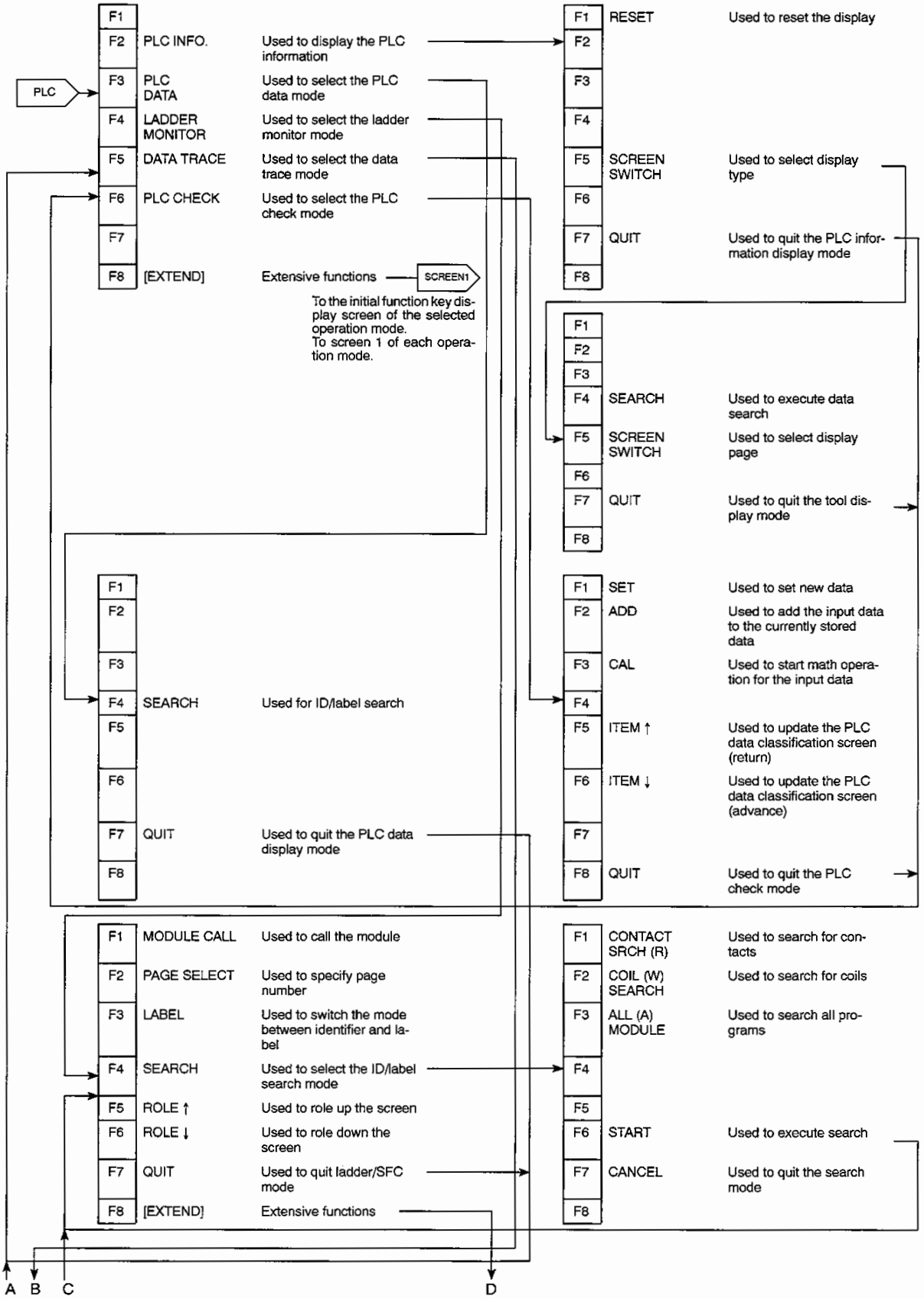
(3) Manual Operation Mode (1/2)



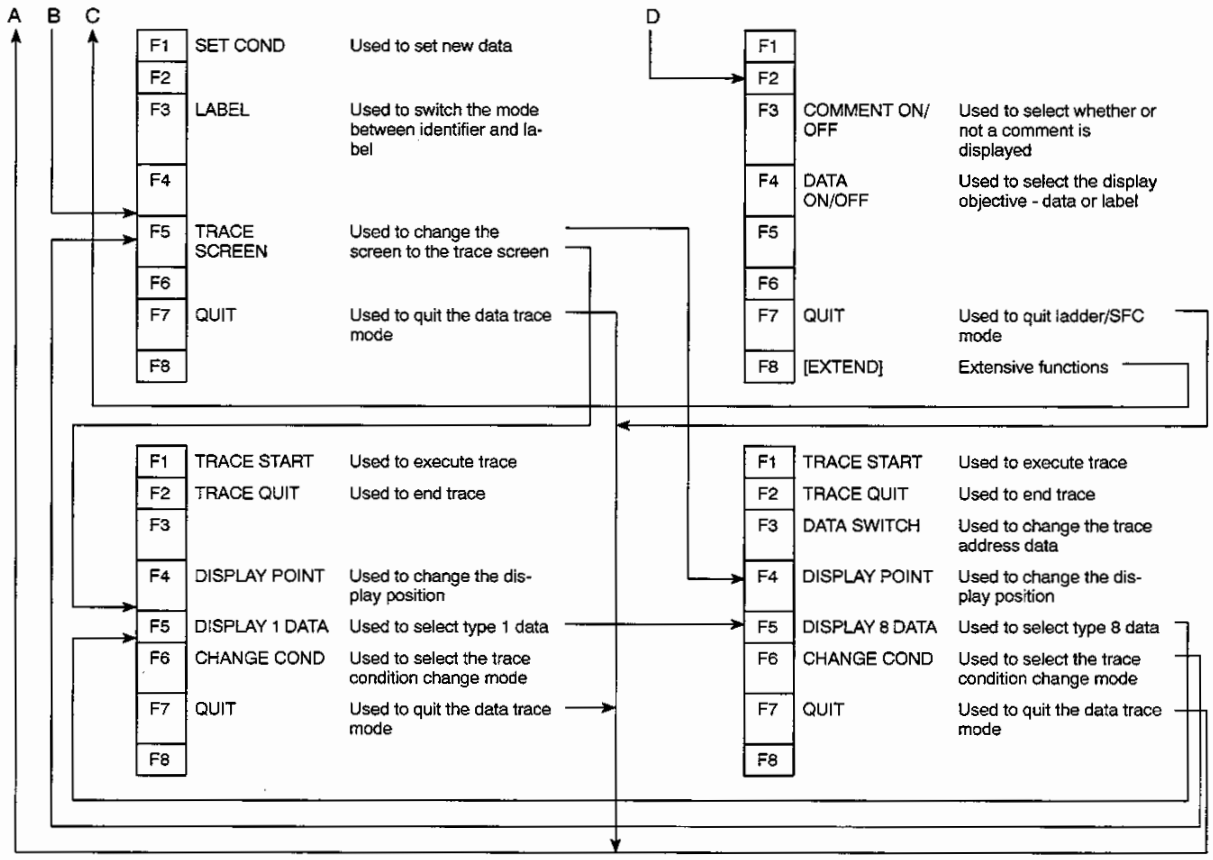
Manual Operation Mode (2/2)



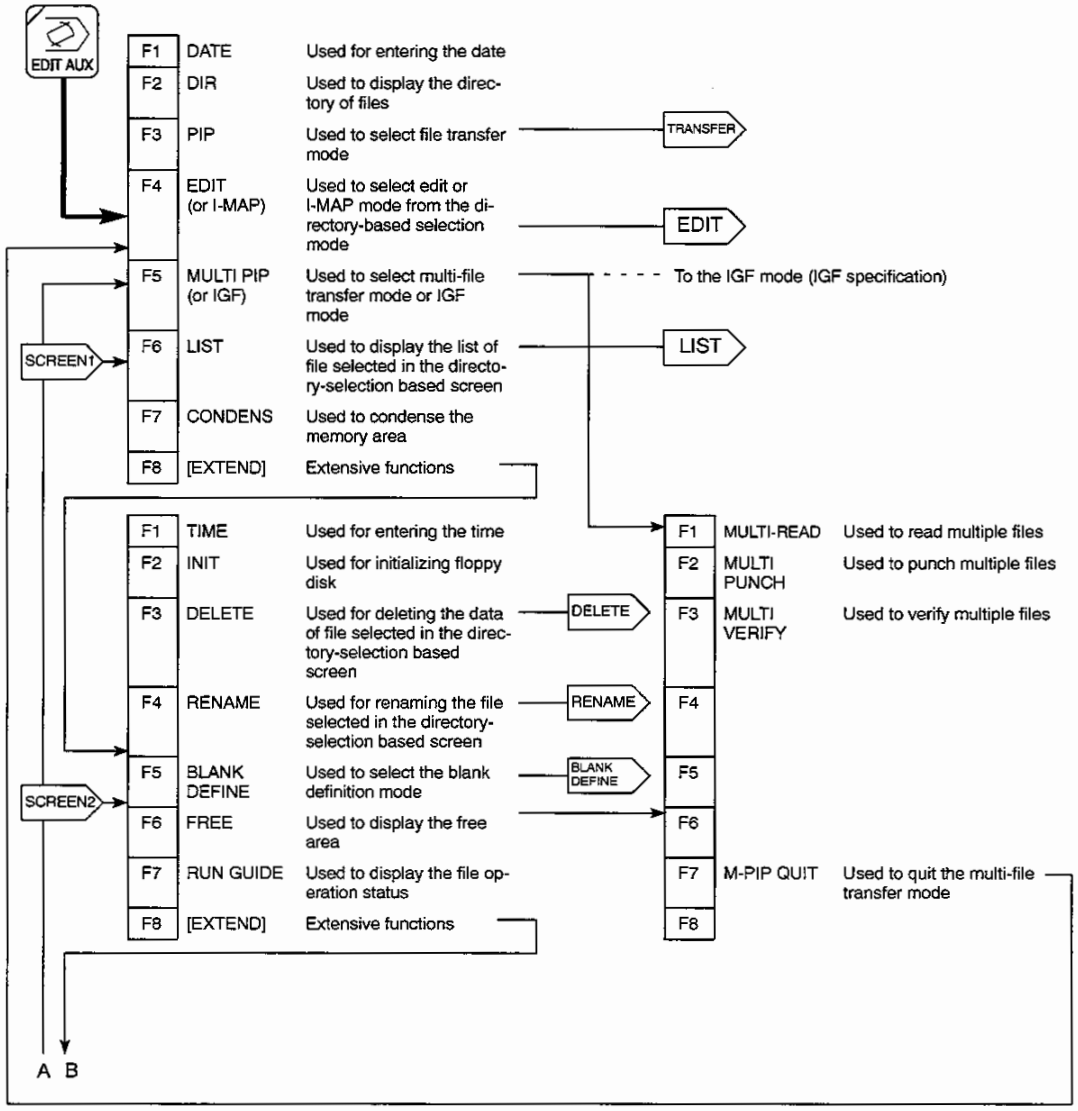
(4) PLC Check Screen Mode (1/2) - From AUTO/MDI/MANUAL Mode



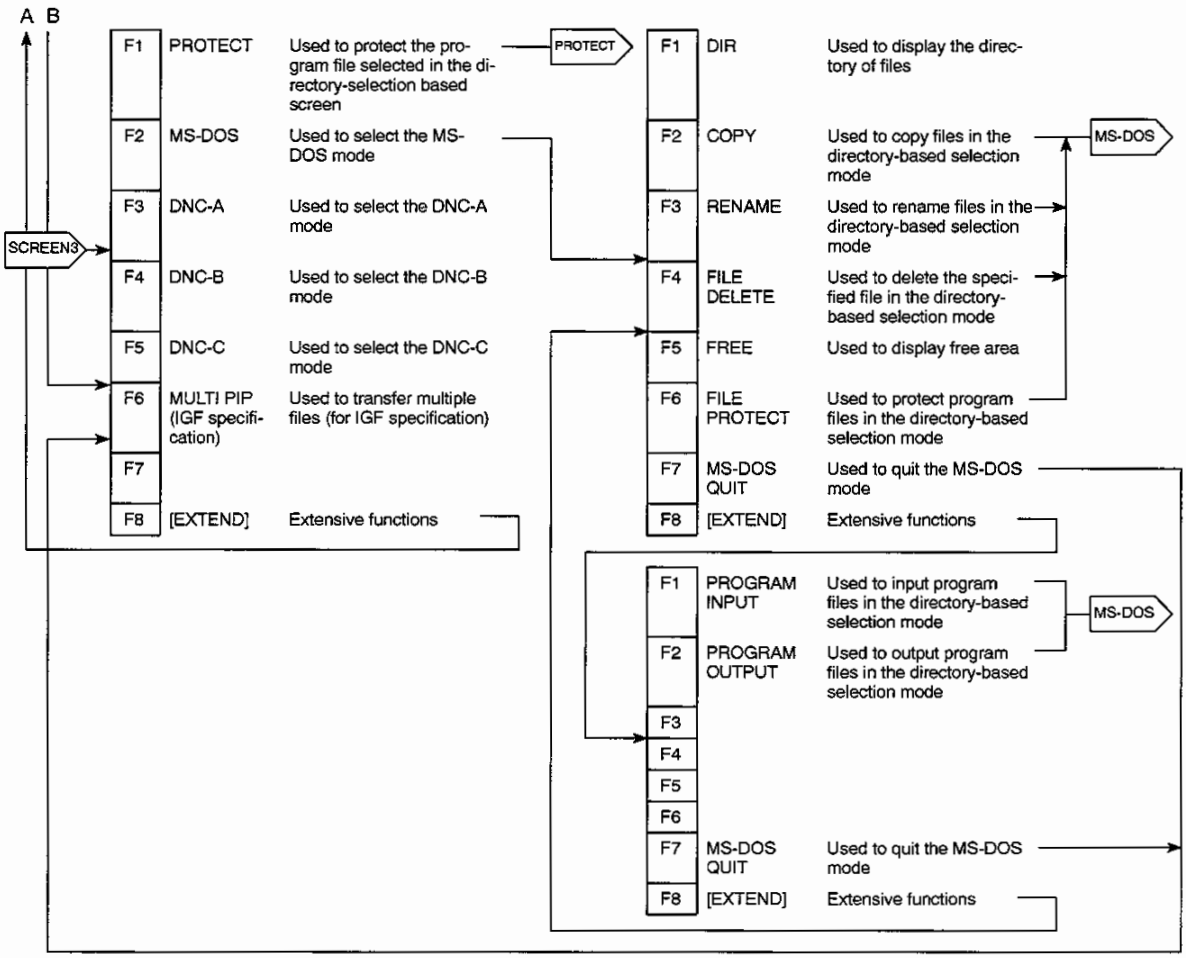
PLC Check Screen Mode (2/2) - From AUTO/MDI/MANUAL Mode



(5) Program Operation Mode (1/6)

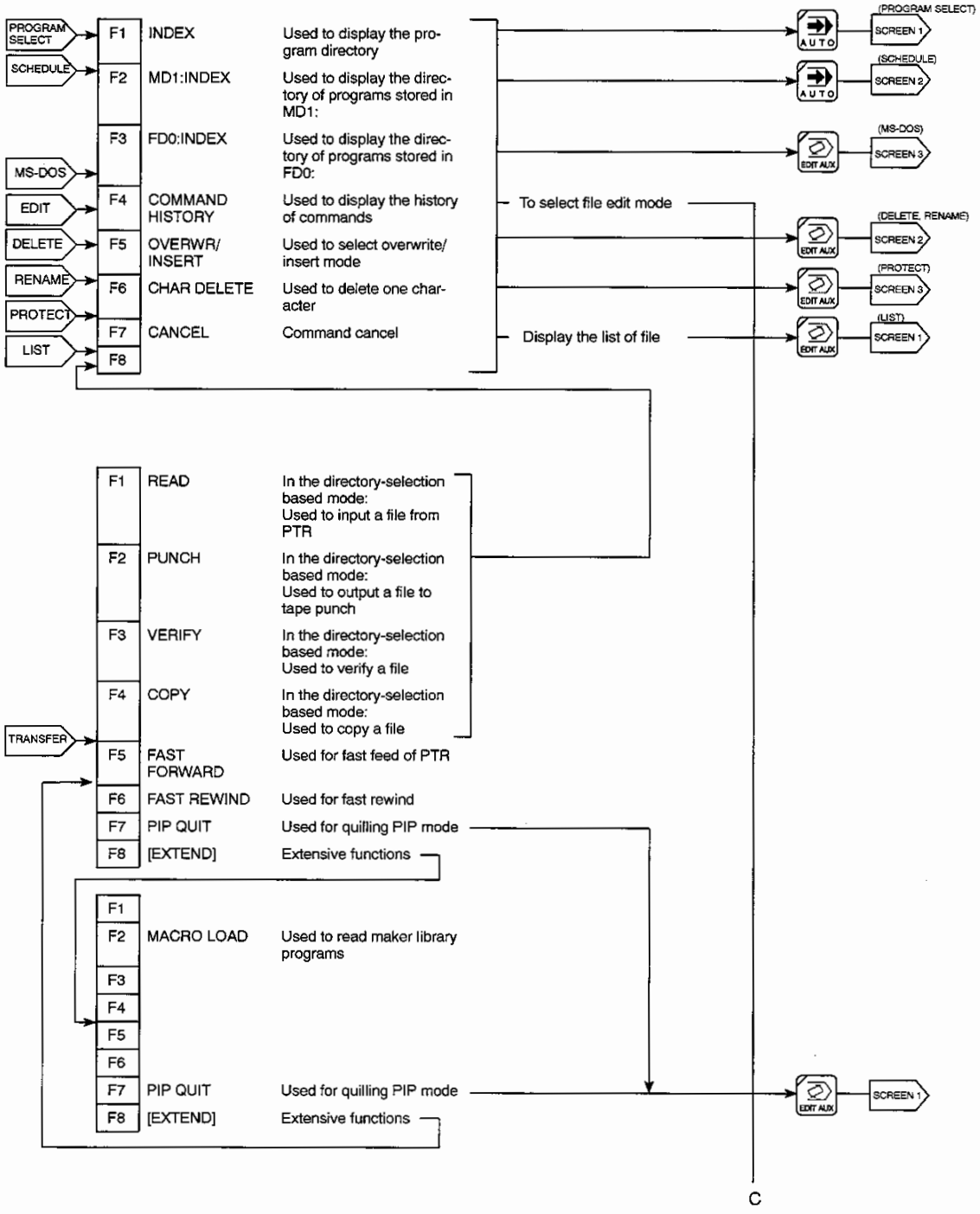


Program Operation Mode (2/6)

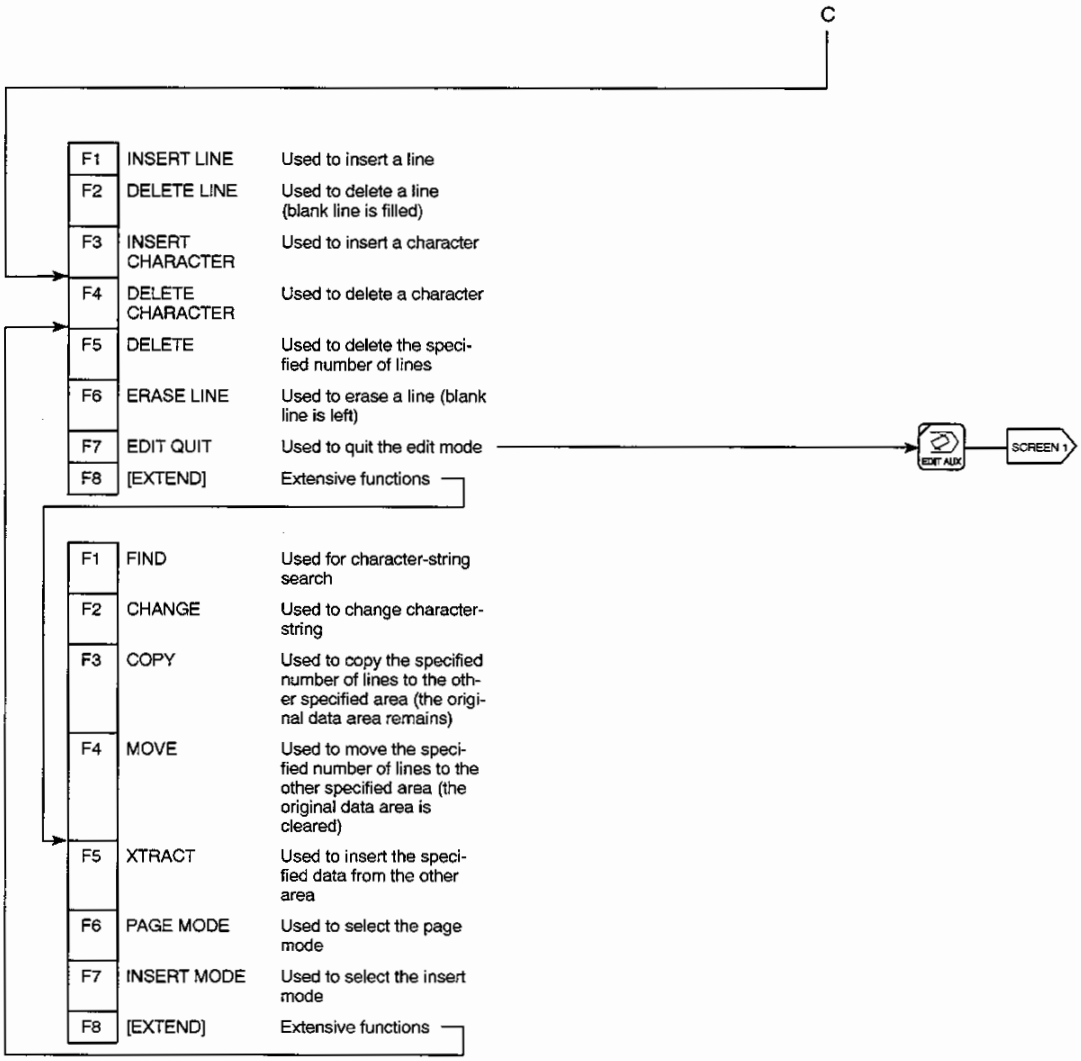


Program Operation Mode (3/6)

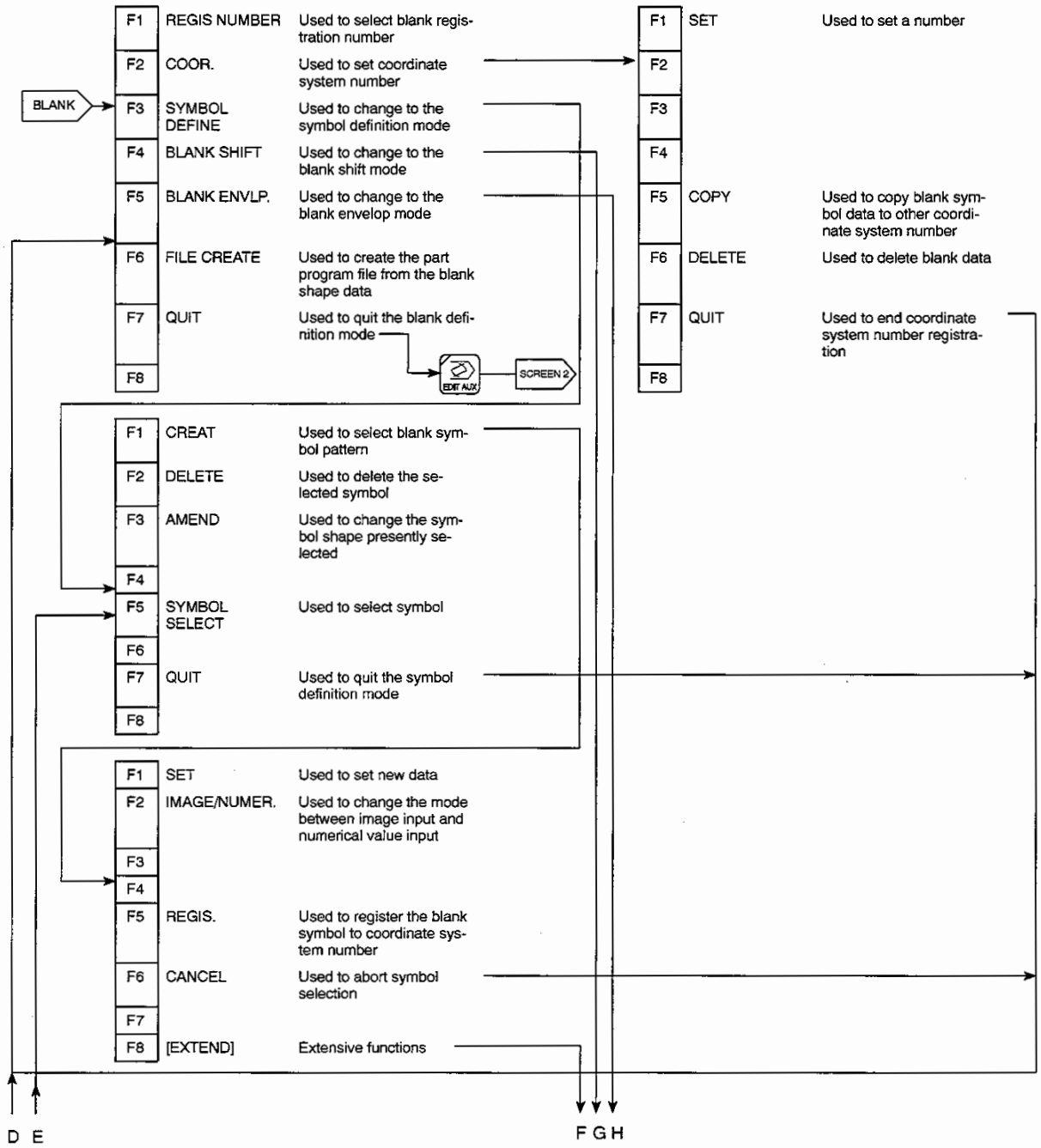
Directory-based File Selection



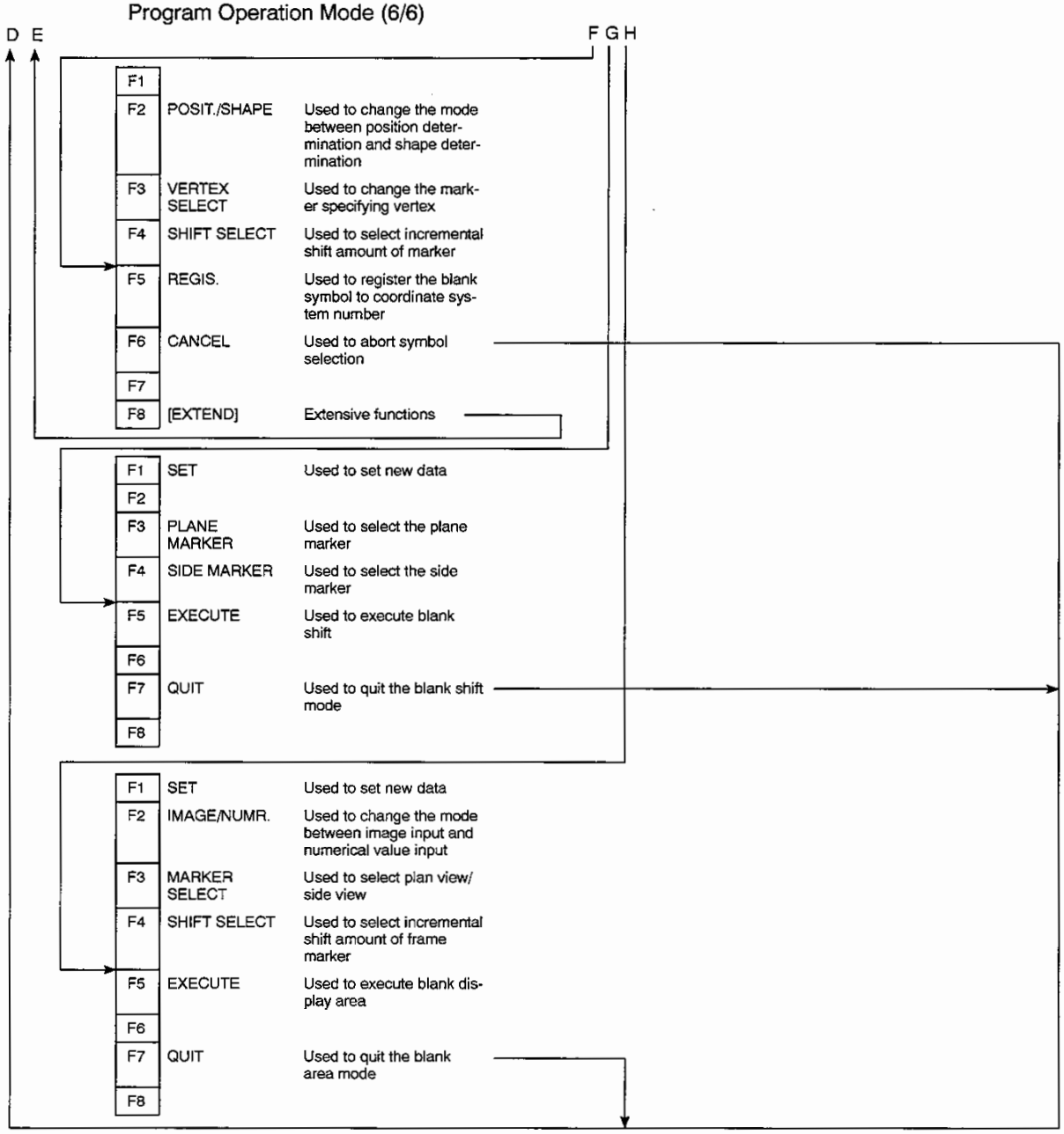
Program Operation Mode (4/6)



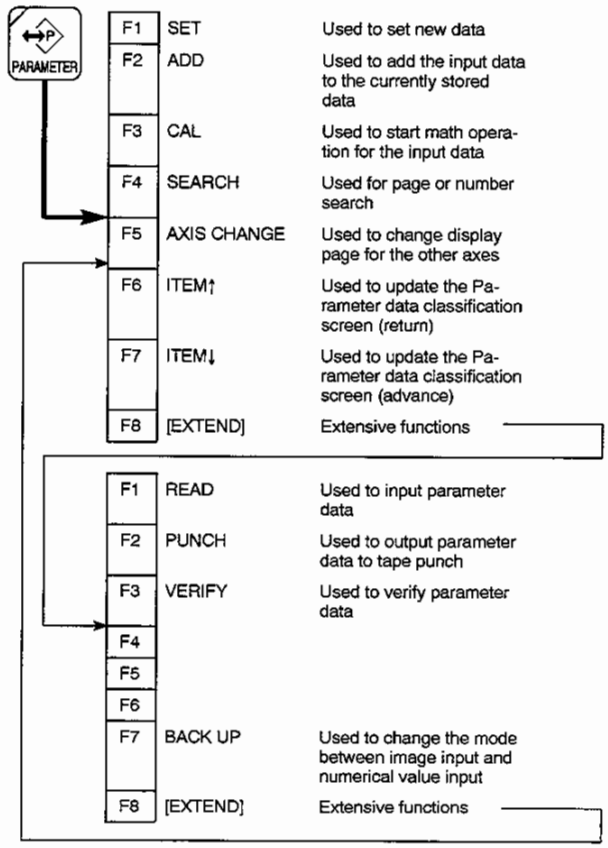
Program Operation Mode (5/6)



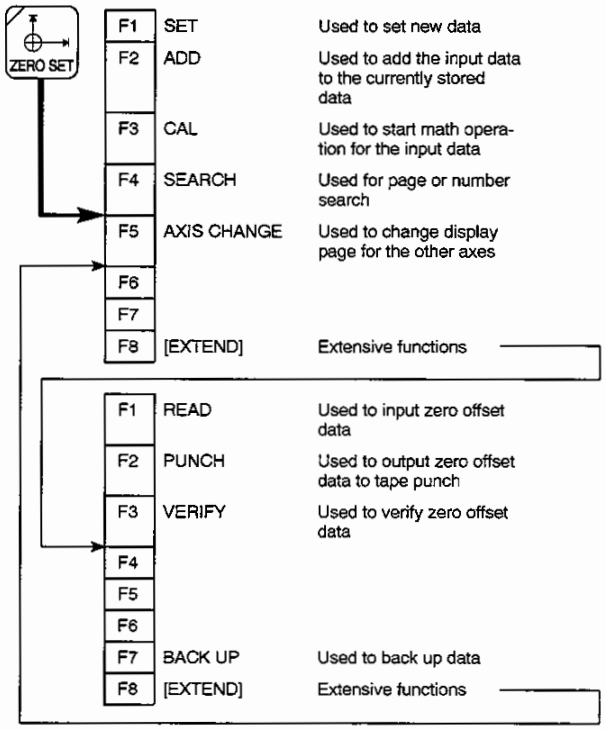
Program Operation Mode (6/6)



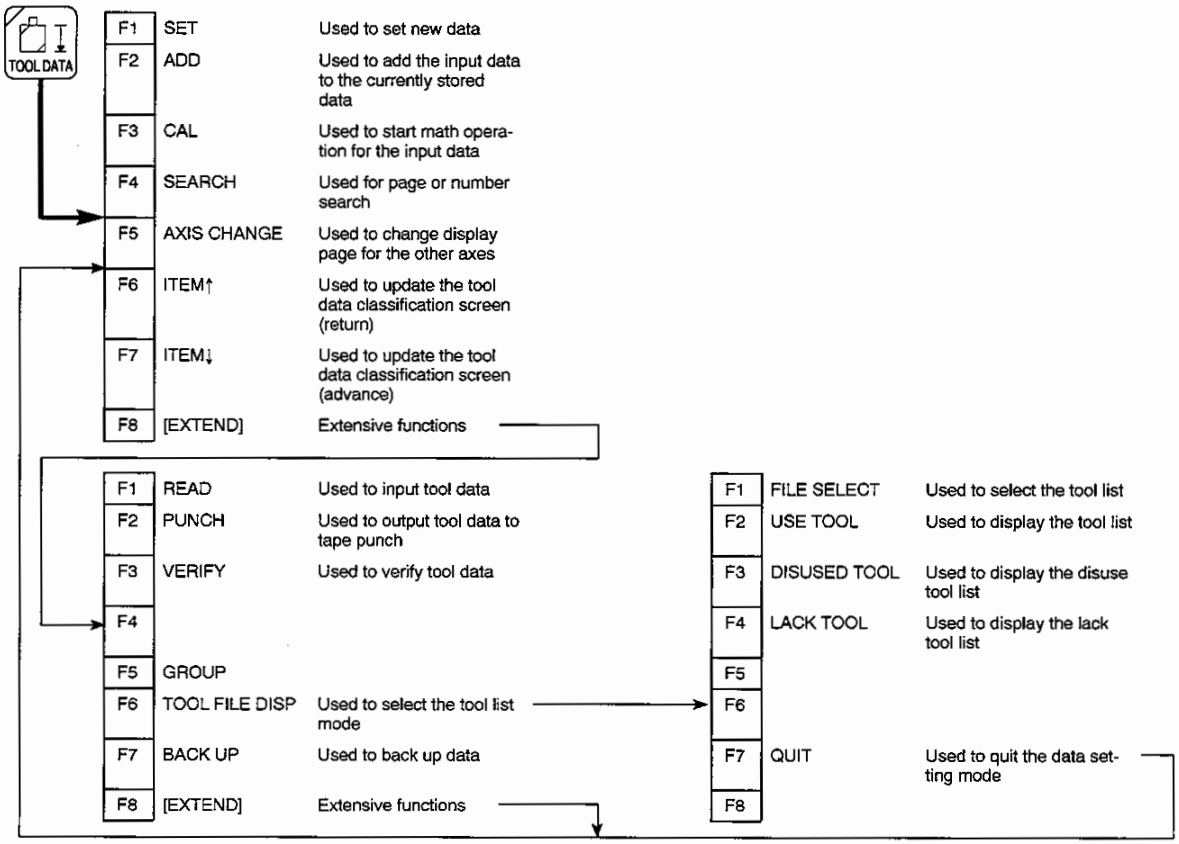
(6) Parameter Setting Mode



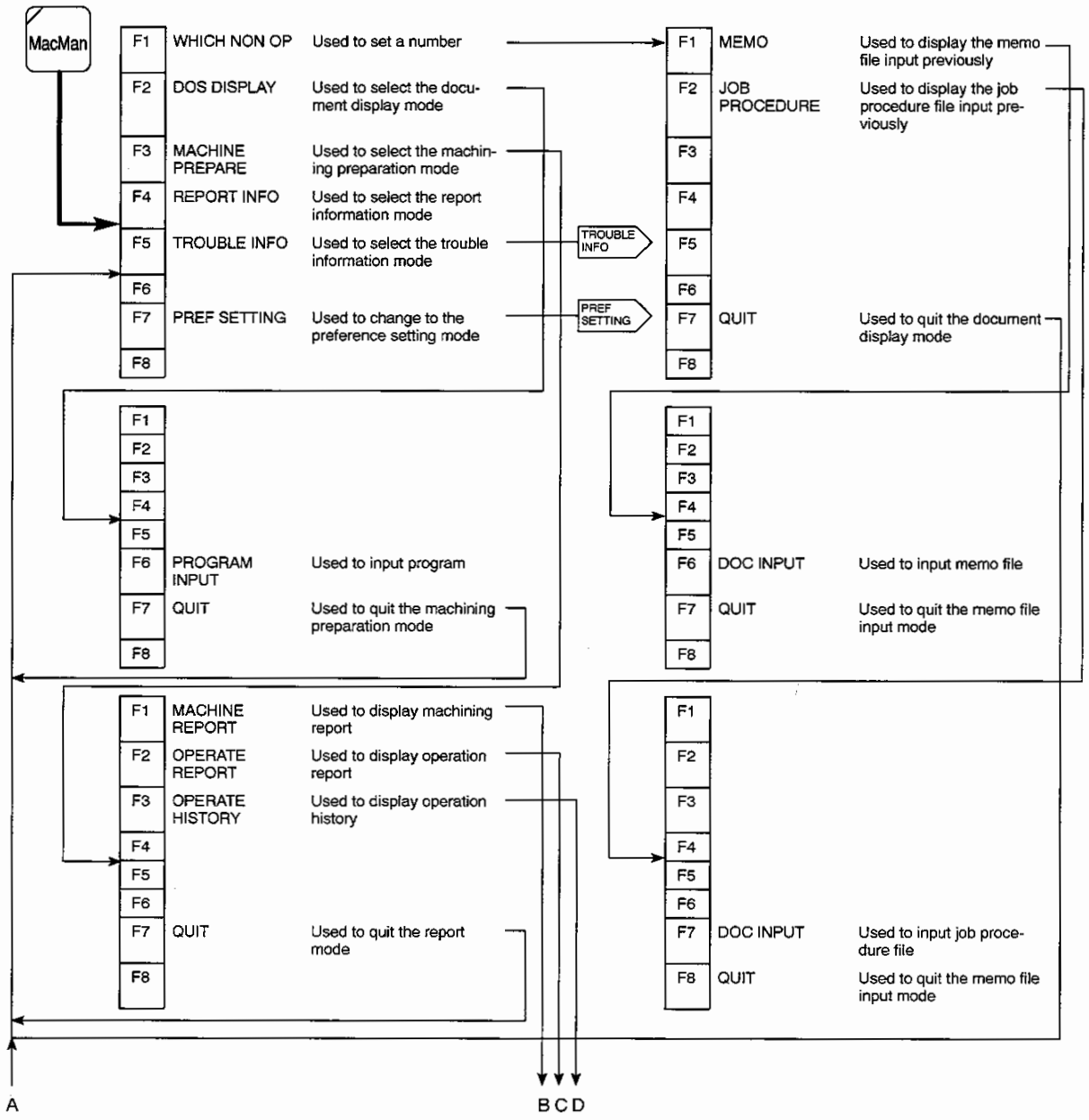
(7) Zero Point Setting Mode



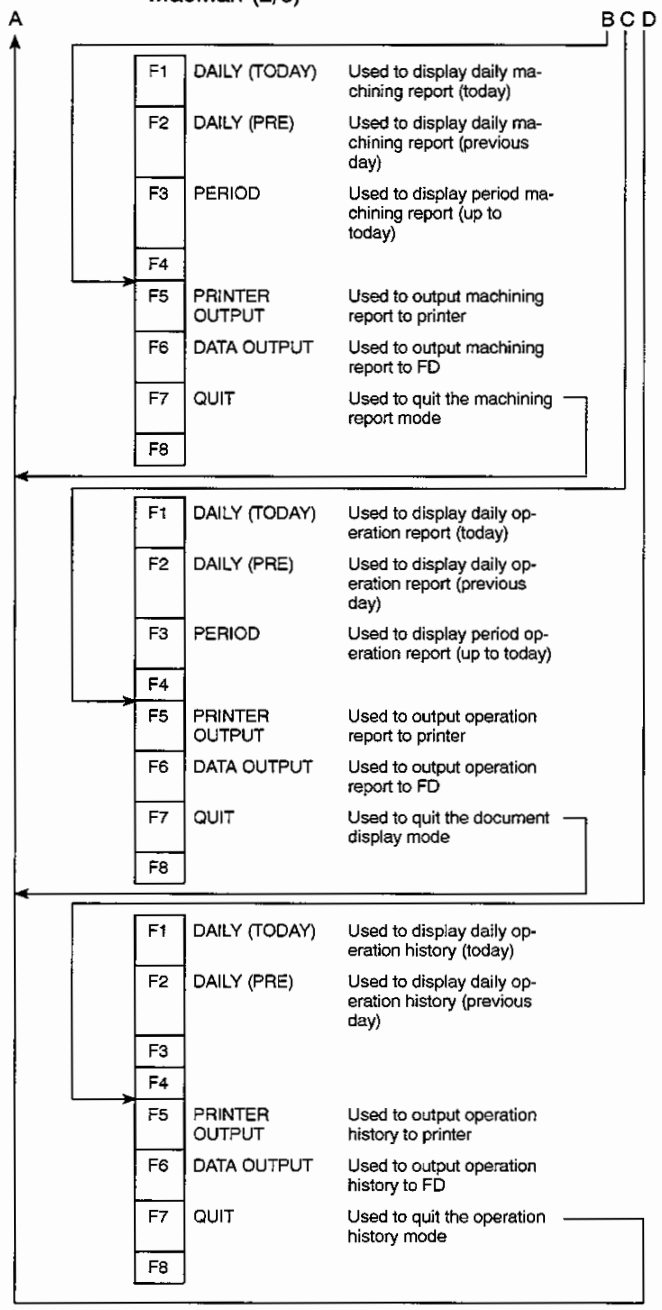
(8) Tool Data Setting Mode



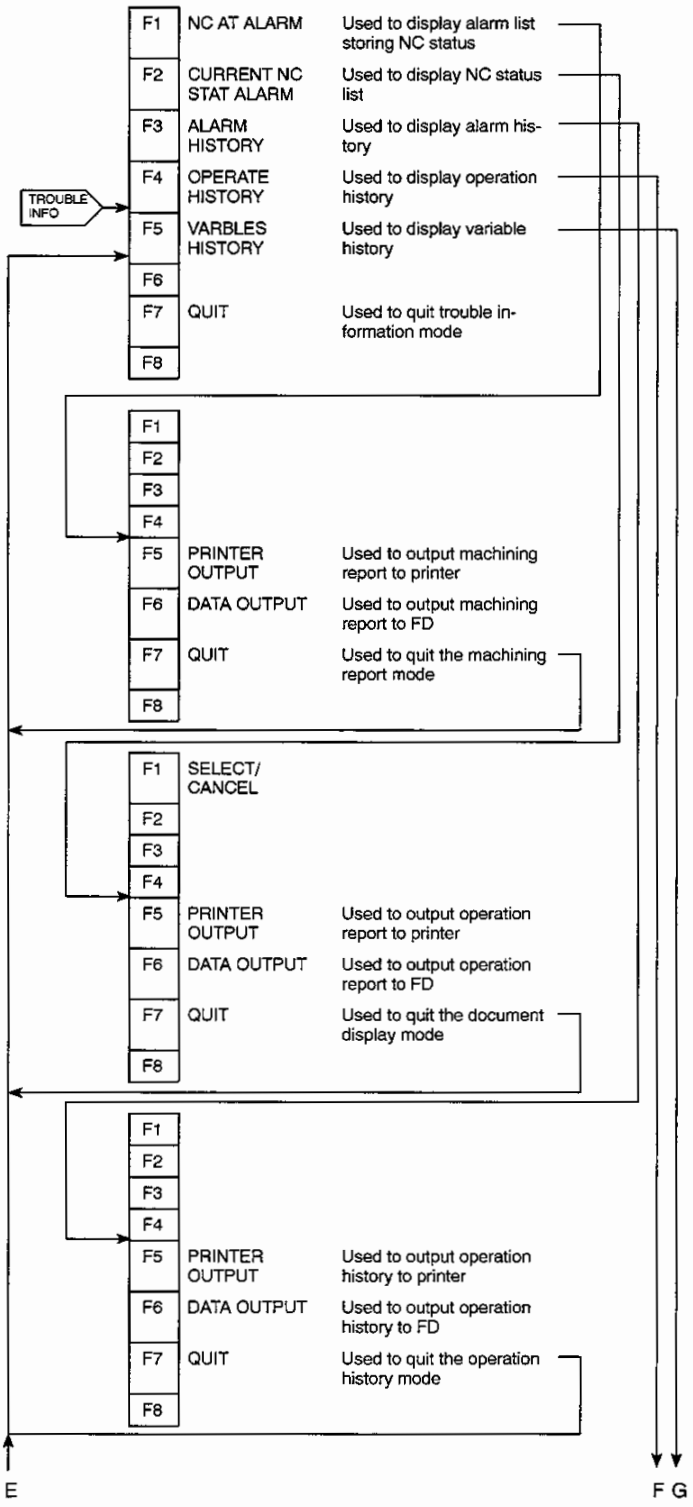
(9) MacMan (1/6)



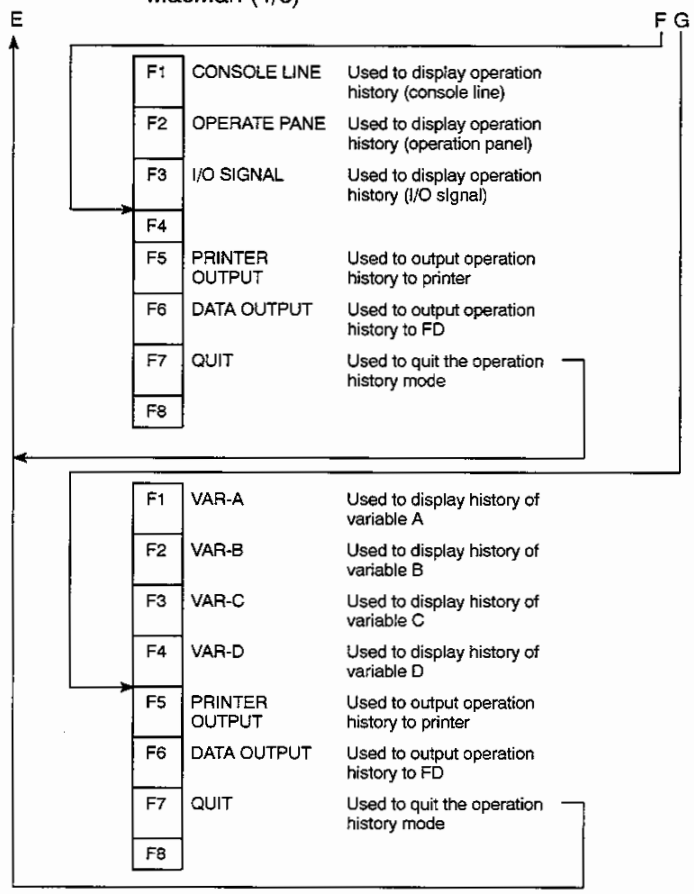
MacMan (2/6)



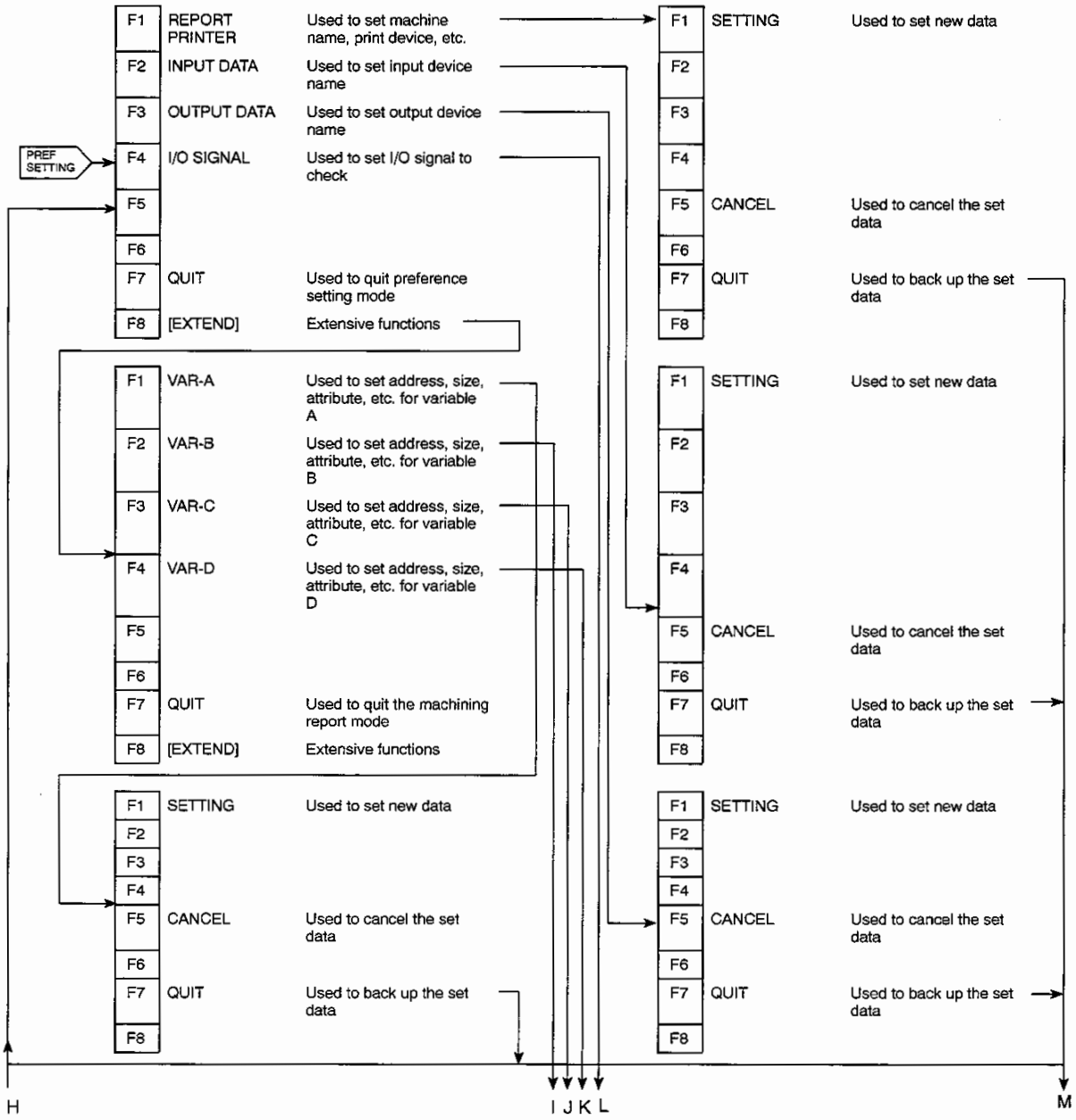
MacMan (3/6)



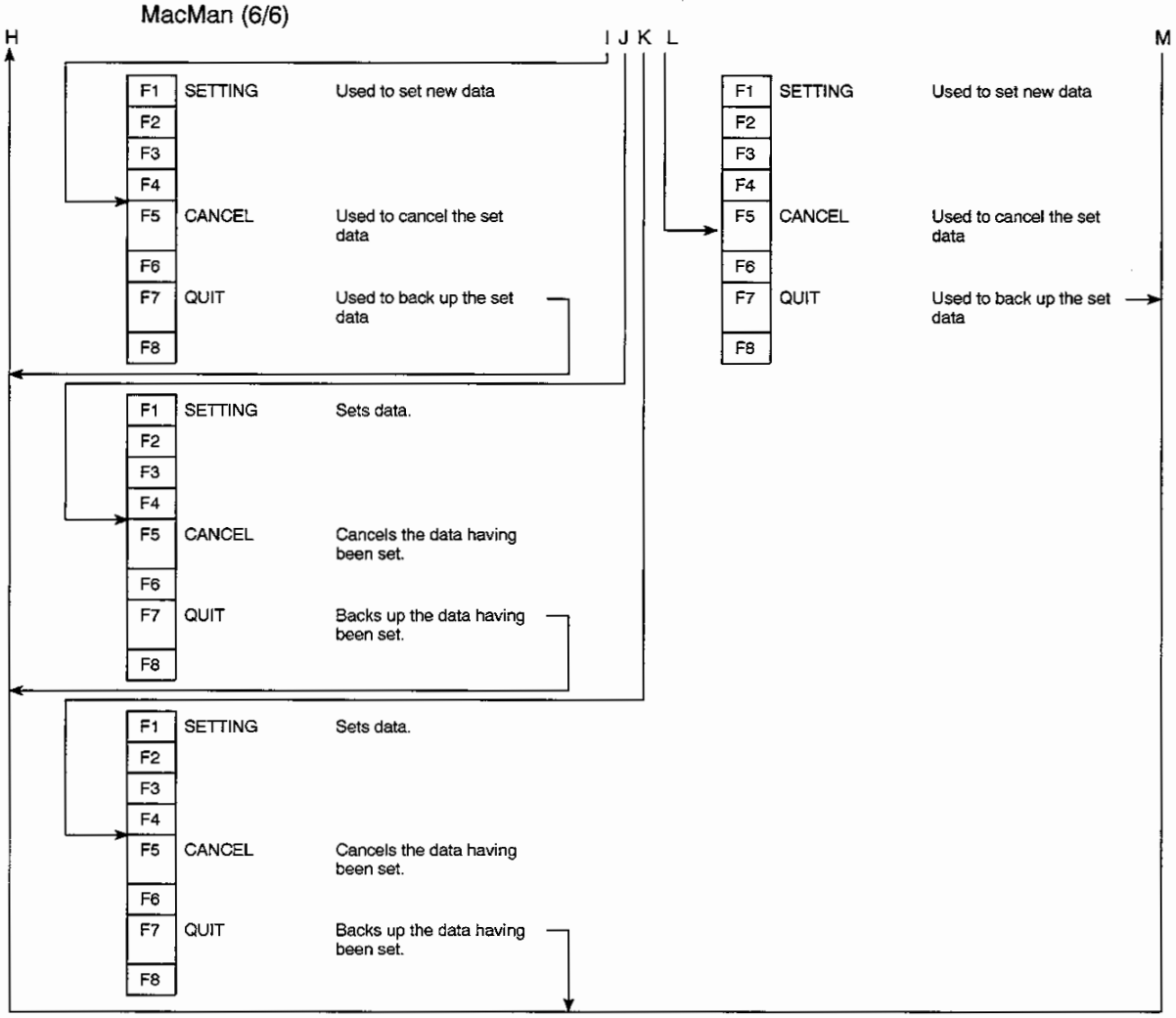
MacMan (4/6)



MacMan (5/6)



MacMan (6/6)



II. OPERATION

SECTION 1 OPERATION

1. Basic Construction of Operation Panels

Operation panels consist of the following four types of panels and switches.

(1) NC Operation Panel

The NC operation panel is used for operating the machine in other than manual mode operation.

It is used for operations such as file operation and data setting.

(2) Machine Operation Panel

Switches and keys mainly used for manual operation are arranged on the machine operation panel.

(3) Option Panel

An option panel is provided when switches and indicating lamps are additionally used according to the selection of an optional specification. Arrangement of the switches and indicating lamps differ depending on the selected optional specification.

(4) Manual Tool Change Operation Panel

The manual tool change operation panel is provided to change tools manually.

Arrangement of the switches and indicating lamps differ depending on the machine models.

(5) Manual Magazine Operation Panel

The manual magazine operation panel is provided to operate the magazine manually.

Arrangement of the switches and indicating lamps differ depending on the machine models.

(6) Parallel Type 2-Pallet APC Operation Panel

The APC operation panel is provided to control the APC manually.

Arrangement of the switches and indicating lamps differ depending on the machine models.

(7) AAC Operation Panel

The AAC operation panel is provided to change attachments manually.

(8) Manual Attachment Tool Change Operation Panel

The manual attachment tool change operation panel is provided to change attachment tools manually.

There are various types of operation panels according to the shape of the panel and the arrangement of the control on it. External views of the operation panels are provided in Appendix in this manual.

2. Outline of Controls on Operation Panel

2-1. Operation Mode Selection Keys

(1) AUTO Key

Select the automatic mode to operate the machine using part programs stored in the memory disk (MD). For the execution of a part program, it is read out to the IC memory from the memory disk.

(2) MDI Key

Select the MDI mode to operate the machine using a program, input from the keyboard, in the same manner as in the automatic mode. In the MDI, mode a program is input and executed in units blocks.

(3) MANUAL Key

Select the manual mode to operate the machine using the manual operation switches provided in the machine operation panel, the pulse handle operation box. and other operation panels.

2-2. Data Setting Mode Selection Keys

(1) EDIT AUX Key

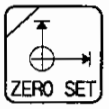
Select the EDIT AUX (program operation) mode to read, edit, punch, or print a part program, to operate the tape reader, or to manage files.

(2) PARAMETER Key

Select the parameter mode to set the parameters (system parameters, user parameters, common variables, NC optional parameters, machine system parameters, machine user parameters, etc.)

(3) ZERO SET Key

Select the zero set mode to set the zero offset data.



(4) TOOL DATA

Select the tool data set mode to set the tool length offset data, tool diameter compensation data, ATC related tool data, tool management data, etc.

(5) MacMan

Press the [MacMan] key to use the MacMan (machining management function).

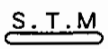
2-3. NC Status Indicating lamps

(1) RUN Lamp

The RUN indicating lamp are lit while the NC is processing data.

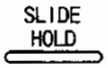
(2) S.T.M Lamp

The S.T.M. indicating lamp are lit while an S (spindle), T (tool), or M (miscellaneous) command is executed.



(3) SLIDE HOLD Lamp

The SLIDE HOLD indicating lamp lights when the [SLIDE HOLD] button on the machine operation panel is pressed.



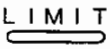
(4) PROGRAM STOP Lamp

The PROGRAM STOP indicating lamp is lit while the operation is suspended in the program stop or optional stop state.

The indicating lamp blinks while a dwell function is executed.

(5) LIMIT Lamp

The LIMIT indicating lamp is lit if an axis is at the variable limit position.



(6) ALARM Lamp

The ALARM indicating lamp lights at the occurrence of an alarm.

The lamp does not light if a warning message is displayed on the screen for operator's errors.

2-4. Other Controls on NC Operation Panel

(1) Function Keys: F1 to F8

When an operator selects a desired operation mode, the screen displays the necessary operation functions at the bottom line. Each function corresponds to a function key (F1 through F8). Select the function to execute and press the corresponding function key.

The functions assigned to the function keys change according to the currently valid mode as the operation progresses.

F1 F2 F3 F4 F5 F6 F7 F8

(2) ? (Help) Key

This key, called the help key, is provided to the left side of function key [F1].

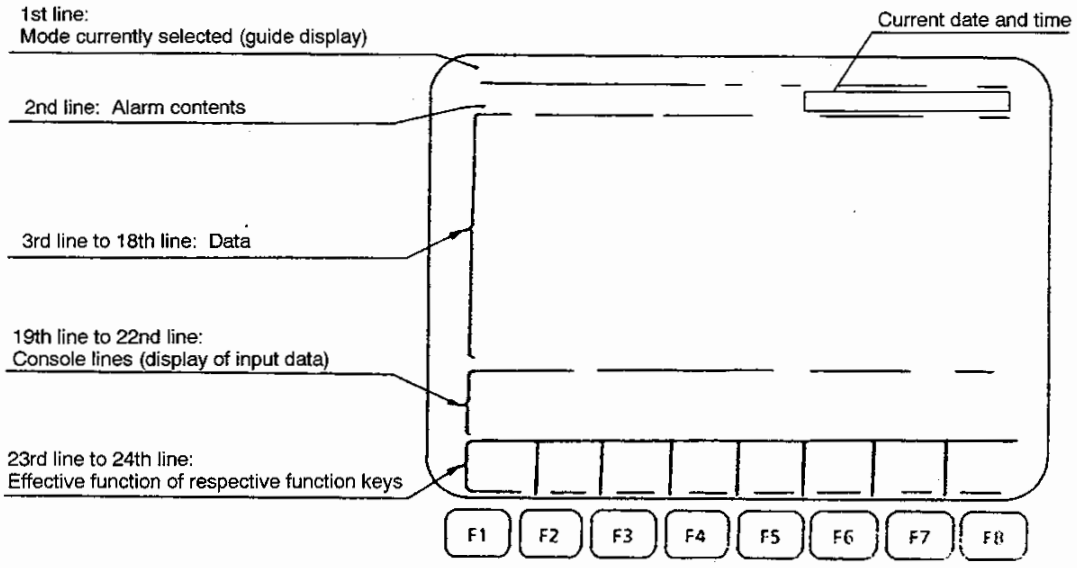
The key is used to display the description of the alarm which occurred during machine operation and also the alarm history.

(3) Display Screen

The display screen has the information display area of 64 characters x 24 lines.

It shows actual position data, part program data, block data, zero offset values, tool offset values, parameter data, alarm description, etc.

The basic format of display on the screen is shown below.



(4) WRITE Key

Press the [WRITE] key to select an operation and also to confirm the input data.

(5) BS (Backspace) Key

Press the [BS] key when erroneous data has been input. Each time this key is pressed, the character input last is erased.

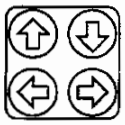
For the display of file index and list, this key is used to display the next page.

(6) CAN Key

Press the [CAN] key when erroneous data has been input. Each time this key is pressed, one line of the data is erased.

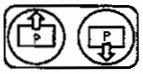
(7) Cursor Keys

Four cursor keys are used to move the cursor displayed on the screen.



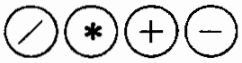
(8) Page keys

If the information called out is displayed in more than one page, the page keys are used to change the display page.



(9) Operator Keys

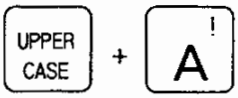
These keys are used when an operator is used for program editing or for entering more than one piece of data with an operator in data setting operation.



(10) Character Keys

Character keys are used for inputting a character for data input, program operation, and file edit operation.

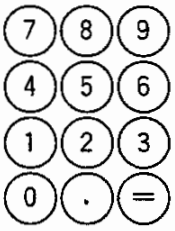
(a) To input a character shown at the upper right corner of a key top, use the [UPPER CASE] key.



(b) In the state the [CAPS LOCK] key is pressed (indicating lamp at the upper left corner lit), upper case alphabetic letters A to Z are input. When the [CAPS LOCK] key is not pressed, lower case alphabetic letters a to z are input.

(11) Ten Keys

Character keys are used for inputting a number for data input, program operation, and file edit operation.



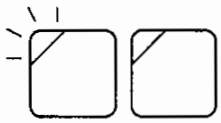
(12) Contrast Adjusting Keys
(only for Operation Panel with Monochrome STN Screen)

These keys are used to adjust the contrast for the display.

2-5. Controls on Machine Operation Panel

Flat keys used on the machine operation panel have features as indicated below depending on whether or not an indicating lamp is provided in it.

< Flat keys with an indicating lamp >



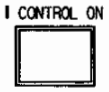
The indicating lamp in a key indicates if the function of the key is valid or not.

- Indicating lamp lit . . . . . Key function is valid.
- Indicating lamp unlit . . . . . Key function is invalid.

< Flat keys without an indicating lamp >

The function of the key is valid only while the key is held down. In the state the key is not pressed, the function is invalid.

(1) CONTROL ON Switch

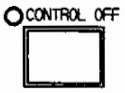


The [CONTROL ON] switch is used to turn on the control power of the NC unit after turning on the main switch of the machine.

The pilot lamp in this switch lights when the control power is turned on.

If the [EMERGENCY STOP] button is pressed, the pilot lamp in this switch goes off. To restore from the emergency stop state, press the [CONTROL ON] switch.

(2) CONTROL OFF Switch



The [CONTROL OFF] switch is used to turn off the control power of the NC unit.

When shutting off the power, turn off the control power first by pressing the [CONTROL OFF] switch before turning off the main switch of the machine.

(3) RESTART Key

The interlock function interrupts program execution if the door is opened during automatic operation.

To restart the interrupted program, press the [RESTART] key. Then, press the [CYCLE START] button.

(4) RESET Key

The NC unit is reset when the [RESET] key is pressed.

The key is used to recover the operation from such as an alarm state.

(5) NC PANEL Switch

(a) UNLOCK position

All controls on both the NC and machine operation panels are enabled.

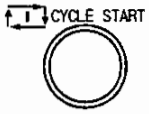
(b) EDIT LOCK position

Operations in the program operation (EDIT AUX) mode and parameter setting mode are disabled.

(c) LOCK position

All controls on the NC operation panel are disabled.

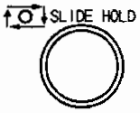
(6) CYCLE START Button



The [CYCLE START] button is used to start the machine operation according to the contents of the commands.

The CYCLE START signal is output when the button is released after it is pressed.

(7) SLIDE HOLD Button



Axis movements of X-, Y-, and Z-axis stop immediately when the [SLIDE HOLD] button is pressed. To resume axis movements, press the [CYCLE START] button.

If this button is pressed while an axis is not moving, the slide hold becomes valid after the completion of the sequence having been executed at the time the [SLIDE HOLD] button was pressed or when the next axis movement is going to be executed.

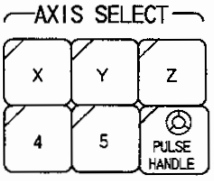
(8) EMG. STOP Button

Press the [EMG. STOP] button when an emergency state takes place.

Power supply to the NC is shut off when the [EMG. STOP] button is pressed.

To release the emergency stop state, unlock the [EMG. STOP] button and press the [CONTROL ON] button.

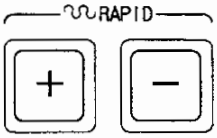
(9) AXIS SELECT Buttons



These buttons are used to select the axis to be moved manually (rapid feed, cutting feed).

To move an axis by the pulse handle, select PULSE HANDLE.

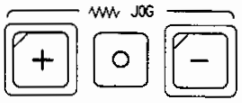
(10) RAPID Buttons



The [RAPID] buttons are used to move an axis manually at a rapid traverse rate. The selected axis moves at a rapid traverse rate only while a [RAPID] button is held pressed.

[Supplement] Rapid traverse rate differs depending on machine model and specifications.

(11) JOG Buttons



The [JOG] buttons are used to move an axis manually at a cutting feedrate. The selected axis starts moving when a [JOG] button is pressed and it keeps moving even after the button is released. It stops moving when the OFF [**O**] button is pressed.

[Supplement] Cutting feedrates differ depending on machine model and specifications.

(12) SPINDLE STOP Button

Use the [SPINDLE STOP] button to stop the spindle manually.

(13) SPINDLE CW Button

Used to start the spindle in the forward (CW) direction.

(14) SPINDLE CCW Button

Used to start the spindle in the reverse (CCW) direction.

(15) SPINDLE ORIENTATION Button

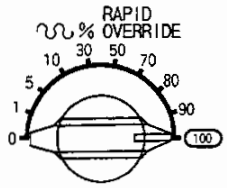
Press the [SPINDLE ORIENTATION] button while holding the [INTERLOCK RELEASE] button to stop the spindle at a predetermined angular position.

(16) SPINDLE RELEASE Button

Press the [SPINDLE RELEASE] button to set the spindle in the neutral state.

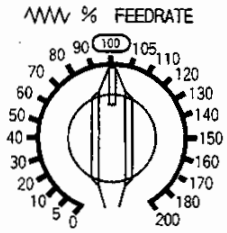
[Supplement] Spindle speeds differ depending on machine model and specifications.

(17) RAPID OVERRIDE Dial



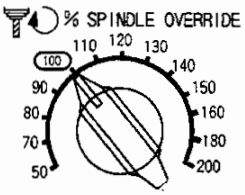
The [RAPID OVERRIDE] dial sets the desired rapid feedrate in "%" in terms of the preset rapid feedrate.

(18) FEEDRATE Override Dial



The [FEEDRATE] dial sets the desired feedrate in "%" in terms of the specified feedrate.

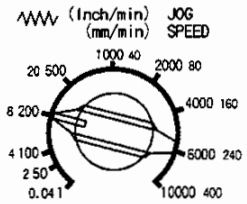
(19) SPINDLE OVERRIDE Dial



The [SPINDLE OVERRIDE] dial sets the desired spindle speed in "%" in terms of the specified spindle speed.

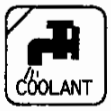
(20) JOG SPEED Dial

The [JOG SPEED] dial sets jog feedrate (manual cutting feedrate).



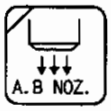
(21) COOLANT Key

The [COOLANT] key is used to turn on manual coolant supply.



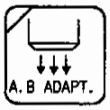
(22) A.B NOZ. Key

The [A.B NOZ.] key is used to turn on air blow through the nozzle.



(23) A.B ADAPT. Key

The [A.B ADAPT.] key is used to turn on air blow through the adapter.



(24) OIL MIST Key

The [OIL MIST] key is used to turn on oil mist.

(25) OIL HOLE Key

The [OIL HOLE] key is used to turn on oil hole coolant supply.

(26) OIL HOLE HIGH Key

The [OIL HOLE HIGH] key is used to turn on high-pressure oil hole coolant supply.

(27) SHOWER Key

The [SHOWER] key is used to turn on shower coolant supply.

(28) LIGHT Key

The [LIGHT] key is used to turn on the machine light.

(29) LUB. Key

The [LUB.] key is used to supply lubricating oil to the slideway surfaces.

(30) ⬅⬅ CHIP CON. Key

The [⬅⬅ CHIP CON.] key is used to operate the chip conveyor in the reverse direction; the chip conveyor operates only while the [⬅⬅ CHIP CON.] key is held.

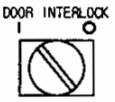
(31) ➡ CHIP CON. Key

The [➡ CHIP CON.] key is used to operate the chip conveyor in the forward direction; the chip conveyor operates only while the [➡ CHIP CON.] key is held.

(32) DISPLAY OFF Key

To turn off the display, set this key valid (indicating lamp at the upper left corner of the key lit).

(33) DOOR INTERLOCK – ON/OFF Switch



The switch is used to select whether or not the door interlock function is made valid for operations on which the interlock is set in the state the door is open.

For details of the door interlock function, refer to the Door Interlock Function Manual.

2-6. Mode Selection Keys

To operate the machine using a program, a variety of operation modes are provided.

(1) SINGLE BLOCK Key

(a) When the [SINGLE BLOCK] key is valid (indicating lamp at the upper left corner lit), a program is executed in units of blocks. To execute the next block, press the [CYCLE START] button.

(b) When the [SINGLE BLOCK] key is invalid (indicating lamp at the upper left corner unlit), program blocks are executed continuously.

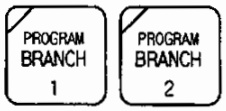
(2) BLOCK SKIP Key

(a) When the [BLOCK SKIP] key is valid (indicating lamp at the upper left corner lit), commands between a slash (/) code and "ER" code are ignored.

[Supplement] A slash code (/) must be placed at the start of a program block or immediately after the sequence number (or sequence name) of a block.

(b) When the [BLOCK SKIP] key is invalid (indicating lamp at the upper left corner unlit), commands entered following a slash code (/) are executed.

(3) PROGRAM BRANCH Key



(a) When the [PROGRAM BRANCH] key is valid (indicating lamp at the upper left corner of the key lit), a program branch instruction in a part program is executed.

(b) When the [PROGRAM BRANCH] key is invalid (indicating lamp at the upper left corner of the key unlit), a program branch instruction in a part program is not executed.

(4) OPTIONAL STOP Key

(a) When the [OPTIONAL STOP] key is valid (indicating lamp at the upper left corner lit), operation stops after the execution of an M01 block in a program.

When the [CYCLE START] button is pressed, the previous state is recovered and the program is continuously executed.

(b) When the [OPTIONAL STOP] key is invalid (indicating lamp at the upper left corner unlit), program is continuously executed even after the execution of an M01 block.

(5) CYCLE STOP Key

(a) While in the execution of a schedule program, execution of a program stops after the completion of a main program when the [CYCLE STOP] key is valid (indicating lamp at the upper left area of the key is lit).

(b) While in the execution of a schedule program, execution of a program does not stop after the completion of a main program and the program is executed continuously when the [CYCLE STOP] key is invalid (indicating lamp at the upper left area of the key is unlit).

(6) AXIS COM. CANCEL Key

The command of the specified axis is not executed if the [AXIS COM. CANCEL] key is invalid (indicating lamp at the upper left corner unlit).

(7) S.T.M LOCK Key

When the [S.T.M LOCK] key is valid (indicating lamp at the upper left corner lit), only axis movement commands are executed and no miscellaneous operations are not executed.

(8) DRY RUN Key

(a) If the [DRY RUN] key is valid (indicating lamp at the upper left corner lit), feed commands specified in the cutting feed mode (G01, G02, G03, etc.) in a program are executed at the feedrate set by the [JOG SPEED] dial and feedrates specified in the program are all disregarded.

(b) If the [DRY RUN] key is invalid (indicating lamp at the upper left corner unlit), feed commands specified in a program are executed at the feedrate specified in the program.

[Supplement] To change the dry run mode valid or invalid state, it is necessary to press the [DRY RUN] key while holding down the [INTERLOCK RELEASE] key.

(9) MACHINE LOCK Key

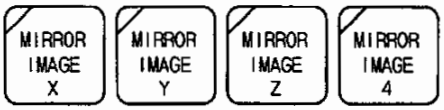
(a) When the [MACHINE LOCK] key is valid (indicating lamp at the upper left corner lit), all commands in a part program are executed without actual machine operation.

However, the actual position data and block data display are updated as the program is executed. The display of such data returns to the previous state when the NC is reset.

(b) When the [MACHINE LOCK] key is invalid (indicating lamp at the upper left corner unlit), all commands in a part program are executed normally.

[Supplement] To change the machine lock mode valid/invalid state, it is necessary to press the [MACHINE LOCK] key while holding down the [INTERLOCK RELEASE] key.

(10) MIRROR IMAGE Keys



(a) With the axis for which the mirror image function is valid (indicating lamp at the upper left corner lit), the sign of the coordinate value data is reversed.

(b) With the axis for which the mirror image function is invalid (indicating lamp at the upper left corner unlit), the sign of the coordinate value data is not reversed.

[Supplement] To change the valid or invalid state of the mirror image function, it is necessary to press the [MIRROR IMAGE] key while holding down the [INTERLOCK RELEASE] key.

(11) INTERLOCK RELEASE Key

To change the valid/invalid state of the dry run mode, machine lock mode and mirror image operation mode, it is necessary to press the [INTERLOCK RELEASE] key at the same time the corresponding mode key is pressed.

This key is also used to start a part program from a selected block.

Although the key has the indicating lamp at the upper left corner, the key is valid only while it is pressed.

(12) SEQUENCE RESTART Key

The [SEQUENCE RESTART] key is used to restart a part program from a desired block.

In the mid. auto manual operation mode, this key is used to return the axes to the position where automatic operation has been interrupted to perform manual operation.

(13) MID. AUTO MANUAL Key

To perform manual operation during automatic or MDI mode operation, press the [MID. AUTO MANUAL] key.

(14) PULSE HANDLE SHIFT Key

The [PULSE HANDLE SHIFT] key is used to add axis movements operated by turning the pulse handle to the operation executed according to the commands in the program.

SECTION 2 POWER ON/OFF OPERATION

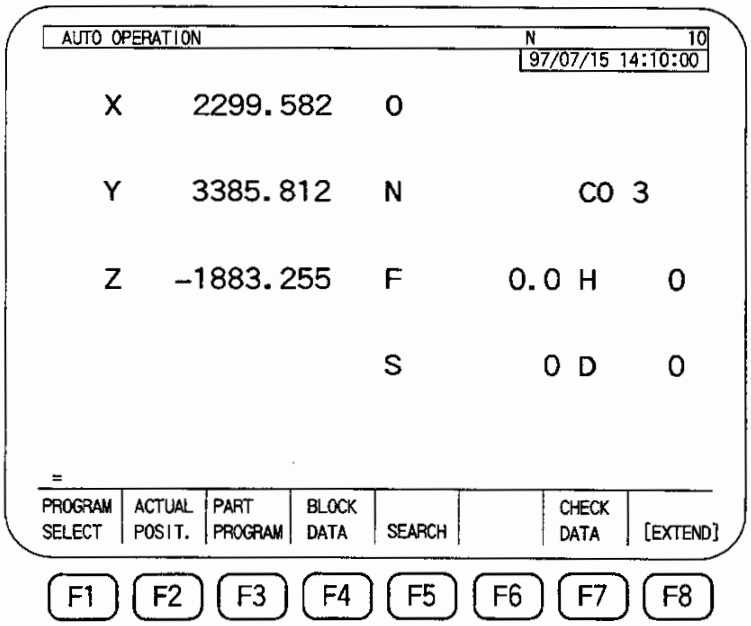
This section describes the basic power ON/OFF operation procedures.

1. Turning on the Power

Procedure:

(1) Press the CONTROL ON switch to turn it ON.

Power is turned on to the NC and the system software, resident in the memory is loaded to the RAM area. While the software is being loaded, the file names are displayed on the screen. After the completion of loading of the system software, initial setting is made for the peripherals. Upon completion of initial setting of the peripherals, the screen as indicated below is displayed. The NC can now operate correctly.



[Supplement] If an alarm or error occurs instead of the display of the screen as indicated to the right, take proper corrective measures by referring to the separately prepared manual, "ALARM & ERROR LIST".

2. Turning off the Power

Procedure:

(1) Make sure that all machine actuators have been stopped.

(2) Press the CONTROL OFF switch to turn it OFF.

If peripherals are connected to the NC, turn off power to these peripherals.

CAUTION

: The NC backs up the data such as tool length offset data, cutter radius compensation data, work coordinate system offset data, and parameter data (excluding the system parameters) in predetermined intervals. Therefore, if power is turned off just after changing such data, the new data may not be backed up and the previous data might remain unchanged.

In such a case, execute the backup command before turning off the power to ensure that the data is changed without fail.

For backup operation, refer to III. DATA OPERATION, Section 1, 3-4-1. "Back Up Command".

3. Emergency Stop

If it becomes necessary to stop the operation immediately, press the EMG. STOP switch. The machine stops immediately when the EMG. STOP switch is pressed.

The push-to-lock type switch is locked if the switch is pressed; to unlock the switch, turn it in the direction indicated by the arrow symbol. After unlocking the emergency stop switch, reset the NC and the NC is placed in the operation ready state.

SECTION 3 MANUAL OPERATION FUNCTIONS

The following manual operation is possible when the MANUAL is selected in the MODE selection keys on the NC operation panel or when manual intervention mode is selected in the AUTO or MDI mode.

(1) Manual axis feed operation (rapid, jog, pulse handle)

(2) Spindle operation (CW/CCW, stop, release orientation)

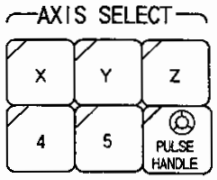
1. Manual Axis Feed Functions

1-1. Manual Rapid Feed

After selecting the axis to feed using the AXIS SELECT switches on the machine operation panel, press the manual rapid feed switch corresponding to the direction in which the axis should move, and the selected axis moves in the required direction at the predetermined rapid feedrate. The RAPID OVERRIDE rotary switch is used to adjust the rapid feedrate.

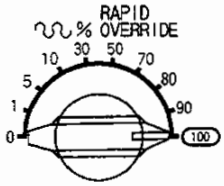
Operation procedure:

(1) Select the axis to feed by the AXIS SELECT switch.



(2) Select the override rate by the RAPID OVERRIDE rotary switch.

This switch is operative while an axis is being fed.

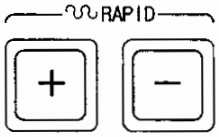


(3) Press the manual rapid feed switch.

Press the RAPID/+ switch to feed the axis in the plus direction.

Press the RAPID/– switch to feed the axis in the minus direction.

The axis moves only as long as these switches are pressed down. When they are released, axis motion stops.

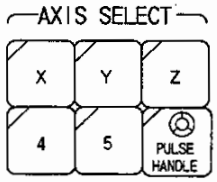


1-2. Manual Cutting (Jog) Feed

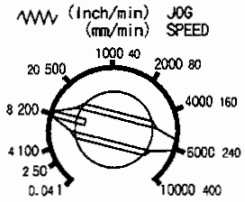
After selecting the axis to feed with the AXIS SELECT switches on the machine operation panel, press the manual cutting (JOG) feed switch corresponding to the direction in which the axis should move, and the selected axis moves in the required direction at the feedrate set with the jog feedrate rotary switch.

Operation procedure:

(1) Select the axis to feed by the AXIS SELECT switch.



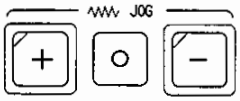
(2) Select the jog feedrate by the jog feedrate selector switch. This rotary switch is operative even during axis feed.



(3) Press the manual cutting feed switch.

Press the JOG/+ switch to feed the axis in the plus direction.

Press the JOG/– switch to feed the axis in the minus direction.



Pressing these switches once will activate the axis feed until the JOG OFF switch is pressed.

(4) When the JOG OFF switch is pressed, the axis feed is stopped.

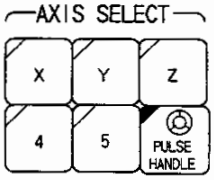
1-3. Manual Pulse Feed

After selecting the PULSE HANDLE in the AXIS SELECT switches, select the axis to feed with the PULSE HANDLE AXIS SELECT switch and turn the pulse handle. The selected axis is moved in response to the rotation of the pulse handle in the direction the pulse handle is turned.

The magnification factor switch is used to select the axis feed distance per pulse.

Operation procedure:

(1) Select the PULSE HANDLE from AXIS SELECT.

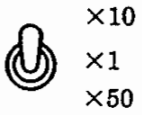


(2) Select the axis feed distance per pulse with the magnification factor switch.

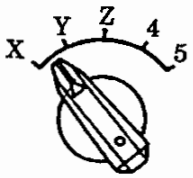
1 ..... The selected axis is fed 0.001 mm (0.00004 in.).

10 ..... The selected axis is fed 0.01 mm (0.0004 in.).

50 ..... The selected axis is fed 0.05 mm (0.002 in.).



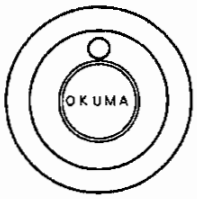
(3) Select the axis to be fed with the PULSE HANDLE AXIS SELECT switch.



(4) Turn the pulse handle.

Turning the handle in the clockwise direction feeds the axis in the positive (plus) direction.

Turning the handle in the counterclockwise direction feeds the axis in the negative (minus) direction.



[Supplement] When a high pulse feed ratio is selected for the magnification, the axis feeds almost as fast as rapid feedrate. In this case, the alarm sometimes occurs.

2. Spindle Operation

It is possible to rotate the spindle using the switches on the machine operation panel.

After setting the spindle speed, in the MDI mode operation for example, press the spindle start (CW, CCW) switch on the machine operation panel, and the spindle rotates at the set speed. Pressing the spindle stop switch stops spindle rotation.

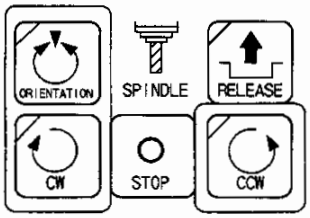
The set spindle can be adjusted using the spindle speed override switch.

Procedure:

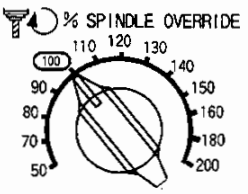
2-1. Spindle Rotation

Enter the desired spindle speed (S command) in the MDI mode. This automatically selects the spindle drive gear range. Note that an S command cannot be given in the manual mode.

Switch to the manual mode, select the spindle rotation direction either CW or CCW, then press the key selected while holding down INTERLOCK RELEASE button.



The spindle starts rotation at a commanded speed. When the spindle speed override rotary switch is set at other than 100%, the spindle rotates at the overridden speed.



2-2. Spindle Stop

Press the SPINDLE STOP button to stop the spindle.

2-3. Spindle Release

Press the SPINDLE RELEASE button to put the spindle gear into the release (neutral) position. This button is operative only while the spindle stays at rest (SPINDLE STOP button pressed). This release state permits manual spindle rotation.

Pressing the CW/CCW button while the spindle is in the release state starts the spindle at a commanded speed after the gear range previously selected has been selected again. The spindle release cannot be canceled in any other way.

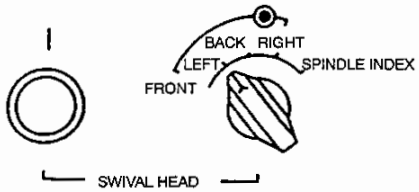
2-4. Spindle Orientation

Press the SPINDLE ORIENTATION button while holding down INTERLOCK RELEASE button to stop the spindle at a definite angular position. This ORIENTATION button is operative while the spindle is rotating. Pressing the ORIENTATION button simultaneously initiates spindle orientation and triggers the button's indicator lamp.

Upon completion of the orientation, the lamp stops flashing and remains illuminated. Rotating the spindle cancels the orientation state. The orientation position and speed are set by machine system parameters.

3. Indexing Swivel Head (Indexing Attachment)

The swivel head (attachment) can be indexed to the required position by pressing the swivel head (attachment) indexing start button after selecting the required position (FR/RH/RR/LH) by the index position selecting switch. For the swivel head (attachment) indexing operation, following conditions must be met.



Conditions for the operation:

(1) Spindle is stopped.

(2) Tool is clamped (both for vertical and horizontal spindles).

(3) Tool change arm is retracted.

(4) Swivel head in indexable range indicating lamp is illuminated.

(5) Swivel head index pin is extracted. (only for MCM)

(6) Spindle orientation pin is not extracted.

(Swivel head index command includes the orientation pin extraction.)

(7) Not in alarm A occurrence

(8) ATC operation sequence number is within 1 to 19, 50 to 66. (only for MCM)

[Supplement]

1. In completely automated operation including ATC, the swivel head is automatically indexed for automatic tool change operation after Z-axis is moved up to the tool change position. (only for MCM)

   RR position for vertical spindle

   FR position for horizontal spindle

2. Usually, the swivel head (attachment) is rotated in the clockwise direction. In the M17 mode, it is rotated in the counterclockwise direction.

4. ATC

4-1. ATC Operations

4-1-1. Establishment of Correspondence between Toolpot Numbers and Tool Numbers by Manual Tool Change Operation

In the memory-random ATC system the tool in the spindle is returned to the toolpot in which the tool to be set in the spindle next is held. Therefore, the correspondence between the toolpot numbers and the tool numbers changes each time the automatic tool change cycle is carried out. This means that the initial correspondence between toolpot numbers and tool numbers must be set and stored in the memory before starting the ATC operation.

For setting this correspondence, there are two ways as follows:

(a) The table listing the correspondence between the toolpot numbers and tool numbers is made in advance, the correspondence table is established on the screen and individual tools are stored in the corresponding toolpots according to the established correspondence.

(b) A tool is manually set in the spindle and is returned to the toolpot specified or to an empty pot, automatically selected by the manual tool change operation.

In this section the procedure for (b) is explained. Refer to III. DATA OPERATION, Section 1, 5-2. "ATC Pot No./Tool No. Table" for the procedure for (a).

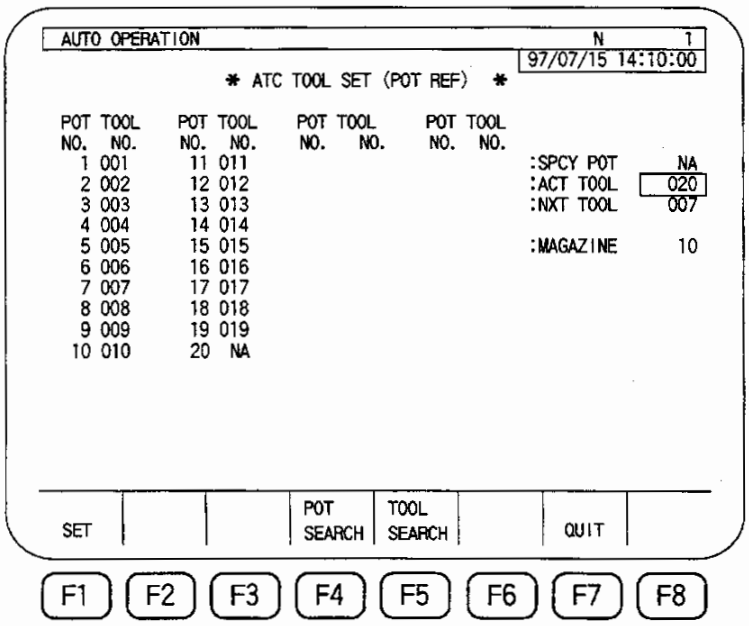
(1) Setting procedure

(a) Switch the mode to "manual" by pressing the MANUAL key.

The display is possible in the automatic and MDI modes also. However, the setting is effective only in the manual mode.

(b) Press function key [F8] (EXTEND) to change function key guide message. Then press function key [F2] (TOOL SET).

(c) The ∗ATC TOOL SET (POT REF) ∗ page is displayed.



Note that POT NO. and TOOL NO. at the left hand column are only for display purpose and setting them is impossible.

(2) Symbols on the display pages are as follows

→ : Indicates the next tool.

>> : Indicates the toolpot number which is located at the position where a tool can be manually removed from or inserted into the toolpot.

(3) The data to be set

(a) SPCY POT

This is used for specifying the toolpot to which the active tool is to be returned, if necessary.

[Supplement]

1. The maximum number is the number of toolpots in the magazine.
2. If another tool number has already been assigned to the specified toolpot number, an error occurs.
3. When specifying a toolpot number for returning a large-diameter tool," the adjacent toolpots should have a dummy tool or they should be left empty. Otherwise, an error occurs.

(b) ACT TOOL

This indicates the tool number of the tool set in the spindle.

[Supplement]

1. The maximum tool number is the same as the number of tool offsets. (50 in standard)
2. In case the set tool number has already been assigned to another toolpot number, an error occurs. Although a large-diameter tool (XX, L) can be set, setting of a dummy tool (D) is impossible. In case the pot number has already been specified in the SPCY POT column, and when a large-diameter tool is specified, the adjacent toolpots should have no tool data or be assigned with dummy tool (D). Otherwise, an alarm occurs.
3. Setting of a large-diameter tool (XX, L) is possible but the setting of a dummy tool (D) is impossible.
4. In case a large-diameter tool is specified with pot number entered in the SPCY POT, an error will occur if no tool or a dummy tool (D) is not assigned with the pots prior/next to the SPCY POT.
5. In case a large-diameter tool is specified with no pot number entered in the SPCY POT data location, an error will occur if there are no three empty pots arranged in succession or no two empty pots in succession next to the pot assigned with a dummy tool (D).

(c) NXT TOOL

This indicates the tool number to be set in the spindle next. No data is entered for the first tool returning cycle.

[Supplement]

1. The maximum number is the same as the active tool.
2. In case there is a mismatch between the tool number specified and the toolpot number, an error occurs.
3. Setting of a large-diameter tool (,L) and dummy tool (D) is impossible.
4. An error will occur when pot number is specified in the SPCY POT data location.

(4) Returning a tool to the magazine

When returning a tool to the magazine pot, there are two methods such as (a) specifying the toolpot number; and (b) returning the tool to an empty pot automatically. These two methods are detailed below. For the procedure to set a tool on the spindle manually, refer to the section covering the manual tool change procedure.

(a) Tool return cycle with pot number specified:

1) Position the cursor on the SPCY POT data location.

Key in the return pot number and press the WRITE key.

2) Set a tool in the spindle.

3) Position the cursor on the ACT TOOL data location.

After keying in the active tool number, press the WRITE key. In this case, the data of NXT TOOL should be NA. If a tool number has been entered, key in "*" after locating the cursor *on* NXT TOOL, to clear the data.

4) Press the 1 CYCLE START key.

The tool in the spindle is returned to the specified pot and the correspondence between the toolpot number and the tool number is set and stored.

If this operation is intended for the pot which is assigned with another tool number, an error occurs and tool return cycle is not started.

(b) Tool return cycle without pot number specified:

1) Clear the data of the SPCY POT by entering as asterisk (*).

2) Set a tool in the spindle.

3) Enter the active tool number for ACT TOOL.

In this data entry, the NXT TOOL data must be NA.

4) Press the 1 CYCLE START key.

The empty pot located nearest to the presently indexed pot is automatically selected and the tool return cycle is started.

[Supplement]

1. Pressing the 1 CYCLE START key with the next tool number specified, initiates the normal tool change cycle.
2. The SPCY POT data is automatically cleared after the execution of "1 cycle start" command.
3. The SPCY POT data is only for tool return cycle. Therefore, if this data and the NXT TOOL data have both been entered when the 1 CYCLE START key is pressed, an error occurs.
4. In the automatic empty pot selection, the empty pot is looked for in the magazine clockwise direction rotation. If there is no empty pot, an error occurs and no return cycle is carried out.
5. When entering a large-diameter tool, enter ",L" following the tool number.

4-1-2. Operation on ATC Operation Panel

(1) Status indication and operation keys

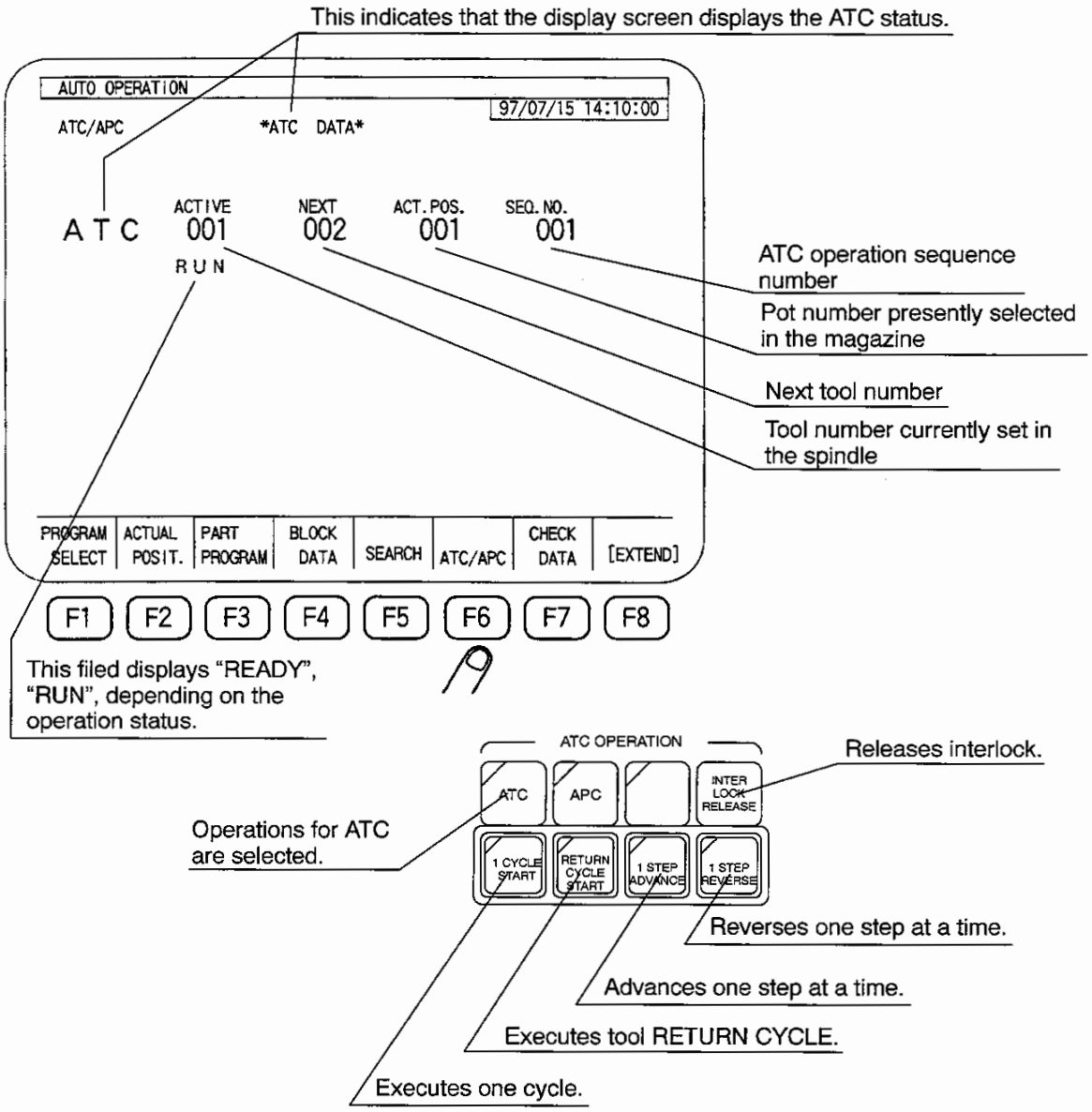


Fig. 3-1 ATC Operation Using Flat Panel

(a) ATC/APC display

In the automatic, MDI or manual mode, press function key [F6] (ATC/APC) to display the ATC/APC screen.

(b) Selection of ATC operation

Press the ATC key at the ATC OPERATION panel. Whether the ATC operation is selected can be checked by the display screen display – ∗ATC DATA∗.

(c) 1 CYCLE START

The "1-cycle start" operation is allowed only when the message "READY" is displayed with the ATC sequence number set at "1". This automatically carries out one complete automatic tool change cycle.

When it is necessary to change the tool numbers of ACTIVE and NEXT, follow the procedure indicated in III DATA OPERATION, Section 1, 5. "Tool Data Set Commands".

(d) RETURN CYCLE START

The return cycle operation is possible from any ATC operation sequence number.

The operations activated by the pressing of the RETURN CYCLE START key depend on the ATC operation sequence where it is pressed. That is, when it is pressed before the tool change arm 180 degree rotation, the tool return cycle immediately starts and no tool change cycle occurs. However, when the RETURN CYCLE START key is pressed after the tool change arm 180 degree rotation sequence, then the automatic tool change cycle is continued.

(e) 1 STEP ADVANCE

ATC operations advance one step at a time. When the cycle does not advance even if this key is pressed, due to presence of unfulfilled conditions for tool change position or spindle orientation, press the I STEP ADVANCE key while pressing the INTERLOCK RELEASE key. It will then ignore them and continue operations.

This key is inoperative while the message "RUN" is being displayed on the display screen even if the ATC is not operating. In this case, clear the "RUN" message from the screen by resetting, before pressing the 1 STEP ADVANCE key.

Note that when mechanical conditions are not met, the 1 STEP ADVANCE key is not operative even when the INTERLoCK RELEASE key is pressed since these conditions are not ignored. The message "RUN" remains on the display screen.

(f) 1 STEP REVERSE

This returns the ATC operations one step each time it is pressed. Functions of the 1 STEP RETURN key are the same as the 1 STEP ADVANCE key except that the ATC operations are returned instead of advanced.

(g) INTERLOCK RELEASE

The spindle orientation completion and tool change position conditions are ignored only as long as this key is pressed. It will not ignore other mechanical conditions.

For ATC operation, refer to the maintenance manuals for each models.

(2) ATC restoration

(a) When the ATC shuts down during the cycle, discover the defect by a diagnosis message, and, after restoring conditions, reset the ATC operation sequence number to 1 with the 1 STEP ADVANCE key.

For diagnosis message, refer to the Maintenance Manual for individual machine models.

(b) If a disconnection occurs during ATC cycle execution, the spindle orientation completion and the tool change position conditions are erased. To restore, press the 1 STEP ADVANCE key while pressing the INTERLOCK RELEASE key to reset the ATC operation sequence number to "1".

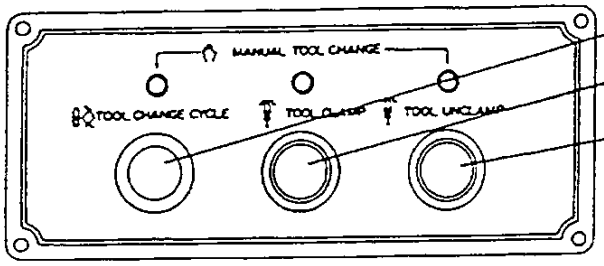
(c) When the ATC operation is reset during the cycle, the 1 STEP ADVANCE, 1 STEP REVERSE or RETURN CYCLE START key can also be used.

(d) In the return cycle, even when the ATC operation sequence number is set to "1" by depressing the RETURN CYCLE START key after resetting the operation, the next tool number is not set at "0". The operation above, during the ATC operation sequence, numbers smaller than those indicated above, resets the next tool number to "0". This is because the tool change operation with the next tool will possibly be made if the next tool number has been written when the ATC operation sequenced number is set to "1" by the 1 STEP ADVANCE key.

When it is necessary to set the next tool number to "0", enter T00 in the MDI mode and press the CYCLE START button after pressing the WRITE key since "0" entry for the next tool is impossible in the tool data setting mode.

To change the next tool number, set the required number at the TOOL DATA SET screen.

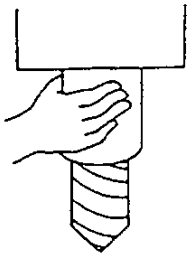
4-2. Manual Tool Change



(1) Press the TOOL CHANGE CYCLE button.

(2) Press the TOOL CLAMP button.

(2) Press the TOOL UNCLAMP button.



(Arrangement of operation switches varies depending on machine model.)

(1) Press the TooL CHANGE CYCLE button.

The X-, Y- and Z-axis move together to the tool change position. (varies depending on machine model.)

(2) Hold the tool set in the spindle by hand, press the TOOL UNCLAMP button, and remove the tool.

(3) Set the new tool in the spindle and press the TOOL CLAMP button. This completes manual tool change operation.

A lamp lights for each button pressed to show the respective condition.

⚠CAUTION

: When changing tools manually, the tool number presently on the spindle and the active tool number displayed on the ATC operation panel will differ. Write the correct active tool number on the ∗TOOL DATA SET∗ page to avoid having the tool returned to the wrong magazine pot.

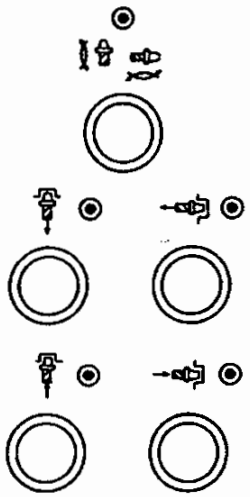
MCM:

(1) Press the TOOL CHANGE CYCLE button.

The indicating lamp above the TOOL CHANGE CYCLE button comes on indicating that a tool change cycle can be carried out.

(2) Hold the tool in the spindle by hand or using a proper base and press the TOOL UNCLAMP button for vertical or horizontal spindle. The tool in the spindle can be removed. When the TOOL UNCLAMP button is pressed, the indicating lamp above the button comes on.

(3) Set a new tool in the spindle and press the TOOL CLAMP button for the spindle for which the tool is to be set. This turns off the TOOL UNCLAMP and TOOL CHANGE CYCLE lamps and the manual tool change cycle ends.



CAUTION

: (1) When it is necessary to cancel the manual tool change cycle mode after pressing the TOOL CHANGE CYCLE button, simply press the TOOL CHANGE FINISH button on the machine operation panel.

(2) When changing tools manually, the tool number presently on the spindle and the active tool number displayed on the ATC operation panel will differ. Write the correct active tool number on the ∗TOOL DATA SET∗ screen to avoid having the tool returned to the swing magazine pot.

4-3. Manual Magazine Operation

Turn the MANUAL INT. switch on the MG MANUAL operation panel ON to allow manual magazine operation.

Switch Name	Function
MANUAL INT - ON	The automatic tool change cycle is interrupted immediately eve during ATC operation when the MANUAL INT. switch is ON. The lamp above the switch lights, indicating that manual magazine operations are enabled. The lamp will not light up when manual magazine operation creates hazards and it is not allowed. After returning the MANUAL INT. switch back to OFF from ON, the interrupted cycle will automatically restart from the ATC operation point reached before turning the switch to ON and will execute until up to the end of the cycle.
CONSTANT INDEX - ON	Continuously rotates the magazine without stopping at each pot.
INDEX START - CW/CCW	CW . . . . . Rotates the magazine in a clockwise direction. CCW . . . . . Rotates the magazine in a counterclockwise direction.
INDEX STOP	Pressing this button while the magazine is in continuous rotation stops the magazine at the nearest pot position in the direction of rotation.
EMG. STOP	Cuts operating power to the NC control box. (Refer to Section 2, 3. "Emergency Stop".)

Operating method is shown below:

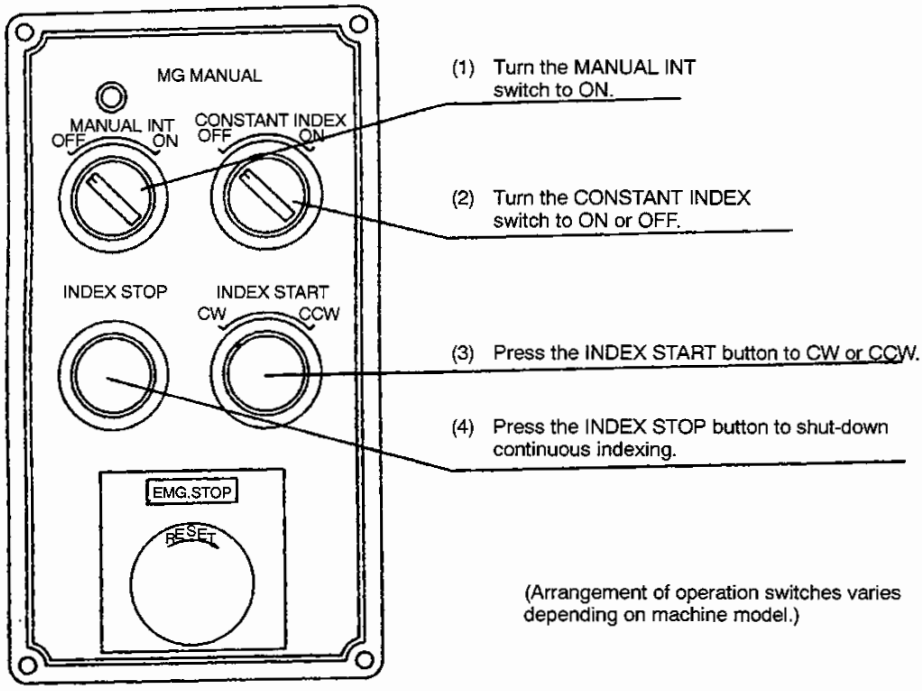


Fig. 3-2 Manual Magazine Operation

(1) The lamp lights when the MANUAL INT. switch is ON, indicating that manual magazine operation is possible.

(2) Set the CONSTANT INDEX switch ON or OFF.

ON ..... Starts continuous rotations.

OFF ..... Stops at each pot.

(3) After setting the INDEX START button to CW or CCW, press it. The magazine starts rotating. Magazine operating conditions are shown below.

Constant Index	Index Start	Magazine Operation
ON	CW	Continuous rotation in the clockwise direction until the INDEX STOP button is pressed
	CCW	Continuous rotation in the counterclockwise direction until the INDEX STOP button is pressed
OFF	CW	Stops at each pot while rotating in the clockwise direction.
	CCW	Stops at each pot while rotating in the counterclockwise direction.

With the CONSTANT INDEX switch turned OFF, the magazine will rotate as long as the INDEX START button is pressed. Releasing the button will stop the magazine at the nearest pot position in the direction of rotation.

(4) The magazine rotates continuously when the CONSTANT INDEX switch is turned ON. Pressing the INDEX STOP button stops the magazine at the nearest pot position in the direction of rotation.

4-4. Manual Tool Change in Automatic Mode Operation

(1) MDB

The entry of M06 places the control in the manual tool change mode like the TOOL CHANGE CYCLE button has been pressed.

Exchange the tools in the same manner as exchanging the tools in the manual mode operation.

After the completion of the tool exchange, press the TOOL CHANGE CYCLE FINISH button on the machine operation panel.

(2) MCV, MCR, MCM

The entry of M70 places the control in the manual tool change mode like the TOOL CHANGE CYCLE button has been pressed.

Exchange the tools in the same manner as exchanging the tools in the manual mode operation.

After the completion of the tool exchange, press the TOOL CHANGE CYCLE FINISH button on the machine operation panel.

5. APC

5-1. APC Operation

(1) Status Indication and operation keys

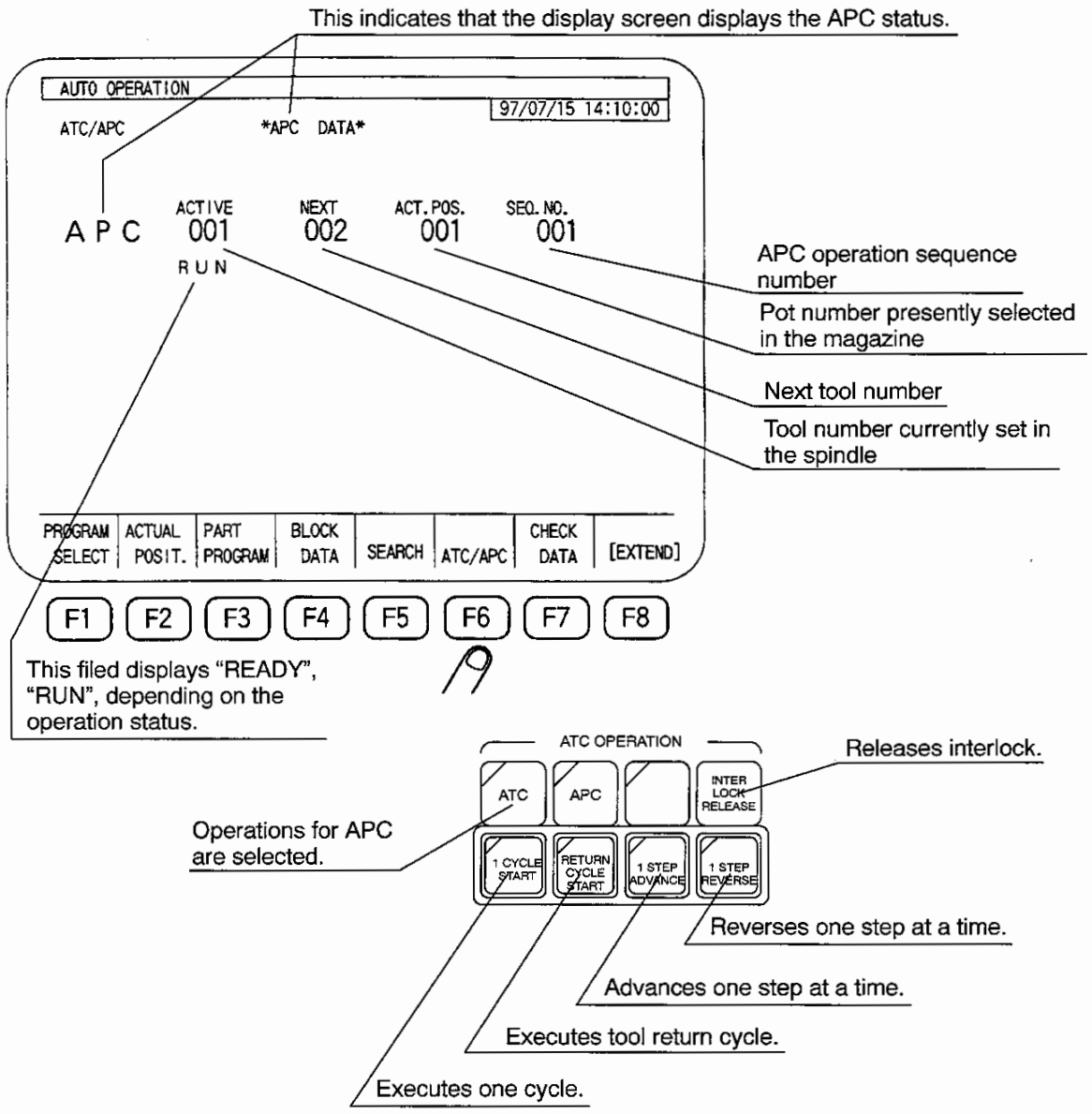


Fig. 3-3 APC Operation Using Flat Panel

(a) ATC/APC display

In the automatic, MDI or manual mode, press function key [F6] (ATC/APC) to display the ATC/APC screen.

(b) Selection of APC operation

Press the APC key at the APC OPERATION panel. Whether the APC operation is selected can be checked by the CRT screen display – ∗APC DATA∗.

(c) 1 CYCLE START

When this key is pressed, one automatic pallet change cycle is carried out. Note that this operation is effective only when the message "READY" is displayed on the screen.

(d) RETURN CYCLE START

When this key is pressed, the automatic pallet change cycle is carried out in the reverse order up to its operation sequence number of "1".

(e) 1 STEP ADVANCE

Each time this key is pressed, the automatic pallet change cycle is advanced step by step. Note that this key is inoperative when "RUN" is displayed on the screen.

If "RUN" message is displayed for a long time, the cycle will be stopped due to unfulfilled step advance conditions. In this case, press the RESET button to clear "RUN" message and then press the 1 STEP ADVANCE key. Should "RUN" message appear again, consult your local Okuma representative.

(f) 1 STEP REVERSE

This operation returns the automatic pallet change cycle step by step each time it is pressed. Functions of the 1 STEP REVERSE key are the same as the 1 STEP ADVANCE key except that the APC operations are returned instead of advanced.

For APC operation, refer to maintenance manuals for each models.

5-2. Automatic APC Operations

(1) Pallet Change

Automatic pallet change cycle is carried out by executing the M60 command.

(2) Workpiece Setup Completion

The automatic pallet change cycle is carried out after the workpiece setup has been confirmed. This setup completion condition is confirmed by pressing the WORK LOAD FINISHED button.

The WORK LOAD FINISHED button is located on the operation panel and also on the separately installed APC operation panel (option). Both of these buttons have the same function. When the WORK LOAD FINISHED button is pressed, its indicating lamp lights.

Even when the automatic pallet change M code command is read while the workpiece setup completion is not confirmed (lamp OFF), the APC does not operate. In this case, the diagnosis message tells that the workpiece setup is not confirmed. Press the WORK LOAD FINISHED button after making sure that the workpiece has been set on the pallet.

In the manual mode, the control is always in the state that the WORK LOAD FINISHED button is pressed.

(3) WORK LOAD RESET Pushbutton Switch

If the WORK LOAD FINISHED button is pressed mistakenly while a workpiece has not been set on the pallet, this setup completion confirmation state can be cancelled by pressing the WORK LOAD RESET button.

The WORK LOAD RESET button is located on the operation panel and also on the separately installed APC operation panel (option). Both of these buttons have the same function. When the WORK LOAD RESET button is pressed, its indicating lamp goes off.

The workpiece setup completed state cannot be cancelled by pressing the RESET button.

5-3. Manual APC Operations

Manual pallet changer operation is possible when the MANUAL INT. switch is set at the ON position.

(1) Parallel or Rotary Type 2-Pallet APC (Vertical/Horizontal Machining Center)

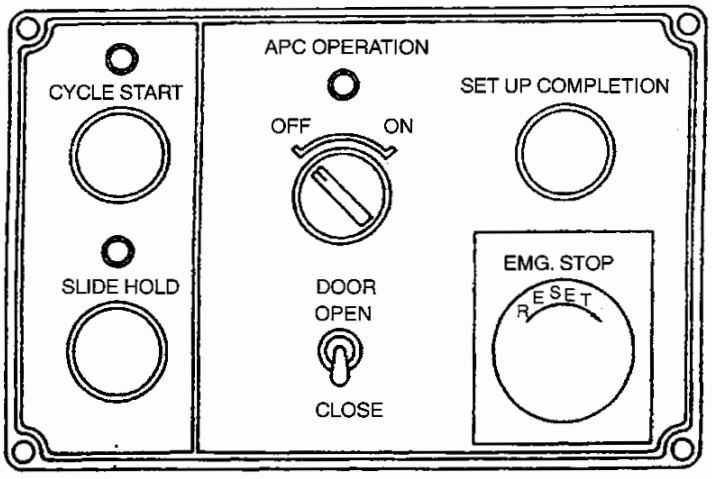


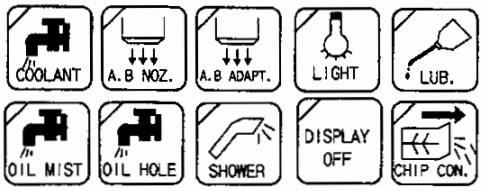
Fig. 3-4 APC Operation Panel – Parallel or Rotary Type 2-pallet APC (Vertical/Horizontal Machining Center)

Switch Name	Function
MANUAL INT. ON/OFF	Turning the MANUAL INT. switch ON during the automatic pallet change cycle interrupts the automatic pallet change cycle being carried out and manual pallet change operation is permitted. The indicating lamp above this selector switch lights when the switch is ON. In case the manual pallet change operation is dangerous, the indicating lamp does not come on, thus inhibiting manual pallet change operation intervention. Returning the switch to the OFF position and pressing the SETUP COMPLETION button will automatically resume the interrupted automatic pallet change cycle from the sequence where the interruption has occurred up to the end of the cycle.
SETUP COMPLETION	This button should be pressed after the setup of workpiece on the pallet has been completed. The indicating lamp lights and the CNC unit acknowledges set up completion.
DOOR OPEN/CLOSE	OPEN .... The door enclosing the machine is opened. CLOSE ... The door enclosing the machine is closed. The setting of the DOOR CLOSE/DOOR OPEN switch is effective even when the MANUAL INT. switch is set in the OFF position. During the automatic pallet change cycle, the door will not be closed even when the switch is turned down to the CLOSE position since automatic pallet change cycle is carried out with the door open. The door will be closed only after the completion of the cycle.
CYCLE START	Pressing this button starts the NC system operation.
SLIDE HOLD	This button brings the NC system into the slide hold mode.
EMG. STOP	This button shuts off the control power of the NC system. (Refer to Section 2, 3. "Emergency Stop".)
PALLET IN POSITION (for MC-H parallel type 2-pallet APC)	The PALLET IN POSITION lamp will light when the pallet is positioned at the predetermined position.
SAFETY GUARD INTERLOCK (rotary type 2-pallet APC)	While the guard is open, the SAFETY GUARD INTERLOCK indicating lamp stays on and automatic pallet changer cycle is disabled. The lamp will go off when the safety guard is closed, thus enabling pallet changer position.

6. Other Functions

These include the COOLANT, OIL MIST, AIR BLOW, OIL HOLE, CHIP CONVEYOR and DISPLAY SCREEN.

(1) Operation keys



These keys are flat keys. When a key is pressed, the LED at the upper left corner turns on and the corresponding function is turned on. When it is pressed again, the function is turned off and the lamp goes off simultaneously.

(2) Keys

(a) COOLANT, OIL MIST, AIR BLOW, OIL HOLE

Setting of these keys is effective independent of the operation mode, whether MANUAL, MDI or AUTO.

For both M08 and M09, the M code entered last becomes effective in the same way as the coolant switches.

(b) LUB.

When the key is pressed, axis slideway is lubricated.

(c) DISPLAY ON/OFF

ON . . . . . Display is disabled.

OFF . . . . . Display is enabled.

Turning this key off when display screen is not required can elongate service life of display screen.

NOTICE

: Y/Z AXIS CROSS RAIL (W) CLAMP

When these axis clamp switches set at the upper position, the corresponding axis (Y for spindlehead, Z for ram and W for crossrail) is clamped with the indicating lamp lighted up. Turning the switches to the lower position unclamp the axis and the indicating lamp goes off.

If the axes are clamped during axis feed, the axis movement is brought to a stop and clamped. However, this operation will cause the guideways to be worn rapidly and therefore clamp/unclamp operation should no be carried out while the axes are being fed.

When power is turned on to the machine, X-, Y-axis and crossrail (W-axis) are in the unclamp state.

SECTION 4 MDI OPERATION

MDI is an abbreviation for Manual Data Input and each block of data entered is executed as in automatic mode operation.

1. Operation Procedure

The operation procedure is described below:

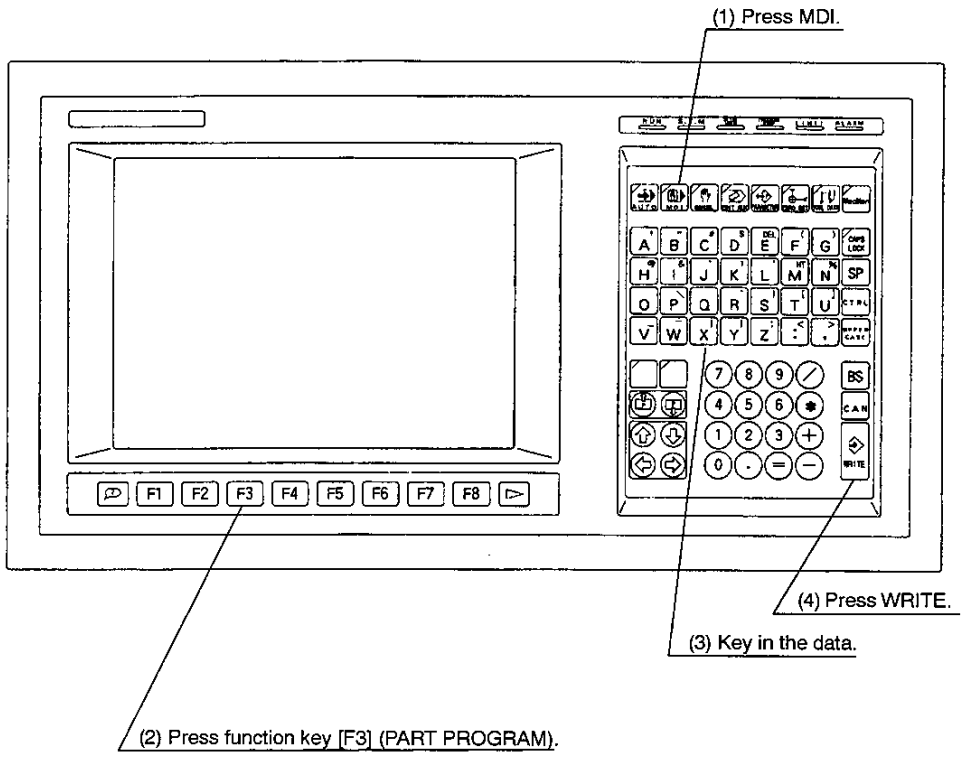


Fig. 4-1 MDI Operation

(1) Press the MDI key.

"IN" is displayed on the 21st line on the display screen.

(2) Press function key [F3] (PART PROGRAM).

The title ∗MDI PROGRAM∗ is displayed on the display screen.

If this display page is not given, press the PAGE key until this page is displayed.

Note that MDI operation is possible without this step.

(3) Enter the data of one block on the keyboard.

This data is displayed on the console line (21st line).

(4) Press the WRITE key.

The entered data is displayed in the buffer field of the MDI program display. The RTMDI (Return from MDI) Instruction is automatically inserted.

In the BUFFER field, only one block of commands may be entered. If an attempt is made to enter a block of commands when another block of commands is displayed in the BUFFER field, the commands presently displayed are cleared.

(5) Press the CYCLE START switch.

The input data is executed when this switch is pressed. The input data is transferred from the BUFFER field to the CURRENT field and the BUFFER field is cleared.

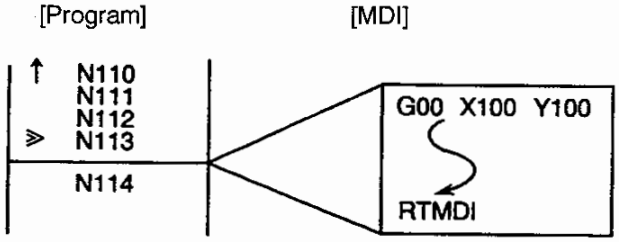
(6) If steps (3) to (5) are executed repeatedly, the NC operates successively.

2. Automatic Mode Operation and MDI Mode Operation

(1) During the execution of the automatic mode operation, the MDI mode operation may be inserted after interrupting the automatic mode operation.

(2) Switching the operation mode from the automatic to the MDI causes the control to halt after the execution of the commands in the block which has been read at the time of operation mode switching, thus permitting the entry of the data. Note that the block which has just been read is identified by the symbol ">>" on the display screen. (The block being executed is designated with "↑".)

When the operation mode is switched from the Single Block mode to the MDI mode, the control is placed in the MDI mode right after the completion of the block, once it has been executed.



(3) If the MDI mode is switched on during N110 execution by automatic operation (single block mode off), blocks up to N113 are executed and the machine stops operation. Then, if the machine is returned to the automatic mode, the program execution is continued from block N114 after several blocks are executed in the MDI mode.

(4) The commands entered the MDI mode are executed in the same manner as those in a program, and the modal state established in the MDI mode will remain active after the operation mode is switched back to automatic.

(5) When the MDI mode is selected while the cutter radius compensation function is active, the axis movement commands keyed in and executed in the MDI mode are also controlled by this function.

(6) The manually inputted data may be executed directly after the commands of the block which has been executed when the operation mode is switched from the automatic (single block mode off) to the MDI. That is, the data reading-in mode as in the single block mode can be set. This setting is made by bit 7 of NC optional parameter (bit) No. 2.

3. Subprogram Call in the MDI Mode Operation

(1) Although the CALL command (single call) may be activated in the MDI mode, the MODIN command (call of subprogram after axis movement) is not effective in this mode. For the call of a subprogram, the main program from which the subprogram is called should be selected before it is called in the MDI mode.

(2) During the execution of a subprogram, the single block mode may be turned on and off as needed. While the single block mode is off, the called subprogram is executed up to its end and then the control stops operation. If the single block mode is on, the called subprogram is executed by one block and the control stops. Pressing the CYCLE START switch after that causes blocks of commands to be executed sequentially block by block each time it is pressed. The entry of new data is not allowed until the completion of the called subprogram.

[Supplement]

1. The following commands cannot be specified in the MDI mode:

   Branch commands ..... GOTO and IF

   Commands used in schedule program ..... VSET, PSELECT, etc.

2. During the execution of a schedule program, the MDI mode operation is possible if a main program is not being executed.

3. The CYCLE START switch becomes effective when it is released after it is pressed as in the automatic mode operation.

SECTION 5 AUTOMATIC MODE OPERATION

1. Main Program Selection and Operation

In order to execute a part program in the automatic mode, first select the part program. Programs stored in the memory have their own file names since programs are managed as files. The specified main program is read from the part programs stored in the file and the subprogram, called in the main program, is searched out in the specified sub file to be loaded to the NC.

For the selection of file, the directory-selection-based file operation screen is used.

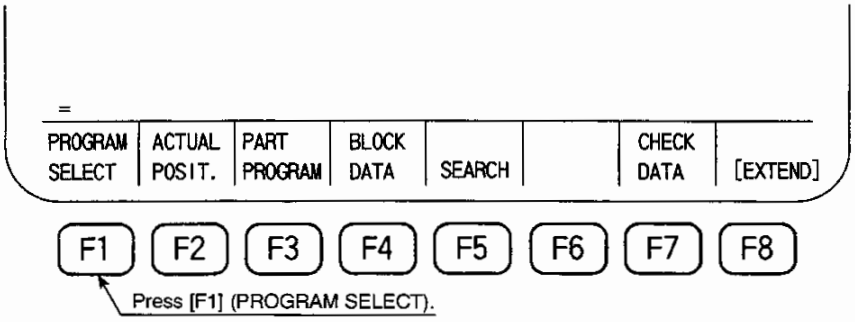
The following explanation gives basic information on program selection operation. In addition to the basic information given below, there are various functions including the function to display the registered part program files in batch. For details of the functions, refer to III. DATA OPERATION, Section 2, 15. "Directory-Selection-Based File Operation Function".

The operating procedure is described below:

(1) Press the AUTO key.

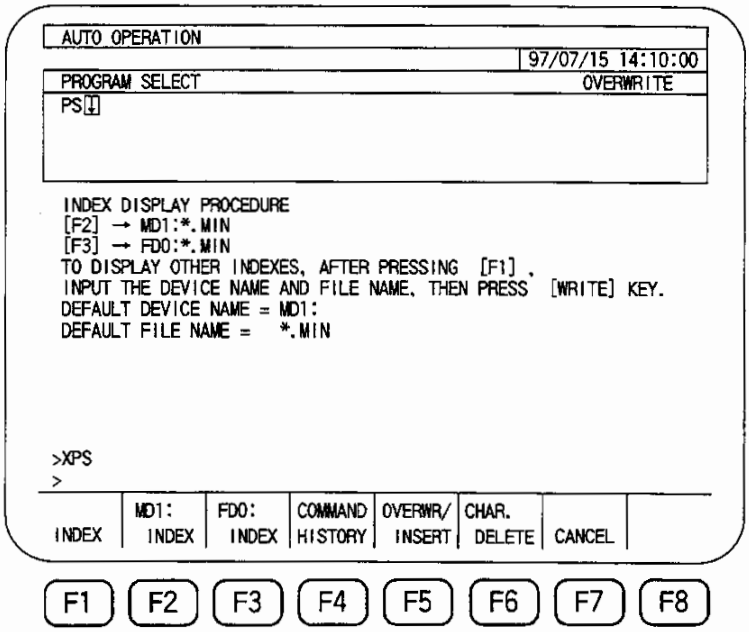
(2) The lamp at the upper left corner in the key lights and the screen changes to the automatic operation screen.

Press function key [F1] (PROGRAM SELECT).



The screen changes to the auto operation screen and the following is displayed on the screen.

PROGRAM SELECT
PS



(3) Enter the designation mode from the table below.

The input format is as indicated below and entry of an asterisk (*) instead of a file name, will display a file name directory.

=PS␣ main-file-name, main-program-name, sub-file-name; option

Main-file-name ..... File name of main programs

Sub-file-name ..... File name of sub programs which are called from a main program

Option ..... Designation of A, B and S option

Procedure	Designation Mode	Contents	Remarks
(a)	PS␣*	Designates main file name.	Designation of device name for calling out main file is also possible.
	PS␣ *;	Designates main file name and option.	Same as above.
(b)	PS␣*,*	Designates main file name and main program name.	Same as above.
	PS␣ *,*;	Designates main file name, main program name and option.	Same as above.
(c)	PS␣ ,*,*,*	Designates main file name, main program name and sub file name.	Designation of device name for calling out main and sub file is also possible.
	PS␣*,*,*;	Designates main tile name, main program name, sub file name and option.	Same as above.

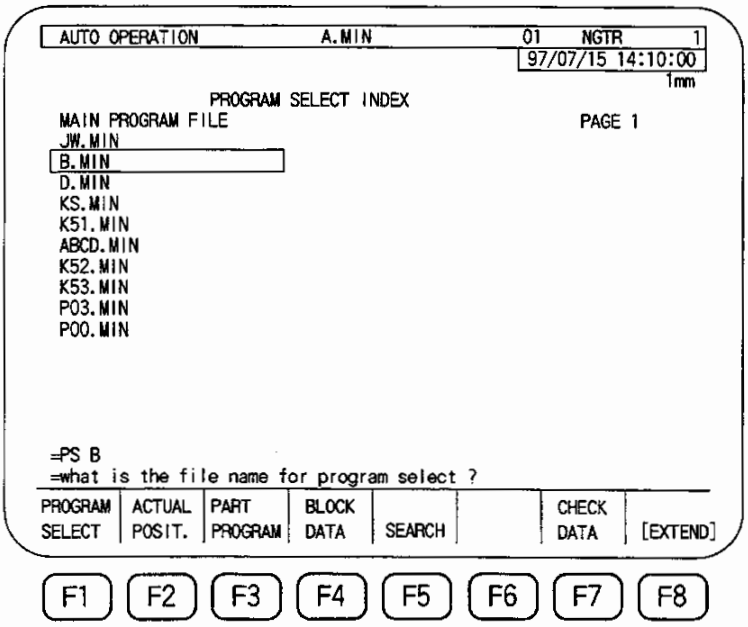
Procedure	Designation Mode	Contents	Remarks
(d)	PS␣*,,*	Designates main file name and sub file name.	
	PS␣,*,*	A.MIN is automatically selected as main file name. Designates main program name and sub tile name.	

(a) Designation mode PS␣ * (or PS␣ *;)

1) Key in as PS␣ * or PS␣ *;.

2) Press the WRITE key.

The display is changed to the PROGRAM SELECT INDEX screen and main file names registered are displayed. (This searches files having extension "MIN" from MD1:.)



3) Position the cursor at the desired file name.

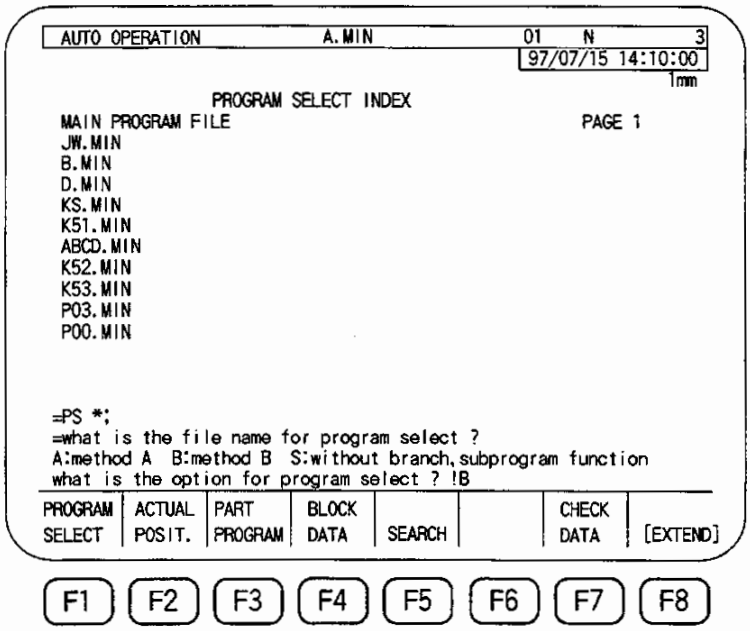
4) Press the WRITE key.

5) If there is an option designation ";", the screen automatically goes to the option designation mode and the messages below are displayed at the lower block on the display screen.

A:method A B:method B S:without branch, subprogram function

What is the option for program select? !

Key in "A", "B", or "S" as desired. (Option B and option S can be specified simultaneously.)



6) Press the WRITE key.

Entry of "B" in response to the prompt "What is the option for program select? !" selects the operation method B (large capacity operation method). If the control is not supported by this operation method, the entry is ignored.

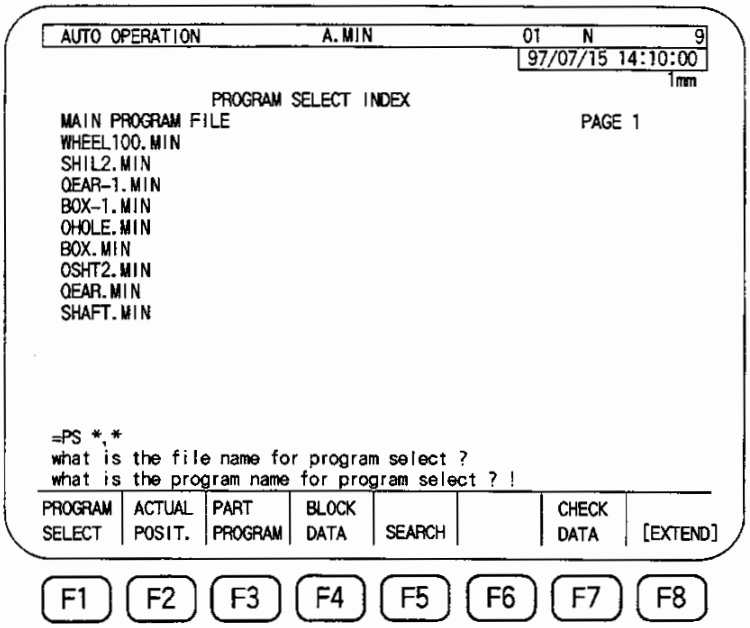
When the WRITE key is pressed without entering any character in response to the prompt "What is the option for program select? !", the control operates in accordance with the setting of the NC optional parameter (word) No. 11.

(b) Designation mode PS␣ ∗,∗ (or PS␣ ∗,∗;)

1) Key in as PS␣ ∗,∗ or PS␣ ∗,∗;.

2) Select main file names in the same procedures as 2), 3) and 4) in (a).

3) Enter the main program name when the prompt "What is the program name for program select? !" is displayed at the lower section of the screen.



For example, selecting main program name O100 is as follows:

What is the program name for program select? !O100

4) Press the WRITE key.

If the WRITE key is pressed without entering the program name, the first program in the main file is selected.

5) When there is an option designation ";", the display screen allows the entry of option designation code. Follow the steps 5) and 6) in (a).

(c) Designation mode PS␣ ∗,∗,∗ (or PS␣ ∗,∗,∗;)

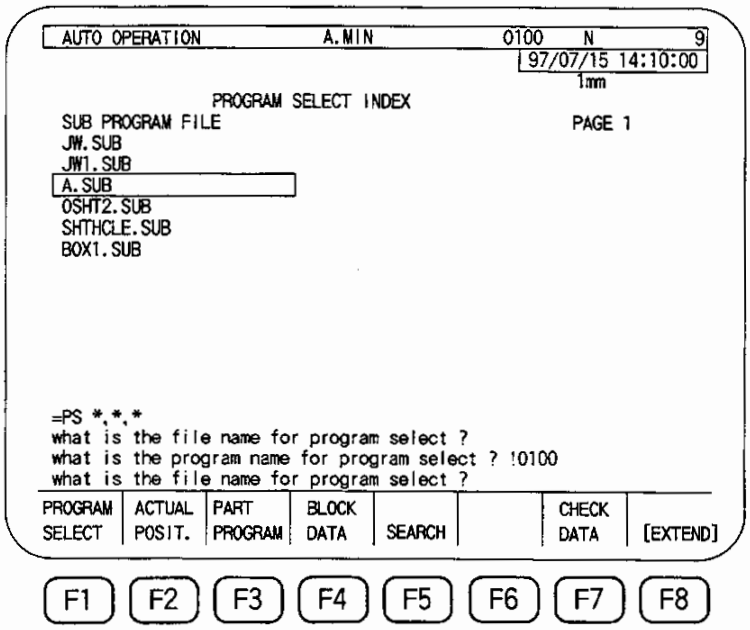
1) Key in as PS␣ ∗,∗,∗ or PS␣ ∗,∗,∗;.

2) Select the main file name in the same procedures as 2), 3) and 4) in (a).

3) Select the program name in the same procedures as 3) and 4) in (b).

4) The screen will then display the subprogram file names.

Files having extension "SUB" in MD1:.



5) Position the cursor at the desired file name.

6) Press the WRITE key.

7) If there is an option designation ";", the display screen allows the entry of option designation code. Follow the steps 5) and 6) in (a).

(4) By pressing the WRITE key, the main program can be read from the specified main file, while the subprogram called up in the main program is loaded to the NC, and the main program is displayed on the display screen.

If the subprogram called up in the main program cannot be found in the specified sub file, it should be searched for in the sub file of the extension SSB so that loading can start. If it still cannot be found, an error occurs.

(5) Press the CYCLE START switch.

By pressing the CYCLE START switch, the main program can be started.

[Supplement]

1. If a main file name is omitted, A.MIN is used. If the main program is omitted, the first program in the main file name is used.
2. Search of the subprogram which has been stored as a part of the main file is made first.
3. When the sub file name is omitted, the search of a subprogram called in the main program is made only for the sub file of the extension SSB or MSB. Therefore, the sub file with extension .SUB should be input without fail. Only one kind of sub file can be input.

   (If the subprogram in the main file calls the other subprogram, the subprogram to becalled must be stored after the one from which it is called.)
4. If there is no specified file name or program name, an error occurs. Then, the program selected previously becomes invalid. Always confirm that the valid file name or program name is displayed on the first line of the display screen.
5. A program once selected is valid until the next program is selected. Selecting the schedule program is invalid.
6. Direct specification of the file name without using symbol "*"is also allowed.
7. Main and sub file name directory can be searched for using alphabetic character, "-", "?", or "*".
8. An asterisk (*) is displayed at the beginning of the file name of the file which is selected currently.

   When the PROGRAM SELECT INDEX screen is displayed, the cursor is positioned on the file name prefixed by an asterisk.
9. When there is no file where asterisk should be set, the first page of the PROGRAM SELECT INDEX screen is displayed with the cursor at the top of the file names.
10. An asterisk (*) is not displayed in program selection such as external program selection, DNC-C program selection, and PPC program selection, other than the selection made by an operator.

Table 5-1 Operation Comparison between Normal Storage Capacity Memory and Large Storage Capacity Memory

Item		Selection and Operation of Normal Storage Capacity	Selection and Operation of Large Storage Capacity		Remarks
Parameter setting		Method A	Method B		Method S
Specification of S option in PROGRAM SELECT command mode		Invalid	Valid		—
			S option not specified	S option specified	—
Program size limitation	Main program	Up to the operation buffer area size.*	Up to total length of the stored main program		Same as Method B
	Subprogram		Total tape length varies depending on the selected operation buffer area capacity.*	—	—
	Library program			Total tape length varies depending on the selected operation buffer area capacity.*	Same as Method B
	Schedule program				Same as Method B
Subprogram function		Available	Available	Unavailable (alarm)	Same as Method B
Branch function		Available	Available	Unavailable (alarm)	Same as Method B
Instruction for jump destination of branch instruction	Main program	Sequence label, sequence number	Sequence label only	—	—
	Subprogram		Sequence label or sequence number	—	—
	Library program			—	—
	Schedule program			—	—
Main program sequence label limit		No limit	Fewer than 30 pcs.	No limit	Same as Method B
Execution time for PSELECT command		Several tens seconds to several minutes	Several tens seconds to several minutes	Ends at once	Same as Method B

*: This capacity can be extended by selecting the operation buffer expansion specification.

2. Schedule Program Selection and Operation

(1) The schedule program function is provided to continuously machine different types of workpieces automatically using the pallet changer, etc. without operator's intervention.

In this item, selection and operation of the schedule program are explained.

For the programming of the schedule program, refer to Section 12, 3. "Schedule Programs" in Programming Manual.

(2) For the selection of a schedule program, the directory-selection-based file operation screen is used.

The following explanation gives basic information on selection and registration of the schedule program. In addition to the basic information given below, there are various functions including the function to display the registered part program files in batch. For details of the functions, refer to III. DATA OPERATION, Section 2, 15. "Directory-Selection-Based File Operation Function".

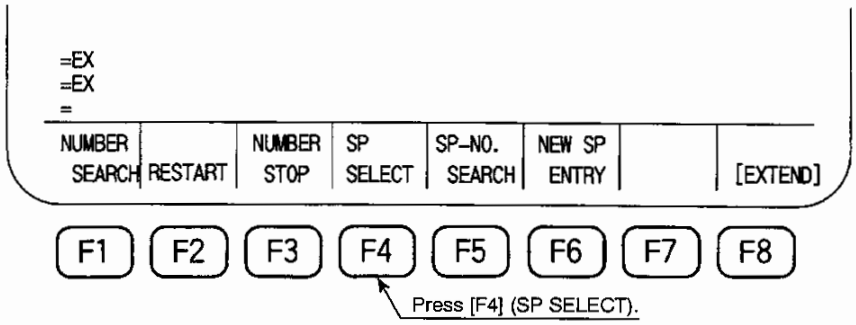
2-1. Selection and Operation of Schedule Program

(1) Press the AUTO key.

(2) The lamp at the upper left corner in the key lights and the screen changes to the automatic operation screen.

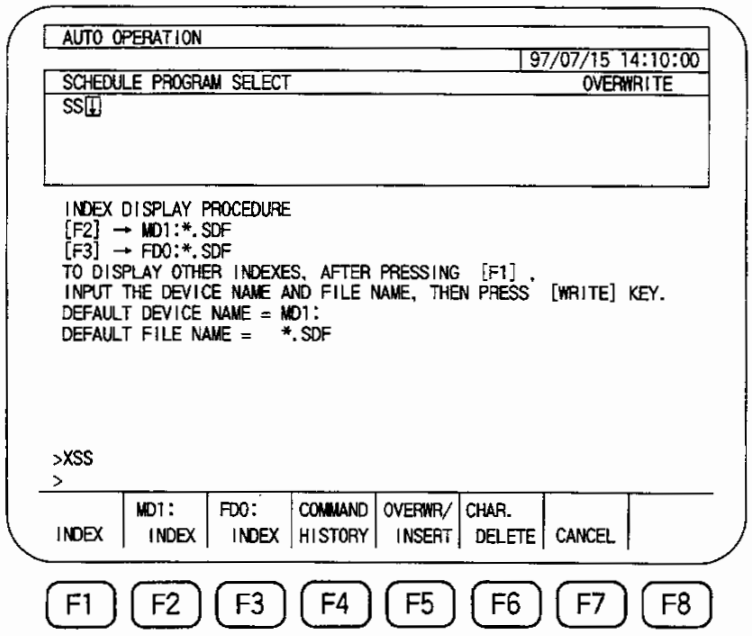
(3) Press function key [F8] (EXTEND) two times.

(4) Press function key [F4] (SP SELECT).



The screen changes to the auto operation screen and the following is displayed on the screen.

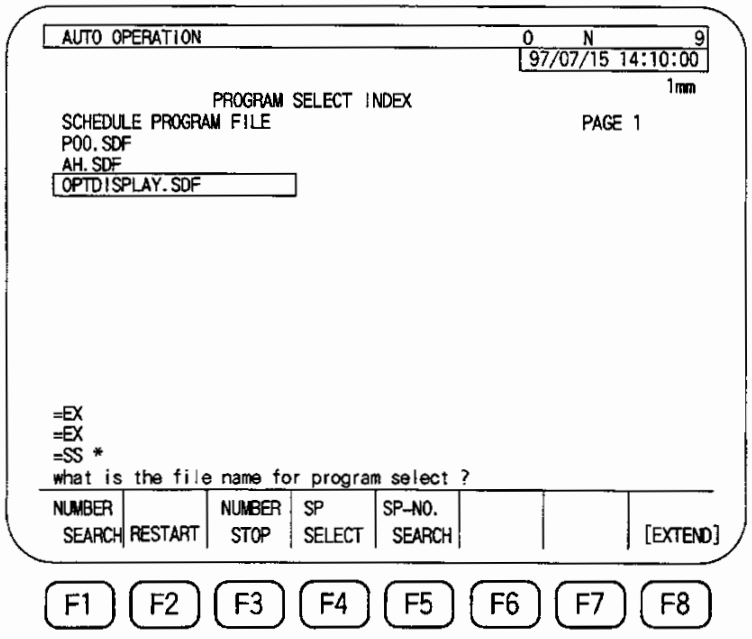
SCHEDULE PROGRAM SELECT
SS



(5) Enter "*" following "SS".

(6) Press the WRITE key.

The display will be switched to the PROGRAM SELECT INDEX page and the schedule program file names registered are shown. (Files having an extension of "SDF" are searched from the MD1:.)



(7) Position the cursor at the desired file name.

(8) Press the WRITE key.

The schedule program is selected and the NC enters the schedule operation mode.

(9) Press the CYCLE START switch.

This starts the continuous operation in accordance with the programmed schedule.

When the schedule operation cycle stop key on the machine operation panel is pressed, the NC enters the cycle stop mode. In this mode, operation cycle stops after the execution of a main program. To resume the operation, press the CYCLE START switch.

[Supplement]

1. Selection of a schedule program file by directly keying in the file name is also possible.

   SS ␣ schedule-program-file-name [WRITE]

2. Main and sub file name directory can be searched for using alphabetic character, "-", "?", or "*".

3. Schedule program selection should be done only after resetting the NC. If the schedule program is selected during operation, an error will occur.

4. When the normal automatic operation (AUTO mode operation by main program selection) is done after selecting the schedule program, the program should be selected again.

5. When the CYCLE START switch is pressed with the SINGLE BLOCK switch set ON in schedule program operation mode, the main program will be selected by the schedule program and the machine will wait in the start state. Then, if the CYCLE START switch is pressed, the machine returns to the normal single block mode state.

   But the machine will not stop in the blocks containing VSET, IF and GOTO instructions.

6. When the RESET switch is pressed during the operation in accordance with a schedule program, the part program selected when the NC has been reset will be executed again from the start if the CYCLE START switch is pressed.

   If the repetition number of the part program is specified in the program block selection block in the schedule program, the program execution stopped during machining will not be counted.

7. When the CYCLE START switch is pressed after; selecting the schedule program, the main program is first selected and machine operation using the selected main program begins after the completion of main program selection. If the control is reset while a main program is being selected, the main program is not selected.

8. The main program executed in the schedule program operation mode is cleared from the operation buffer after the completion of the program execution.

9. An asterisk (*) is displayed at the beginning of the file name of the file which is selected currently.

   When the PROGRAM SELECT INDEX screen is displayed, the cursor is positioned on the file name prefixed by an asterisk.

[Supplement]

10. When there is no file where asterisk should be set, the first page of the PROGRAM SELECT INDEX screen is displayed with the cursor at the top of the file names.

11. An asterisk (*) is not displayed in program selection such as external program selection, other than the schedule program selection made by an operator.

3. Cycle Start and Slide Hold

(1) Cycle Start

Press the CYCLE START switch on the machine operation panel to start the NC operation with either the selected part program or the one-block program entered in the MDI mode.

(a) Cycle start after NC reset:

This is effective during automatic operation or MDI operation. The program is read and executed for each separate mode, cycle start requires the following conditions.

[In automatic operation]

The schedule program or the main program has been selected correctly.

[In MDI operation]

The one-block instruction has been entered in the MDI buffer.

(b) Cycle start after shutdown by single block or program stop:

The next block can be executed by pressing the CYCLE START switch in automatic mode.

(c) Cycle start in slide hold mode:

When the CYCLE START switch is pressed, function generation which was interrupted, begins again.

[Supplement]

1. Press and release the CYCLE START switch to begin the operation, but when the machine is stopped temporarily due to the activation of the SLIDE HOLD switch, cycle start is made when the CYCLE START switch is only pressed.

2. Pressing the CYCLE START switch during the program selection, sequence number searching and return search is ineffective.

3. While the SLIDE HOLD switch is being pressed, the CYCLE START switch is inoperative.

4. During the operation, the RUN lamp on the NC operation panel comes on, excluding the slide hold mode.

5. Even in the data setting mode, cycle start is possible provided that the mode previously selected is auto or MDI and the setting of bit 5 of NC optional parameter (bit) No. 2 is "1".

6. When alarms (P, A, B, and C) are on, cycle start by pressing the CYCLE START switch is impossible.

7. An error occurs when the CYCLE START switch is pressed after return search has been executed. In this case, cycle start is possible by pressing the SEQUENCE RESTART switch.

(2) Slide Hold

By pressing the SLIDE HOLD switch on the machine operation panel while the machine is operating as initiated by pressing the CYCLE START switch, explained in item (1) above, axis feed is suspended or program execution is stopped.

(a) Slide hold means the NC halt is made during axis movement. Start-up hold means the NC halt made before or after the completion of an axis movement.

(b) Slide hold during function generation:

- During axis movement by rapid feed or cutting feed

  Axis movement stops after deceleration. When the axis stops halfway in a commanded axis travel, it is in a slide hold state. If the axis reaches the target point before it is stopped, or the operation mode stops after the execution of the other commands in that block are completed, then this is the start-up hold state, and is the same as a stop in the single block or program stop.

- During dwell

  Dwell immediately stops and the machine is brought to the slide hold state.

(c) During operation, excluding function generation
(during the execution of miscellaneous commands):

The slide hold is not effective for miscellaneous functions but the SLIDE HOLD lamp stays on. The machine is brought to a start-up hold state, since the operation halts after the execution of miscellaneous functions.

[Supplement]

1. When axis movement and miscellaneous functions are in the same block, there are two cases for the execution order of the commands.

   a) With ..... The execution of axis movement commands and auxiliary functions start simultaneously.

   b) After ..... The axis movement is completed the execution of miscellaneous function starts.

   Depending on the above conditions,

   if machine hold occurs during axis movement
   (including dwell) ..... Slide hold

   if the machine halts at a time other than
   axis movement ..... Start-up hold

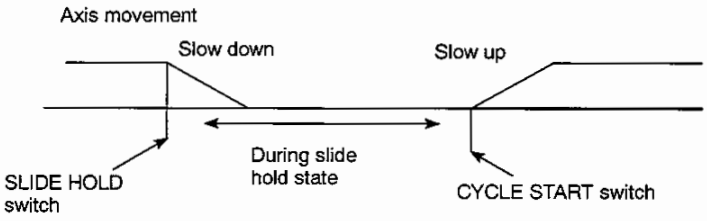
2. During the slide hold (excluding start-up hold), the SLIDE HOLD lamp on the NC operation panel comes on (although the slide hold state is a part of the machine operating state, the RUN lamp will go off).

[Supplement] 3. If the machine is brought to the start-up hold state by the activation of the SLIDE HOLD switch, both the SLIDE HOLD and the RUN lamp go off.

CAUTION : Cycle start in slide hold is activated once the CYCLE START switch is pressed. (In the start-up hold state, cycle start is activated when the pressed CYCLE START switch is released.)

Examples of slide hold:

[During axis movement]



[During miscellaneous function execution]

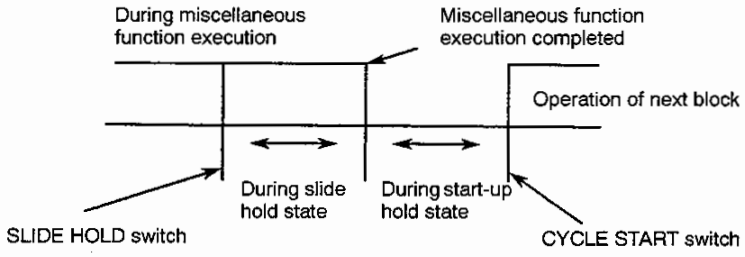
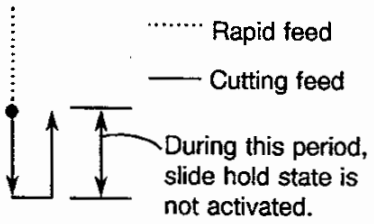


Fig. 5-2 Examples of Slide Hold

4. Even if the SLIDE HOLD switch is pressed during the execution of a tapping cycle – G84 (tapping cycle) and G74 (reverse tapping cycle), the tapping cycle is not interrupted. Slide hold is activated after the completion of the tapping cycle. The machine will not stop operation, but after the operation is completed, it stops operation temporarily. Note that the synchronized tapping cycle (G284 and G274) is different from above described tapping cycle. For details, refer to SPECIAL FUNCTIONS MANUAL No. 1, "SYNCHRONIZED TAPPING".



5. The slide hold function can be activated and deactivated by the programmed M codes, M140 and M141.

   M140 : Slide hold ineffective

   M141 : Slide hold effective

   The SLIDE HOLD switch is inoperative for the blocks containing M140 and M141, and the slide hold function is not activated even when the SLIDE HOLD switch is pressed during such period.

   Note that the control is in the M141 mode after it is reset.

4. Resetting NC

The NC reset means initializing the internal NC status.

The NC system is reset when:

(1) the RESET switch on the machine operation panel is pressed.

(2) the external reset signal is input.

(3) The MACHINE LOCK key on the machine operation panel is turned on or off.

(4) the operation mode is changed over from MANUAL mode to AUTO or MDI mode by pressing the AUTO or MDI key on the NC operation panel.

(5) the operation mode is changed over from AUTO or MDI mode to MANUAL mode by pressing the AUTO or MDI key on the NC operation panel.

(6) When the operation mode is changed from MANUAL mode to DATA SET mode by pressing the DATA SET key on the NC operation panel, the system is not reset; however, when the mode is changed to AUTO or MDI next, the system is reset.

The state that the NC is reset by the change of the operation mode is called mode reset.

NC resetting operation:

The NC resetting operation stops the machine operation immediately and the NC system is initialized at the same time.

[Supplement]

1. When the RESET switch is pressed during axis movement, the machine slows down and then stops axis movement. The actual reset is done after axis movement has stopped.
2. Even if the RESET switch is continuously pressed, reset is done only one time.

5. Sequence number Search and Mid-Start

Sequence search is used to start the operation from a required sequence of a main program. The specified sequence is searched by the sequence name or the cursor, and then the operation is started from the searched sequence by pressing the CYCLE START switch.

The operating procedure for the sequence number search is described below.

Sequence Number Search by Sequence Name or No. of Blocks

When the main program is selected correctly in automatic mode, perform the following operation.

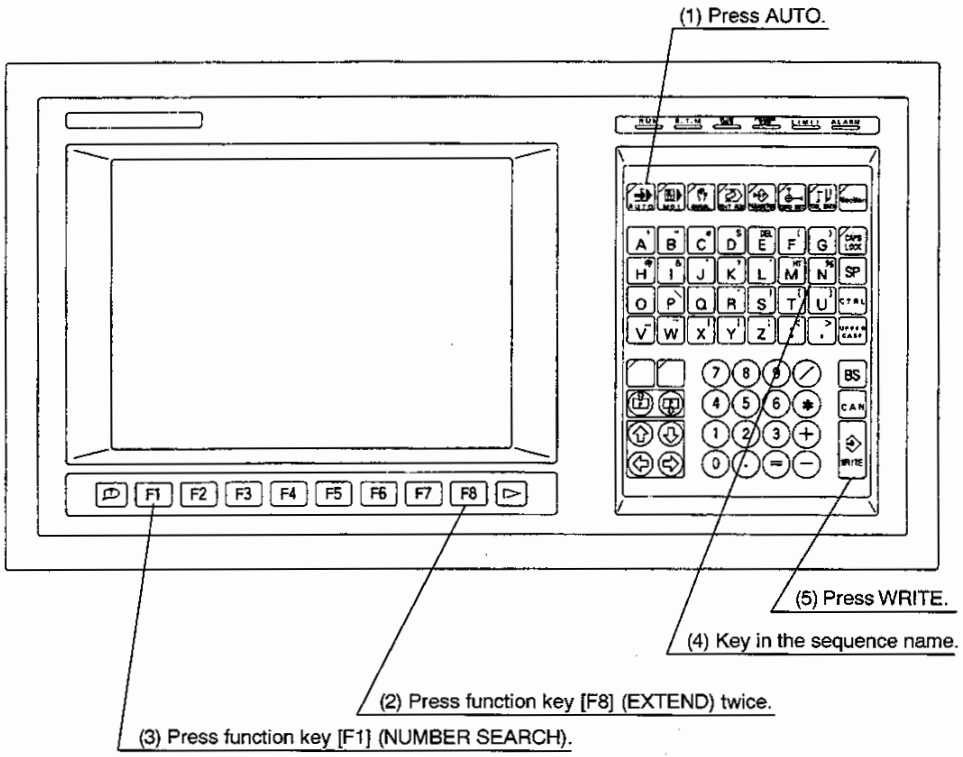


Fig. 5-3 Sequence Search by Sequence Name or No. of Blocks

(1) Press the AUTO key.

(2) Press function key [F8] (EXTEND) twice.

Function names such as [F1] NUMBER SEARCH will be displayed.

(3) Press function key [F1] (NUMBER SEARCH). "NS" is displayed on the 21st line of the display screen.

(4) Enter the specified sequence name or the required number of blocks.

(5) Press the WRITE key.

The sequence name is searched for from the main program head currently selected, and the sequence pointer moves to the found sequence name position. When the number of blocks has been keyed in, the search is made in the specified number (either positive or negative) of blocks from the currently located pointer position.

The following cases result in errors:

(a) When the specified sequence name is not found in the program.

(b) While the schedule program is executed (from schedule program start-up to the end).

(c) Whether the search is made or not during the execution of a main program can be selected by setting proper data at bit 3 of NC optional parameter (bit) No. 4.

(d) When the main program is not selected correctly.

[Supplement] In cases (b) and (c), the sequence number search can be executed after resetting the NC.

Sequence Number Search by Cursor

In the automatic mode, the sequence number pointer may be moved as desired by the cursor keys when the main program has been selected correctly and the screen displays the program.

⇩ ..... one sequence advance

⇧ ..... one sequence return

In the following cases, the cursor keys are inoperative:

- While the schedule program is being executed
- When the display screen is not the program display
- When the sequence pointer leaves the selected main program by the cursor key operation

Restart after Sequence Number Search

Program execution starts from the sequence identified by the sequence pointer when the CYCLE START switch is pressed.

Since programmed commands which were not read during the sequence number search are not valid, a model status must be set as needed by entering the necessary commands from the keyboard so that the actual status and the programmed status match.

[Supplement]

1. During the sequence number search, the read pointer is moved, while the modal instruction value and coordinate instruction value are disregarded. Subprogram CALL and GOTO are not done.
2. The sequence number search is used for start-up after a pause during the machining work, while the return search is used for the return to the block while the machining is underway.
3. The number of the sequence repetition cannot be specified during sequence number search.
4. Additionally, the optional block skip does not affect the sequence number search.

6. Return Search and Sequence Restart

When the machining cycle is interrupted during automatic operation because of tool breakage or other troubles, this function is used to restart the operation after necessary measures such as tool replacement have been taken.

After locating the sequence pointer to the specified sequence by return-search-operation, in which the commands are processed in the CPU, press the SEQ. RESTART switch. This positions the axes at the point commanded last at the manual cutting feedrate. Press the CYCLE START switch, then the operation will be resumed from the same sequence.

6-1. Return Search

When the main program is selected correctly in the automatic mode, carry out the steps following:

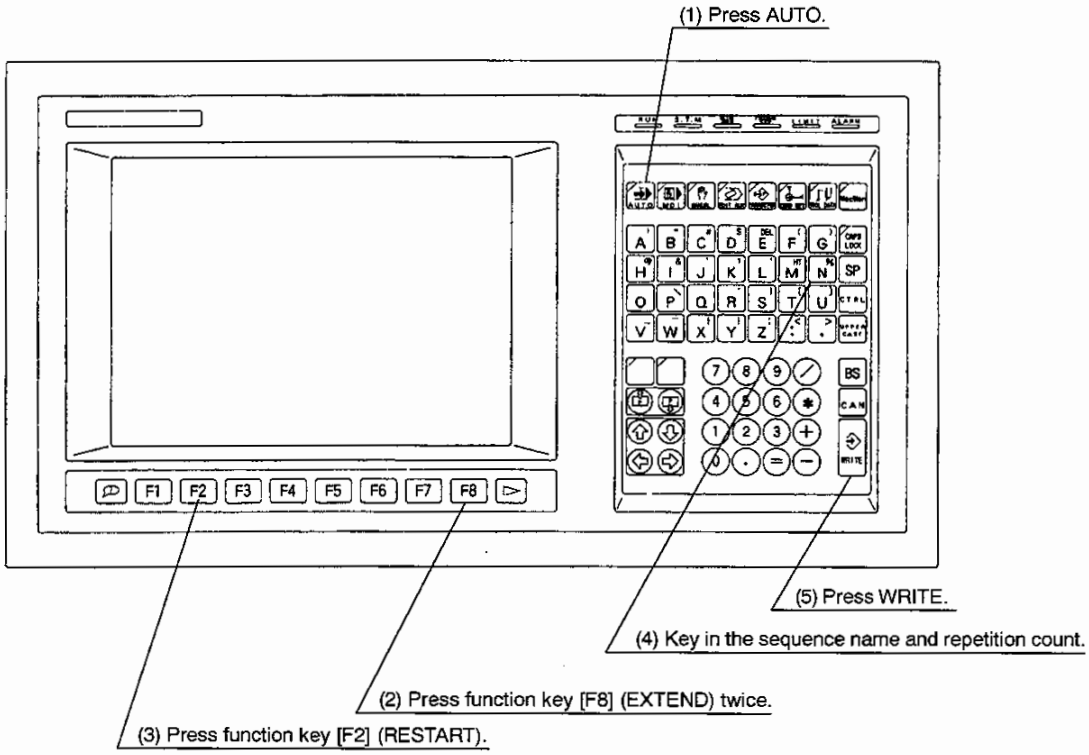


Fig. 5-4 Return Search and Sequence Restart

(1) Press the AUTO key.

(2) Press function key [F8] (EXTEND) twice.

Function name "RESTART" is displayed for function key [F2].

(3) Press function key [F2] (RESTART).

"RS" is displayed on the 21st line on the display screen.

(4) Enter the sequence name and repetition count, or the block count.

Input format is as follows:

= RS␣ sequence-name, repetition-count or block-count-value

When the sequence name is specified, the repetition count must be less than 9999. If entry of the repetition counter is omitted, it is regarded as "1".

When the block count is specified, the count value must be less than 99999999.

For entering a block count, the relative number may be given as indicated below.

Example:

592 ..... 592nd block

* ..... Block count value which was counted at NC reset

*–2 ..... The block two blocks ahead of the block count value above

(5) Press the WRITE key.

The return operation is executed up to the specified sequence.

Restarting operation refers to the operation in which all the commands are processed within the control, without giving output signals for axis motions, and S, T, M and B functions. CALL command, RTS command and coordinate system shifting are also processed.

The block count is the count of the sequence executed from the program start after reset. Control statements such as GOTO, CALL, etc. are not counted. The count value and sequence name are not cleared by NC reset or by turning the power source on or off, and can therefore, be used for return after reset. They are cleared when the operation begins.

[Supplement]

1. If return search operation is intended while a schedule or a main program is being executed, an error occurs.
2. The return operation up to M02 of the program is possible by the [F2] (RESTART) ␣ E [WRITE] key operation. Reset by M02 (or M03) is not carried out.

6-2. Sequence Restart

This function can be used only after the return search. (For the return search operation, refer to 6-1. "Return Search" in this section.)

When the SEQ. RESTART switch on the machine operation panel is pressed, the program status up to the specified block is returned automatically.

(1) Automatic Restoration of Miscellaneous Functions

(a) Restoring the last S code

If there is an S command, the S code of that command is executed unconditionally.

(b) A T code is not restored automatically.

Since a T code (next tool command) is not restored automatically, it is necessary to set the correct tool number if the next tool number presently active is incorrect. If the next tool number is "0", input the tool number in the MDI operation before executing search.

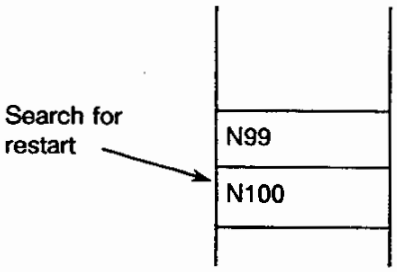
(c) Only M codes related to spindle operation can be restored.

Since M codes are processed in groups, the last modal state of the individual M code groups is restored.

- M03, M04, M05, and M19 are regarded as M codes in the same group, and the last state of them is restored.
- M codes related to ATC operation (M06, M63, M64, and M65) and APC operation (M60, etc.) are not restored automatically. The operator must restore the correct status before restarting the operation.
- One-shot M codes (M00, M01, etc.) are not restored.

(d) The axes return to the point programmed in the return sequence at a manual cutting feedrate.

(e) After axes have reached the return point in the sequence return operation, the operation stops at that point independent of SINGLE BLOCK key setting. To resume the operation, the CYCLE START switch must be pressed.



1) Key in N100 after pressing function key [F2] (RESTART).

Then, press the WRITE key. This prepares for the return of the latest state up to the N100.

2) Press the SEQ. RESTART switch.

The miscellaneous commands (S, T, M) are output to the PLC, then after the confirmation of the respective answer signals, the axes return to the point commanded last at the cutting feedrate.

3) After axes have reached the return point in the sequence return operation, the operation stops at that point independent of SINGLE BLOCK key setting. To resume the operation, the CYCLE START switch must be pressed.

7. Sequence Stop (Option)

This is the function to stop the program execution at a desired sequence while the automatic operation is carried out. Note that the sequence to be set must be the one already executed. The operation stops in the same manner as a single block stop. The operation can be resumed by simply pressing the CYCLE START switch.

The operation procedure is described below:

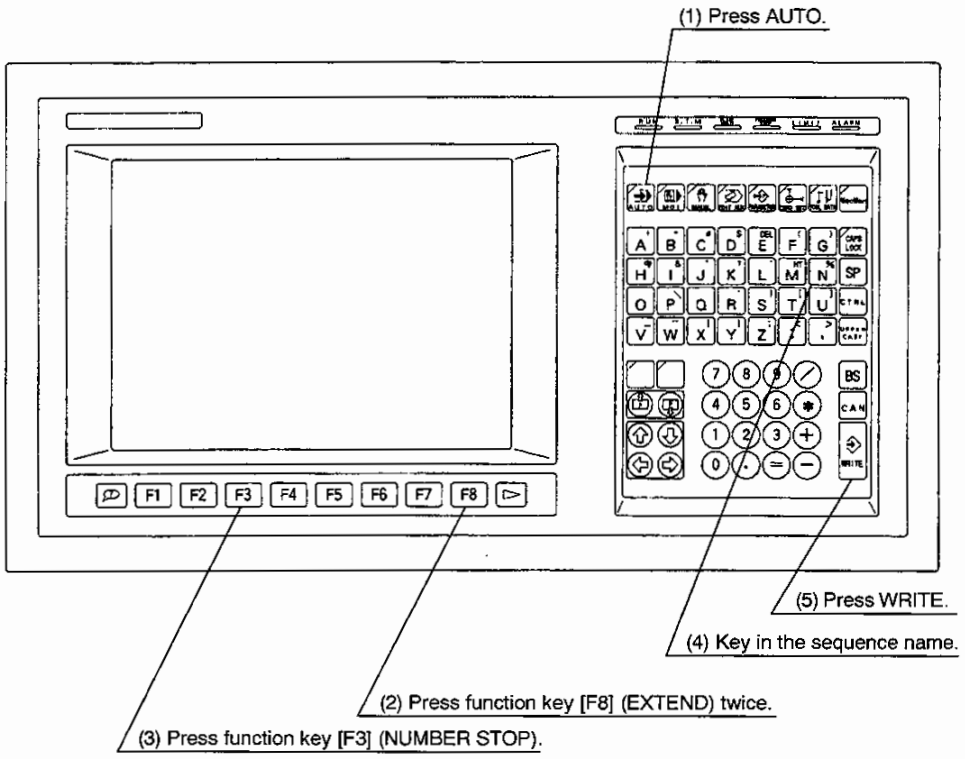


Fig. 5-5 Sequence Stop Operation

(1) Press the AUTO key.

(2) Press function key [F8] (EXTEND) twice.

Function name "NUMBER STOP" is displayed for function key [F3].

(3) Press function key [F3] (NUMBER STOP).

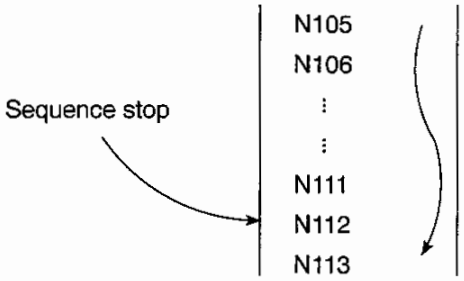
"NST" is displayed on the 21st line on the display screen.

(4) Key in the sequence name where the operation is to be halted on the keyboard.

(5) Press the WRITE key.

When the block of the specified sequence name is read during automatic operation, the blocks up to the sequence before the specified sequence are executed and the machine stops.

Example:



When N112 is entered following function key [F3] (NUMBER STOP) during the execution of N105 sequence, the machine stops after N112 execution and before N113 execution.

The sequence name, where the sequence stop is to be executed, can be changed by specifying another required sequence name. It is also possible to cancel the sequence stop by pressing the WRITE key directly following function key [F3] (NUMBER STOP) without keying in any sequence name data.

[Supplement]

1. The sequence stop setting is cleared by NC reset.
2. The sequence name entered for the step sequence name is handled as a character string and therefore, comparison as a number is not made.
3. Setting during the scheduled operation causes errors.
4. If the main program is selected correctly, setting is possible either before or during execution of the main program.
5. Even if the sequence name which has been already read is set, the program cannot be stopped at that sequence.

8. Single Block

When the SINGLE BLOCK switch on the machine operation panel is switched ON, the single block function is turned on and the program stops after executing the current program block.

There are two types of single blocks.

(1) Execute Single Block

This stops by the block accompanying axis movement execution, miscellaneous function operation or coordinate system setting. This does not stop by control statements such as CALL, GOTO, etc., or a macro call command, return command, and NOEX statement.

(2) Read Single Block

This stops at all blocks including the control statement.

(a) Execute single block is generally used, but for checking programmed operation, read single block is used.

(b) Read single block is switched on by setting 1 at bit 0 of NC optional parameter (bit) No. 2.

(c) Execute single block is determined by switch status after one-block execution.

The read single block is determined by switch status when one block is read.

(d) If the single block is switched on during automatic operation and single block OFF state, the block under execution is completed and the machine stops operation. If there is any buffered block at this stage, one block is executed every time the CYCLE START switch is pressed. If the buffer empties, a new block is read and executed.

(e) Read single block is used to stop the execution of a program by each control statement, IF, GOTO and VSET in the schedule program.

(f) During the program execution called in MDI mode, setting of the SINGLE BLOCK key is effective.

(g) For the details of the stopping manner during fixed cycle operation, refer to "FIXED CYCLES" in the Programming Manual.

(h) During the area machining mode, the axis stops at the completion of each motion when the single block is on.

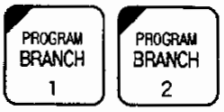
9. Optional Block Skip

When the BLOCK SKIP switch on the machine operation panel is switched ON, the block skip function is turned on and the blocks preceded by the slash code (/) are skipped.

For details, consult "OPTIONAL BLOCK SKIP" in the Programming Manual.

10. Program Branch

When the PROGRAM BRANCH switch on the machine operation panel is switched ON, the program branch function is turned on and the program branch commands in the program are executed.



Two PROGRAM BRANCH keys are provided and each of them turns on/off a program branch command respectively.

For details, refer to "SUBPROGRAM FUNCTIONS" in the Programming Manual.

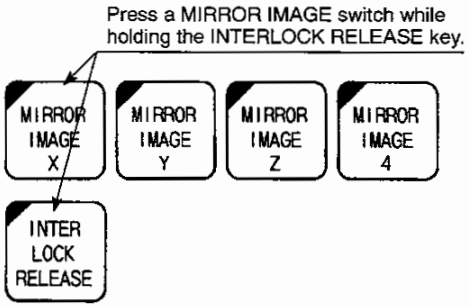
11. Optional Stop

When the OPTIONAL STOP switch on the machine operation panel is switched ON, the optional stop function is turned on and program execution is suspended at the block in which M01 is specified. Pressing the CYCLE START switch cancels the optional stop state and the program is restarted.

When the switch is off, M01 is neglected. In this case, the program is executed continuously without being stopped.

12. Mirror Image

When the MIRROR IMAGE switch on the machine operation panel is switched ON, and the mirror image function is turned on for the corresponding axis. For the axis for which the mirror image function is called, the sign of the coordinate values is reversed.



In addition, there is a programmable mirror image (G62) function, having the mutual relation described below.

Mirror Image by Switch	Mirror Image by G Code	Switch of the Coordinate Value Data Signs
OFF	OFF	Does not switch
OFF	ON	Switches
ON	OFF	Switches
ON	ON	Does not switch

The relation is established for each axis, independently.

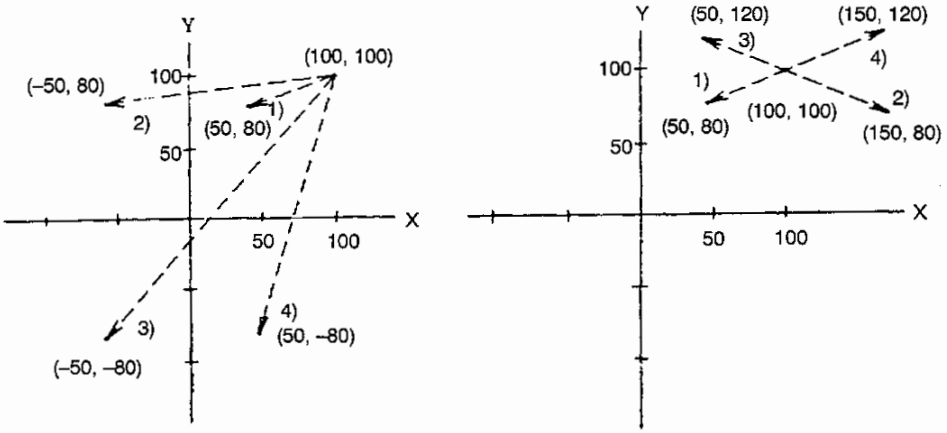
For details of the programmable mirror image function, refer to "Programmable Mirror Image (G62)" in the Programming Manual.

Example:

a) In absolute dimensioning
N80 G90 X100 Y100
N81 X50 Y80

MIRROR IMAGE
Setting changed
here

b) In incremental dimensioning
N80 G90 X100 Y100
N81 G91 X–50 Y–20



1) X,Y: Normal
2) X : Mirror image ON
Y : Normal
3) X,Y: Mirror image ON
4) X : Normal
Y : Mirror image ON

Fig. 5-6 Example of Mirror Image

When the mirror image is on, as shown in the example, the sign of the programmed command itself is switched, disregarding whether the selected dimensioning system is absolute or incremental.

[Supplement]

1. When the MIRROR IMAGE key is changed during automatic operation, the state will be changed over from the newly read block. The buffered commands are executed in the previously selected mirror image/normal state.

2. During the single block mode operation switching, the MIRROR IMAGE key from on to off or vice versa after the completion of a block of commands will change over the state from the next block.

   Example:
   N100
   N101
   → N102
   Mirror image ON

   When, after the execution block N101 in the single block mode, start-up is done with mirror image ON, the operation starts from N102 in the mirror image ON state.

3. Be aware of the following related capabilities:

   The mirror image function is valid for the instruction G92 IP __ which establishes a work coordinate system.

4. The mirror image function is valid for the instruction G51 IP __ which indicates the coordinates of the center for scaling.

5. The mirror image function is invalid for the coordinate system shift G11 IP __.

[Supplement]

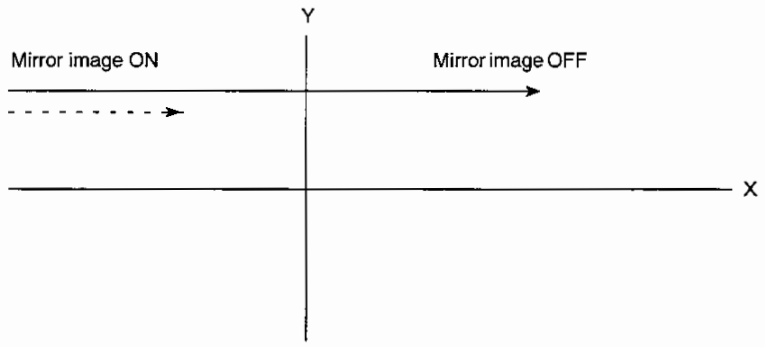
6. While the mirror image function is active, G codes which indicate the direction of axis movement and I, J, and K commands are changed as needed.

   Circular interpolation (G02,G03)

   Cutter radius compensation (G41,G42), etc.

7. The positioning direction for 660 one-direction positioning is not changed even in a mirror image ON state.

   Example:



8. On the display screen, the mirror image ON axes are identified by the "–" sign before the axis address of X, Y, Z, etc.

12-1. Mirror Image in the Work Coordinate System

Normally, when programming is executed in the local coordinate system, the mirror image function is effective in the local coordinate system. However, it is also possible to activate the mirror image function in the work coordinate system currently selected by changing parameter data.

(1) Parameter Setting

Whether the mirror image function is activated in the local coordinate system or in the work coordinate system can be set at the following parameter:

NC Optional Parameter (bit) No. 34, bit 2	
0	The mirror image function is activated in the local coordinate system.
1	The mirror image function is activated in the work coordinate system.

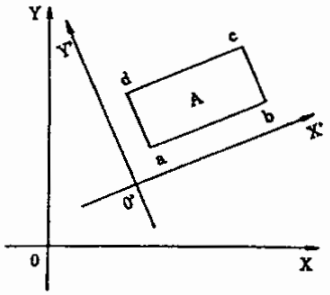
CAUTION

: (1) The initial setting is "0".

(2) When the setting has been changed, press function key [F7] (BACKUP). After the completion of backup operation, turn off the power to the NC and turn it back on again. The new setting does not become effective only by changing the setting.

(2) Comparison of Mirror Image Between in the Local Coordinate System and in the Work Coordinate System

In the figure to the right, the local coordinate system X'-Y' is set on the X-Y plane of the work coordinate system X-Y, and area A is machined. Under such conditions, the relation of mirror image between in the local coordinate system and in the work coordinate system is as explained below.



(a) In the G90 (absolute command) mode

1) Mirror image in the local coordinate system

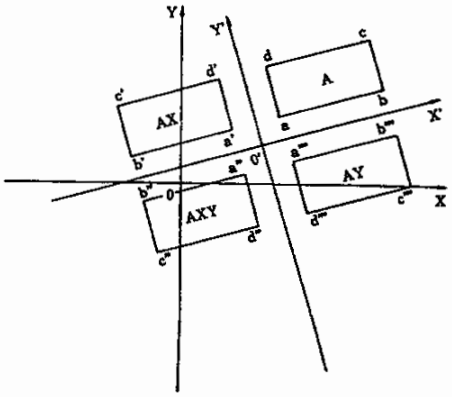


Fig. 5-7 Mirror Image in the Local Coordinate System (G90 Mode)

2) Mirror image in the work coordinate system

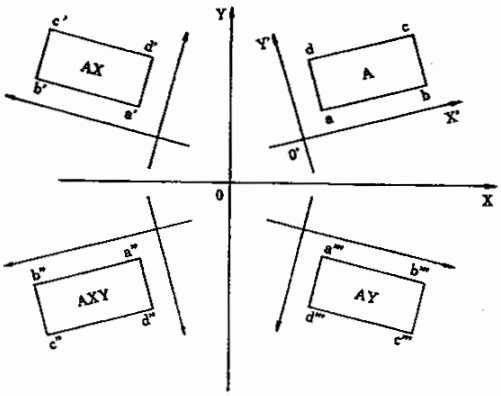


Fig. 5-8 Mirror Image in the Work Coordinate System (G90 Mode)

(b) In the G91 (incremental command) mode

1) Mirror image in the local coordinate system

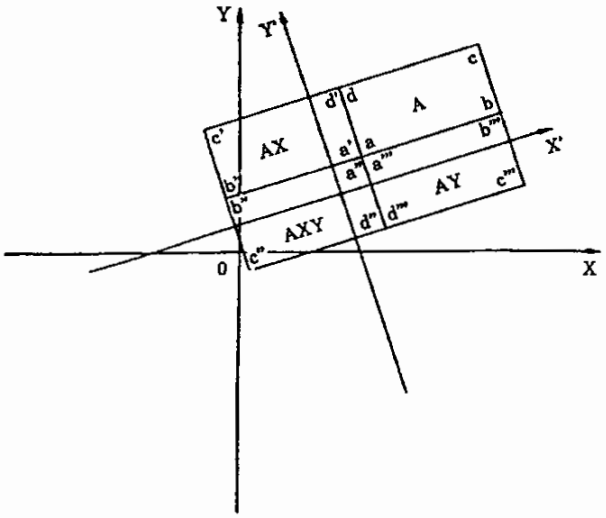


Fig. 5-9 Mirror Image in the Local Coordinate System (G91 Mode)

2) Mirror image in the work coordinate system

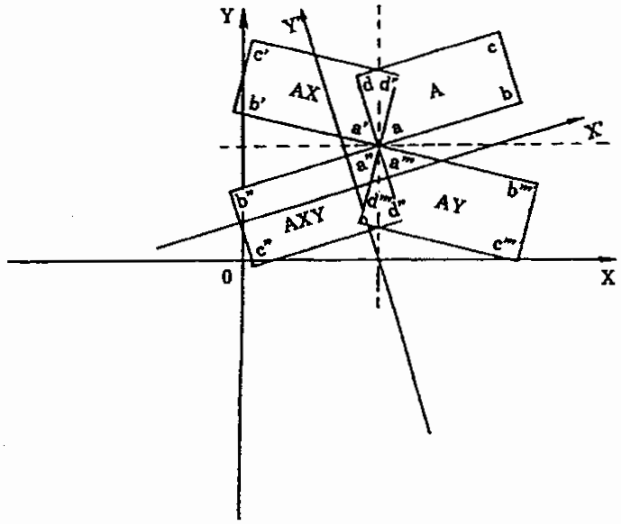


Fig. 5-10 Mirror Image in the Work Coordinate System (G91 Mode)

In the G91 mode, if no rotational elements are included in the local coordinate system and the coordinate system is shifted only parallel, the mirror image function has the same effect in the local and work coordinate systems.

Explanation for the figures:

AX ..... X-axis mirror image is turned on for machining area A.

AY ..... Y-axis mirror image is turned on for machining area A.

AXY ..... X-axis mirror image and Y-axis mirror image are turned on for machining area A.

(Machining order : a → b→ c→ d)

13. Override

The override function changes the feedrate or the spindle speed during machine operation within a certain range. The function includes the following:

- Rapid feedrate override
- Cutting feedrate override
- Spindle speed override

13-1. Feedrate Override

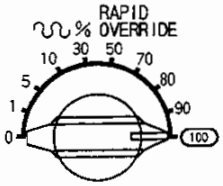
Programmed, manually input, or dial-set feedrates can be changed during operation.

13-1-1. Rapid Feedrate Override

This is effective during manual rapid feed operation and programmed rapid feed mode (G00, G60, etc.).

Actual rapid feedrate is "rapid feedrate" × "override value".

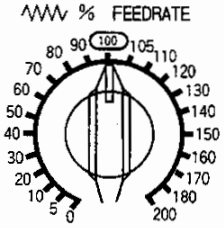
When 100% is selected, the axes move at the rapid feedrate determined by the machine specification.



13-1-2. Cutting Feedrate Override

This is effective for the programmed cutting feedrates in G01, G02, G03 and other modes.

Actual cutting feedrate is "F command value" × "override value".



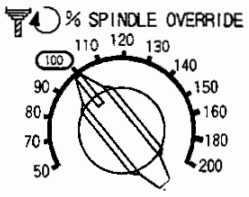
[Supplement]

1. Override rotary switch setting is ignored in tapping cycles called by G74 and G84, or in synchronized tapping cycles called by G274 and G284.
2. After the M136 (cutting feedrate override ineffective command) execution, the override rate is fixed at 100% irrespective of the rotary switch setting until M137 (M136 cancel command) is commanded and executed.
3. The axis does not move at a 0% override switch setting.

13-2. Spindle Speed Override

Spindle speed can be changed while the spindle is rotating.

The NC operates according to the spindle speed command given from the PLC. The actual spindle speed is displayed on the screen.



14. Manual Intervention During Automatic Operation and Restart

Manual intervention refers to the function in which manual operation is performed during AUTO or MDI mode operations.

(1) During the AUTO or MDI mode operation, press either the SLIDE HOLD switch or the SINGLE BLOCK switch to stop the cycle.

(2) Press the MANUAL INT ON switch.

The control is now placed in the manual intervention mode.

(3) Carry out necessary manual operations.

- Manual axis cutting feed
- Manual axis rapid feed
- Manual axis feed by pulse handle
- Spindle rotation
- Tool change, etc.

After manual axis feed, that distance is displayed on the display screen - 2nd page of ACT POSIT pages:

[Display screen]

MANUAL SHIFT ACTUL ..... Manually shifted amount in the present manual intervention operation

MANUAL SHIFT TOTAL ..... A total of manually shifted amounts until the present manual intervention operation

(4) Before restarting the sequence operation, restore the miscellaneous functions to the previous conditions, and locate the axes near the position where the intervention has been made using manual cutting feed or pulse handle. Then, press the SEQ. RESTART switch. With this, the axes return to the original position. The data displayed at MANUAL SHIFT ACTUL will become zero at the same time.

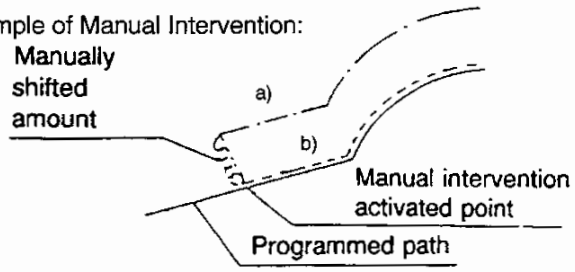
⚠CAUTION

: In this return operation, the axes are fed at a rapid feedrate. Therefore, it is necessary to confirm that the return motion will not cause interference between the spindle or the cutting tool with the workpiece or the fixture on the table.

If the SEQ. RESTART switch is not pressed, the manually fed amount is not zeroed.

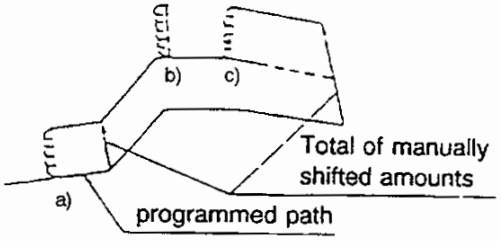
(5) Pressing the MANUAL INT OFF switch or SEQ. RESTART switch automatically cancels the manual intervention mode.

Example of Manual Intervention:



a) —— · —— · ——
SEQ.RESTART not pressed after manual axis feed

b) - - - - - - - - - - -
SEQ.RESTART pressed after manual axis feed



a) SEQ.RESTART not pressed after manual axis feed
b) SEQ.RESTART pressed after manual axis feed
c) SEQ.RESTART not pressed after manual axis feed

[Supplement] During manual intervention mode, automatic return of miscellaneous functions is not made. This permits the change of spindle speed or tools during this mode.

⚠CAUTION

: Even when tool offset and/or cutter radius compensation data has been changed for a newly set tool (manual change), this data does not become effective at the point when the return to the originally located position is completed.

15. Inserting Pulse Handle Operations

On a machining center, it is sometimes required to feed the Z-axis manually while positioning of the X- and Y-axis is made as programmed. Or when machining a cast workpiece on which stock removal amount varies greatly, it is necessary to adjust the depth of cut manually. In such operations, axis motion controlled by the pulse handle can be inserted to the programmed axis movements.

Operation to insert axis movement by the pulse handle is explained below:

(1) Press the PULSE HANDLE SHIFT key on the machine operation panel to turn it on.

(2) Set the AXIS SELECT selector on the pulse handle operation panel to the axis which is to be moved. Also select the multiplication factor.

(3) Feed the axis by turning the pulse handle.

The amount fed by the pulse handle is shown in the MANUAL SHIFT TOTAL line. Automatic return is not made for the amount fed by the pulse handle. If it is then necessary to return the axis by turning the pulse handle while observing the MANUAL SHIFT TOTAL data on the display screen.

[Supplement]

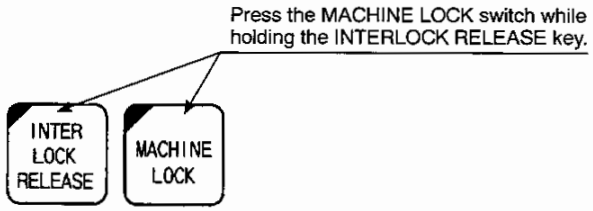
1. The MANUAL SHIFT ACTUL data is cleared ("0") when the MANUAL INT. ON key is pressed.
2. The MANUAL SHIFT TOTAL data is cleared ("0") when the POWER ON switch is pressed.

   It is also cleared when the RESET switch is pressed when parametric data (bit 2 of NC optional parameter (bit) No. 4) is so set.
3. Axis travel amount using the pulse handle is added to the axis position data which is used for judging travel end.
4. While the PULSE HANDLE SHIFT key is off, the pulse handle is inoperative.

16. Lock Functions

16-1. Machine Lock

When the MACHINE LOCK switch on the machine operation is switched ON, the machine lock function is turned on. In this state, actual position values on the screen are updated as the program is executed while the machine is stopped.



[Supplement] When the machine lock function is turned on or off, the NC is reset.

16-2. Cancellation of Axis Command

When the AXIS COM. CANCEL switch on the machine operation panel is switched ON, the axis command cancel function is turned on and the commands of the axis set for the corresponding parameter are ignored to disable movement of that axis. The axis for which the commands are ignored is set for NC optional parameter (bit) No. 7.

[Supplement] With the home position return command given by an external signal, the axis set to be ignored is also moved according to the command.

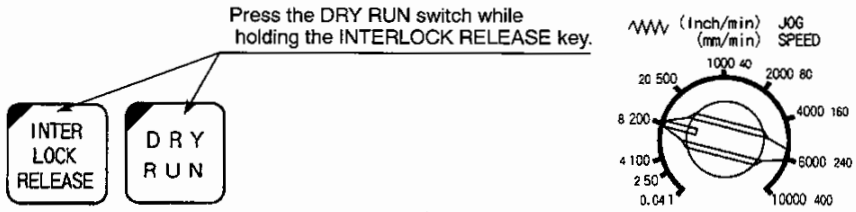
16-3. S, T, and M Function Lock

When the STM LOCK switch on the machine operation panel is switched ON, the STM lock function is turned on. In this state, the miscellaneous function operation specified by the S, T, and M codes is not executed, and only axis feed is executed.

[Supplement]
1. Override or dry function is also effective as in normal cutting operation.
2. The axis specified by the axis command cancel function may be moved by manual or manual intervention operation.
3. Spindle operation control is not executed.
4. With the home position return command given by an external signal, the axis set to be ignored is also moved according to the command.
5. While the STM lock function is active, manual operation of S, T and M functions is possible by manual intervention operation.

17. Dry Run

Dry run is a function for running the machine at the feedrate set by the cutting feedrate rotary switch on the machine operation panel, while disregarding the programmed feedrates in G01, G02, G03 and other similar modes.



In the rapid feed (G00) mode, the data set at bit 2 of NC optional parameter (bit) No. 2 determines whether the dry run is effective or not.

Switching the DRY RUN switch on/off is possible even while commands in a block are being executed. When changed over, the machine is immediately set to the state selected.

S, T and M functions are executed as usual when the DRY RUN switch is on.

The dry run function is effective while the machine lock function is active.

[Supplement] Be careful when activating this dry run function since it is effective during a G74 and G84 tapping cycle, or during the G31 skip function.

18. Library Program Registration

This is the function necessary for executing such items as a subprogram and a G code macro through the MDI operation or for operating the program which contains subprogram call commands in the large capacity mode operation after specifying the S option. That is, the registration of subprograms is possible with this library program registration function. Such a registration is usually made when the PROGRAM SELECT function key is pressed.

The operating procedure is shown below:

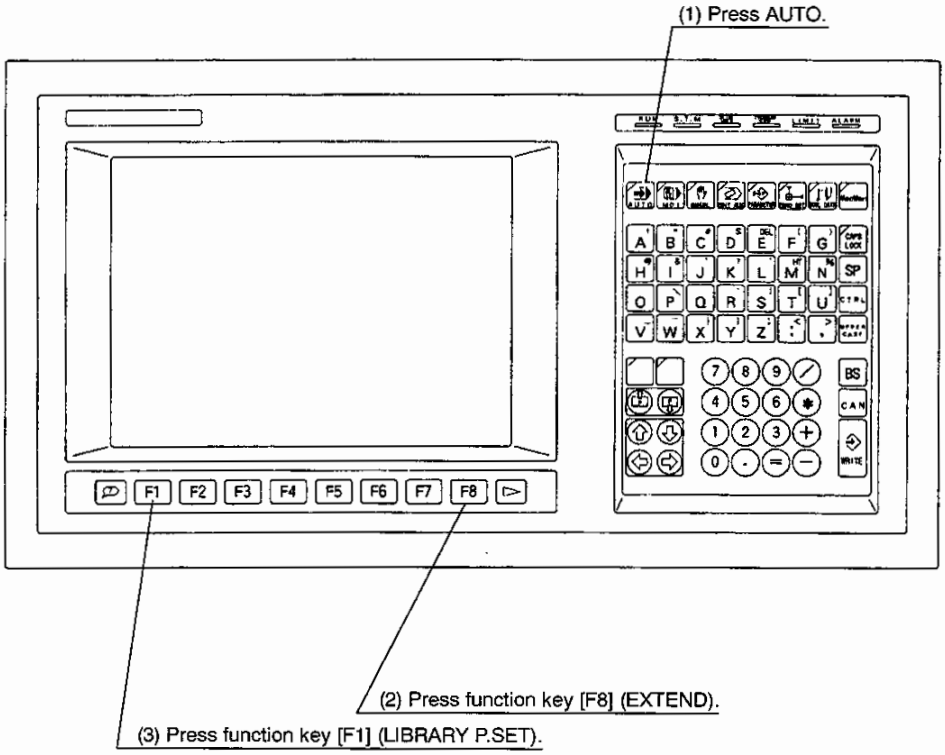


Fig. 5-11 Registering Library Programs

(1) Press the AUTO key.

(2) Press function key [F8] (EXTEND).

The function messages will change as shown above. (The message "LIBRARY P.SET" appears above F1 .)

(3) Press function key [F1] (LIBRARY P.SET).

"LP" is displayed on the 21st line on the display screen.

Operating procedure for library program registration:

(1) Library Program Directory Display

Press function key [F1] (LIBRARY P.SET), key in "LP ␣ " and then press the WRITE key.

The screen displays the library program directory and the remaining capacity in the number of bytes.

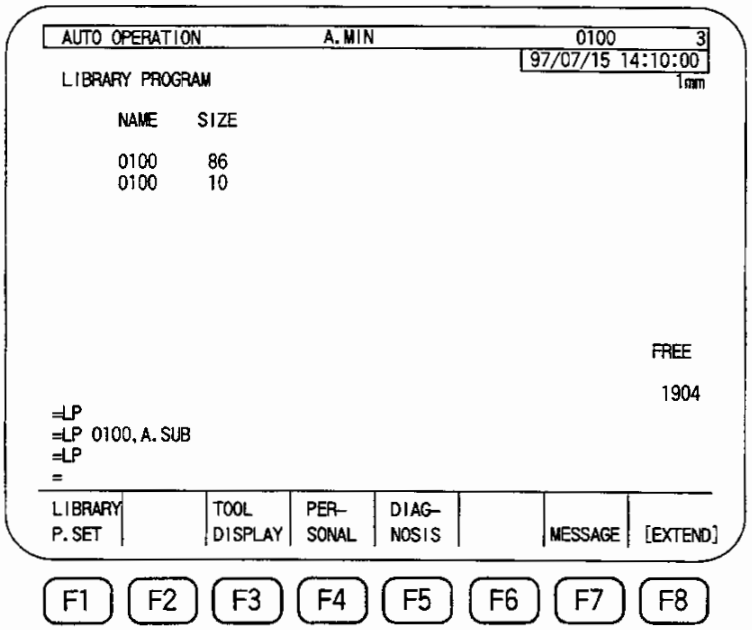


Fig. 5-12 Library Program Directory Display

When library program directory is displayed on two pages, use the BS or WRITE key to change the display screen.

(2) Library Program Registration

Press function key [F1] (LIBRARY P.SET) and key in program name and file name as follows:

LP ␣ program name, file name [WRITE]

The library program can now be registered.

When a file name is omitted, subprograms in all the SSB files are registered when the entered program name is "O∗∗∗∗".

When a program name is omitted, all the subprograms in the file specified following the comma (,) are registered as library programs.

Up to 65 subprograms can be registered.

Note that a main program cannot be registered as a library program.

(3) Deleting Library Program

Press function key [F1] (LIBRARY P.SET) and key in the program name as follows:

LP ␣ program name;C [WRITE]

With the operation above, the programs registered as library programs are deleted.

(4) Initializing Library Program

Press function key [F1] (LIBRARY P.SET) and key in as follows:

LP␣ ;I [WRITE]

With the operation above, the programs registered as library programs are all deleted.

(5) Specifying Buffer Size of Library Program

Press function key [F1] (LIBRARY P.SET) and key in as follows:

LP␣ n;I [WRITE]

With the operation above, the buffer size of "n" bytes for registering the library programs is ensured.

Note that when the buffer size specification is changed, the library program registration state and the program selection state are all cleared.

To ensure the NC program registration area for operation without using library programs as much as practicable, zero the library program registration by the operation below.

Press function key [F1] (LIBRARY P. SET) and key in as follows:

LP␣ 0;I [WRITE]

The library programs registered in the operations above, can be accessed by the required MDI mode operation. They can also be referenced in the S option mode or the equivalent operation mode (DNC, for instance).

(6) The subprograms in the file which have an extension LIB are automatically registered as library programs when power supply to the control is turned on. Therefore, G code macro or other subprograms which are frequently used are recommended to be stored in the LIB file. This permits them to be called any time as conventional G codes.

NOTICE

: (1) A library program is distinguished only by its program name. Therefore, it is impossible to register more than one library program which have the same name.

If the subprogram in the user program has the same name as the library program, the library program is given priority when such a subprogram is intended to be called.

(2) Turn off and on the power alter adding a new library program.

19. Operation End Light (Option)

The operation end light goes on when the following conditions have been satisfied. Note that the setting for the related machine user parameter must be set "effective".

Mode	Condition
Automatic operation	When program is completed
Single block off	(1) schedule program after executing END in a schedule program.
	(2) main program after executing M00, M01, M02 or M30 in a main program.

Restarting will extinguish the operation end light.

When the alarm occurs, resetting the CNC unit will extinguish the operation end light.

20. Operation End Buzzer (Option)

Operates in the same conditions as the operation end light. The operation end buzzer sounds when these conditions have been satisfied. Note that the setting for the related machine user parameter must be set "effective".

The operation end buzzer sounds for the length of time set for machine user parameter, "Buzzer, 7. Operation end buzzer timer".

Restarting will cut off the operation end buzzer.

21. Error Light (Option)

The ERROR lamp is turned on at the occurrence of an alarm. Note that the setting for the related machine user parameter must be set "effective".

The lamp is turned off when the NC is reset.

22. Auto Power Off (Option)

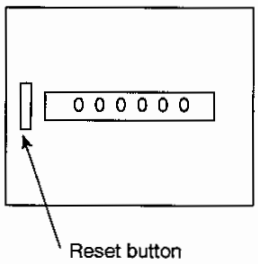
The power is shut down when the following conditions are satisfied. Note that the setting for the related machine user parameter must be set "effective".

Mode	Condition
Automatic operation Single block off	(1) Schedule program after executing END in a schedule program (2) Main program after executing M02 or M30 in a main program

When this function is used and there are blocks changing/setting parameters on the program, it is recommended to make the backup function effective with M02/M03 (Set "1" at NC optional parameter (bit) No. 33, bit 1).

23. Work Counter (Option)

Count data is incremented when the machining completion signal (M02 or M30) is executed. The counter has a six-digit capacity (0 to 999999). It is provided with the reset function.

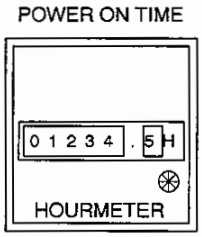


24. Hour Meter (Option)

24-1. POWER ON TIME Hour Meter

The hour meter accumulates length of time in which operation power has been turned on.

Hour meter range: 0 to 99999.9 hours

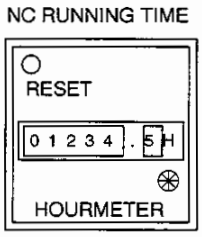


24-2. NC RUNNING TIME Hour Meter

The hour meter accumulates length of time in which the RUN lamp in the NC operation panel status indicating lamps has been lit.

Hour meter range: 0 to 9999.9 hours

The hour meter is provided with the RESET button.

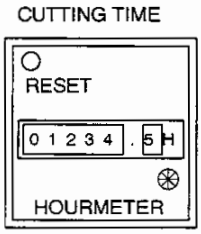


24-3. CUTTING TIME Hour Meter

The hour meter accumulates length of time in which cutting has been conducted (G01, G02 or G03 mode) in the automatic or MDI operations.

Hour meter range: 0 to 9999.9 hours

The hour meter is provided with the RESET button.

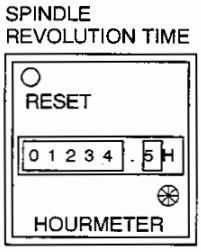


24-4. SPINDLE REVOLUTION TIME Hour Meter

The hour meter accumulates length of time in which the spindle has been rotating (CW or CCW) disregarding the operation mode.

Hour meter range: 0 to 9999.9 hours

The hour meter is provided with the RESET button.



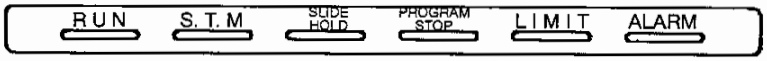
[Supplement] When hour meters are selected, 24-1. "POWER ON TIME Hour Meter" and 24-2. "NC RUNNING TIME Hour Meter" are usually equipped.

SECTION 6 DISPLAY ON NC OPERATION PANEL

This section describes the contents of NC STATUS lamps on the NC operation panel, contents of the information displayed on the operation mode screen, and the information displayed on the special screen such as NC HOUR METER screen.

1. Status Indicating Lamps

On the NC operation panel, the following six NC status indicating lamps are arranged, and the current NC operating status can be confirmed from the lamp which is lit.



Lamp Name	Function
RUN	This lamp lights when NC is computing the axis position.
S.T.M	This lamp lights while the NC is executing the processing for the S (spindle function), T (tool function), and/or M (miscellaneous function) command.
SLIDE HOLD	This lamp lights when the SLIDE HOLD switch on the machine operation panel is pressed.
PROGRAM STOP	This lamp lights when the NC is in the program stop or the optional stop status. It flickers while the dwell command is being executed.
LIMIT	This lamp lights if the calculated axis position is on or beyond the soft-limit position.
ALARM	This lamp lights when an alarm comes on. This lamp does not light when a warning message comes from an operation mistake.

2. Actual Position Display

When function key [F2] (ACTUAL POSIT.) is pressed in the operation mode, the actual position data screen is displayed.

The actual position data is displayed in the following three absolute position data display modes and also in the relative position data display mode. The display screens can be changed by using the page keys.

2-1. Actual Position Display

For page [1] of actual position data display, two display modes are provided, double extension mode and four-fold extension mode. Which of the display mode should be used can be set using NC optional parameter (bit) No. 4, bit 6.

(1) Page [1] (Double Extension)

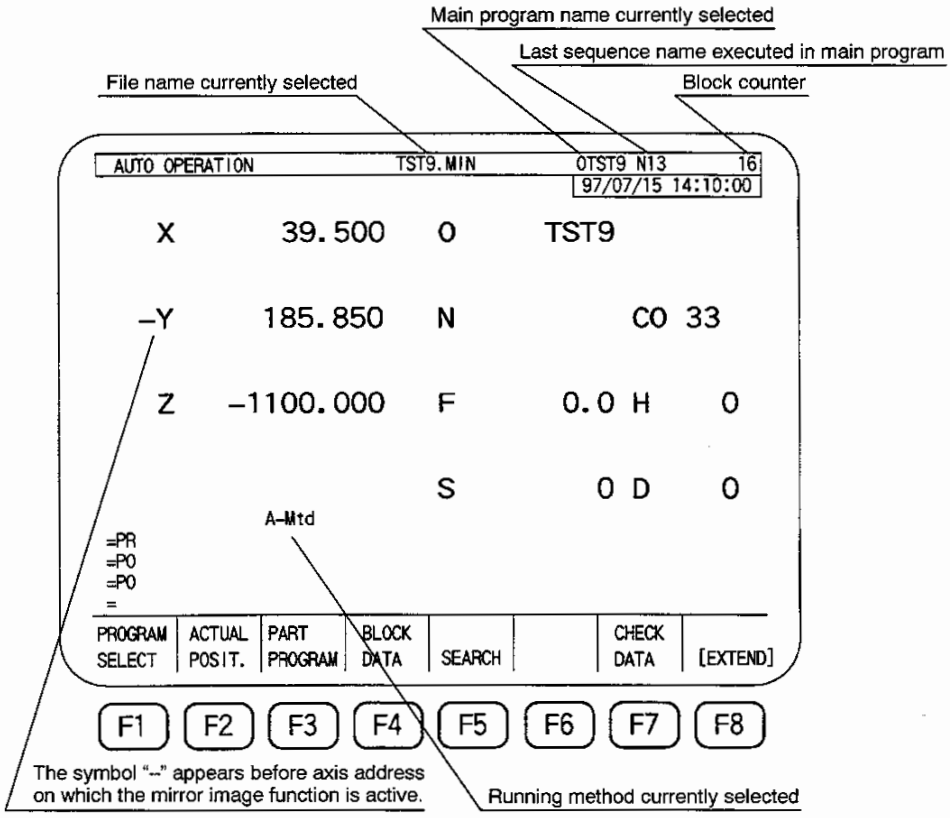


Fig. 6-1 Actual Position Display – Page [1] (Double Extension)

The following display data items are in common to the two actual position data display screens [1] (double extension and four-fold extension) and also to actual position display screen [2].

X : X-axis actual position on active block
Y : Y-axis actual position on active block
Z : Z-axis actual position on active block
CO : Work coordinate system number
O : Currently active program name

N : Currently active sequence name

F : Actual feedrate (overridden programmed F value)

S : Actual spindle speed (overridden programmed S value)

H : Tool length offset number

D : Cutter radius compensation number

[Supplement] Actual position display of additional axes

In the double extension display mode:

1st additional axis data is displayed below "Z-axis".

2nd and 3rd additional axis data are displayed in the next page, which is accessible by pressing function key [F8] (EXTEND) and [F6] (AXIS CHANGE).

In the four-fold extension display mode:

1st to 3rd addition axis data are displayed in the next page, which is accessible by pressing function key [F8] (EXTEND) and [F6] (AXIS CHANGE).

(2) Page [1] (Four-fold Extension)

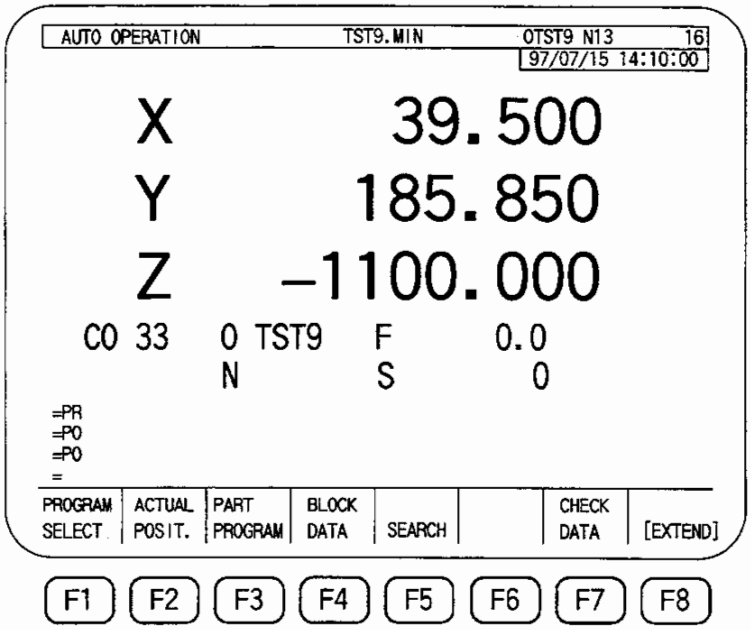


Fig. 6-2 Actual Position Display – Page [1] (Four-fold Extension)

(3) Page [2]

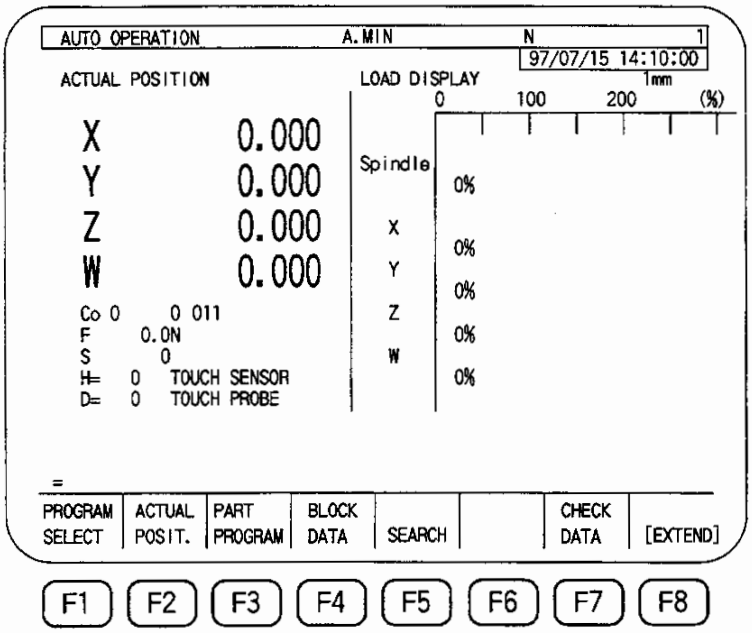


Fig. 6-3 Actual Position Display [2]

TOUCH SENSOR	:	Touch sensor status; Reverse display with touch sensor ON
TOUCH PROBE	:	Touch probe status; Reverse display with touch probe ON
LOAD DISPLAY	:	Loaded condition of the spindle and axes (indicated by graph and percent values)

[Supplement] For the spindle overload monitor specification, the symbol " ∇ " (max. load value) and the message "LOAD MONITOR (***%)" are displayed on the screen. The message "TORQUE MONITOR (***%)" is displayed instead of "LOAD MONITOR (***%)" during torque monitoring for synchronized tapping operation.

(4) Page [3]

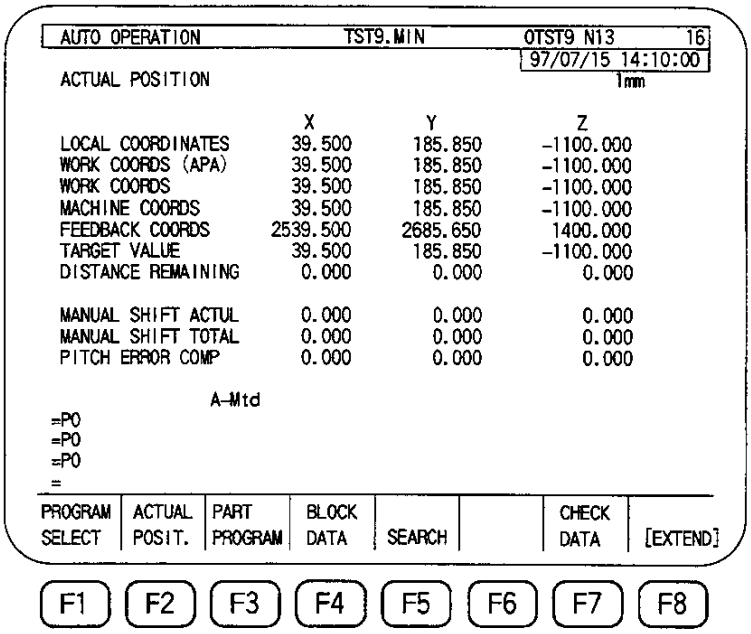


Fig. 6-4 Actual Position Display [3]

LOCAL COORDINATES	:	Distance referenced to the origin of the local coordinate system
WORK COORDS (APA)	:	Distance referenced to the origin of the work coordinate system
WORK COORDS	:	Distance referenced to the origin of the work coordinate system
MACHINE COORDS	:	Distance referenced to the machine origin
FEEDBACK COORDS	:	Output (numerical value) from the position encoder
TARGET VALUE	:	Target value
DISTANCE REMAINING	:	Distance remaining to the target point (commanded point)
MANUAL SHIFT ACTUL	:	Axis manual shift amount (current operation) in manual or pulse handle intervention operation
MANUAL SHIFT TOTAL	:	Axis manual shift amount (total) in manual or pulse handle intervention operation
PITCH ERROR COMP	:	Thread pitch error compensation amount

2-2. RELATIVE ACT POSIT Screen

The RELATIVE ACT POSIT screen looks like as follows.

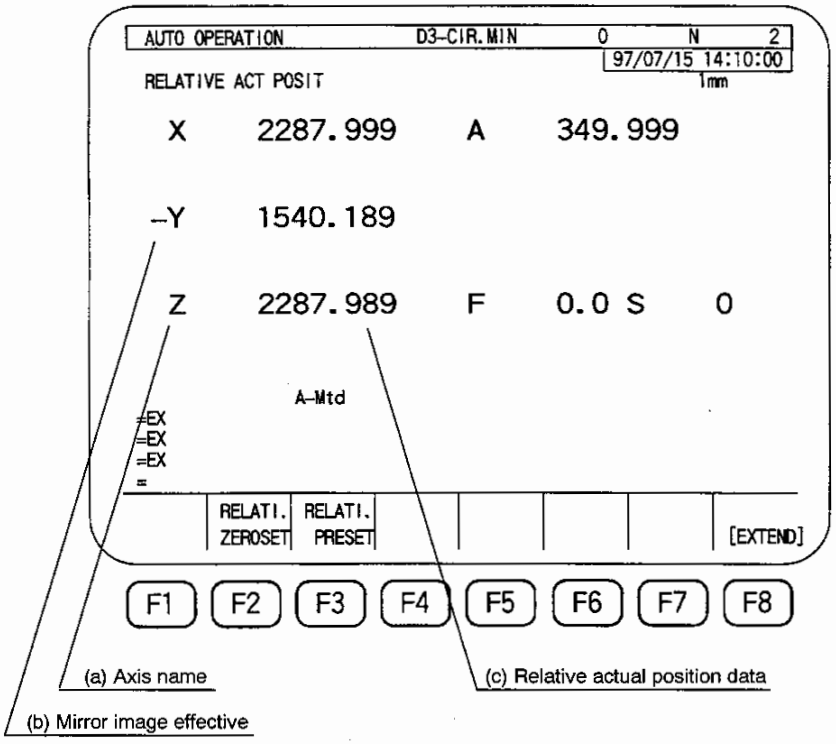


Fig. 6-5 Relative Act Posit Screen

(a) Axis name

Indicates a basic axis name (X, Y, or Z) or an additional axis name (A, B, C, etc.).

An additional axis name is displayed only when an additional axis has been selected.

(b) Mirror image effective

When mirror image is effective, a minus sign "–" is placed preceding the axis name.

When mirror image is not effective, no sign is placed.

(c) Relative actual position data

Relative actual position data calculated using the following equation is displayed in the selected unit system.

Relative actual position data = (Coordinate value output from the encoder *1)
– (Reference position *2) – (Tool length offset value)
– (Machine zero point)

*1 ..... Whether or not the manual shift amount is added can be set at NC optional parameter (bit) No. 5, bit 7.

*2 .... The reference position is the zero point (in the machine coordinate system) for the relative actual position. For the procedure to set the reference position, refer to (1) "Reference Position Setting".

(d) Reference position

The reference position is the zero point in the machine coordinate system and is used to display the relative actual position, or, in their words, the zero point in the relative coordinate system. The reference position is calculated form the equation below and displayed for each axis in the selected unit system.

Reference position = (output from position encoder *1) – (actual position value *2)
– (tool length offset value) – (machine zero point)

*1 ..... Like the actual position display, it is possible to select whether or not the manual shift amount is included in the output form the position encoder by setting data at NC optional parameter (bit) No. 5, bit 7.

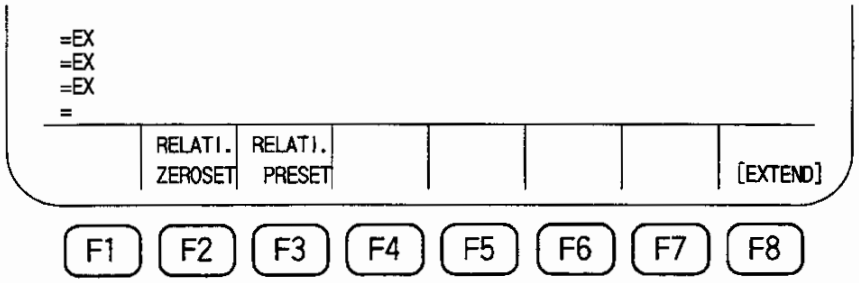
*2 ..... Where the actual position is set in the coordinate system is input.
Refer to (1) "Reference Position Setting".

(1) Reference Position Setting

The reference position is the zero point (in the machine coordinate system) which is used to display the relative actual position, or, in other words, the zero point in the relative coordinate system. The reference position can be obtained by setting the coordinate value of the actual position.

The reference position can be set in two different manners: by setting the actual position at "0" and by setting the actual position at a desired position.

To set the reference position, press function key [F8] (EXTEND) in the automatic, MDI, or manual operation mode repeatedly until functions "RELATI. ZEROSET" and "RELATI. PRESET" are assigned to function keys [F2] and [F3], respectively.

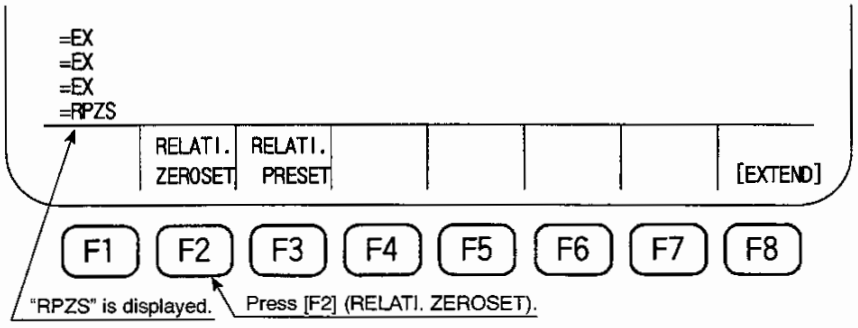


(a) Setting the actual position at "0"

Follow the procedure below when setting the actual position at "0" in the relative coordinate system.

1) Press function key [F2] (RELATI. ZEROSET) in the automatic, MDI, or manual operation mode.

The prompt "= RPZS" will be displayed on the console line of the display screen.

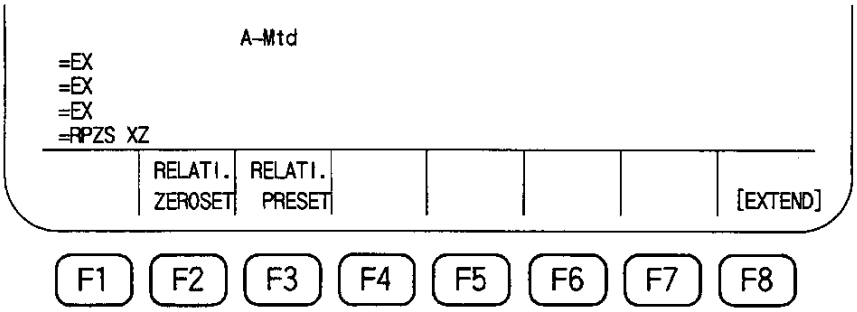


2) Key in axis address(es) for which "0" is set through the keyboard. When no axis address has been keyed in, "0" is set for all axes.

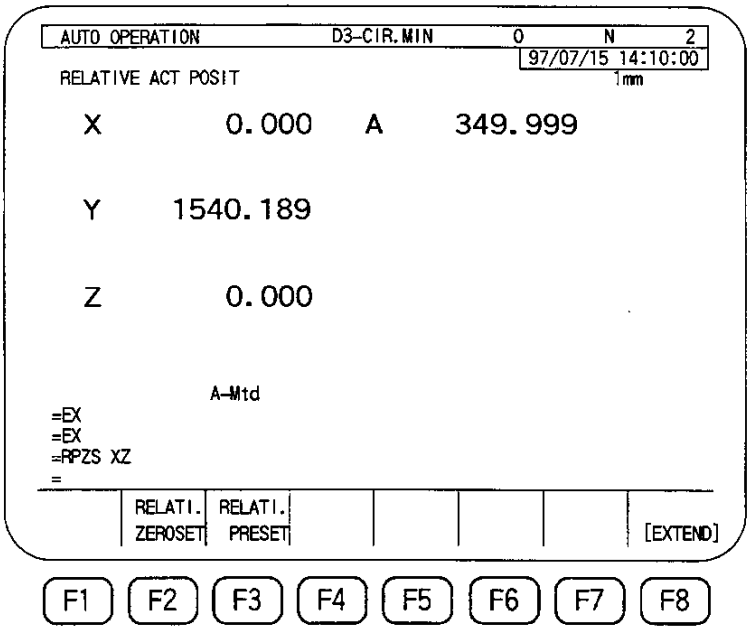
Example: To set "0" for X and Z axes

= RPZS XZ

Key in axis addresses



3) Press the WRITE key.



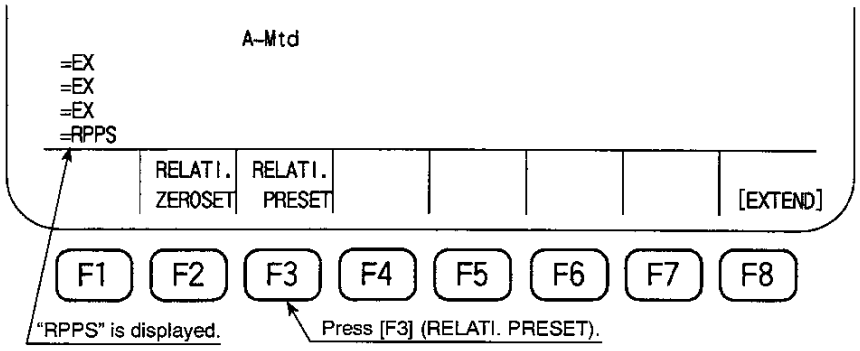
The reference position with which the actual position of the designated axis is "0" is obtained and relative actual position data of the designated axis will change to "0".

(b) Setting the actual position at a desired position

Follow the procedure below when setting the actual position at a desired position in the relative coordinate system.

1) Press function key [F3] (RELATI. PRESET) in the automatic, MDI, or manual operation mode.

The prompt "= RPPS" will be displayed on the console line of the display screen.



2) Key in axis address(es) and numerical value for which the actual position is set at a desired position through the keyboard. When no axis address has been keyed in, the actual position is set at a desired position for each axis.

Example 1: To set the actual position of X and Z axes at 200 and 300, respectively

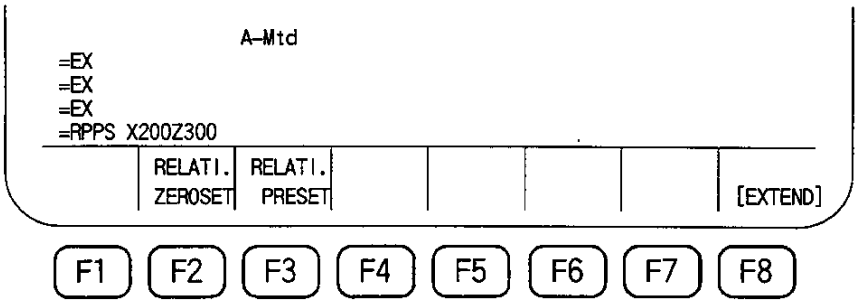
= RPPS X200Z300

Key in axis addresses and numerical values.

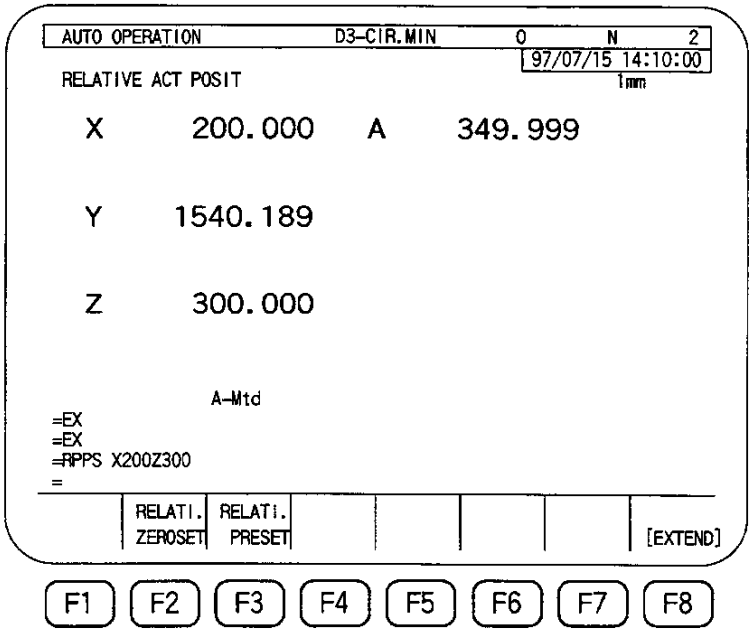
Example 2: To set the actual position of all axes at 100

= RPPS 100

Key in a numerical value without specifying axis addresses.



3) Press the WRITE key.



The reference position with which the actual position of the designated axis is a desired position is obtained and relative actual position data of the designated axis will change to a desired position.

[Supplement] Pressing the WRITE key without keying in address(es) and numerical value(s) does not set anything.

(c) Data setting range and restrictions

1) Data is input in the unit system (metric or inch) employed for machine operation and the decimal point position is fixed. For example, when "1" has been input while the 0.001 mm unit system is selected, it is recognized as 1 mm. The same rule also applies to the inch system.

2) Data can be set within the following range.

For linear axes: –99999.999 mm to +99999.999 mm

(When the inch system is selected, the entered value is converted into a metric value and checked if it is within the above range.)

For rotary axes: –99999.999° to +99999.999° (for the 0.001° unit system)

–9999.9999° to +9999.9999° (for the 0.0001° unit system)

(2) Precautions

(a) Data is input in the unit system (metric or inch) employed for machine operation and the decimal point position is fixed. (For example, when "1" has been input while the 0.001 mm unit system is selected, it is recognized as 1 mm.)

(b) When changing the reference position of all axes including rotary axes, the entered value is interpreted as length and degree.

(c) The reference position cannot be set for an indexable axis. In this case, the actual position data is displayed on the RELATIVE ACT POSIT screen.

However, when axis designation was not made with reference position setting, "0" is set at the indexable axis, causing no error.

(d) When the power is turned off, reference position data becomes "0" since it is not backed up by turning off of the power. (The machine zero point is employed as the reference position.)

However, when actual position data in the work coordinate system is rounded (parameter (bit) No. 2 bit 1 is ON) with the multi-turn rotary table specification, reference position data is calculated in reverse order. Therefore, when the work zero point is other than "0", a value other than "0" is set as reference position data.

(e) Work coordinate values do not change when the reference position has been changed.

(f) When the relative actual position value is smaller than –99999.999 mm (–9999.9999 inch for the inch system), "– OVERFLOW" will be displayed on the display screen.

When the relative actual position value is larger than +99999.999 mm (+9999.9999 inch for the inch system), "+ OVERFLOW" will be displayed on the display screen.

(g) The display of the relative actual position of a rotary axis (rotary table) varies depending on the rotary axis specification.

1) Rotary table and indexable axis specification

The relative actual position is displayed within 0° and 360°. The reference position is also displayed within 0° and 360°.

2) Rotary axis with limits and multi-turn rotary table

The relative actual position obtained using the equation on page 23 is displayed as it is. With the multi-turn rotary table, whether or not relative actual position data is expressed within 0° and 360° when the NC is reset can be set at NC optional parameter No. 2, bit 1.

When the additional axis is removed with the removable axis specification, "– OVERFLOW" will be displayed as relative actual position data.

3. Program Display

In the operation mode, press function key [F3] (PART PROGRAM) and, the program information screens are accessed. There are three types of program information display screens such as schedule program, main program and MDI program. The display screen can be changed by pressing the PAGE key.

(1) Schedule Program

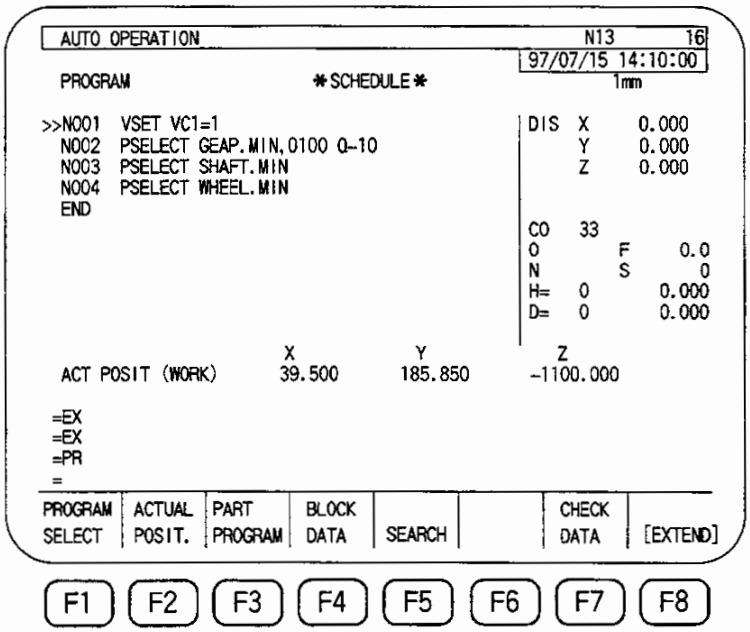


Fig. 6-6 Schedule Program Screen

The following display data items are in common to the CURRENT MAIN PROGRAM, READ MAIN PROGRAM, and MDI PROGRAM display screens.

DIS X : Remaining X-axis movement distance to the target position

DIS Y : Remaining Y-axis movement distance to the target position

DIS Z : Remaining Z-axis movement distance to the target position

Co : Work coordinate system number

O : Currently active program number

N : Currently active sequence number

F : Actual feedrate (overridden programmed F value)

S : Actual spindle speed (overridden programmed S value)

H : Tool length offset number and offset data

D : Cutter radius compensation number and compensation data

ACT POSIT (WORK) X : Actual X-axis position in the currently active block (work coordinate system)

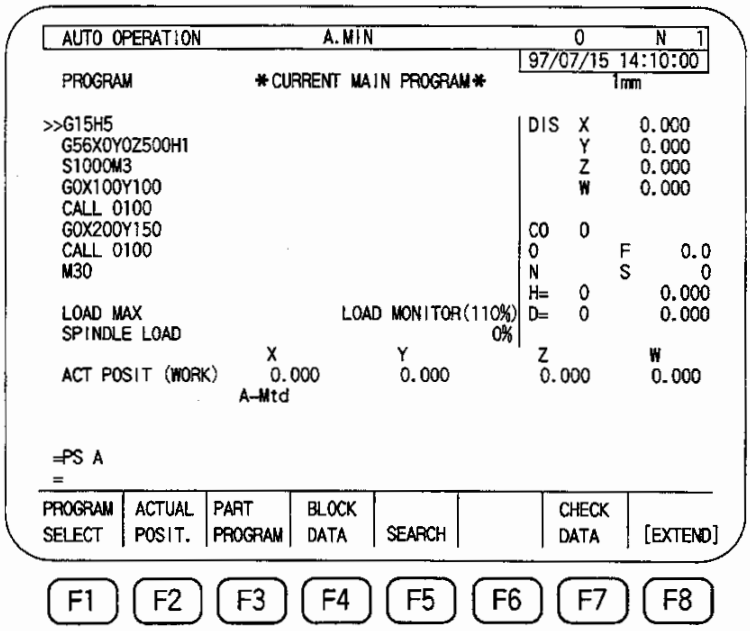
ACT POSIT (WORK) Y : Actual Y-axis position in the currently active block (work coordinate system)

ACT POSIT (WORK) Z : Actual Z-axis position in the currently active block (work coordinate system)

[Supplement] The DIS data and ACT POSIT (WORK) data of additional axes are displayed in the following manner.

For the first additional axis, the data is displayed below the "Z-axis" data of DIS and right to the "Z-axis" data of (ACT POSIT) on the screen indicated above. For the second and third additional axes, the data is displayed on the page accessible by pressing function key [F8] (EXTEND) and [F6] (AXIS CHANGE).

(2) Current Main Program



>> : Block just read into the buffer

↑ : Block being executed.

Fig. 6-7 Current Main Program Screen

[Supplement] For the spindle overload monitor specification, the symbol " ∇ " (max. load value) and the message "LOAD MONITOR (∗∗∗ %)" are displayed on the screen. The message "TORQUE MONITOR (∗∗∗ %)" is displayed instead of "LOAD MONITOR (∗∗∗ %)" during torque monitoring for synchronized tapping operation.

(3) Read Main Program

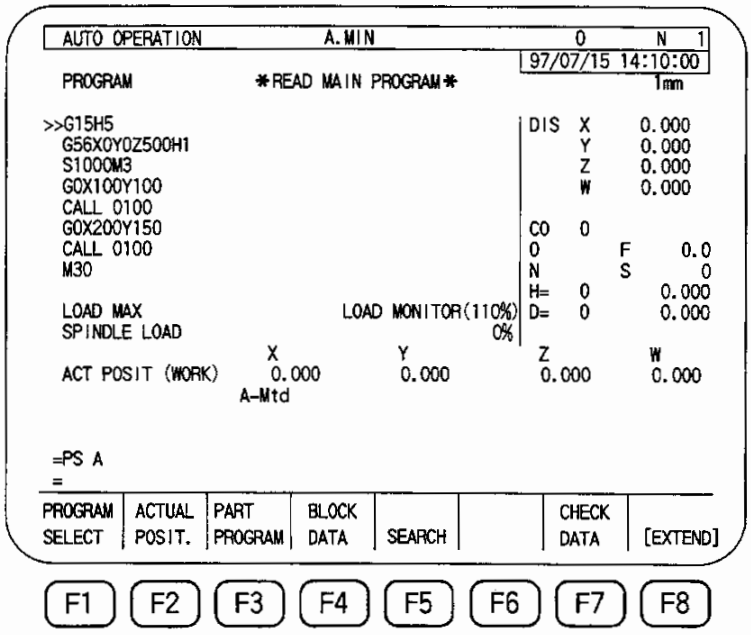


Fig. 6-8 Read Main Program Screen

(4) MDI Program

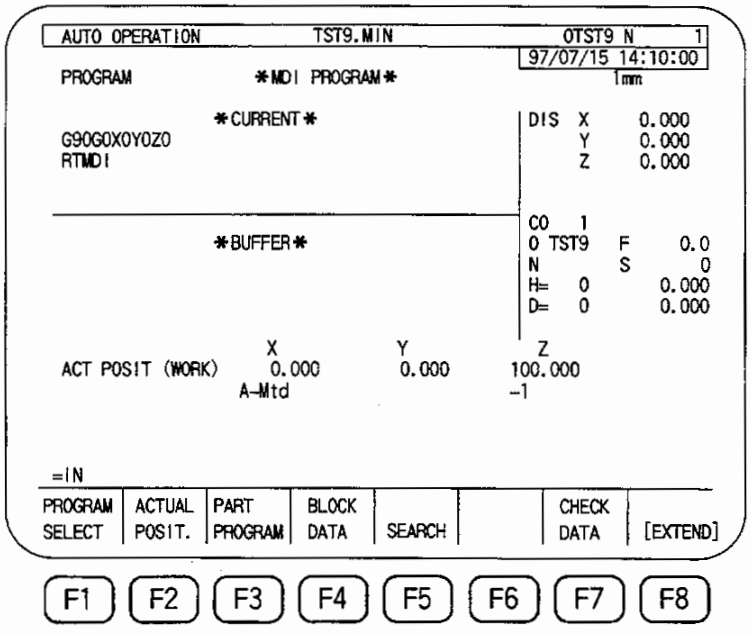


Fig. 6-9 MDI Program Screen

4. Block Display

In operation mode, function key [F4] (BLOCK DATA) accesses the block data screens.

Under the heading of BLOCK DATA, four screens of block data display are available: CURRENT, BUFFER, SECOND BUFFER, and THIRD BUFFER.

These display screens are selectable by pressing the PAGE key.

(1) Display of One Block Data Currently Executed

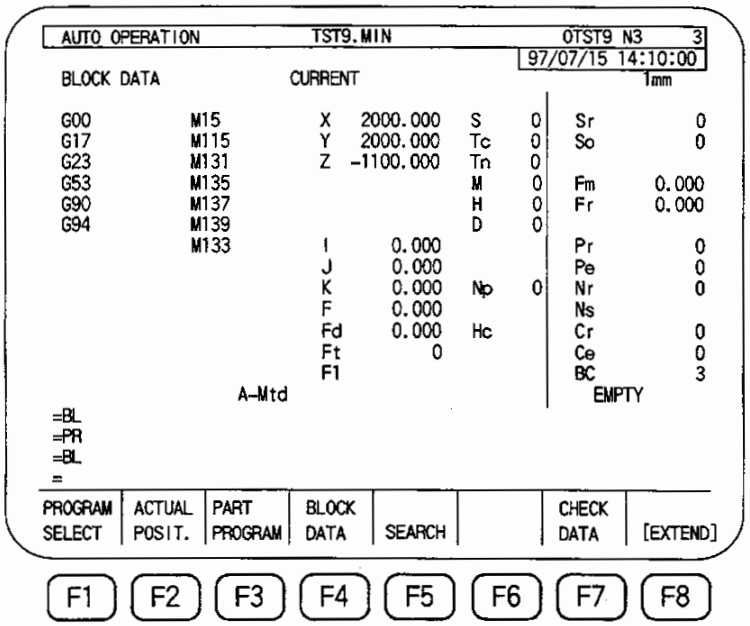


Fig. 6-10 Display of One Block Date Currently Executed

The following display data items are in common to the BUFFER, SECOND BUFFER, and THIRD BUFFER display screens.

X : X-axis command value
Y : Y-axis command value
Z : Z-axis command value
I : I command value
J : J command value
K : K command value
F : Feedrate command value
Fd : Feedrate command value (0.001 mm/6.4 ms)
Ft : F command value for dwell
F1 : Feedrate (F1-digit command)
S : Spindle speed command value
Sr : Actual spindle speed
So : Actual spindle speed (overridden programmed S value)

Tc : Active tool number
Tn : Next tool number
M : M command value
H : Tool length offset number
D : Cutter radius compensation number
Fm : Actual feedrate (mm/min)
Fr : Actual feedrate (mm/rev)
Pr : Main program repeat count by schedule operation
Pe : Main program execution count by schedule operation
Np : Hole number in coordinate calculation
Nr : Hole number for restart
Ns : Sequence specified by the sequence stop
Hc : Work coordinate system number
Cr : Number of subprogram to be repeated
Ce : Number of subprogram actually repeated
BC : Block counter
EMPTY : No data in buffer
(EXIST : Data existing in buffer)

[Supplement] For the additional axis specification, the data of the additional axes (first, second, third) is displayed below the "Z-axis" data.

(2) Display of One Block Data in Buffer (to be Executed Next)

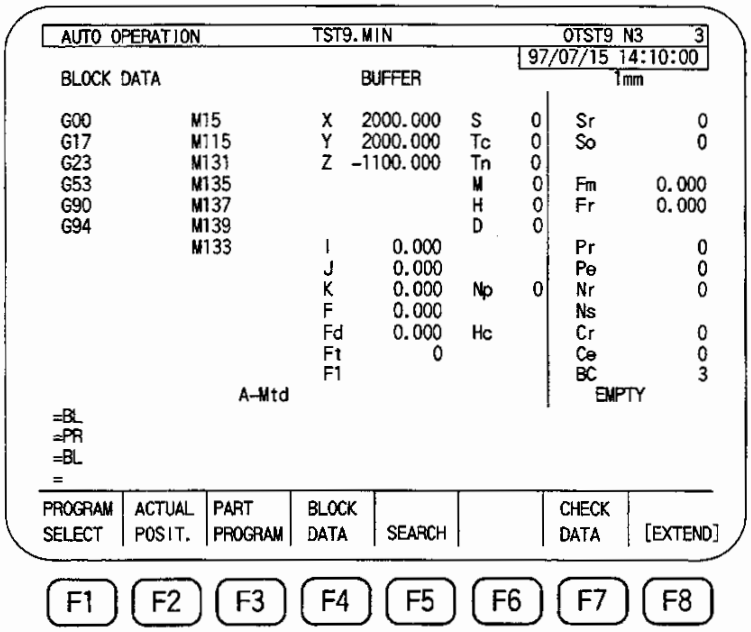


Fig. 6-11 Display of One Block Data in Buffer (to be Executed Next)

(3) Display of One Block Data in Second Buffer

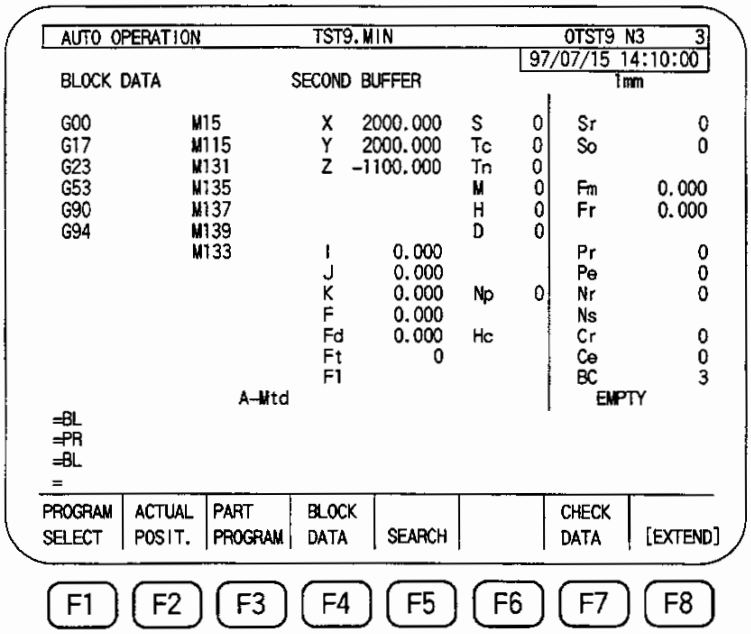


Fig. 6-12 Display of One Block Data in Second Buffer

(4) Display of One Block Data in Third Buffer

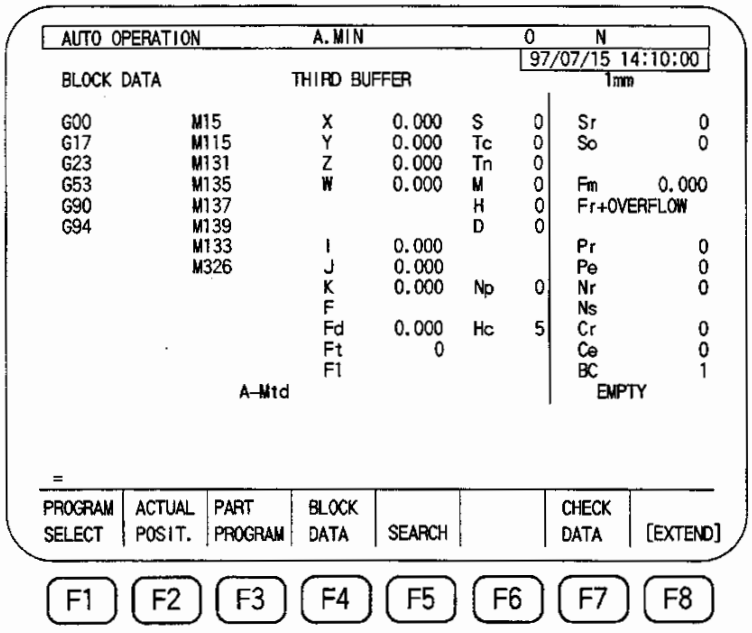


Fig. 6-13 Display of One Block Data in Third Buffer

5. ATC Tool Setting Data Display (Memory-Random ATC Specification)

Pressing function key [F8] (EXTEND) changes the key guidance display. Function key [F3] (TOOL DISPLAY) allows the ATC tool setting page to be accessed.

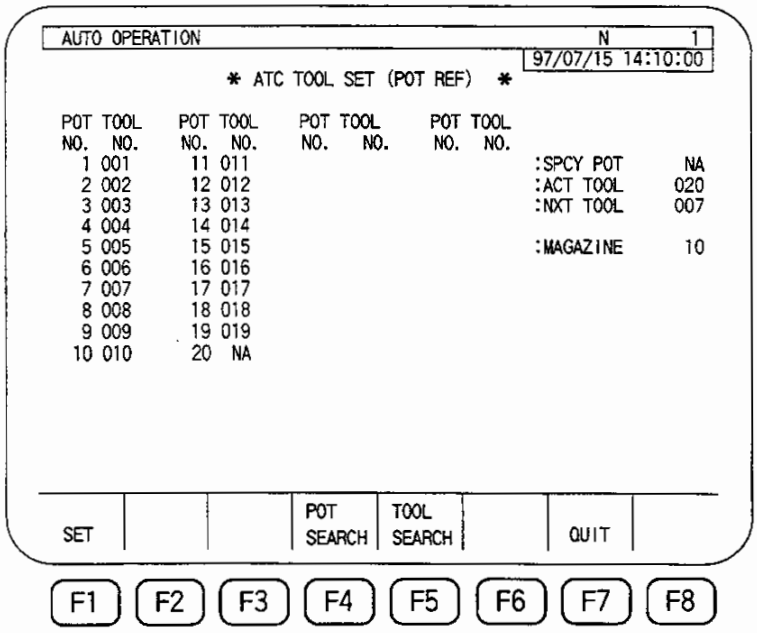


Fig. 6-14 ATC Tool Set (Pot Reference) Screen

6. Message Display (Option)

In the operation mode, display the function guide and press function key [F7] (MESSAGE) and the messages in a program can be displayed.

While the display screen is in the message display mode, display page may be switched to the actual position display, program display, block display, and check display using a proper function key. The NMSG command in a program automatically returns the display mode from the message display mode to the original display mode. The message displayed on the display screen is the one specified in the program last.

Example:

N100 :

N101 :

N102 M00 MSG (CHECK TOOL!) ..... This automatically changes the display mode to the message mode and "CHECK TOOL!" appears on the display screen.

N103 NMSG ..... This restores the display mode to the original mode.

N104 :

N110 X100 Y100 (WORK FINISH) ..... Switching the display mode into the message by pressing function key allows the display screen to display the comment "WORK FINISH".

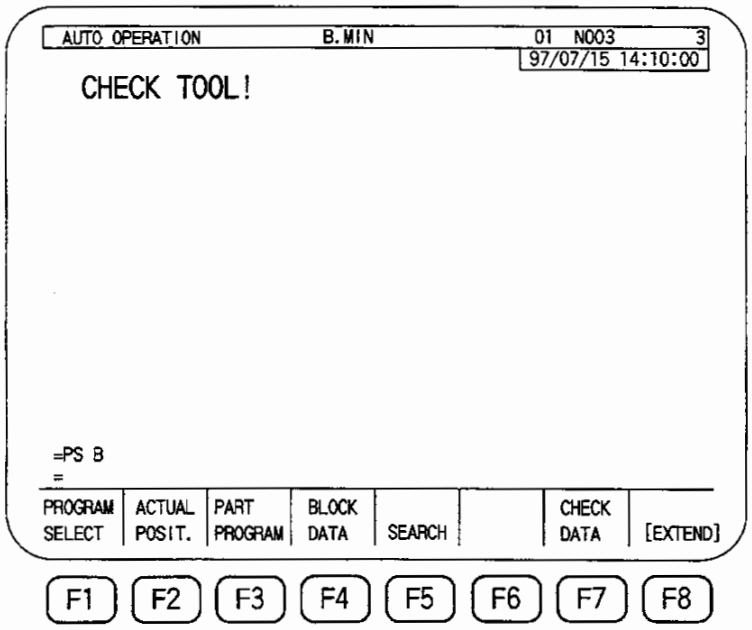


Fig. 6-15 Message Display Screen

7. Check Display

During operation in automatic, MDI, or manual mode, it is possible to check the NC axis data and the contents of the system variables by displaying them on the screen.

The following check items can be displayed.

Note that the actual display screens and check items will vary according the selected specifications.

1. NC specification codes
2. NC axis data
3. NC axis data enlarge display
4. Diagnostics
5. System variables – axis data
6. System variables – zero offset
7. System variables – tool offset
8. System variables – system parameter
9. System variables – home position
10. System variables – NC communication
11. System variables – other data

Select the data to be displayed by an NC optional parameter (bit) No. 5, bit 0 to bit 4.

Description of operating procedure:

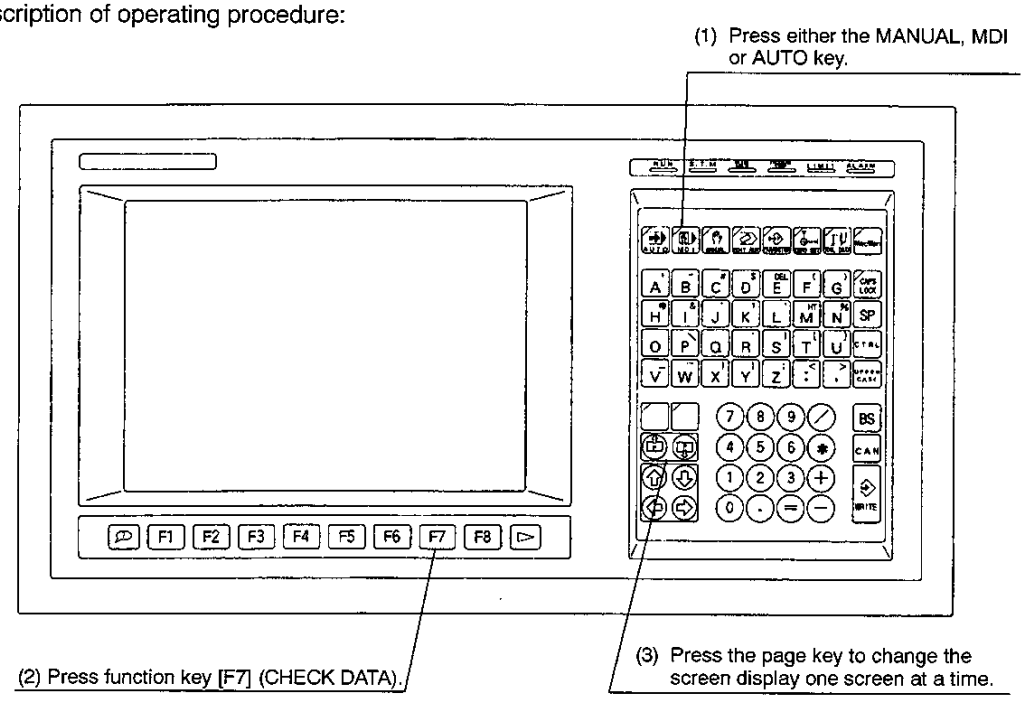


Fig. 6-16 Displaying the CHECK DATA INDEX Page

(1) Press either MANUAL, MDI, or AUTO key.

(2) Press function key [F7] (CHECK DATA).

The screen displays a check data indications page.

(3) Press either the ⇩P or ⇧P page key to display the check data desired.

Pressing ⇩P once advances a page.

Pressing ⇧P once returns a page.

The SEARCH command displays the check data by one-touch operation, without repeatedly pressing the page key.

The explanation of operations (1) and (2) given above is omitted here as they both apply in this case.

(4) Press function key [F5] (SEARCH).

"= F" is displayed on the display screen console line.

(5) Enter the desired page number through the keyboard.

The input data is displayed following "= F ␣ ".

Example: = F ␣ 10

(6) Press the WRITE key.

This will display the desired check data.

When the WRITE key is pressed without inputting data following "= F ␣ ", the menu display shown below will be displayed.

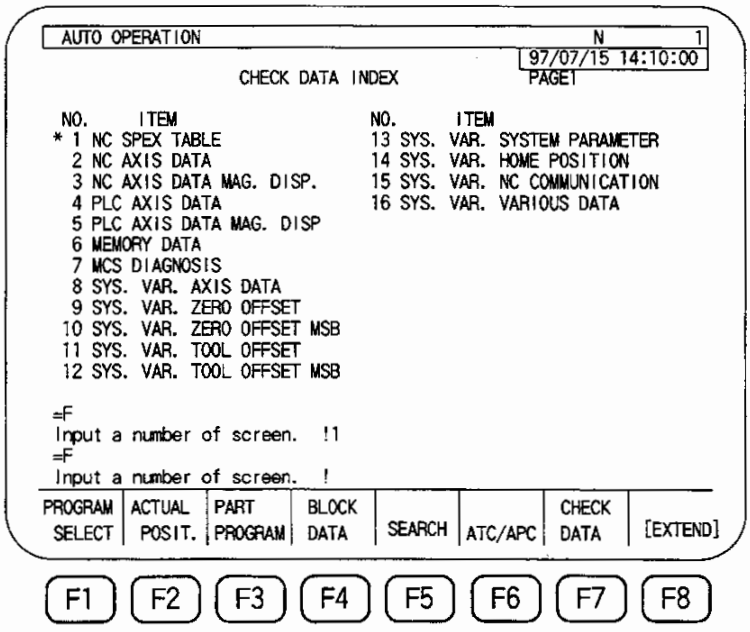


Fig. 6-17 Check Display Screen

Input the number for required item and press the WRITE key to display the first page of the required item screen.

7-1. Display Screen

7-1-1. NC Specification Codes

The NC SPEC TABLE screen has three pages and page selection is possible using the page keys.

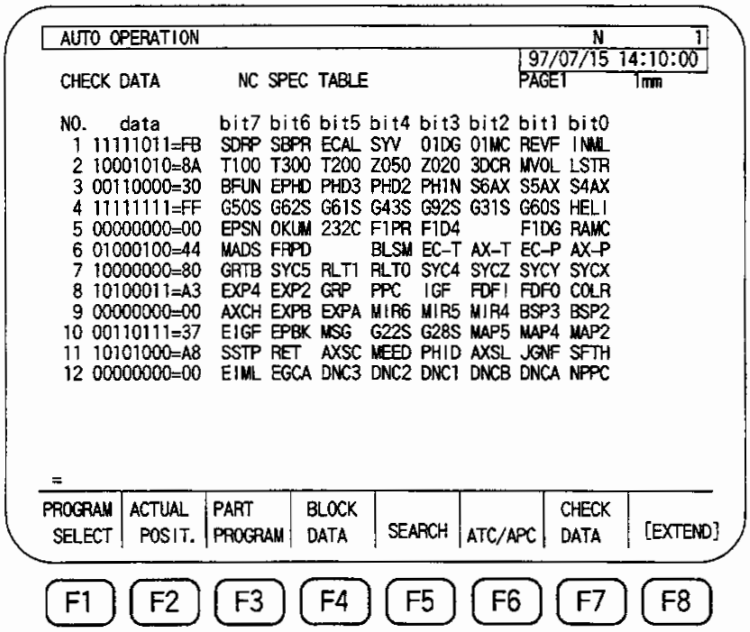


Fig. 6-18 NC Specification Codes Screen

7-1-2. NC Axis Data

The NC axis data is displayed in decimal numbers on the display screen, as shown below.

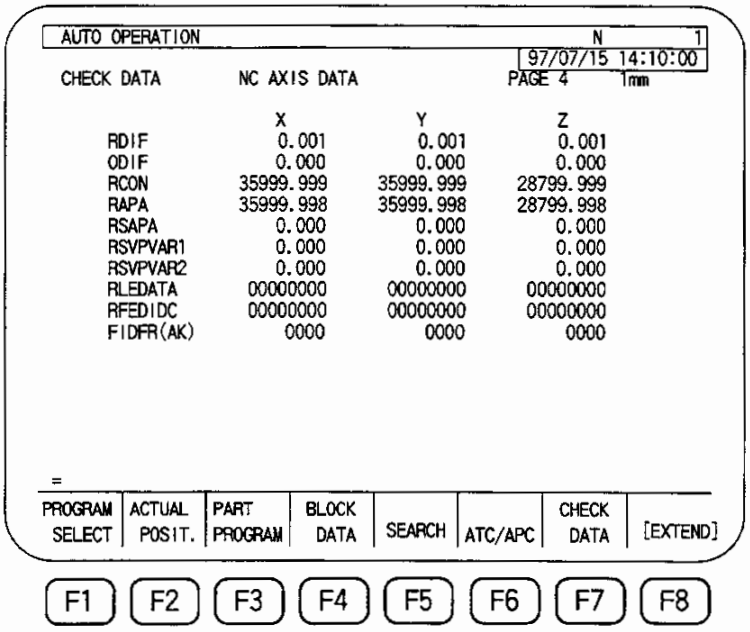


Fig. 6-19 NC Axis Data Screen

RDIF : Difference between calculated value and position encoder output

ODIF : Difference between calculated value and position encoder output with acceleration/deceleration activated

RCON : Calculated value

RAPA : Position encoder output

RSAPA : Position encoder output when contact with the touch setter is detected

RSVPVAR1 : Servo data (Designate the content of display with NC optional parameter (word) No. 10.)

RSVPVAR2 : Servo data (Designate the content of display with NC optional parameter (word) No. 10.)

RLEDATA : Absolute scale data

RFEDIDC : Position encoder data

FIDFR(AK) : Indicates the inductosyn ON/OFF state.

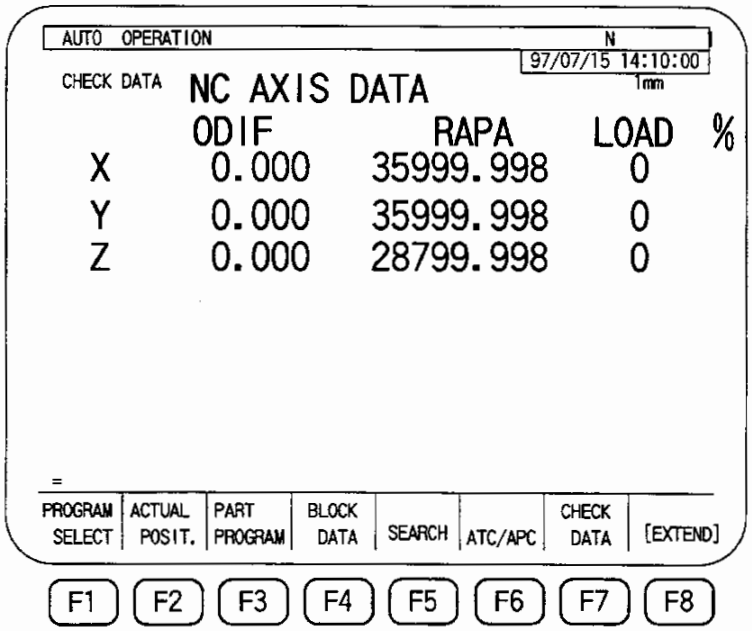
0000 .... Inductosyn effective. For the axis for which inductosyn on/off is ineffective, "0000" is always displayed.

8080 .... Inductosyn ineffective.

8000 .... Inductosyn effective/ineffective status is changing from ineffective to effective.

0080 .... Inductosyn effective/ineffective status is changing from effective to ineffective.

The NC axis data screens also include the following page where ODIF, RAPA, and LOAD values are displayed in enlarged characters. This page is displayed by pressing the page key from the screen indicated above.



LOAD : Axis loaded status is displayed in %.

7-1-3. Diagnostics

Any memory content in the memory can be displayed in a designated format on the screen.

The diagnostics function si provided to be used by the machine tool manufacturer.

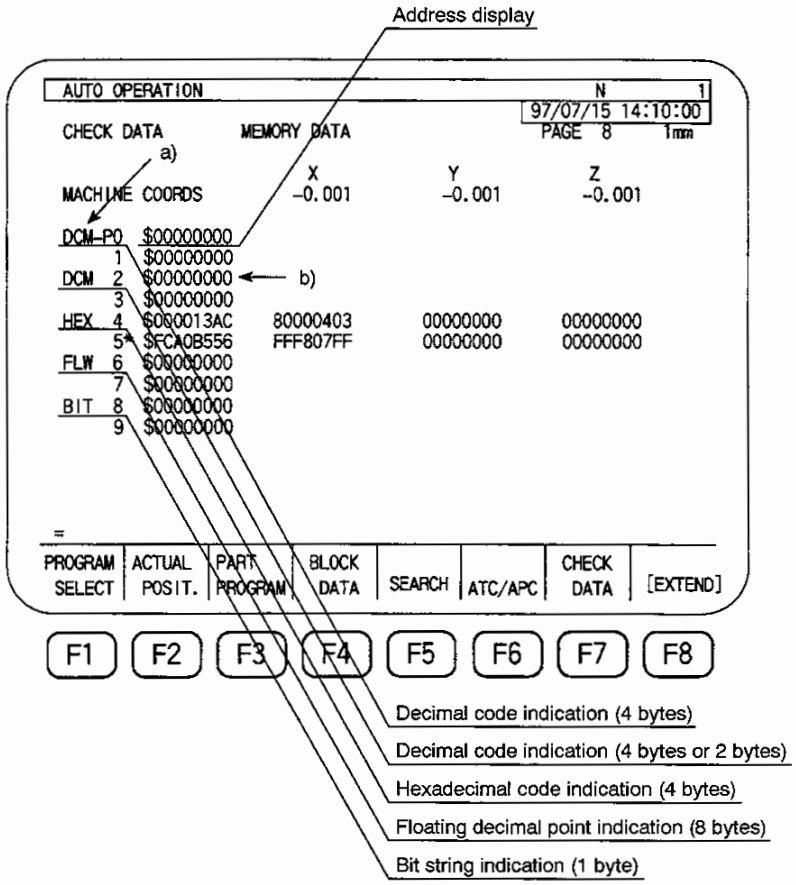


Fig. 6-20 Diagnostics Screen

a) ＊ : Displayed to the right of the diagnosis data: indicates the cursor key operation enabling position.

(Once a check address is set in the conventional manner, check address is increased or decreased in units of the data type being checked by pressing the cursor keys ⇧ , ⇩ , ⇦ , ⇨ .)

b) W : 2-byte indication of DCM data

L : 4-byte indication of DCM data

7-1-4. System Variables

The contents of the system variables are displayed on the screen.

Some of system variables (tool offset, etc.) cannot be displayed in one page. For such variables, the next page can be displayed by pressing the page key.

For details of the system variable names, refer to "System Variables" in the Programming Manual.

[Supplement] On the display screens where axis related system variables are displayed, those for the first additional axis are displayed to the right of the "Z-axis" data. For the second and third additional axes, the data is displayed on the page accessible by pressing function key [F8] (EXTEND) and [F6] (AXIS CHANGE).

(1) Axis Data

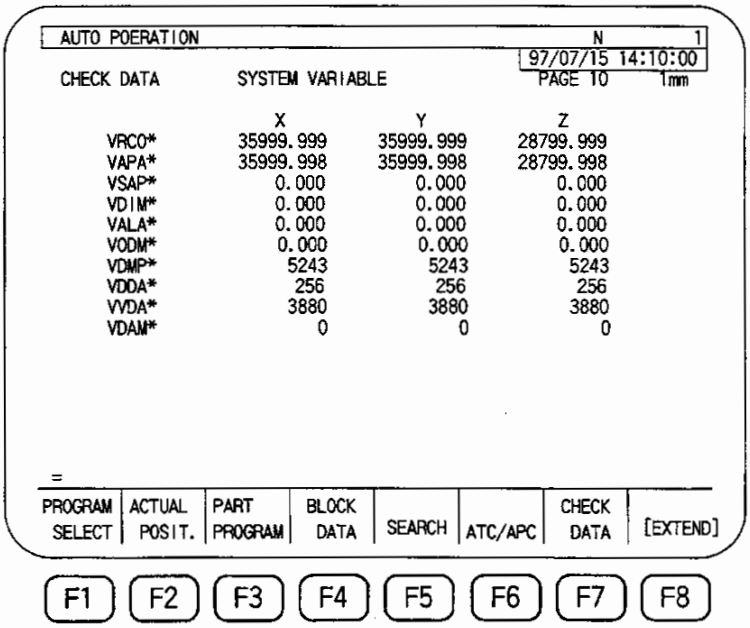


Fig. 6-21 System Variables Screen – Axis Data

(2) Zero Offset

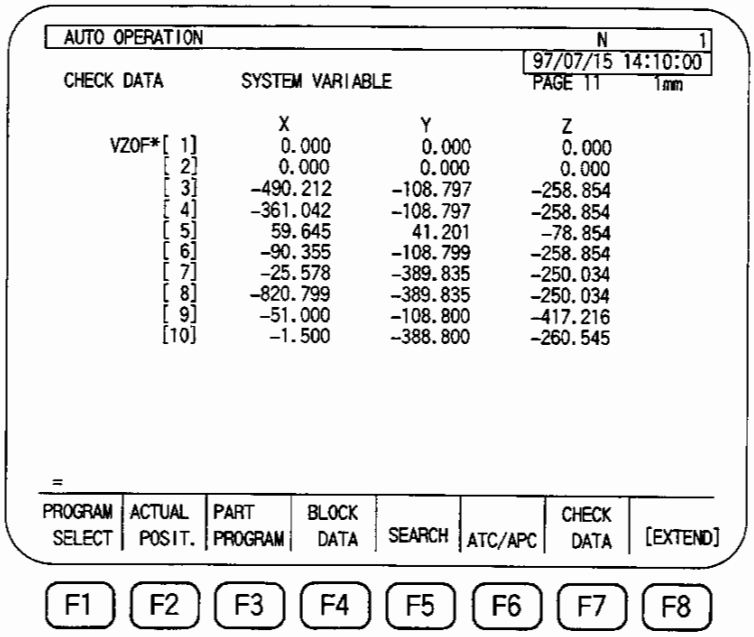


Fig. 6-22 System Variables Screen – Zero Offset

(3) Zero Offset (for system)

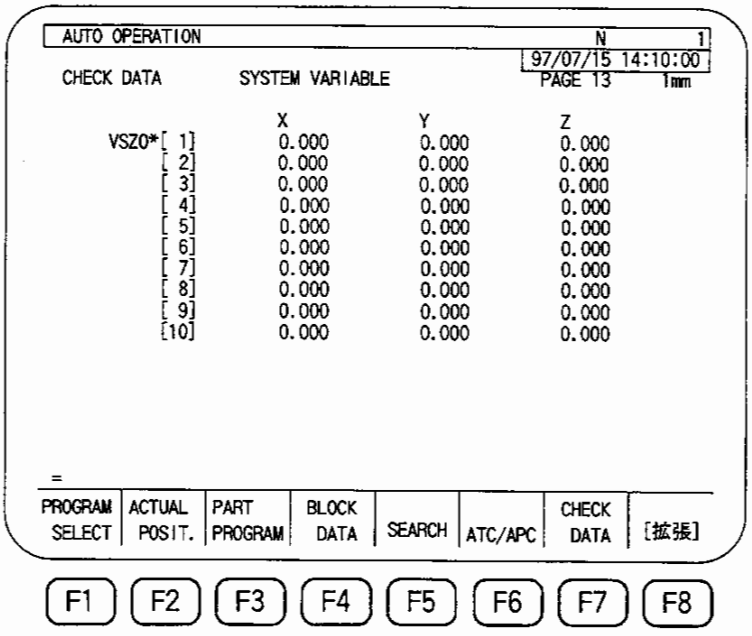


Fig. 6-23 System Variables Screen – Zero Offset (for system)

(4) Tool Offset

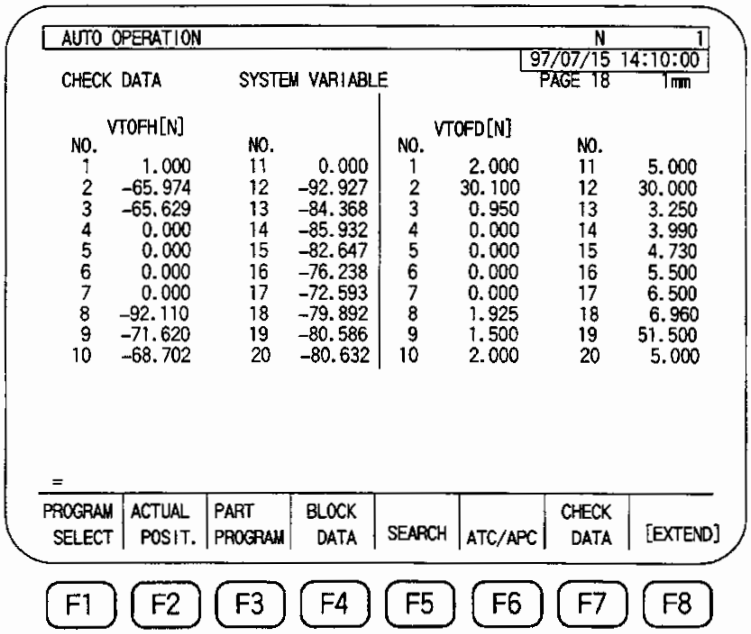


Fig. 6-24 System Variables Screen – Tool Offset

(5) Tool Offset (for system)

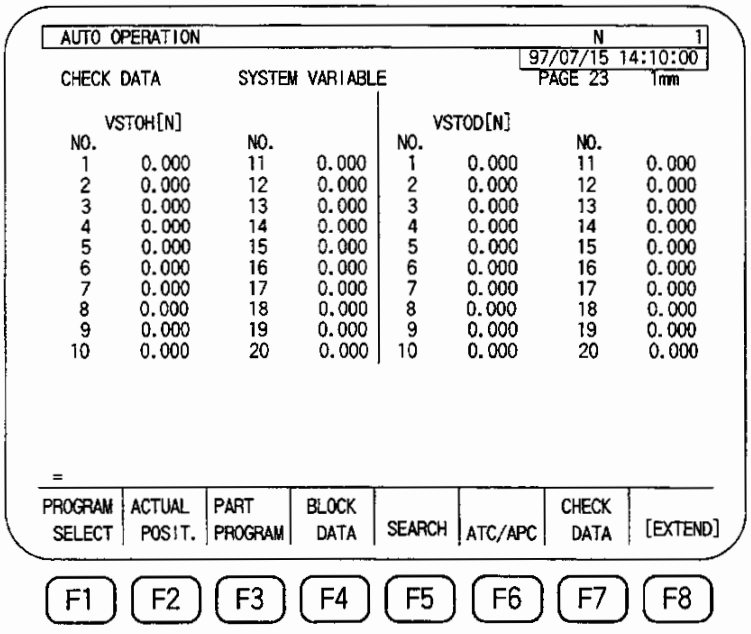


Fig. 6-25 System Variables Screen – Tool Offset (for system)

(6) System Parameter

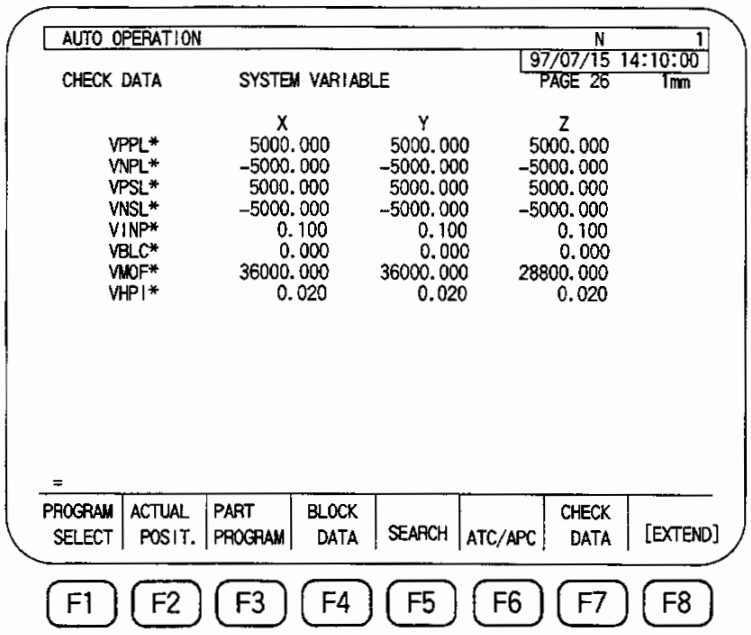


Fig. 6-26 System Variables Screen – System Parameter

(7) Home Position

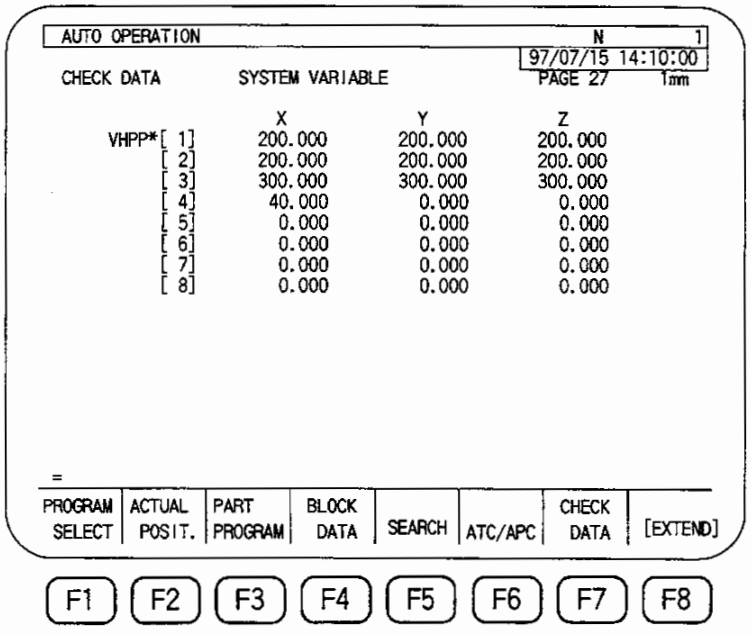


Fig. 6-27 System Variables Screen – Home Position

(8) NC Communication Buffer

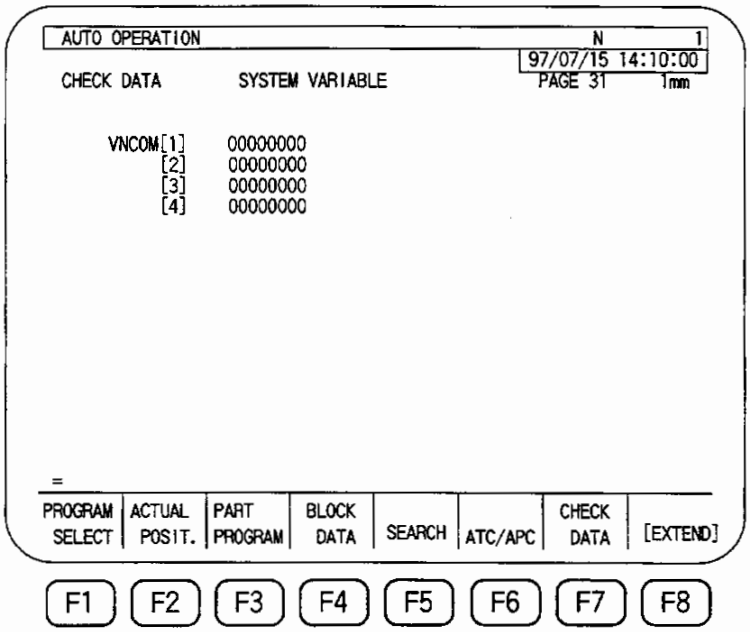


Fig. 6-28 System Variables Screen – NC Communication Buffer

(9) Other Data

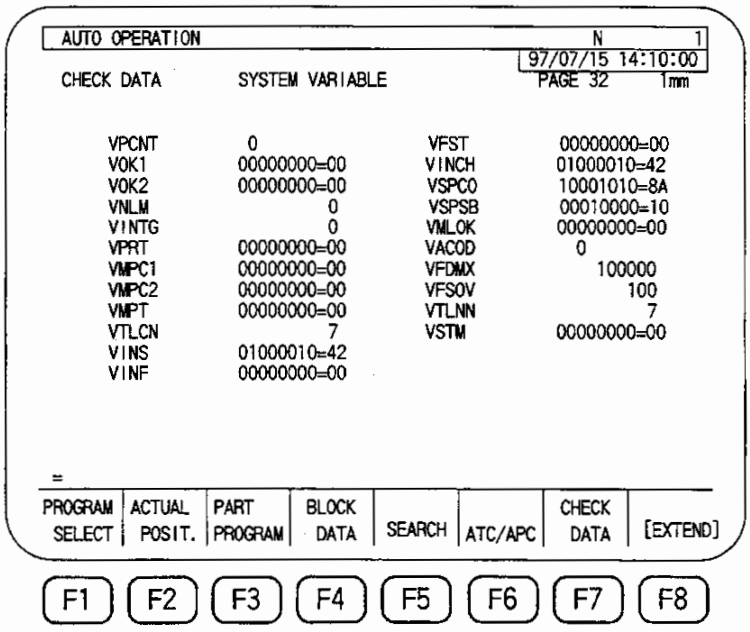


Fig. 6-29 System Variables Screen – Other Data

7-1-5. PLC Axis Data

The PLC axis data is displayed in decimal numbers on the display screen, as shown below.

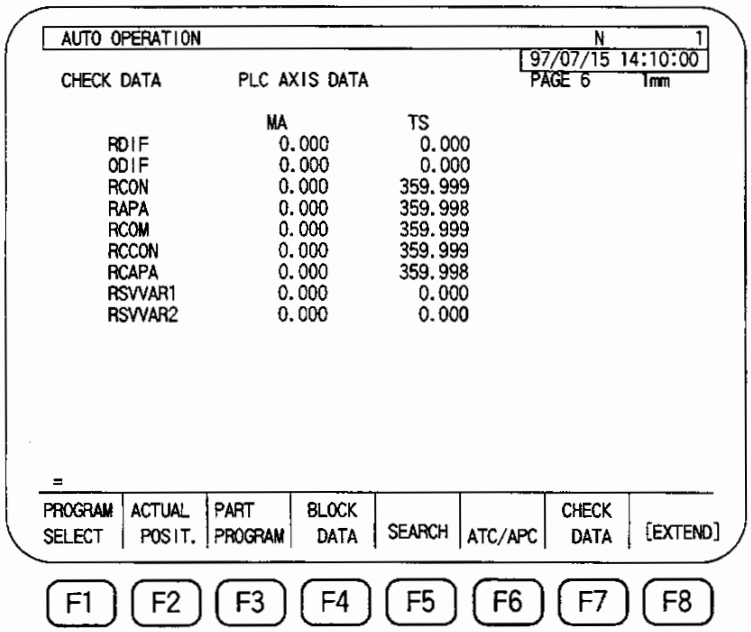


Fig. 6-30 PLC Axis Data Screen

RDIF : Difference between calculated value and position encoder output

ODIF : Difference between calculated value and position encoder output with acceleration/ deceleration activated

RCON : Calculated value

RAPA : Position encoder output

RCOM : Command value

RCCON : This is the RCON with the position encoder offset incorporated (applies to systems with axis switching specifications).

RCAPA : This is the RAPA with the position encoder offset incorporated (applies to systems with axis switching specifications).

RAVVAR1 : Servo data (Designate the content of display with NC optional parameter (word) No. 10.)

RAVVAR2 : Servo data (Designate the content of display with NC optional parameter (word) No. 10.)

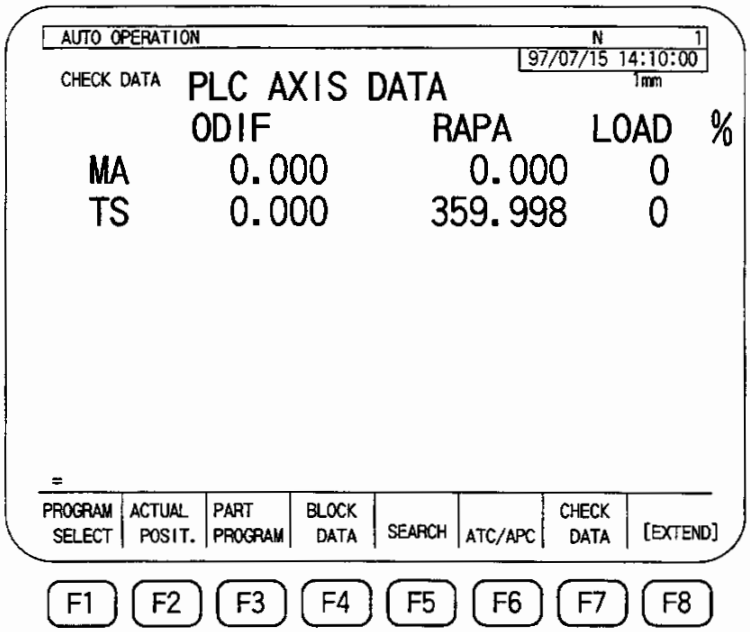
WA : Crossrail

MA : Magazine

TS : Varies depending on the machine being used. Refer to the Maintenance Manual for the machine in question.

TI : Varies depending on the machine being used. Refer to the Maintenance Manual for the machine in question.

Additionally, the machine axis data enlarge display screen displaying ODIF, RAPA and load data in enlarged characters is provided.



7-1-6. MCS Diagnostics

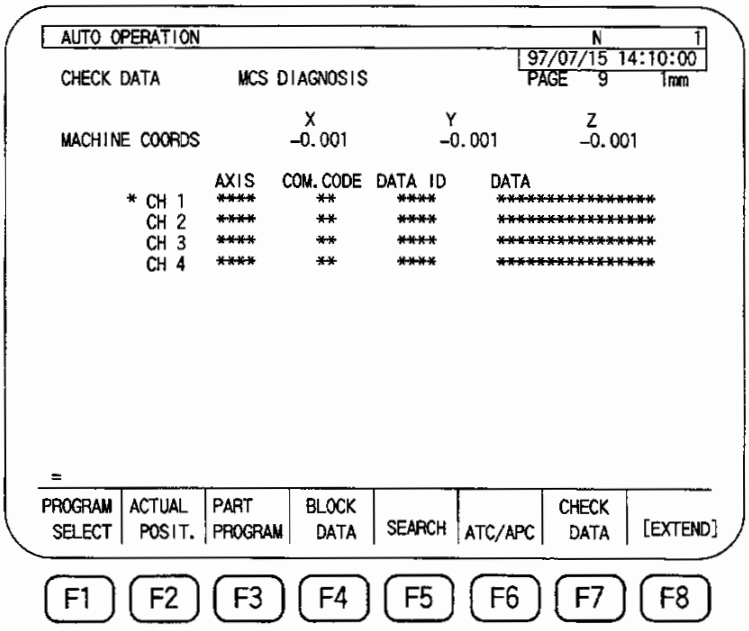


Fig. 6-31 MCS Diagnostics Screen

8. Run Guide Display

After selecting the EDIT AUX mode, press function key [F7] (RUN GUIDE), and the RUN GUIDE screen is displayed.

(1) RUNNING FILE

The operation status of the file currently selected is displayed at the left half area on the screen.

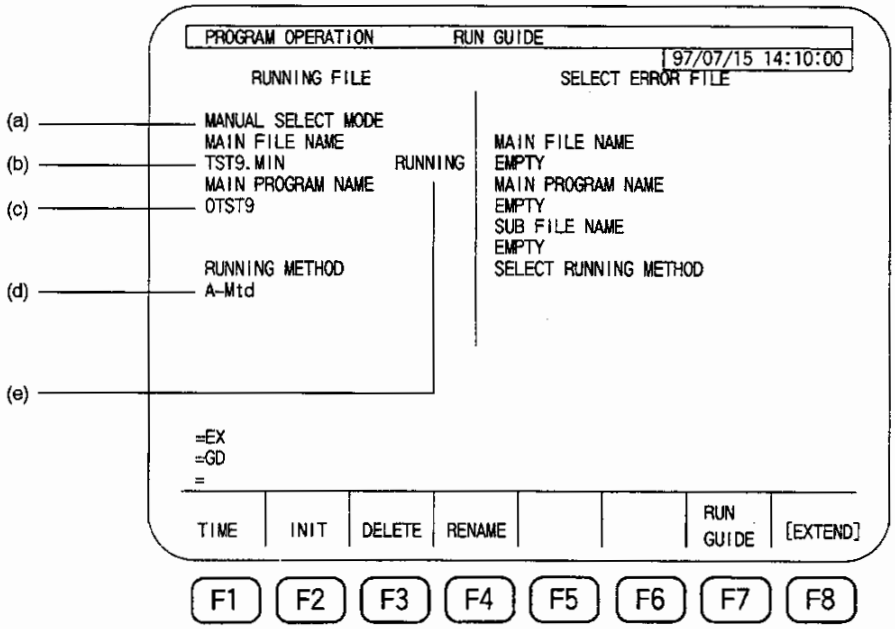


Fig. 6-32 Running File Display

(a) File selection method

This field indicates how the file has been selected and is being operated.

Display	Contents
EXTERNAL SELECT MODE	Operation by external program selection command
SCHEDULE MODE	Scheduled program operation
MANUAL SELECT MODE	Operation by manual program selection

(b) MAIN FILE NAME

This field indicates the main file name currently selected.

(c) MAIN PROGRAM NAME

This field indicates the main file program name currently selected.

(d) RUNNING METHOD

This field indicates the operation method of the program currently selected.

Display	Contents
A-Mtd	Normal operation
B-Mtd	Large volume operation
S-Mtd	Operation without branching and subprogram

(e) Operation status

This field indicates the current operation status of the program selected.

Display	Contents
SELECTED	Program selection complete, but it is not run.
RUNNING	Program is being executed.
END	Program execution has been completed; this display is given until the next program is selected or the next cycle is started.

(2) SELECT ERROR FILE

If an error occurred during automatic program selection, file is displayed at the right half of the screen.

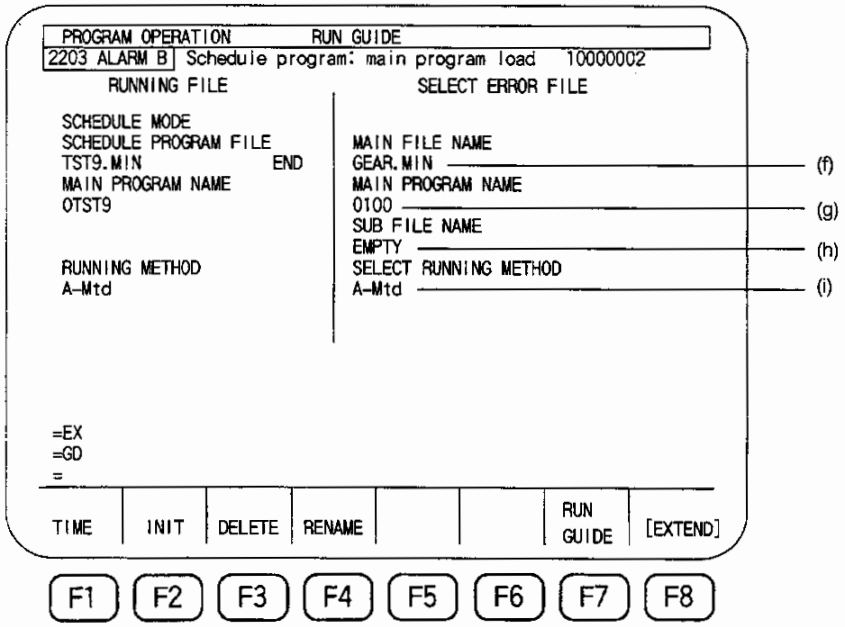


Fig. 6-33 Select Error File Display

(f) MAIN FILE NAME

This field indicates the main file name selected if a program selection error has occurred.

(g) MAIN PROGRAM NAME

This field indicates the main file program name selected if a program selection error has occurred.

(h) SUB FILE NAME

This field indicates the sub file name selected if a program selection error has occurred.

(i) SELECTED RUNNING METHOD

This field indicates the operation method selected when a program selection error has occurred. The operation method is explained in detail in d) in (1), "RUNNING FILE".

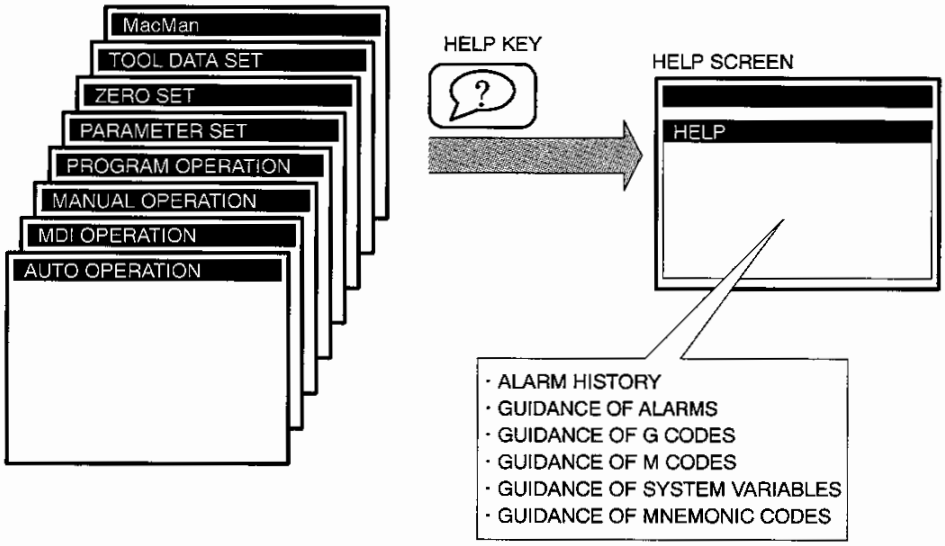
SECTION 7 HELP FUNCTION

1. Summary

If your are in trouble due to the occurrence of an alarm, or if you are not sure about G/M codes or other commands while you are creating a program, press the HELP key.

The HELP screen displays guidance concerning the following information:

- Alarm
- G codes
- M codes
- System variables
- Mnemonic codes

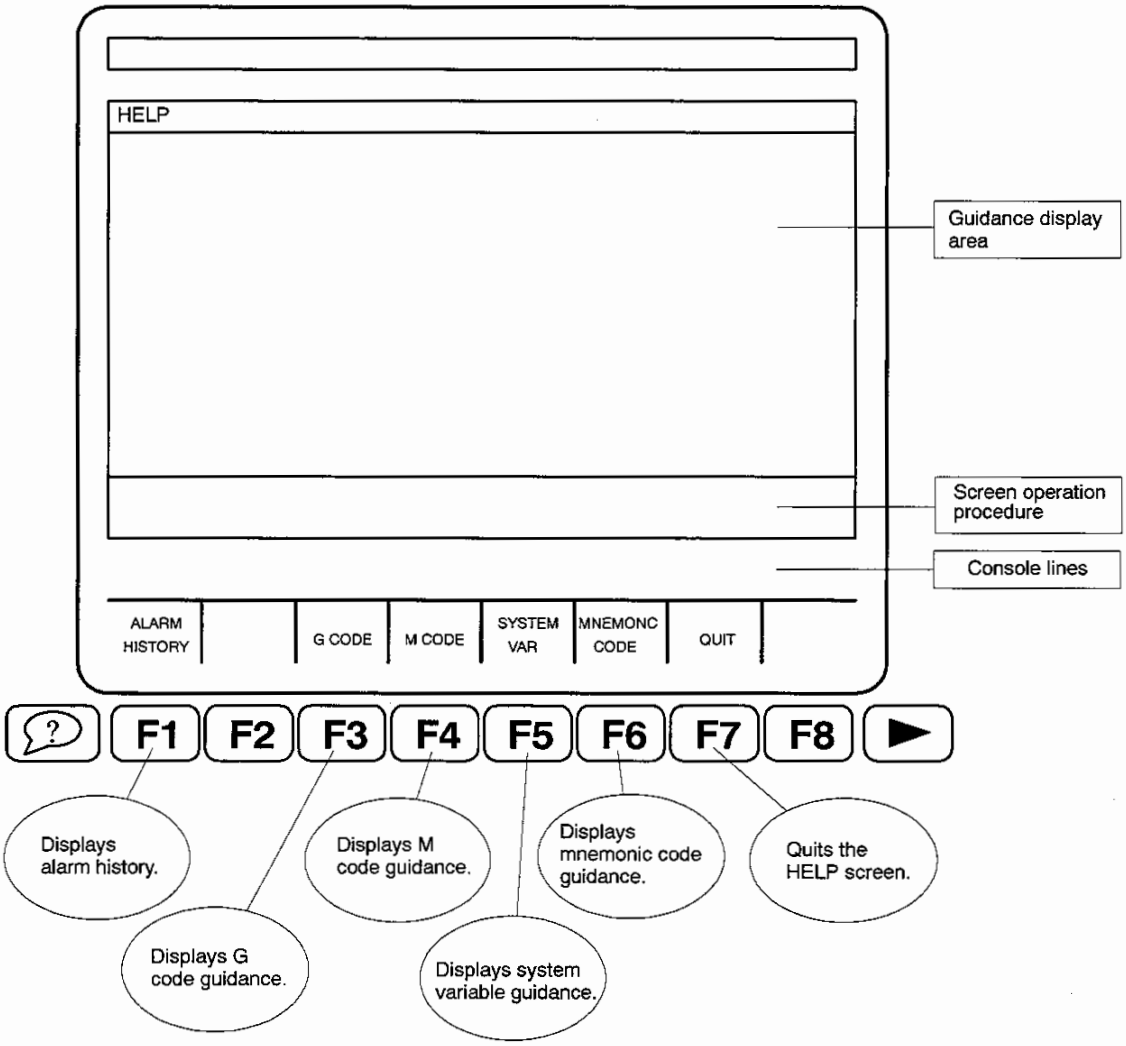


When the HELP key is pressed in an alarm state, guidance of the alarm is displayed.

If the HELP key is pressed while the NC is not in an alarm state, the HELP screen which was displayed last is displayed. In the previous operation, however, if the guidance screen was scrolled by cursor keys or page keys, the guidance screen before it was scrolled is displayed.

2. HELP Screen

After calling the HELP screen, you can display the desired guidance by pressing the corresponding function key.



"What G code should be used for this fixed cycle?"

If this is your question, press [F1] (G CODE), and the list of G codes is displayed.

Scroll the screen using cursor keys or page keys until you find the G code of the desired fixed cycle.

What is the nature of alarm No. 2000?

What mode is called by G91?

What function is called by M05?

What is VPVLX?

What is ATAN?

If you need the guidance on specific alarm or code, input the alarm number or the code and press the WRITE key.

3. HELP Screen for Alarms

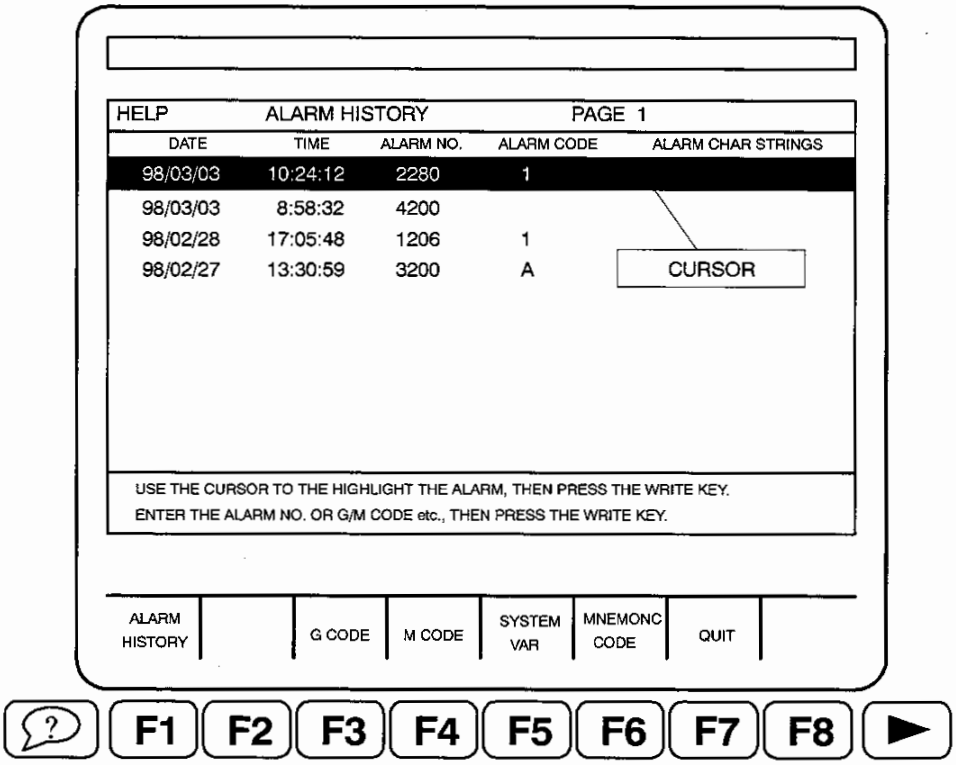
3-1. Guidance on Active Alarms

If the NC is in an alarm state, simply press the HELP key and the guidance is displayed for the active alarm.

If an alarm occurred while a HELP screen was displayed, quit the HELP screen once by pressing [F7] (QUIT) then press the HELP key again.

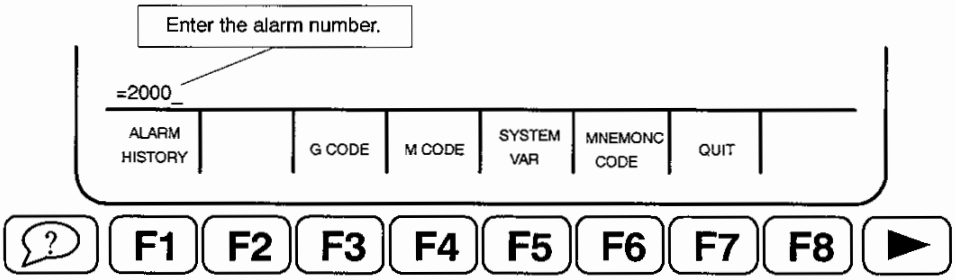
3-2. Selection from Alarm History

Move the cursor to the alarm for which you need the guidance and press the WRITE key.



3-3. Entering an Alarm Number

After entering an alarm number using numeric keys, press the WRITE key.



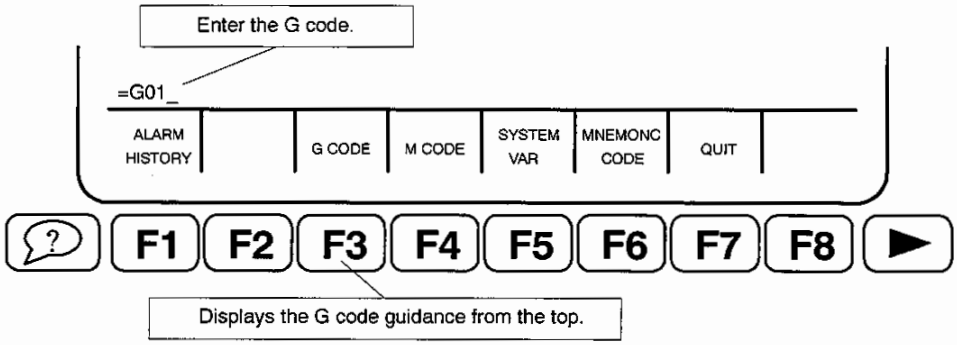
4. Program Help

The program help screens show the guidance on G codes, M codes, system variables, and mnemonic codes.

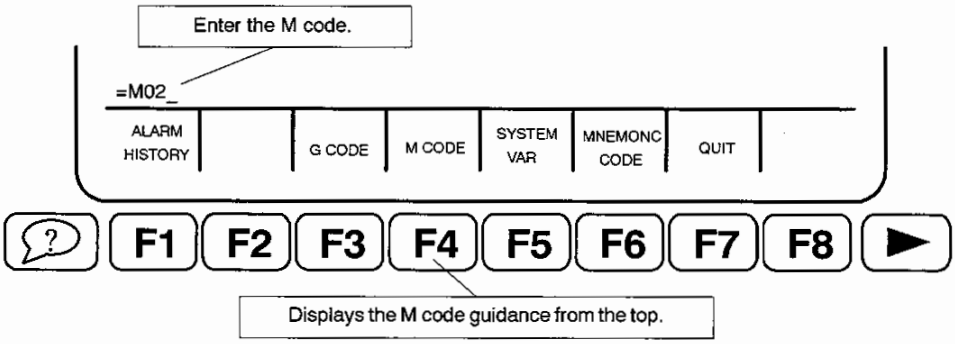
When a function key ([F3] to [F6]) is pressed, the guidance is displayed from the top. Scroll the screen by pressing cursor keys and page keys until the screen displays the guidance you need.

To display the guidance of a specific code, enter the code and press the WRITE key. The screen displays the guidance on the entered code.

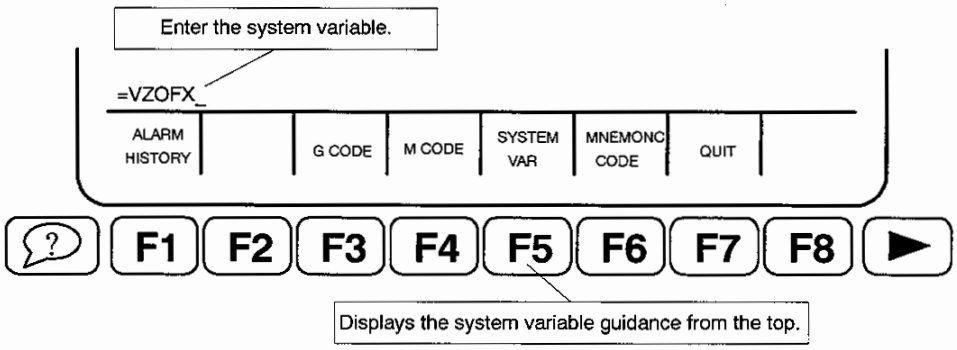
4-1. G Codes



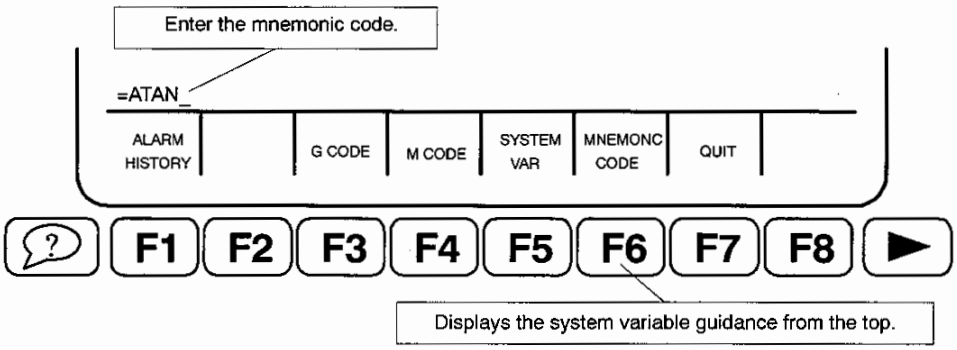
4-2. M Codes



4-3. System Variables



4-4. Mnemonic Codes

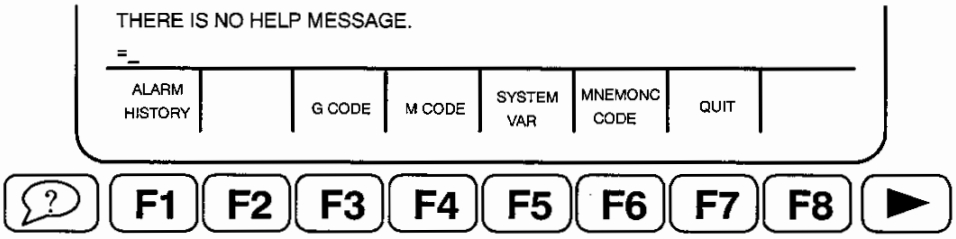


5. Supplement

There are screens (REPORT IMFORMATION and JOB PROCEDURE DISPLAY in the MacMan mode, etc.) on which the help function does not run due to the restrictions on internal processing.

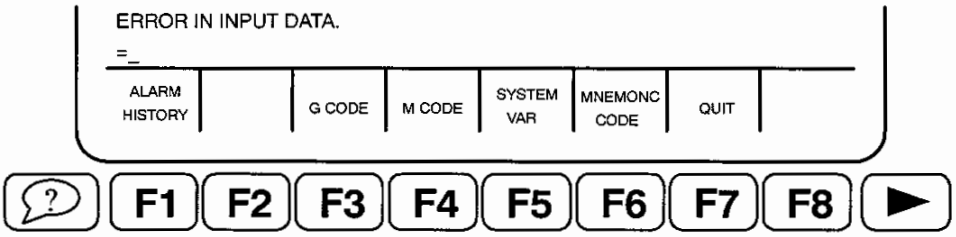
If the HELP key is pressed while these screen are displayed, the screen does not change.

If the guidance is not provided for the entered alarm number, G code, M code, system variable, or mnemonic code, "THERE IS NO HELP MESSAGE" appears in the console line and the guidance display area is blanked.



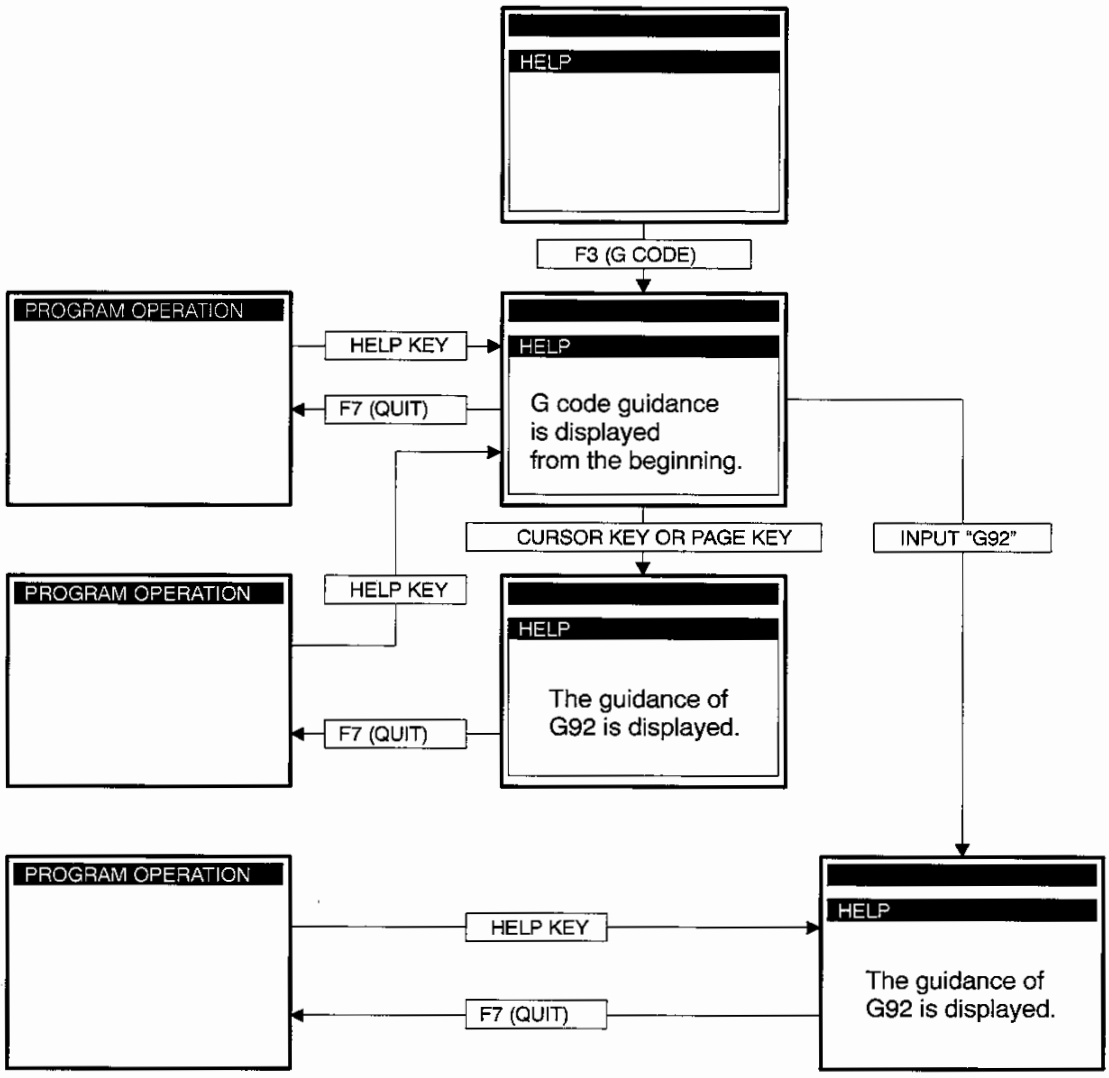
If you input numbers or character-strings shown below, "ERROR IN INPUT DATA" is displayed. In this case, the previous guidance remains displayed in the guidance display area.

- An alarm number of 2 digits or less or 5 digits or larger
- A G or M code of 6 characters or more
- A G or M code including an alphabetic letter other than G and M
- A character-string of 10 characters or more



If the HELP key is pressed while the NC is not in an alarm state, the HELP screen displayed last is displayed. If the last HELP screen was scrolled, the screen before the scroll is displayed.

Example



III. DATA OPERATION

SECTION 1 DATA SETTING

This section describes the commands used in the parameter set, zero set, and tool data set mode operation. The procedure for setting the zero point data and tool data is also explained. For the procedure used for setting the parameter data and the contents of the parameters, refer to III "PARAMETER" in this manual.

1. Mode Selection Keys

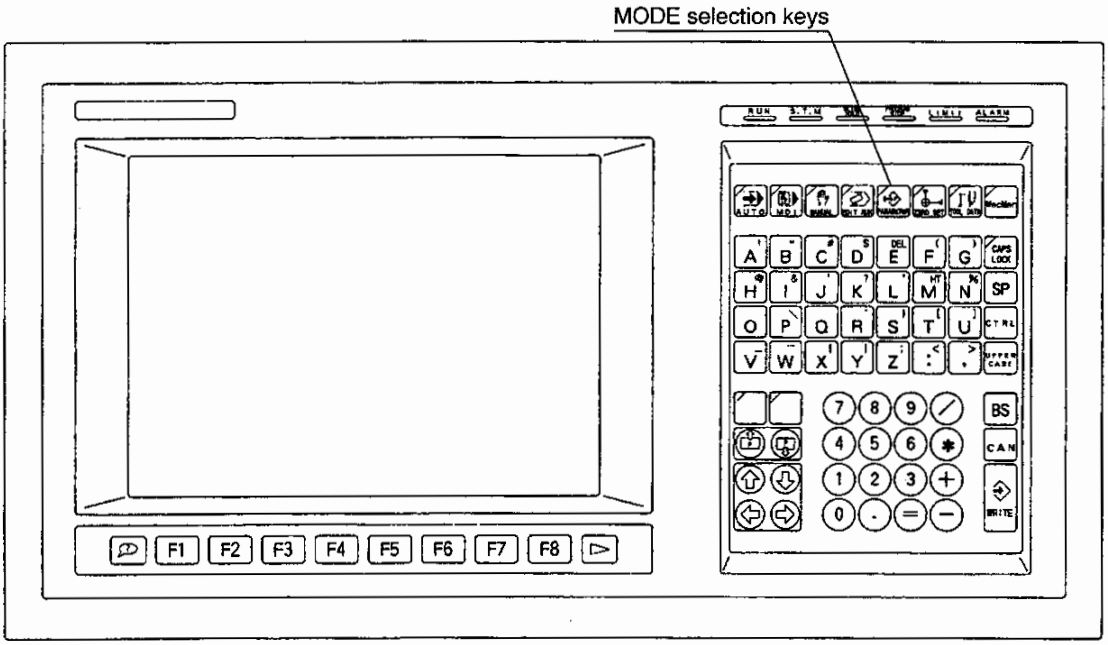


Fig. 1-1 Mode Selection Keys

The mode selection keys are classified into the three groups, operation mode, data setting mode, and machining management (MacMan) mode.

(1) Operation Mode

(a) AUTO

In the automatic mode, the part program stored in the memory area is read into the operation buffer and then executed.

(b) MDI

In the MDI mode, the program is input from the keyboard and executed.

(c) MANUAL

In the manual mode, machine operation is controlled using the switches on the machine operation panel.

(2) Data Setting Mode

(a) EDIT/AUX

This is the mode for reading, editing, punching-out, and printing out the program, operating the tape reader, and managing files.

(b) PARAMETER

Parameters and variables, including system parameters, user parameters, common variables and NC optional parameters are set.

For details of the parameters, refer to IV "PARAMETER" in this manual.

(c) TOOL DATA

Used to set the tool data such as tool length offset values and cutter radius compensation values.

(d) ZERO SET

In this mode, the work zero offset value is set.

(3) MacMan Mode

The actual status of the production field is collected in this mode, and the result of data processing is output to the NC screen, printer, or 3.5-inch floppy disk.

For details of the MacMan mode, refer to the separately prepared manual, "MacMan INSTRUCTION MANUAL".

(4) Pressing any of the mode operation selection keys will light the lamp in the key.

(5) If the mode is switched from any of the operation modes to the data setting mode, the lamp in the selected operation mode key starts flashing. This allows the operator to recognize the selected operation mode at a glance.

(6) Once program execution is started in the AUTO mode or MDI mode, switching the mode to Data Setting Mode, such as EDIT/AUX, PARAMETER, TOOL DATA, and ZERO SET, will not interrupt the program execution. Therefore, program editing, tape punching-out, tape reading-in, parameter setting, zero setting, tool data setting and other data setting operations are possible during stored program execution.

When program execution halts in the AUTO mode operation, while data setting operation is being carried out, due to Single Block ON or Program Stop command, it is necessary to press the CYCLE START switch after switching the mode to AUTO to continue the AUTO mode operation.

(7) Switching the operation modes in the following sequence will reset the control:

(a) From manual to auto or MDI

(b) From auto or MDI to manual

(c) When the mode is switched from manual to the data setting mode, although the control is not reset, it is reset when any operation is selected after that.

: When the data has been set, the new data is stored in memory after two to three minutes have passed. Therefore, if the power is turned off immediately after the data has been set, the data may not be updated as desired.

Before turning off the power supply and after setting the data, backup the data following the procedure explained in 3-4-1. "Back Up Command".

2. Data Setting

Here is a list of parameters for data setting, together with their contents.

Category	Subcategory	Sub subcategory	Entry Type	Axis Type	Data Elements	Unit	Internal Data Type
Work coordinate origin	—	—	Microns; integer	Linear axis	4 to Max. 100	Inch system Metric system	4-byte integer
				Rotary axis	4 to Max. 100	Degrees	4-byte integer
Tool data	Tool data	Tool length offset	Microns; integer	Linear axis	50 to Max. 300	Inch system Metric system	4-byte integer
		Cutter radius compensation	Microns; integer	Linear axis	50 to Max. 300	Inch system Metric system	4-byte integer
Parameter	Common variable	—	Microns; integer	—	200	—	8-byte floating-point data
	System parameter	Travel end limit	Microns; integer	Liner axis	2/1 axis	Inch system Metric system	4-byte integer
				Rotary axis	2/1 axis	Degrees	4-byte integer
		Pitch error compensation range	Microns; integer	Liner axis	2/1 axis	Inch system Metric system	4-byte integer
				Rotary axis	2/1 axis	Degrees	4-byte integer
		Pitch error compensation interval	2-byte; integer	Liner axis	1/1 axis	Inch system Metric system	4-byte integer
				Rotary axis	1/1 axis	Degrees	4-byte integer
		Number of pitch error compensation points	2-byte; integer	Liner axis	1/1 axis	Inch system Metric system	4-byte integer
				Rotary axis	1/1 axis	Degrees	4-byte integer
		Zero return operation execution sequence	2-byte; integer	Liner axis	1/1 axis	Inch system Metric system	4-byte integer
				Rotary axis	1/1 axis	Degrees	4-byte integer
		In-position width	2-byte; integer	Liner axis	1/1 axis	Inch system Metric system	4-byte integer
				Rotary axis	1/1 axis	Degrees	4-byte integer

Category	Subcategory	Sub subcategory	Entry Type	Axis Type	Data Elements	Unit	Internal Data Type
Parameter	System parameter	Home position	2-byte; integer	Liner axis	32 axis	Inch system Metric system	4-byte integer
				Rotary axis	32 axis	Degrees	4-byte integer
		Machine coordinate system origin	Microns; integer	Liner axis	1/1 axis	Inch system Metric system	4-byte integer
				Rotary axis	1/1 axis	Degrees	4-byte integer
	User parameter	Programmable travel limit	Microns; integer	Liner axis	2/1 axis	Inch system Metric system	4-byte integer
				Rotary axis	2/1 axis	Degrees	4-byte integer
		G60 over-passing amount	Microns; integer	Liner axis	1/1 axis	Inch system Metric system	4-byte integer
				Rotary axis	1/1 axis	Degrees	4-byte integer
		Backlash	Microns; integer	Liner axis	1/1 axis	Inch system Metric system	4-byte integer
				Rotary axis	1/1 axis	Degrees	4-byte integer
	G/M code macro	Simple call	Character	—	10	—	4-byte character
		Axis move call	Character	—	10	—	4-byte character
	Program name	—	Character	—	4	—	4-byte character
	Pitch error compensation	—	Integer	Liner axis	384	—	2-byte integer
				Rotary axis	384	—	2-byte integer
	NC optional parameter (long word)	—	Integer	—	64	—	4-byte integer
	NC optional parameter (word)	—	Integer	—	120	—	2-byte integer
	NC optional parameter (bit)	—	Bit string	—	512 bits	—	1-byte

[Supplement] The unit system for data setting can be set at NC optional parameter (bit) No. 9.

3. Data Set Commands

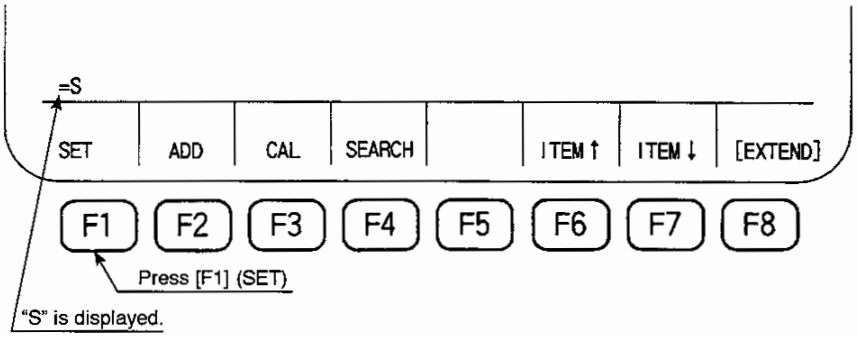
The data set commands are detailed in the following pages, and may be classified into three groups: commands for data setting, commands for parameter selection, and input/output commands for peripherals.

3-1. Commands for Data Setting

This group consists of three commands:

SET, ADD, and CAL

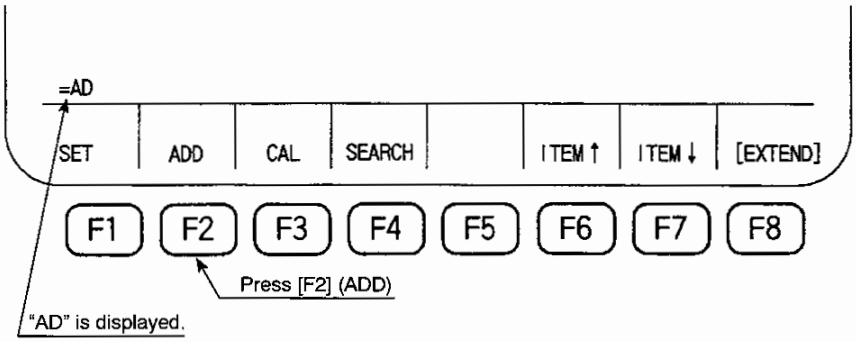
3-1-1. SET Command



The data entered itself is a command serving as new data. The SET command is effective when function key [F1] is pressed, and displays "S" on the 21st line on the display screen.

Enter the data from the keyboard and press the WRITE key, then the keyed in data is input.

3-1-2. ADD Command

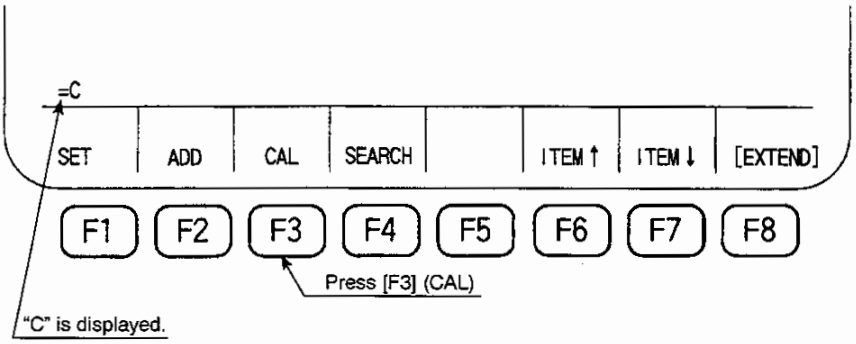


The data entered is added to the current data to form a command serving as new data.

The ADD command is effective when function key [F2] is pressed, providing a display of "AD" on the 21st line on the display screen.

Enter the data from the keyboard and press the WRITE key, and the entered data is added to the current data. The result of addition is input as the new data.

3-1-3. CAL Command



An arithmetic operation is carried out between the data entered and the current value to form a command serving as new data for setting.

The CAL command is effective by pressing function key [F3], providing a display of "C" on the 21st line on the display screen.

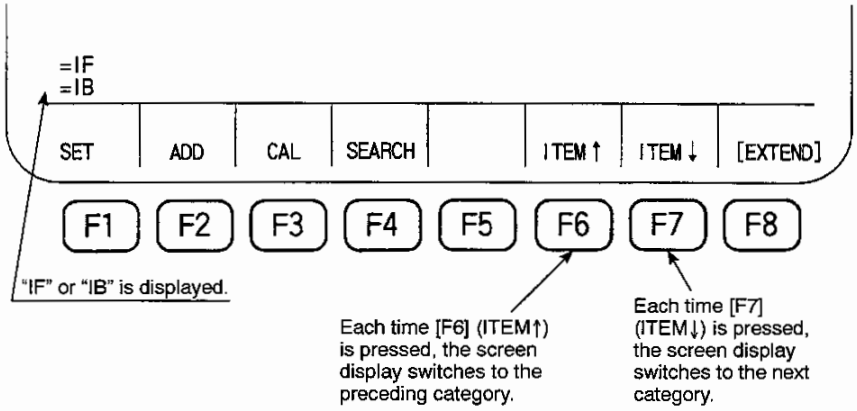
Enter the data from the keyboard and press the WRITE key, and the math operation is executed between the entered data and the current data. The result of math operation is input as the new data.

3-2. Commands for Parameter Selection

This group consists of six commands:

ITEM, SEARCH, AXIS CHANGE, CURSOR, PAGE and EXTEND

3-2-1. ITEM Command

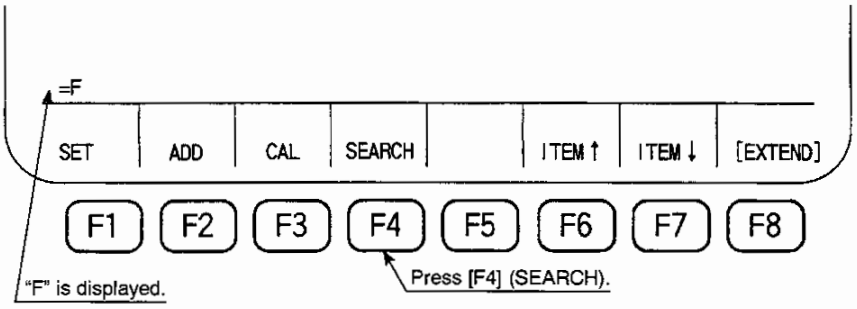


This command is intended to select an appropriate parameter from those belonging to the subcategories in the table given in Section 4, 2. "DATA SETTING".

The ITEM command is carried out when function key [F6] or [F7] is pressed. Each time one of these keys is pressed, the display screen is switched over to the preceding or next subcategory items.

"IF" or "IB" is displayed on the 21st line on the display screen and the screen display is switched over.

3-2-2. SEARCH Command



In the subcategory group, which involves several data elements, the screen display is, sometimes, greater than one page. This SEARCH command, engaged by function key [F4], may be conveniently used to set the cursor with ease, although it is possible to place the cursor at the desired data using the page key and the cursor key.

Operating procedure is given below:

(1) Press function key [F4].

This produces display of "F" on the 21st line on the display screen.

(2) Key in a data number on the keyboard.

Display of "F" is followed by this particular data.

(3) Press the WRITE key.

This allows the cursor to be positioned at the data number specified. If the current screen does not include the data number, then the screen is switched over until that data number appears and the cursor is positioned there.

If there is nothing corresponding to the data number entered, the cursor is then positioned as follows:

(1) When smaller

The cursor is positioned at the first data.

(2) When greater

The cursor is positioned at the last data.

The screen for setting bit type data, NC optional parameter (bit)) allows the simultaneous setting of both parameter number searching and parameter number setting.

(1) Press function key [F4].

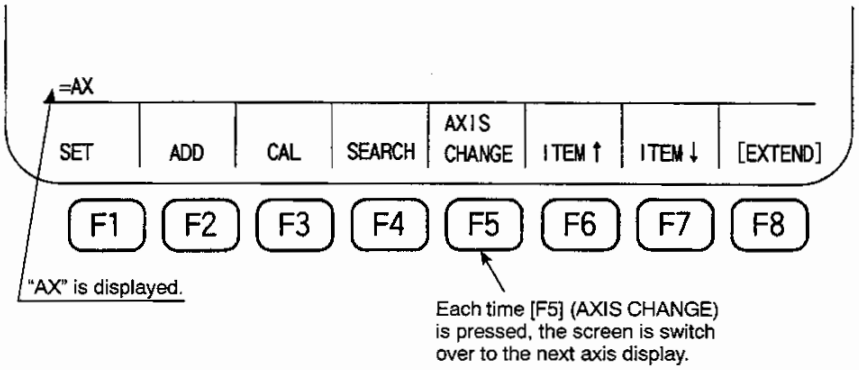
(2) Key in the parameter number.

(3) Key in a comma (,).

(4) Key in a bit number.

(5) Press the WRITE key.

3-2-3. AXIS CHANGE Command

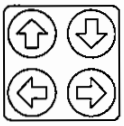


In data setting, if there is a parameter of axis type, the 5th and 6th axes cannot be displayed on the same screen. The AXIS CHANGE command is intended to switch the screen from one display to another.

Since the pitch error compensation data may be displayed on one axis per screen, the command is used for axis selection.

When function key [F5] is pressed, "AX" appears on the 21st line on the display screen, resulting in a screen switch.

3-2-4. Cursor Keys



Move the cursor in the arrow-pointed direction, where the cursor stays at only the points including data to be set. When, for example, the cursor is at

rest at the extreme left, press the cursor key ⇦ ;

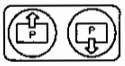
this brings the cursor to the data element located at the extreme right. When the cursor is at the

extreme right, press the cursor key ⇨ ; this

brings the cursor to the data element located at the extreme left. A similar relationship exists between

the cursor keys ⇩ and ⇧ .

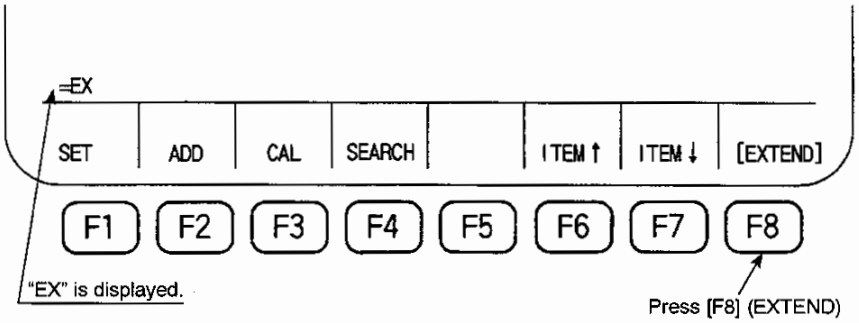
3-2-5. Page Keys



When the PAGE ↓ key is pressed, the screen advances one page in the same category only.

When the PAGE ↑ key is pressed, the screen returns one page in the same category only.

3-2-6. EXTEND Command



Data setting involves many commands, which cannot be displayed at the same time (there are eight function keys available). The EXTEND command is intended to switch command displays.

Function key [F8] provides a display of "EX" on the 21st line on the screen, resulting in a switched command only.

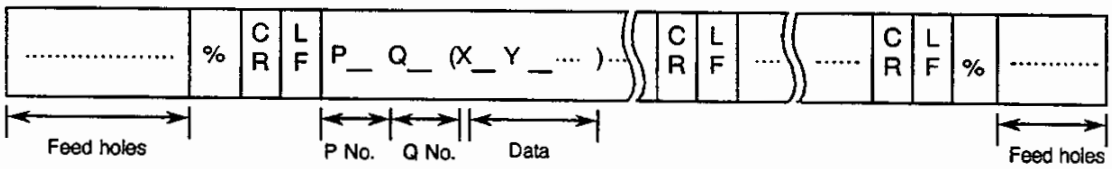
3-3. Input/Output Commands for Peripherals

This group consists of two commands: READ and PUNCH.

3-3-1. READ Command

This is a command to read a variety of data required for data setting from paper tape and set it in place.

The format is shown below:



The P and Q numbers must be specified, and are related to data setting as follows: P and Q specify the category and subcategory. Axis data is specified by X, Y, and Z, and the data not related to an axis is specified by R.

P and Q numbers are modal. It is not necessary to reprogram if the number is the same as the one programmed previously.

Both ISO and EIA codes may be used as conventional programs as the coding system.

The relationship of data setting, P numbers and Q numbers, is as indicated below.

Category	Subcategory	P No.	Q No.	Remark
Work coordinate system origin	—	100	1 to No. of work coordinate systems	
Tool data	Tool length offset	200	1 to No. of offsets	
	Cutter radius compensation	210	1 to No. of offsets	
Parameter	Common variable	300	1 to 200	
	System parameter	400	1 to 56	1 to 40 : real 41 to 56 : integer (Supplement)
	User parameter	410	1 to 32	
	Pitch error compensation	600	1 to No. of compensation points.	(Supplement)
	NC optional parameter (long word)	700	1 to 64	1 to 32 : user 33 to 64 : system
	NC optional parameter (word)	710	1 to 120	1 to 32 : user 33 to 120: system
	NC optional parameter (bit)	720	1 to 64	1 to 16 : user 17 to 64 : system

Operating procedure is given below:

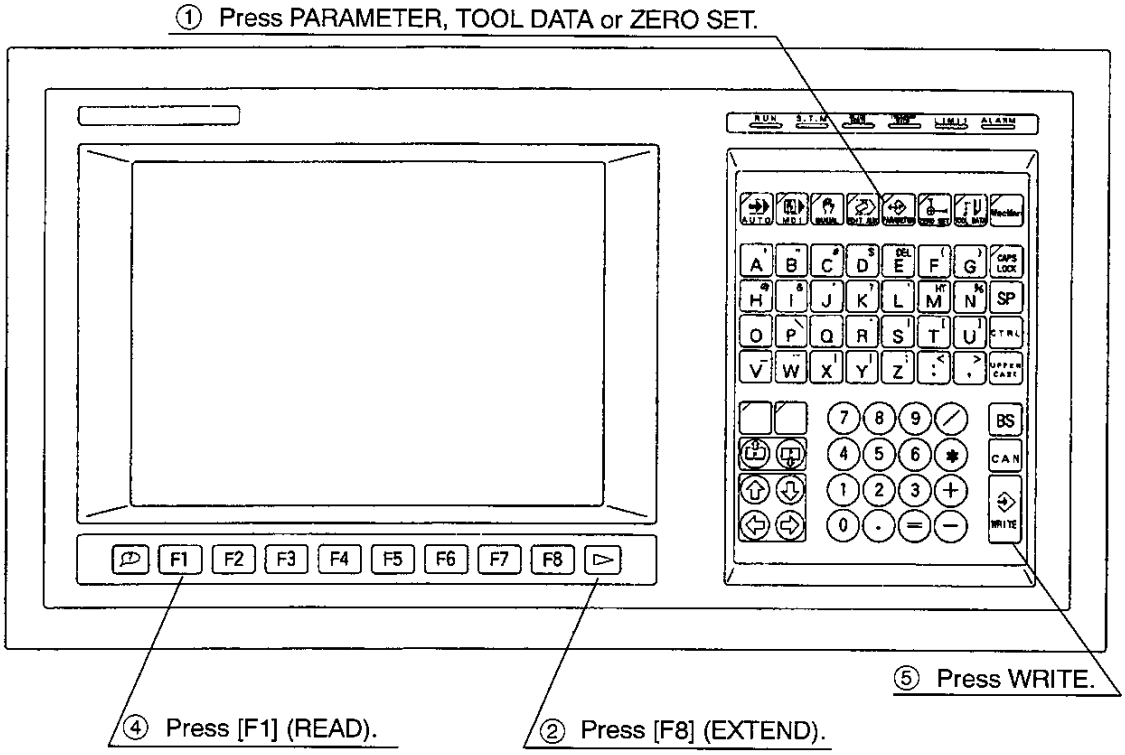


Fig. 1-2 Reading the Data from Tape

① Press the PARAMETER, TOOL DATA or ZERO SET key.

② Press function key [F8] (EXTEND).

This displays the READ (F1) command.

③ Set a paper tape for data setting on the tape reader so that the leading feed holes come to the reader.

④ Press function key [F1] (READ).

This displays "R" on the 21st line on the display screen.

⑤ Press the WRITE key.

This allows the paper tape to advance, so that the data on the tape is sequentially read and set.

Note that the tape reader stops when an error occurs during the setting and the display screen shows the message below:

read continuing? (Y/N)!

Press Y or N key. Keying in "Y" permits the tape reader to continue reading. The entry of "N" aborts the read command.

3-3-2. PUNCH Command

This is a command to punch various data required for data setting on the paper tape. Paper tape format is the same as with the READ operation. This command allows setting data to be stored on a paper tape.

Tape format is the same as indicated in Section 4, 3-3-1. "READ Command".

Punching out data under special conditions are shown below:

R	Normal data
R/0	Empty
R/1	+ overflow
R/2	– overflow
R/3	+ underflow
R/4	– underflow

When the data of the type indicated above is entered, the same condition is set. Operating procedure is shown as follows:

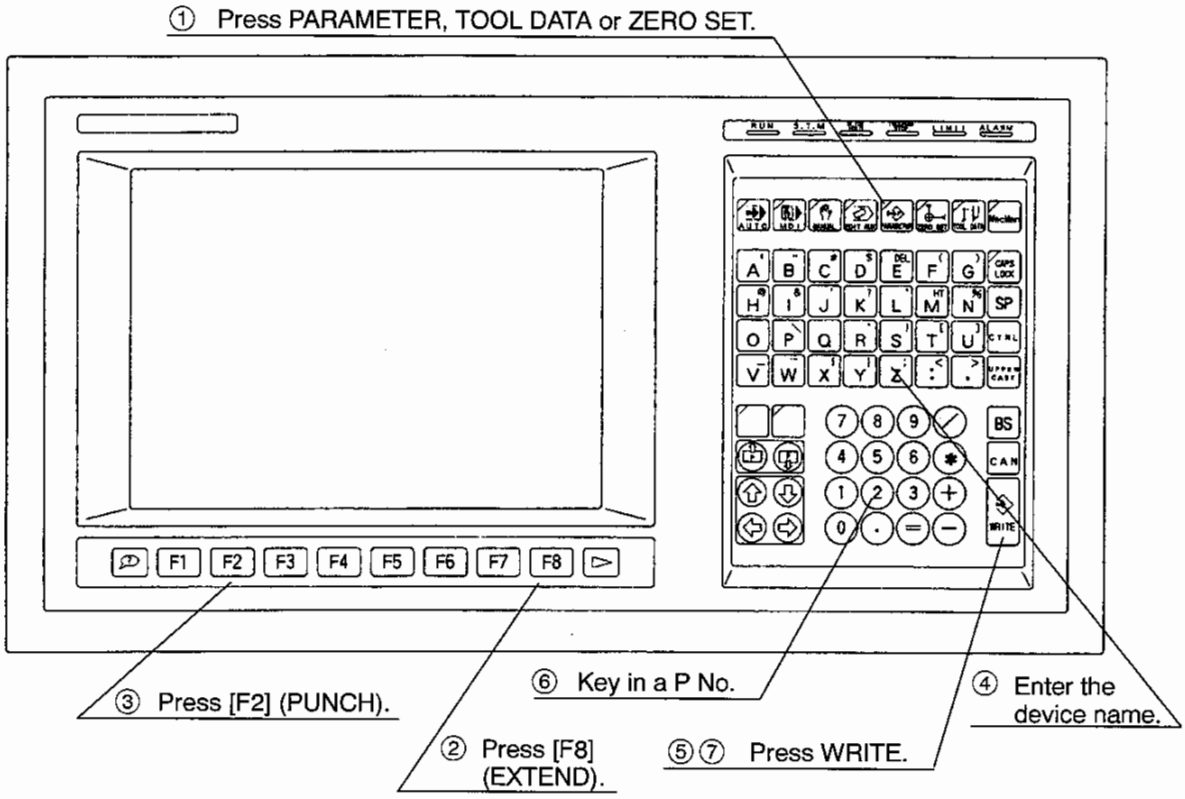


Fig. 1-3 PUNCH Command

① Press the PARAMETER, TOOL DATA or ZERO SET key.

② Press function key [F8] (EXTEND)

This displays the PUNCH [F2] command.

③ Press function key [F2] (PUNCH).

This displays "PU" on the 21st line on the display screen.

④ Enter the device name following "PU",the following names are usable.

PU ␣ device name: File name

If a sector device is designated, a search will be conducted for the relevant sector device, and a check will be conducted to determine if a file of the same name already exists. If a file of the same name is found, a "File exists. over write? (Y/N)!" message will be displayed. Enter "Y" to execute overwriting, or "N" to cancel the punch operation. A "Comment input" message will be displayed, requesting any comments which may be required regarding the punch data. Enter a comment if necessary. If no comment is required, nothing should be entered.

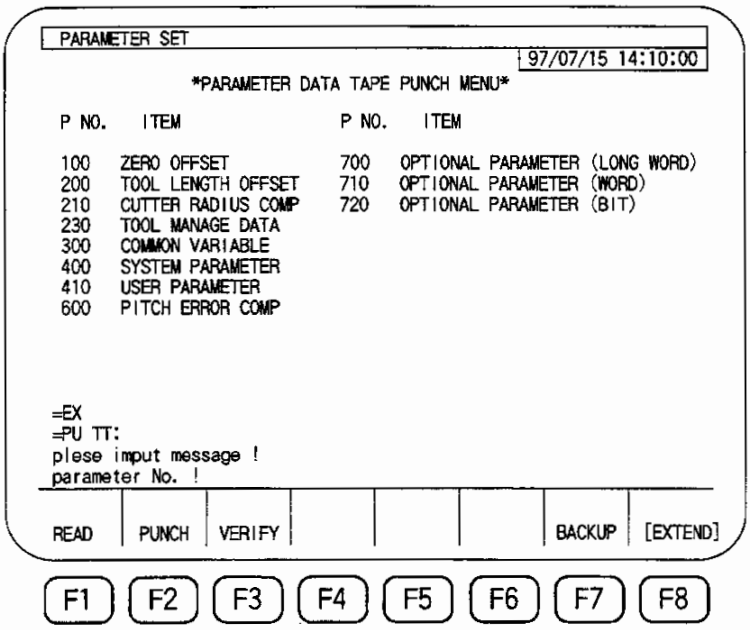
* Parentheses marks "(" and ")" cannot be used in the comment. If used, an error will occur.

"5320 Wring character"

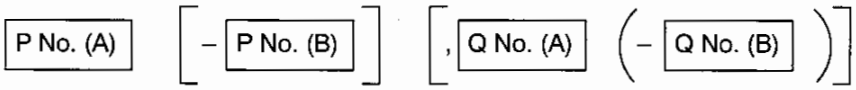
⑤ Press the WRITE key.

The punch menu is displayed under the heading of ⁎PARAMETER DATA TAPE PUNCH MENU⁎ and then the feed holes and the percent code (%) are punched on paper tape.

The prompt [parameter No.!] then appears.



⑥ From the menu, select the item number of the parameter data to be punched. The data entry format is as below:



Entry of a P and Q number should be made without characters P and Q. Use a delimiter "," when a Q number is entered following a P number.

When a range of P numbers or Q numbers is to be specified, the P number (B) or the Q number (B) must be larger than the P number (A) or the Q number (A), respectively.

For the data entry, see examples below:

Example 1: Punching out all tool length offset data

parameter No. !200 [or 200-200]

Example 2: Punching out all the data from tool length offset to common variable

parameter No. !200-300

Example 3: Punching out No. 8 data of tool length offset data

parameter No. !200, 8 [or 200, 8-8]

Example 4: Punching out No. 8 data of parameter data from tool length offset data to common variable data

parameter No. !200-300, 8

Example 5: Punching out tool length offset data within a required range, from No. 2 to No. 8, for example

parameter No. !200, 2-8

Example 6: Punching out within a required range of parameter data from tool length offset data to common variable data

parameter No. !200-300, 2-8

⑦ Press the WRITE key.

The data within the selected range is punched out from the specified output device.

⑧ After the completion of punching out the desired data, the parameter No. ! is displayed again. Repeat the steps f) and g) to punch out all the required data.

⑨ Finally, press only the WRITE key.

The percent (%) code and the trailing feed holes are punched out on the paper tape, thus ending the data punch mode. The display mode is also restored from the punch menu to the originally selected mode.

3-3-3. Verify

The VERIFY operation occurs in the same manner as the READ operation. The data which is read is not determined by the parameter settings. There may be cases when an error occurs even though the numeral displayed at "Parameter Set" is the same as that at the verify data. However, this is due simply to the fact that the number of digits following the displayed numeral are being held by the OSP, and there is no actual error.

A "tolerance" designation can be made at the VERIFY operation as follows:

DV Device name; file name; numeric value

By entering the optional tolerance (numeric value) designation, an error will not occur even if a data mismatch occurs, provided that part of the parameter data which is read is within the tolerance range. Only positive integers can be designated as tolerance values. The tolerance system-of-units varies according to the parameter types being compared. Regarding data items with decimal points (system parameters, user parameters, zero offset, tool data, etc.), comparison will begin from the smallest displayed numeral (following decimal point). Optional parameter words and long parameter words, etc., have no decimal points, and are therefore compared as they are.

If the data error value exceeds the tolerance range, the following error message will be displayed:

5375 DATA VERIFY ERROR "MISMATCH LINES"

The following parameters (including the tolerance value) are compared during the VERIFY operation:

PNo.

100	Zero offset
200	Tool length offset
210	Cutter radius compensation
400	System parameter (excluding home position return order data)
410	User parameter
600	Thread pitch offset
700	NC optional parameter (long word)
710	NC optional parameter (word)
720	NC optional parameter (bit)

3-3-4. Omitting the File Name and Device Name

- If the device name is not specified at the READ and VERIFY operations, the setting will be determined by optional parameter word No. 104 (initial value: 0, setting range: 0-11).

  The devices which correspond to the setting values are shown below.
  (This parameter setting becomes valid when power is switched ON.)

Setting Value	0	1	2	3	4	5	6	7	8	9	10	11
Device Name	TR	CN0	CN1	CN2	CN3	CN4	MD0	MD1	FD0	FD1	FD2	FD3

The "CN0" device name shown above represents the same device as the "TT" (teletyper) name.

- If the device name is not specified at the PUNCH operation, the setting will be determined by optional parameter word No. 103 (initial value: 0, setting range: 0-11). The devices which correspond to the setting values are shown below.
(This parameter setting becomes valid when power is switched ON.)

Setting Value	0	1	2	3	4	5	6	7	8	9	10	11
Device Name	CN0	CN1	CN2	CN3	CN4	PP	MD0	MD1	FD0	FD1	FD2	FD3

The "CN0" device name shown above represents the same device as the "TT" (teletyper) name.

- If the file name is not specified, a default file name will be designated according to operation function and device in question.

The default file name is "A.TOP". This function features separate default values for the file and extend names. If only the extension name is omitted, it will be designated as ".TOP".

3-4. Other Commands

The NC has other commands as explained below:

3-4-1. Back Up Command

CAUTION

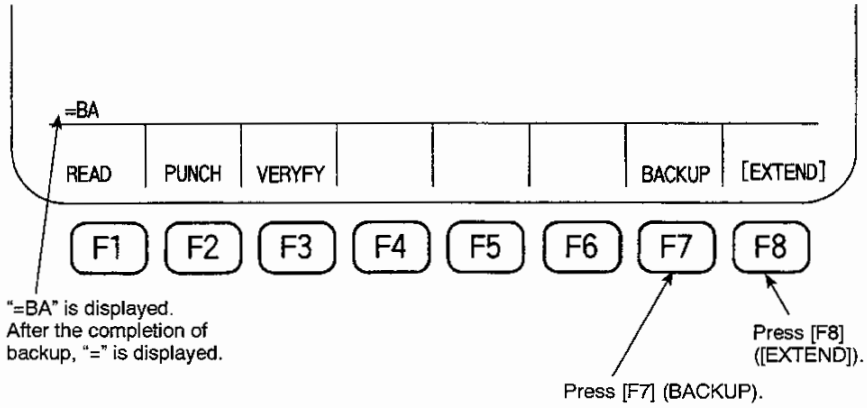
: Data such as tool length offset, cutter radius compensation, origin of work coordinate systems and parameter except system parameter is backed up to the memory in a preset interval. Therefore, turning off the power to the control right after renewing the data will cause the data to stay as it was without being updated.

The execution of the back up command will update the data even when the power is turned off.

Operating procedure is shown below:

(1) Press the PARAMETER, ZERO SET or TOOL DATA key.

(2) Press function key [F8] (EXTEND).
The commands will be changed as indicated right.



(3) Press function key [F7] (BACKUP).

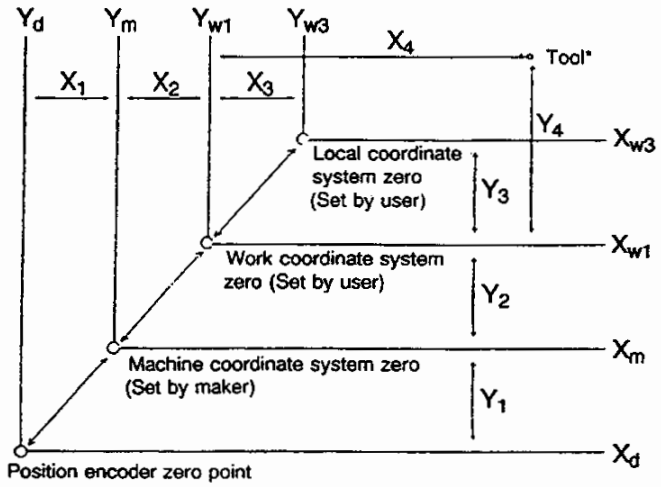
"= BA" appears on the console line and back up is continuously executed.
After back up completion, "=" will appear on the screen.

Now, all the data has been backed up and the power to the control may be turned off at any time.

4. Zero Set Commands

4-1. Work Coordinate System Origin

This is the origin of the work coordinate system referenced to the origin of the machine coordinate system. As the standard feature, 20 sets of the work coordinate system origin can be set, and this can be expanded to 50 or 100 sets.



Y_1: Machine zero offset amount

Y_2: Work zero offset amount

Fig. 1-4 Work Coordinate System Origin

A function called the machine coordinate system origin has been implemented. After the position detector is replaced, all that remains is to set another machine coordinate system origin, without having to set all of the work coordinate system origins (and others) at new values. This may be applied to soft-limits, thus helping to reduce the jobs required after the position encoder is replaced.

How to set the work coordinate system origin as follows:

(1) Press the ZERO SET key.

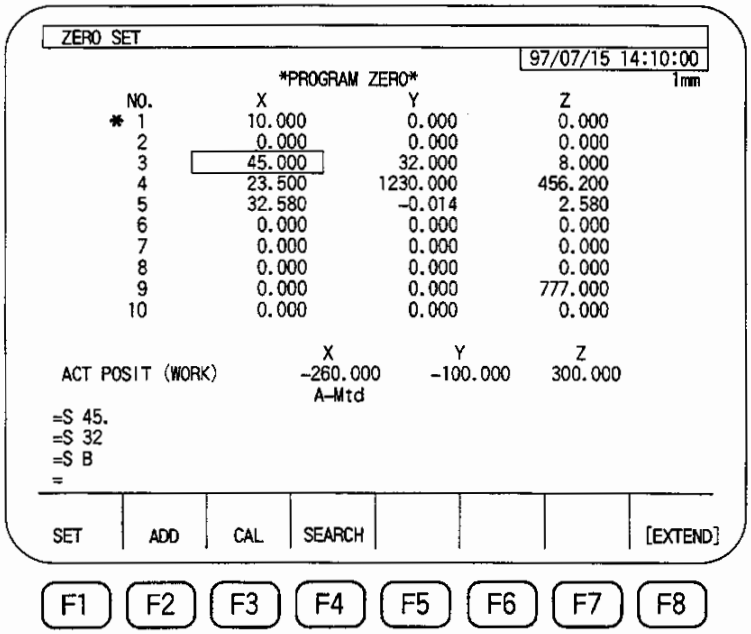
This changes the display screen to Zero Set display.

(2) One page of the screen can display 10 sets of data. To display the data for the 11th and later sets,

press the page key .

From the standpoint of axes, one page displays the data for four axes. Therefore, to display the data for the fifth and later axes, press function key [F5] (AXIS CHANGE).

When the desired page is displayed, move the cursor to the data which should be set or changed.



(3) Setting

(a) When the offset of the work zero (origin of work coordinate system) is known, press function key [F1] (SET) and enter that work zero offset. (The entry data is X_2 and Y_2 on the previous drawing.)

(b) When the work zero has been set and it serves as the reference of further offset, press function key [F2] (ADD) and enter the distance of the position to be set as viewed from the preset position.

(c) When it is necessary to set the work zero offset which causes the present actual machine position to be the new desired actual position, press function key [F3] (CAL) and enter the new actual position data. (In the previous drawing, key in X_4 and Y_4, to set X_2 and Y_2.) The entered data is displayed on the 21st line of the screen.

(4) Press the WRITE key.

This updates the data indicated by the cursor.

Note that a "*" appears before the number of the work coordinate system which is currently selected.

[Supplement] Local coordinate systems are effective only in programming.

5. Tool Data Set Commands

5-1. Tool Length Offset and Cutter Radius Compensation

Tool offset or compensation has been incorporated since the tip position is dependent on tool type.

Tool data consists of length offset data and cutter radius compensation data.

The system offers 50 sets of tool length offset and cutter radius compensation data as the standard feature, and this can be expanded to 100, 200, or 300 sets of offset and compensation data.

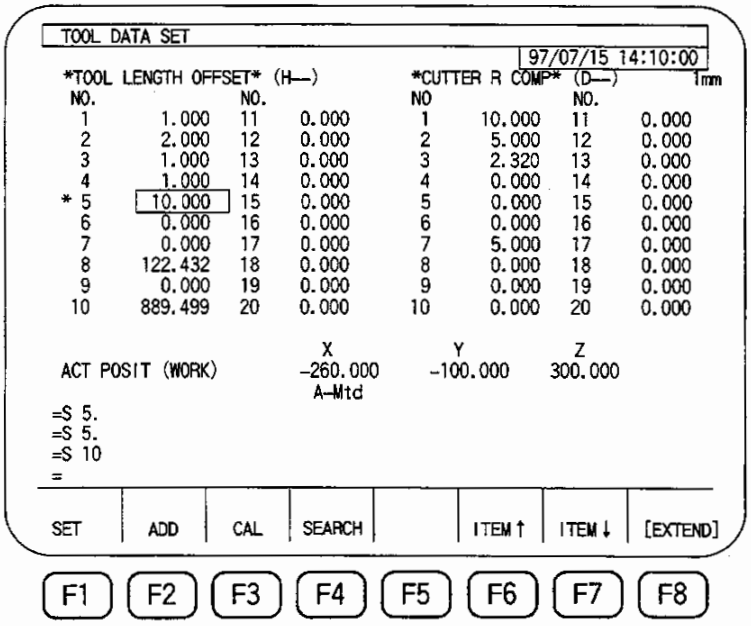
For offset number 0, only "0" can be set.

Data is set as follows:

(1) Press the TOOL DATA key.

This displays the tool data.

(2) One page of display covers 20 sets of tool length offset values and as many sets of cutter radius compensation values. If desired data is not seen on the page, operate the page keys or the [F4] (SEARCH).



After obtaining the page displaying the desired tool data, position the cursor at the desired data element.

(3) Setting

(a) When the tool data is known, press function key [F1] (SET) and enter tool data on the keyboard.

(b) When the tool data has been set and the change amount from the set data is known, press function key [F2] (ADD) and enter the change amount.

(c) Tool length offset

Before carrying out the above steps (1) and (2), set the zero offset of the tool axis. Mount the tool for setting.

Manually align the tool tip with the reference surface.

Press function key [F3] (CAL) and key in the data, which consists of the axis name, the direction, and the current position as viewed from the origin. Note, here, that the axis name represents the axis parallel to the axis on which the tool rotates (X-, Y- and Z-axis).

Generally, the axis name is Z-axis.

Example: CAL Z 10.5
CAL Z –20.5

(4) Press the WRITE key.

The data is set at the position indicated by the cursor.

The tool offset number presently selected is identified by an asterisk (*) appearing right before that tool offset number.

5-2. ATC Pot No./Tool No. Table

For vertical machining centers and other machines which have a small number of tools, the memory-random ATC specification is adopted and for machines with a large number of tools, the fixed address ATC specification is adopted.

5-2-1. Memory-random ATC Specification

⚠CAUTION

: In the memory-random ATC system, the tool set in the spindle is returned to the magazine toolpot of the tool to be set in the spindle next. Therefore, the correspondence between the tool number and the pot number will change each time the tool change cycle is carried out. This requires the initial correspondence between the tool number and the magazine pot number to be stored in the control memory after setting all the tools in the magazine.

In addition, since the use of a large-diameter tool will cause an interference with adjacent tools, the control must be capable of recognizing a large-diameter tool so that the toolpot which accommodates one is placed between the pots having dummy tools or no tool. That is, the large-diameter tool must be returned to the toolpot originally stored.

A large-diameter tool is distinguished from other conventional tools based on the machine specifications. Distinguishing of tools-large-diameter tools and conventional tools – is made according to the tool diameter and the value used to classify tools into these two categories depends on the machine specifications.

Setting of the correspondence between the tool number and toolpot number is made in the following two ways:

(1) The table listing the original correspondence between the tool numbers and toolpot numbers should be made beforehand on the display screen. After that, the tools are set in the toolpots in accordance with the correspondence table data.

(2) Tools are set in the spindle and they are returned to the magazine in the manual tool change operations. In this case, the toolpot where the tool in the spindle is to be returned may be specified or the one automatically selected may be used, as required.

Explanations in this section cover the procedure indicated in (1). For the procedure of (2), please refer to II, OPERATION, Section3, 4-1 "ATC".

Setting:

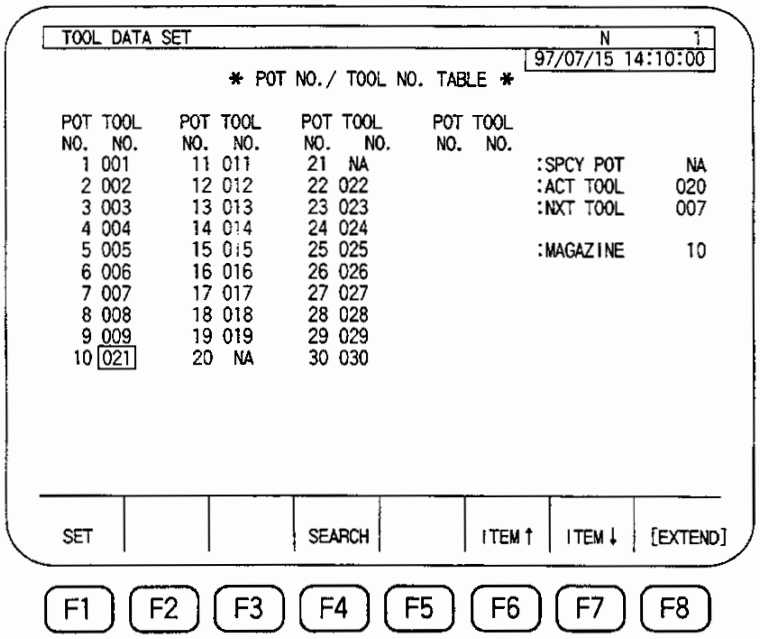


Fig. 1-5 Tool Data Offset (ATC Pot No./Tool No. Table)

(1) Press the TOOL DATA key.

(2) Press function key [F7] (ITEM ↓).

The CRT will display the page of "∗POT NO./TOOL NO. TABLE∗".

(3) Locate the cursor at TOOL NO. position of the POT NO. for which the tool number is to be set.

(4) Press function key [F1] (SET).

"S ␣ " will be displayed on the console line. (" ␣ " indicates the space.)

(5) Key in the desired tool number through the keyboard.

(a) Conventional tool — S ␣ 1

(b) Large-diameter tool — S ␣ 7, L

(c) Dummy tool — S ␣ D

(d) For clearing tool number — S ␣ ∗

(e) Planer tool (optional) — S ␣ 6, P

(f) Heavy tool (depending on the machine type) — S ␣ 5, M

(g) Press the WRITE key.

This sets the correspondence between the tool number and the toolpot number.

[Supplement]

1. The symbols "→" and ">>" appearing in the POT NO. column indicate the position of the corresponding toolpot.

   → : Tool change position with A TC
   >> : Manual tool change position

2. The range of toolpot numbers which can be set is from "1" to the magazine capacity (the number of tools accommodated in the magazine).

   The usable number of tool numbers is identical to the programmable number of tool offset numbers.

3. For a large-diameter, setting is allowed only when the two adjacent toolpots are assigned with no tool number or dummy tool code, "D". An error occurs if either of two adjacent toolpots is assigned with an actual tool number.

   The setting of a large-diameter tool in a toolpot automatically sets dummy tool code, "D", at two adjacent toolpots.

4. In case the tool number already used is again entered for a new toolpot, an alarm occurs.

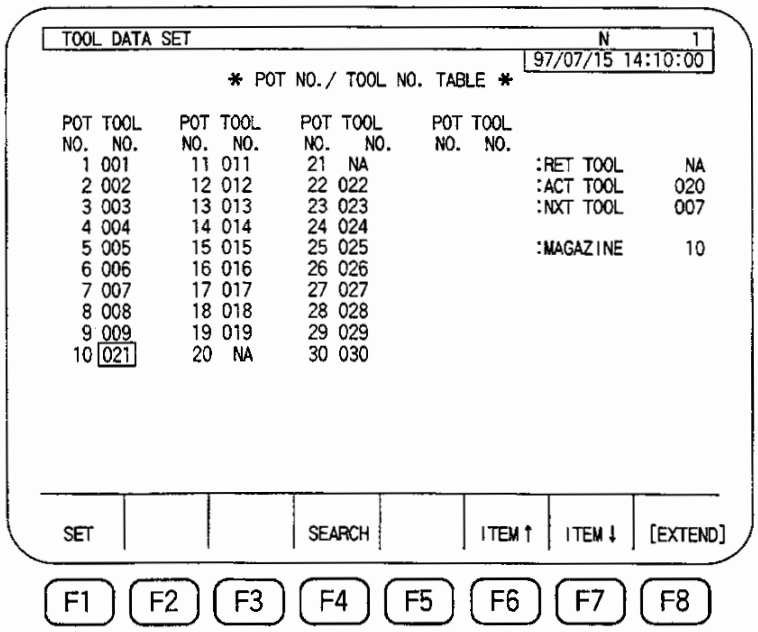
5. Any attempt to set a tool number for a toolpot which has a dummy tool in it causes an error. In this case, cancel the dummy tool code by entering "*" code. Note that the dummy tools placed in the adjacent toolpots for the one accommodating a large-diameter tool should not be cleared. A dummy tool may be placed between two large-diameter tools as a common dummy tool.

5-2-2. Fixed Address ATC Specifications

To select a tool from the tools in the magazine using a tool number command, it is necessary to set the correspondence between the tool numbers and the toolpot numbers.

If an interference occurs between the tools stored in the two adjacent toolpots due to their diameters, set the safety adaptor in toolpots at both sides of the toolpot which holds a large-diameter tool. This prevents an occurrence of interference between the tools during tool setting operations.

Setting:



(1) Press the TOOL DATA key.

(2) Press function key [F7] (ITEM ↓).

The CRT will display the page of "∗POT NO./TOOL NO. TABLE∗".

(3) Locate the cursor at the TOOL NO. position of the POT NO. for which the tool number is to be set.

(4) Press function key [F1] (SET).

The CRT will display "S" on its console line. (␣ indicates the space.)

(5) Key in the desired tool number through the keyboard.

(a) Tool number	S␣1
(b) Safety adaptor	S␣D
(c) For clearing tool number	S␣∗
(d) Planer tool (optional)	S␣6, P
(e) Heavy tool	S␣1, M

(6) Press the WRITE key.

This sets the correspondence between the tool number and the toolpot number.

[Supplement] 1. If the tool number already used is again entered for a new toolpot, an alarm occurs.

2. An attempt to set a tool number for a toolpot which has a dummy tool in it causes an error. In this case, cancel the dummy tool code by entering "*" and set.

5-2-3. Clearing/Setting Tool Numbers

It is possible to clear tool numbers set on the "*POT NO./TOOL NO. TABLE*" screen at one time, or to set tool numbers which correspond to toolpot numbers (having same numbers) on the "ATC POT NO./TOOL NO. TABLE" at one time.

Note tool numbers can not ben set at one time unless the correspondence between toolpot numbers and tool numbers are all cleared.

Operating Procedure

(1) Clearing tool numbers

(a) Press the TOOL DATA key.

(b) Press function key [F7] (ITEM ↓).

The CRT will display the page of "*POT NO./TOOL NO. TABLE*".

(c) Key in "ATC" through the keyboard and press the WRITE key.

The following message will be displayed on the screen.

Tool table initialize OK? (Y/N)

(d) Key in "Y" and press the WRITE key to clear tool numbers.

Key in "N" and press the write key to cancel clearing tool numbers.

(2) Setting tool numbers

(a) Press the TOOL DATA key.

(b) Press function key [F7] (ITEM ↓).

The CRT will display the page of "ATC POT NO./TOOL NO. TABLE".

(c) Key in "TSET" and press the WRITE key.

[Supplement] When an attempt is made to set tool numbers without clearing the correspondence between toolpot numbers and tool numbers, no data will be set.

6. Parameter Setting

To perform NC operations, for example positioning, program editing, and so forth, data such as axis travel ranges, tape output code, and others, are predetermined for each individual function. However, there are cases in which these data needs to be changed in accordance with the change in operation conditions.

The data elements used to control NC functions are called parameters.

The parameters can be classified into 18 types as indicated below.

(1) Display selection (selection for display/not-display of parameter setting screens)

(2) Common variable

(3) User parameter

(4) G/M code macro

(5) NC optional parameter (long word)

(6) NC optional parameter (word)

(7) NC optional parameter (bit)

(8) Input unit system

(9) NC optional parameter – RS232C (CN0:)

(10) NC optional parameter – Spindle (OKUMA VAC)

(11) Machine axis parameter

(12) System parameter

(13) Pitch error compensation data

(14) NC run timer

(15) Spindle load monitor

(16) Tapping torque monitor

(17) Machine user parameter

(18) Machine system parameter

Contents and setting procedures of parameters are detailed in IV "PARAMETER".

SECTION 2 PROGRAM OPERATION

This section describes the program operation procedure and the contents of the commands used in the program operation.

The NC unit has commands for DATE entry, initializing, program deletion, etc. in addition to reading in and punching-put of a program tape and program editing.

In this system the file names can also be interchanged as individual programs are assigned a file name for managing the programs.

1. List of Program Commands

Item	Command	Functions	Remarks
Date	DATE	Sets the date.	
Directory	DIR	Displays file directory.	
Transfer *	PIP	Transfers program file.	Sub commands provided
Edit * (Supplement 1)	EDIT	Edits program file.	Sub commands provided
Multi-file transfer	MPIP	Transfers multiple files between the NC and an external device using the RS232C interface.	Sub commands provided
List *	LIST	Lists file contents.	
Arrangement	CONDENS	Arranges the stored data.	
Time	TIME	Sets the time.	
Initializing	INIT	Initializes the memory, floppy disks and other data storage devices.	
Deletion *	DELETE	Deletes the specified file.	
Operation guide (Supplement 2)	GD	Displays the operation state of the selected file.	
Free area	FREE	Displays the free area in the memory.	
Renaming *	RENAME	Changes the specified file name.	
File protection *	PROTECT	Prohibits writing to or renewing of the specified file.	
MS-DOS *	MSDS	Transfers the program files in the MS-DOS format.	Sub commands provided

The commands indicated by an asterisk (*) are operated using the directory-selection-based file operation screen. For the PIP command, the directory-selection-based type file operation screen is used only for READ, PUNCH, VERIFY, and COPY commands. Basic operation using the commands indicated above is explained below, such as the function to display the registered machining programs in batch using the function displayed on the directory-selection-based file operation screen. For details of the functions, refer to Section 15, "DIRECTORY-SELECTION-BASED FILE OPERATION FUNCTION".

[Supplement]
1. The file edit command is changed to the I-MAP edit command for the I-MAP specification. For details and operation procedure of the I-MAP edit command and sub commands, refer to I-MAP EDIT FUNCTION published separately.
2. For details of operation guide commands, refer to II OPERATION, Section 6, 8. "Run Guide Display".

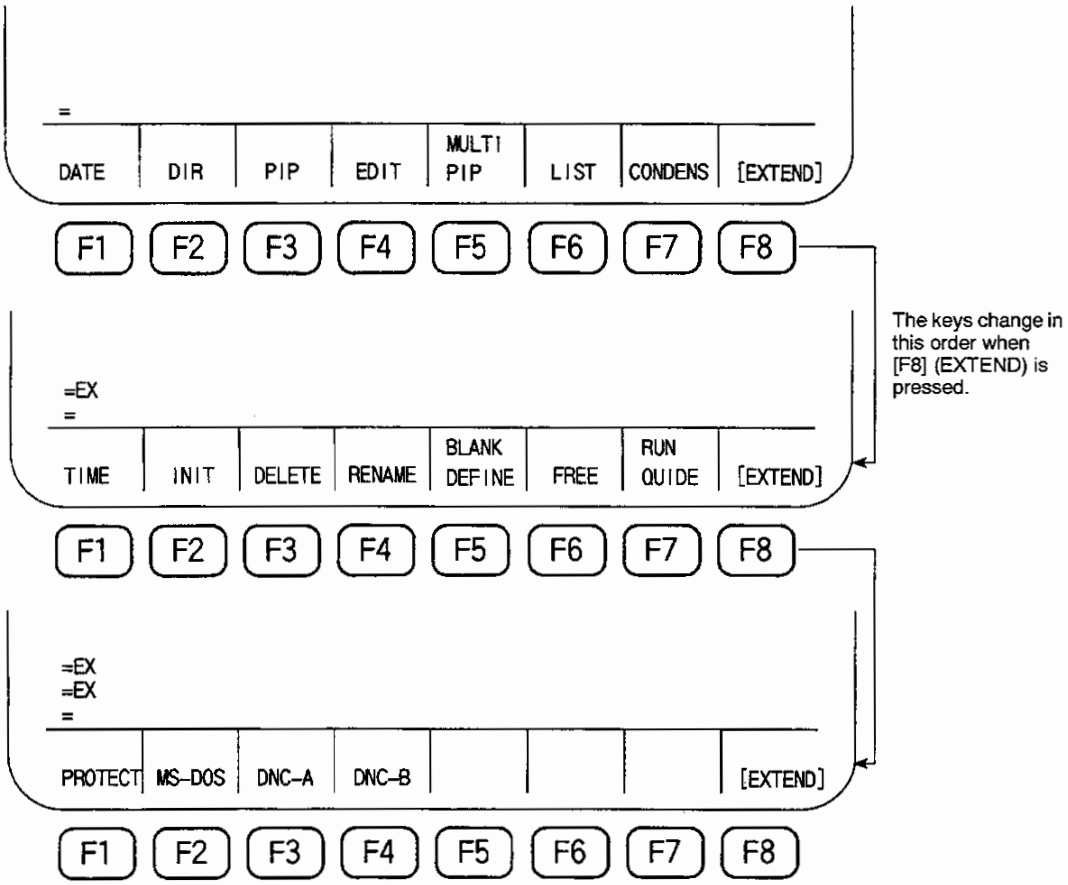
Details of the commands accessible in the program operation mode are explained below.

The operation to select the program operation mode before starting the command operation is used in common to all commands. This program operation mode selection procedure is first explained; this step is not explained for the explanation on the command operation.

Procedure to select the program operation mode:

(1) Press the EDIT AUX key.

(2) The lamp at the upper left corner in the key lights and the screen changes to the program operation screen. The function names also change as indicated below.



The keys change in this order when [F8] (EXTEND) is pressed.

These commands are explained below.

2. Date

The NC's clock function continues counting time even when the power is turned off. Therefore, when the power is turned on, the current date is displayed.

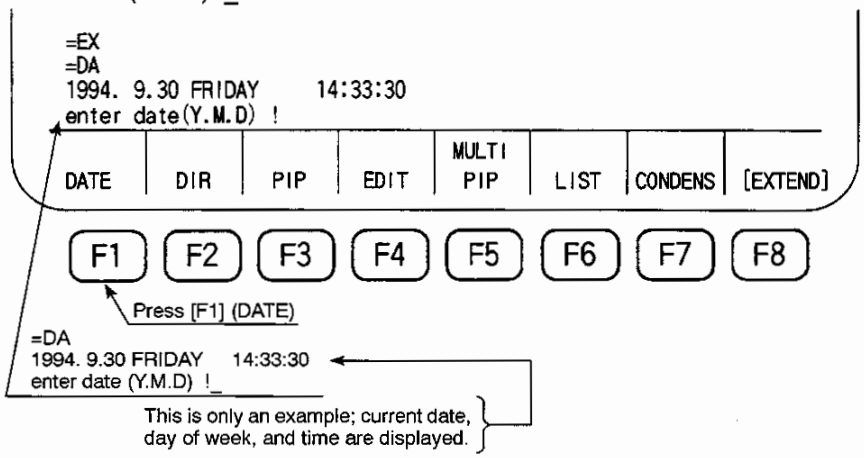
NOTICE : Since this date data is very important for the functions such as MacMan, alarm log, etc., do not change it inadvertently.

Date setting procedure is given below.

(1) Press function key [F1] (DATE).

The following is displayed on the console line and the system becomes ready for the input of date.

```
=DA
1994. 9.30 FRIDAY 14:33:30
enter date (Y.M.D) !_
```



(2) Key in the year, month, and date with period put after each item following the prompt "!".

Example: 1994. 9.30

(3) Press the WRITE key.

When the correct entry has been made, the display screen indicates date and a day of the week.

If the data entry is not correct, the display screen requests data entry again.

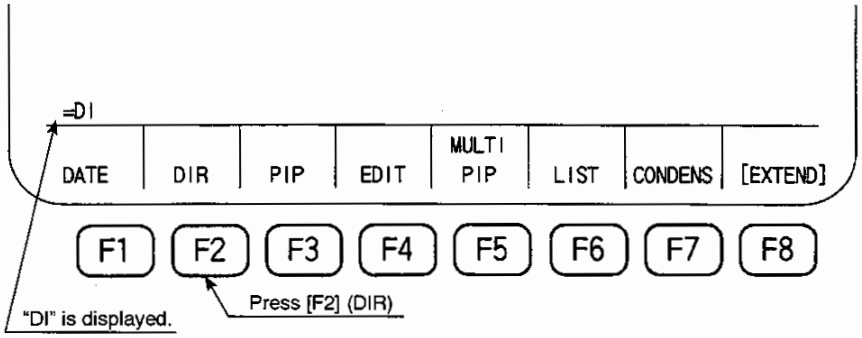
[Supplement]
1. Entry of only right two digits is acceptable for year entry.
2. Pressing the WRITE key without entering the date ends the operation and nothing occurs.

3. Directory

This is the function for making a list of files stored in the memory (MD1:) or the floppy disk (FD0:). The list may be displayed on the display screen and it may also be printed.

(1) Press function key [F2] (DIR).

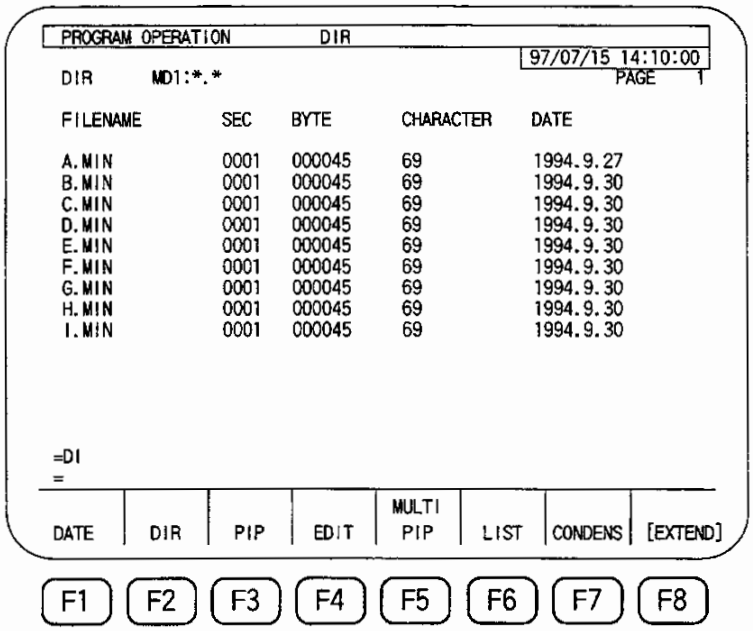
The screen displays the prompt "DI" on its console line.



(2) Enter the device name (MD1: or FD0:) following "=DI". The default device name is MD1:.

(3) Press the WRITE key.

The directory of file names of the files registered in the specified device (MD1: or FD0:) is displayed.



[Supplement]

1. Up to 12 filenames are displayed on the screen.

   When all filenames are not indicated on one display page, the display screen does not provide the prompt "=" and the cursor remains as it was.

   In this case:

   (1) Press the BS key, and the display advances one page.

   (2) Press the WRITE key, and the display will advance continuously. To stop this advancement, press the BS key.

   (3) Press the CANCEL key, and the command will be aborted with the display unchanged.

   Example: When there are many filenames,

   - DIR and WRITE ..... Display of the 1st page
   - BS ..... Keep pressing until the required page is displayed.
   - CANCEL ..... Abort the directory mode
   - EDIT ..... Specify the file, observing the display.

2. When there are no files, the message "no file" is given.

3. Key in a file name following the prompt "DI", and you can check whether that file exists or not.

   In this file name entry step, the use of symbols "*" (asterisk) and "?" (question mark) is permitted.

   The symbol "*" indicates a string of characters while the symbol "?" represents a character. "*" may be used only once in both a file name and extended name.

   Therefore, by specifying "*" and "?" in a filename, all the file names corresponding to the entered file name are given.

   Example 1: = DI␣ *.MIN [WRITE]

   All the file names assigned with the extended file name MIN

   Example 2: =DI␣ BOX*.MIN [WRITE]

   All the file names assigned with the extended name MIN and the main file name beginning with BOX

   Example 3: = DI␣ *.* [WRITE]

   All the file names (same as no data entry)

   Example 4: = DI???.SUB [WRITE]

   All the file names assigned with the extended name SUB, and whose main file name consists of up to three characters

   Example 5: = DI␣ BOX-1 ???.* [WRITE]

   All the file names whose main file name begins with BOX-1 and the remaining filename consists of up to three characters

[Supplement] 4. Output device name can be entered following the filename. A comma should be inserted before the output device name.

Example 6: = DI␣ ∗.∗, TT: [WRITE]

With the data entered as above, all the filenames are printed out by the teletypewriter.

As an output device name, PR: (printer) is also used.

5. There is an Option Setting, indicated below, which follows the filename.

;P (file protected state is displayed following the date)

00 : Not protected
01 : File protected

For the file protection specification method, refer to Section 5, 14. "Protect".

4. File Transfer

This is the command to transfer a program, with the following sub commands:

Item	Command	Functions
Read	READ	Registers a part program after reading it through the tape reader.
Punch	PUNCH	Punches out the part program stored in the memory.
Verify	VERIFY	Verifies the program in the memory with the program on the paper tape.
Copy	COPY	Copies the program file on memory.
Forward	FAST FORWARD	Tape reader rapid forward feed motion
Rewind	FAST REWIND	Tape reader rewinding
PIP quit	QUIT	Ends transfer mode and restores the program operation mode.
Macro program loading	MACRO LOADING	Copies files with extension .LIB from 3.5-inch floppy disk drive to MD1:.

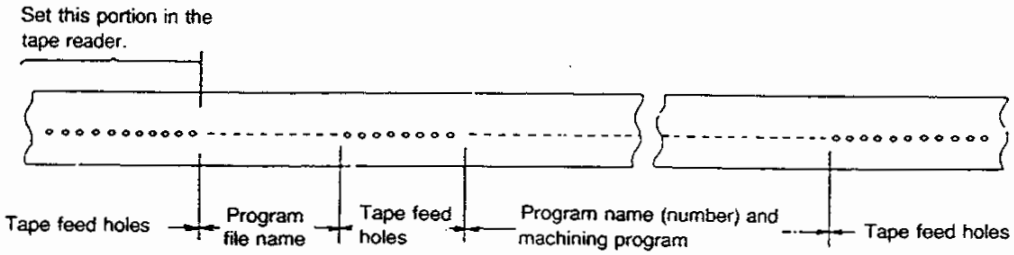
NOTICE : Never turn off power supply during the execution of file transfer or file editing. If it is turned off, the file contents will be unreliable.

4-1. Read

This is the operation to read a part program from program reading device such as tape reader and to store it in the memory.

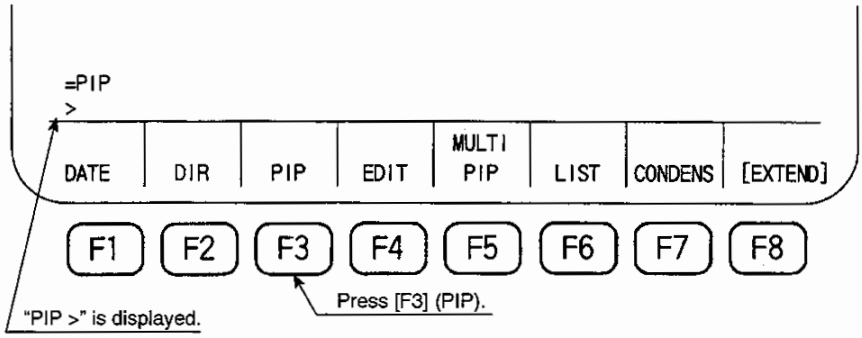
The following explanation is given assuming a taper reader.

(1) Set the program tape in the tape reader.

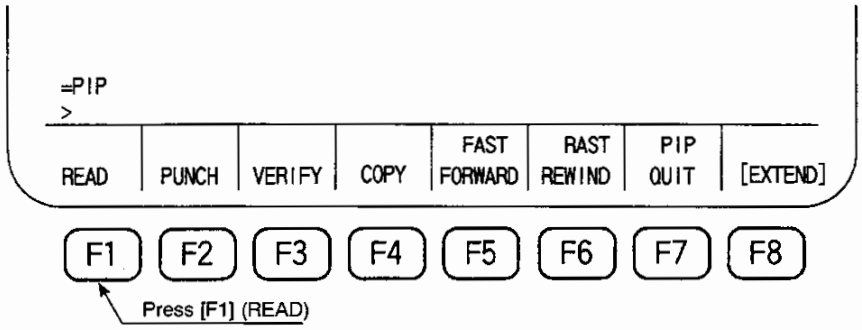


(2) Press function key [F3] (PIP).

The function names on the screen will change to those given in item (3) below.

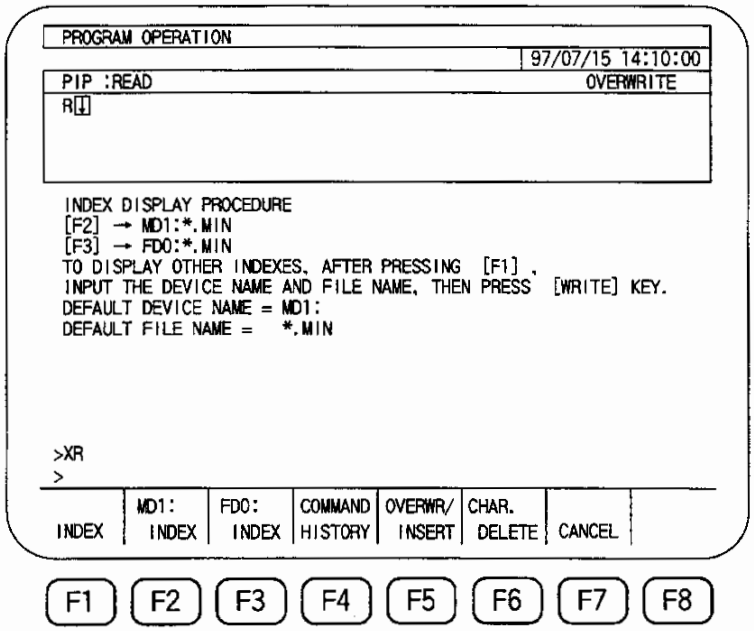


(3) Press function key [F1] (READ).



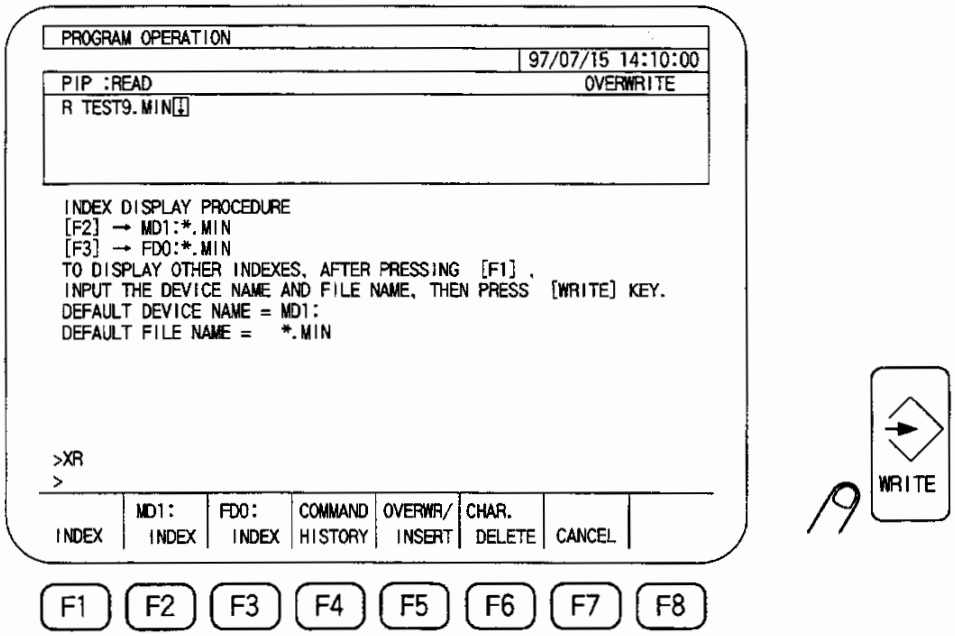
The screen changes to the directory-selection-based file operation screen and the following is displayed on the screen.

PIP:READ R



(4) Enter the file name of the file to be punch and press the WRITE key.

Example: TEST9.MIN



Pressing this key starts the tape reader. The commands on the tape are read and stored in memory.

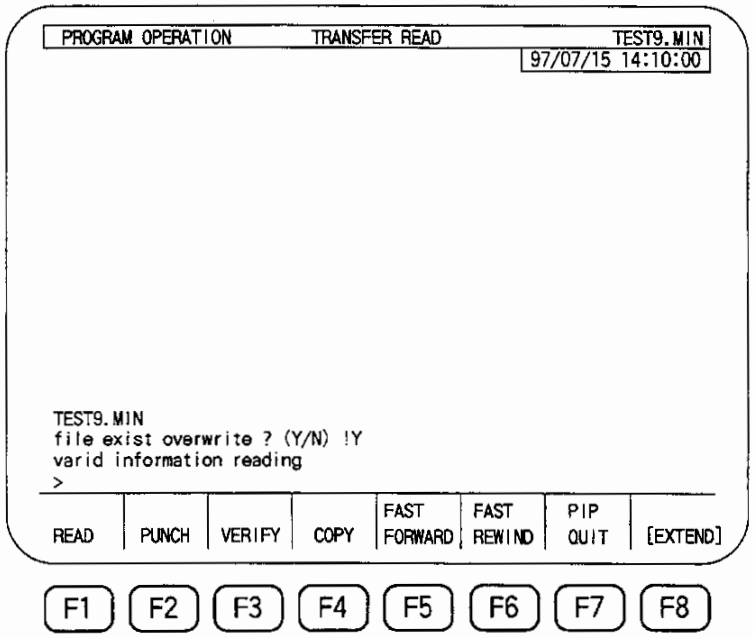
While the tape is being read, the screen displays "READ" along with the "file name" on the first line.

When the first EOB code appears after the start of the tape reading-in, the message "VALID INFORMATION READING" is displayed.

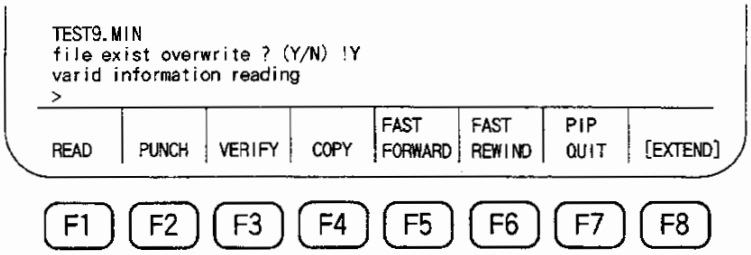
At the completion of the tape reading-in, the tape is then rewound and read in the reverse order to verify the read and stored program against the program on the tape.

When the tape reading-in and verification is completed, ">" appears on the console line.

[Supplement] Tape rewinding with or without tape verification is selectable by setting bits 4 and 5 of NC optional parameter (bit) No. 1.



(5) Press function key [F7] (PIP QUIT).



The screen returns to the one displayed in item (1). Details and precautions on this operation are given in 4-3-1. "Precautions for Tape Reading-in, Punching-out, and Verifying Operations". Be sure to read this item.

[Supplement] If an error occurs during tape reading, 31 characters preceding the error character are displayed on the console line of display screen.

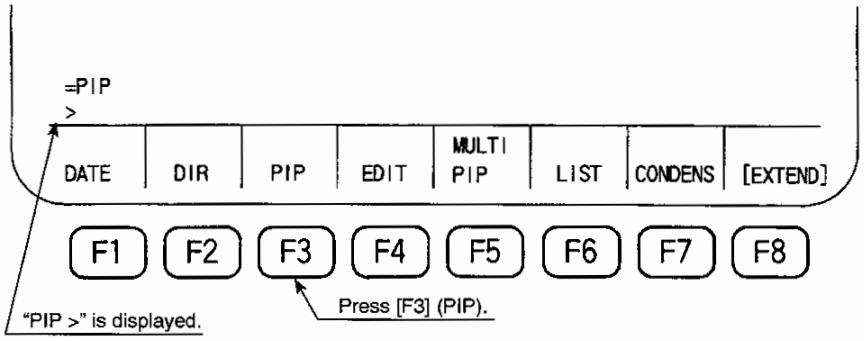
4-2. Punching Out Stored Program Data

This is the function to punch out the program data stored in the memory.

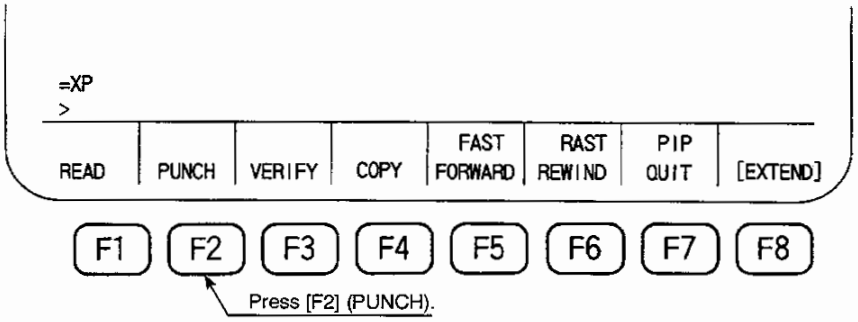
The procedure is as follows:

(1) Press function key [F3] (PIP).

The function names on the screen will change to those given in item (2) below.

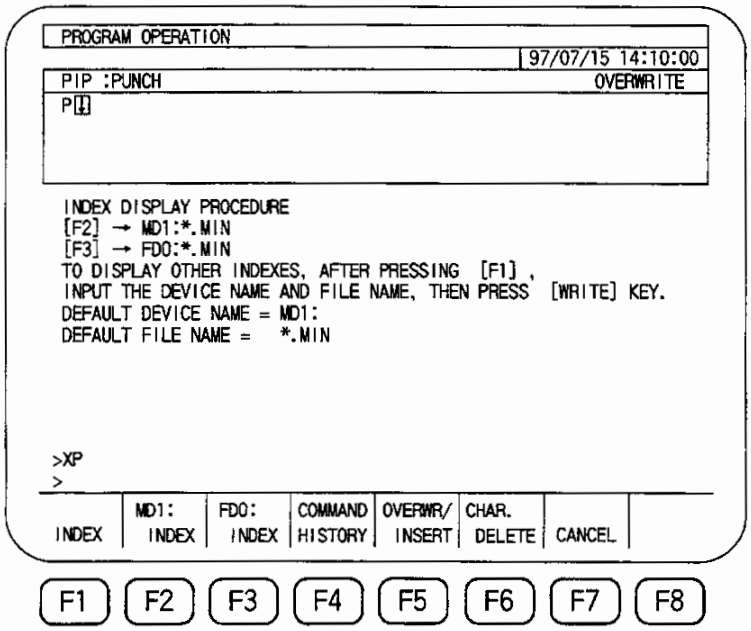


(2) Press function key [F2] (PUNCH).



The screen changes to the directory-selection-based file operation screen and the following is displayed on the screen.

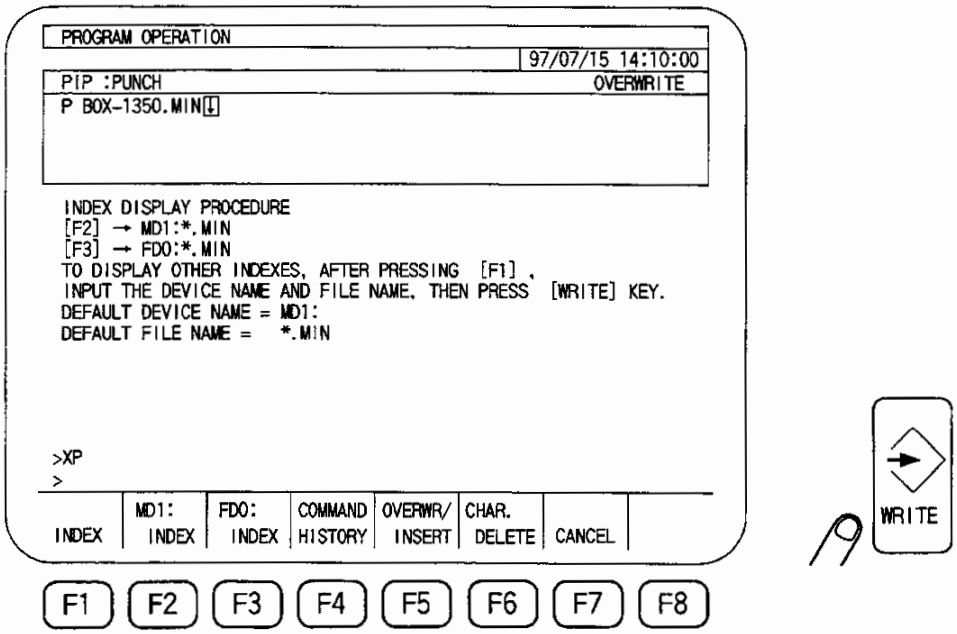
PIP:PUNCH P



(3) Enter the file name of the file to be punch and press the WRITE key.

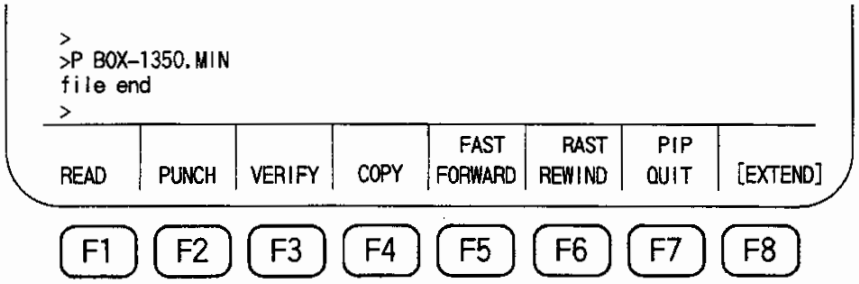
Example: BOX-1350.MIN

This step is unnecessary for a program without a file name, i.e., A.MIN.

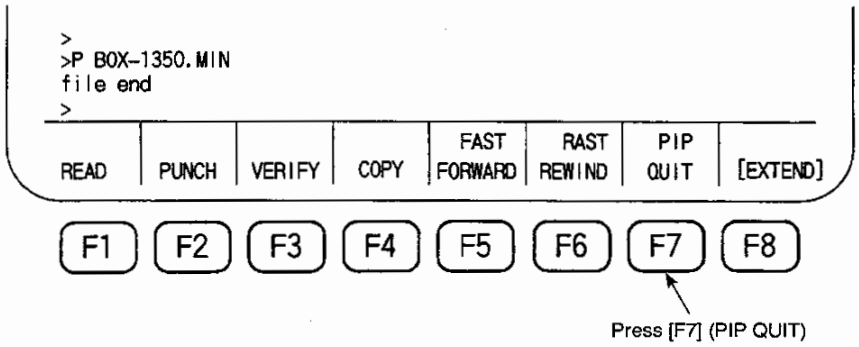


This starts the tape punching out operation, during which the screen displays "PUNCH" along with the "filename".

When tape punching-out is completed, the message "file-end" is given on the console line and ">" appears in the following line.



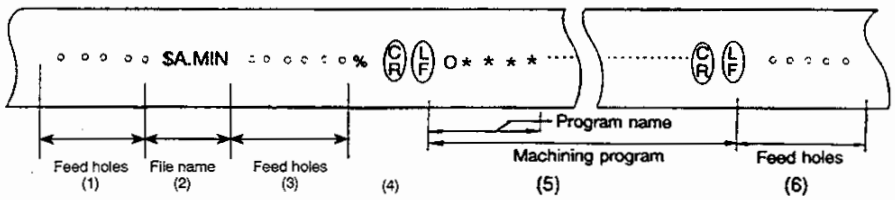
(4) Press function key [F7] (PIP QUIT).



This completes the tape punching out operation and the display returns to the mode as in step (1).

[Supplement] 1. That tape punching speed will be slowed down while machine operation is carried out simultaneously.

2. Tape Punching Out Format



(1) 600 tape feed holes are punched in the tape leader section.

The number of feed holes to be punched out can range, as needed, from 1 to 10000 with a parameter.

For details, refer to Ⅳ "PARAMETER", Section 4, 5. "NC Optional Parameter (Word)".

(2) The file name is punched out following the "$" code. (Program data is punched out in the ISO coding system.)

(3) 50 tape feed holes are punched out.

The number of the tape feed holes cannot be changed.

(4) "%", and "CR", "LF" codes are punched out.

(5) The part program data is punched out following the program name (number).

(6) The same number of tape feed holes as in (1) are punched out in the tape trailing section.

[Supplement] 1. When the program data is punched out in the EIA coding system, the "CR" code is punched instead of the "CR" and "LF" codes.

When the program data is punched out in the EIA code, the presence of a code not available in the EIA coding system causes an error. Tape punching-out halts and an error message is given on the display screen.

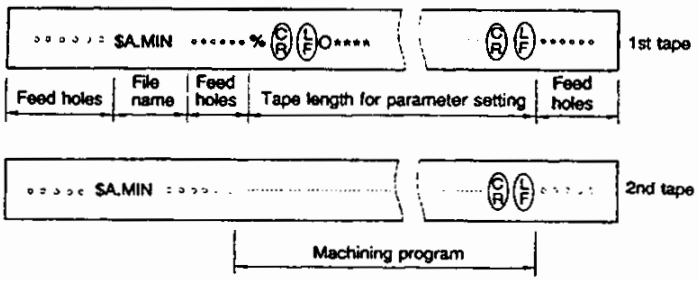
When the tape delimiting code is the "%" (ER) code, i.e., when bit 3 of parameter No. 1 of NC optional parameter (bit) is 1, the "%" code is punched out before feed holes.

2. The part program is split and punched out, if it is too long to be contained in one paper tape roll. Paper tape length may be changed from 1 to 300 meters (3 to 984 feed) using the NC optional parameter (word) No. 2.

As the format, the file name is also punched out, for the second tape and so on. Since the tape ends with "CR" or "LF", actual tape length is somewhat different from the tape length set using the parameter.

When designating paper tape punch out operation on more than one paper taper roll, specify option D in the following format:

P <file-name>, <device-name>:;D



Refer to 4-3-1, "Precautions for Tape Reading-in, Punching-out, and Verifying Operations" for details and cautions on this operation.

4-3. Verifying Punched Out Programs

This is the function for verifying the program transmitted to a target device or medium against the program stored in the source device between the paper tape and the floppy, the paper tape and the memory, the floppy and the memory, the floppy and the floppy, the memory and the memory.

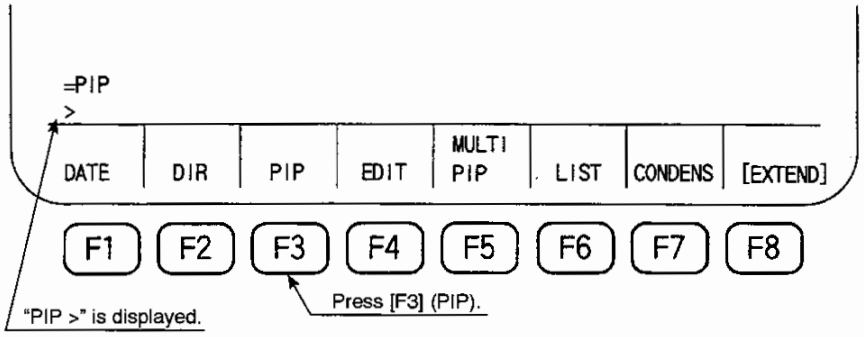
The following explanation is given for the verify operation made between the program punched on tape and the program stored in memory.

The procedure is as follows:

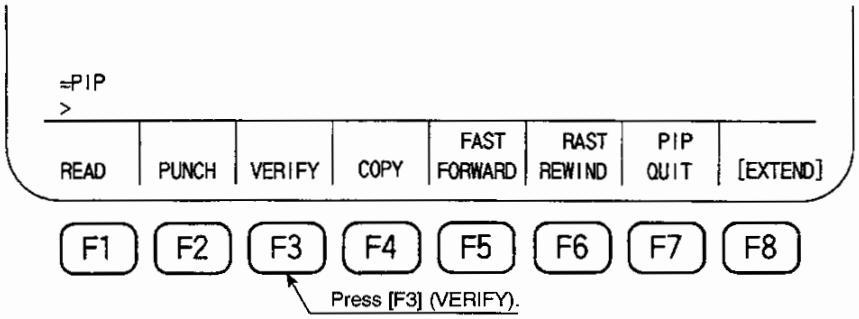
(1) Set the tape to be verified in the tape reader in the same manner as for storing a program from a tape to memory.

(2) Press function key [F3] (PIP).

The function names on the screen will change to those given in item (3) below.

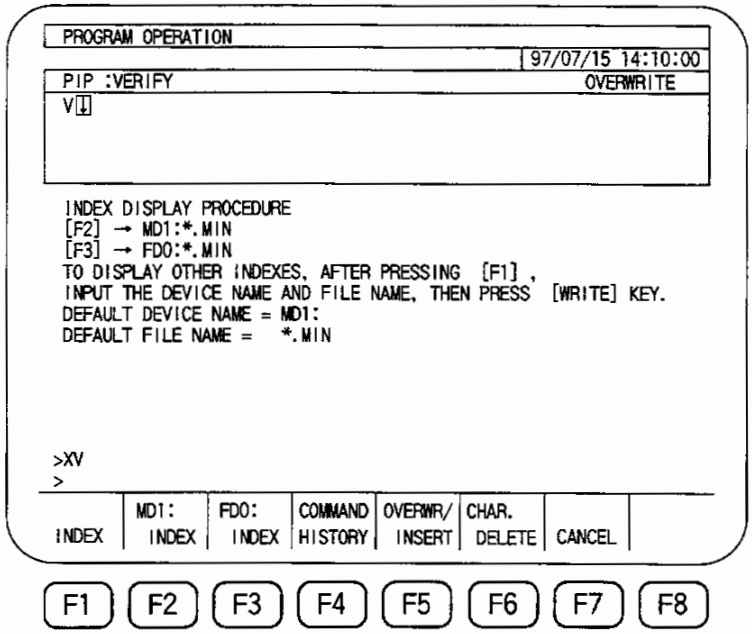


(3) Press function key [F3] (VERIFY).



The screen changes to the directory-selection-based file operation screen and the following is displayed on the screen.

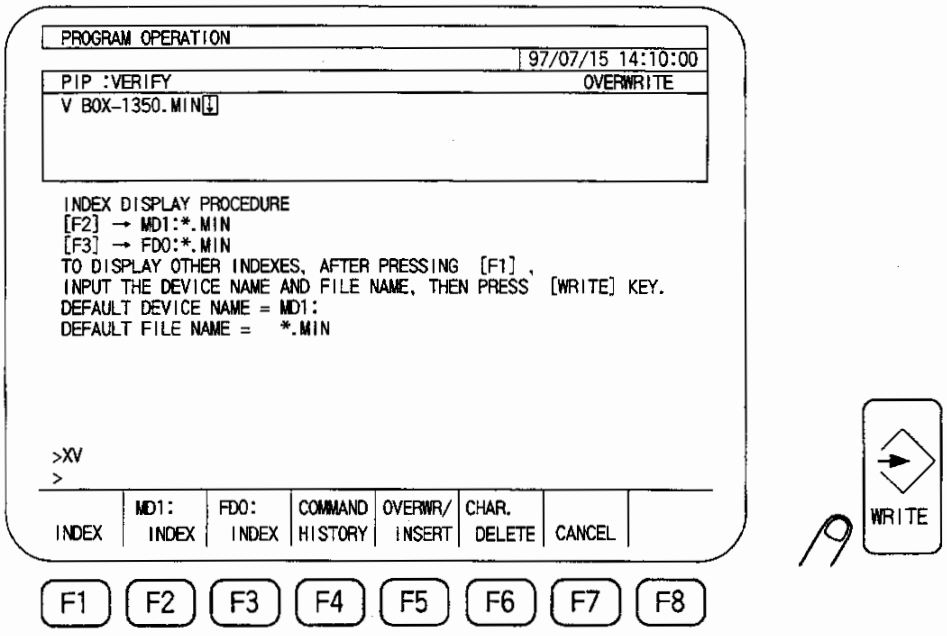
PIP:VERIFY V



(4) Enter the file name of the file to be verify and press the WRITE key.

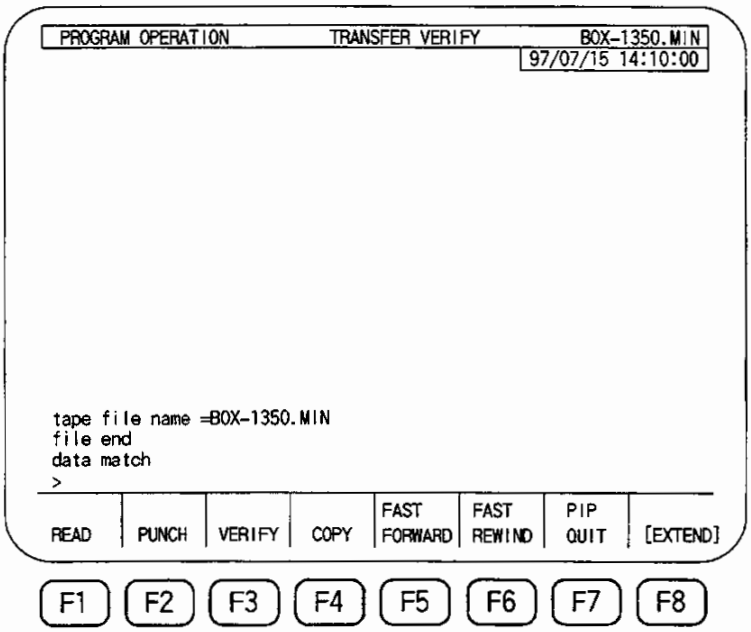
Example: BOX-1350.MIN.

This step is unnecessary for a program without a file name, i.e., A.MIN.

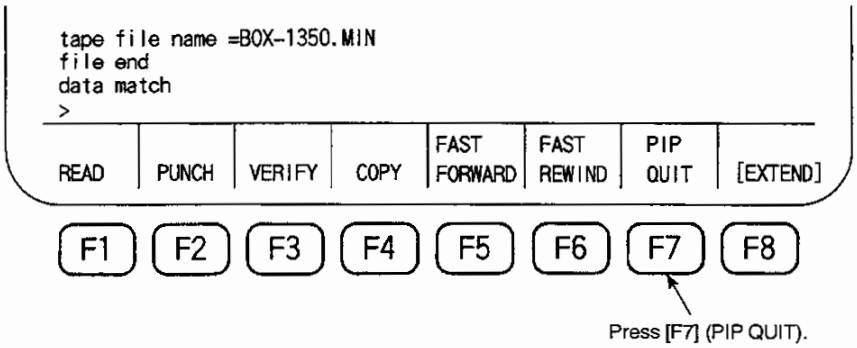


This starts the tape reader, and program data on the tape is read and compared with the stored program data.

While verifying operation, the screen displayed "VERIFY" along with the "file name".

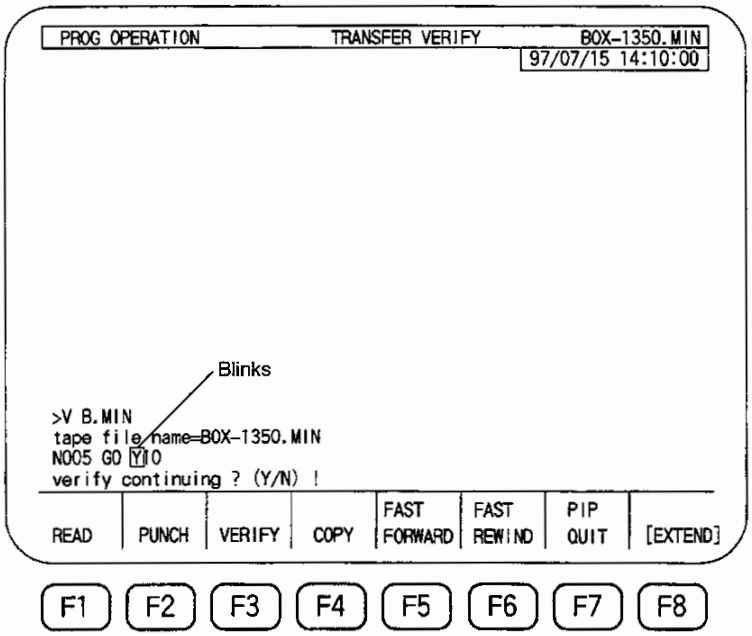


(5) Press function key [F7] (PIP QUIT).



This completes verification of the punched out program data and the display mode return to the one in step (1).

[Supplement] When a data mismatch is found during tape verification, the block (line) which contains inconsistent data is displayed on the screen and the inconsistent character flickers.



The following message is displayed, asking the operator if he wants to continue verification.

To continue verification, type "Y" and press the WRITE key.

To abort verification, type "N" and press the WRITE key.

When no data mismatch is found in verification operation, the following message will be displayed on the screen.

tape end
file end
data match

If data is left in the file after data on a tape has been read, the following messages will be displayed on the screen.

tape end
data match

If data is left in the tape after data on the file has been read, the following messages will be displayed on the screen.

file end
data match

Example 1: Verifying A.MIN in TR: (paper tape) against A.MIN in FD0: (floppy disk)

V␣ TR:A.MIN,FD0:A.MIN

Example 2: Verifying A.MIN in TR: (paper tape) against A.MIN in MD1: (memory)

V␣ TR:A.MIN,MD1:A.MIN

Example 3: Verifying A.MIN in FD0: (floppy disk) against A.MIN in MD1: (memory)

V␣ FD0:A.MIN,MD1:A.MIN

Example 4: Verifying A.MIN in FD0: (floppy disk) against B.MIN in FD0: (floppy disk)

V␣ FD0:A.MIN,FD0:B.MIN

Example 5: Verifying A.MIN in MD1: (memory) against B.MIN in MD1: (memory)

V␣ MD1:A.MIN,MD1:B.MIN

Note that the underlined device name MD1:, which is the default device name, can be omitted.

4-3-1. Precautions for Tape Reading-in, Punching-out, and Verifying Operations

(1) There are two tape coding systems, EIA and ISO. The selection of a coding system can be conducted by:

(a) Parameter setting

Bit 1 and bit 0 of NC optional parameter (bit) No. 1 are used to determine the tape coding system: bit 1 for tape code parity discrimination and bit 0 for tape code. The tape coding system is determined by the combination of these bits.

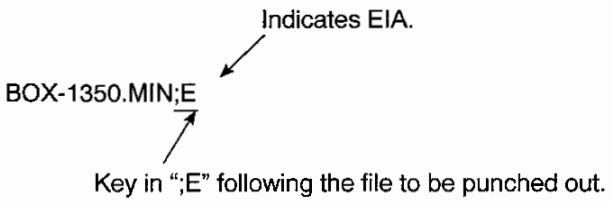
Refer to IV "PARAMETER", Section 4, "DESCRIPTION OF PARAMETER AND SETTING PROCEDURE" for the procedure to set parameters.

(b) ISO or EIA designation for READ, VERIFY, and PUNCH operations

Follow the steps below when conducting READ, VERIFY, and PUNCH operations. This will allow the operator to directly select the coding system regardless of the coding system set by the parameter.

Example: To punch out stored program data in the EIA code

Key in the following command in step (3) of the punch-out procedure of a stored program.



Designation of EIA ISO, and Verifying

;E ..... EIA code
;I ..... ISO code
;V ..... Verifying

(2) There are two different methods to operate the machine with stored programs.

(a) When one main program is stored in the memory

In this case, it is necessary to assign a file name to the program. In the memory, however, the program is assigned the file name "A.MIN".

(b) When more than one program is stored in the memory

In this case, a program can be executed in two different ways.

1) One file for one program

Only one program is registered in one file.

2) One file for several programs

More than one program is registered in one file.

In both cases, it is advisable to create the program by assigning a file name on the tape. If the file name is not assigned on the tape, follow the steps below and assign a file name when storing a program in the memory.

① Press function key [F1] (READ).

② Key in the file name following a comma.

",file-name"

③ Press the WRITE key.

With the steps above, the file name is specified and the program on the tape is stored in the memory.

To simplify program tape management, it is recommended to register one program in one file.

(3) To store program data following the program data already stored in the memory, follow the steps below.

① Press function key [F1] (READ)

② Key in the file name and ";A".

",file-name;A"

③ Press the WRITE key.

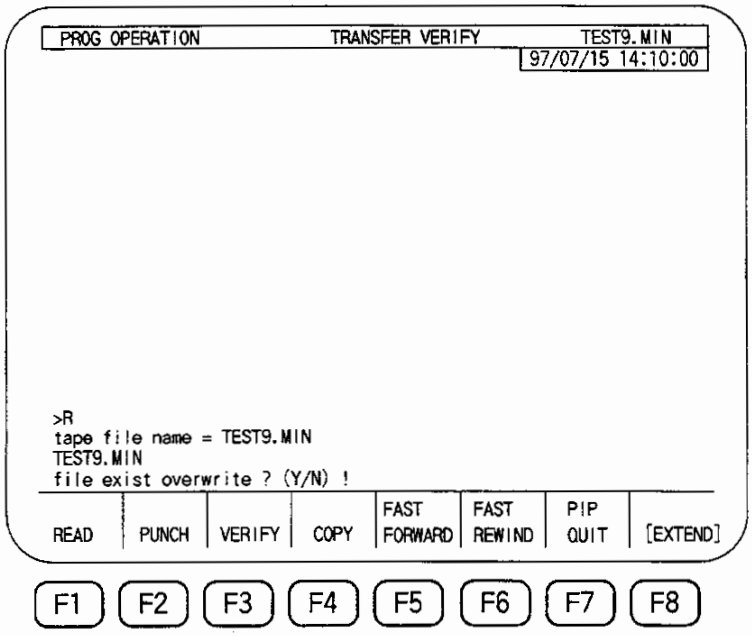
When the program is long and cannot be punched on one tape, the second and subsequent tapes should be read following the above steps.

(4) When the file name is already registered in the memory and when it is necessary to store a program with the same file name, follow the steps indicated below to erase the previous program and to store a new program.

① Press function key [F1] (READ), key in the file name and press the WRITE key.

② The following message will be displayed on the display screen.

file exist overwrite? (Y/N)



③ Type "Y" and press the WRITE key.

Data in the specified file is erased and new data is read from the tape reader and stored in the memory.

[Supplement] If data does not need to be stored, type "N" and press the WRITE key.

When a file name is not given on the tape while the name of the file stored in the memory is "A.MIN" (that is, the file is not assigned a file name), it is not necessary to specify the file name after pressing function key [F1] (READ).

(5) File names can be specified and changed as required by inputting the following.

[F1] (READ) "input file name", "output file name"

When an input file name has not been specified, the file name given on the tape is taken as the input file name. If no file name is given on the tape, the program is assigned the file name "A.MIN."

When an input file name is specified, it is necessary to check that the specified file name agrees with the file name on the tape. If the specified file name agrees with the file name on the tape, an error is generated. (An error message is displayed on the display screen.)

When an output file name has been specified, the specified file name is created in the memory.

When an output file name has not been specified, the input file name is used as the output file name.

In this case, the delimiter "," can be omitted.

To specify an output file name without entering an input file name, be sure to enter the delimiter ",".

Example 1: [F1] (READ) BOX-1.MIN, BOX-2.MIN [WRITE]

A program assigned the file name "BOX-1.MIN" is stored in the memory with its file name changed to "BOX-2.MIN".

Example 2: [F1] (READ), BOX-2.MIN [WRITE]

The program is stored in the memory assigned the file name "BOX-2.MIN" regardless of the current file name.

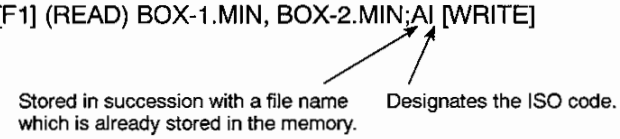
Example 3: [F1] (READ) BOX-2.MIN [WRITE]

The control first checks whether or not the file name given on the tape is "BOX-2.MIN". Then, the program is stored in the memory assigned with the file name "BOX-2.MIN".

Example 4: [F1] (READ) [WRITE]

The program is stored in the memory with a file name assigned on the tape. If not file name is given on the tape, the program is assigned the file name "A.MIN".

Example 5: [F1] (READ) BOX-1.MIN, BOX-2.MIN;AI [WRITE]



The ISO-coded program data which has the file name "BOX-1.MIN" is stored following the file which is already stored in the memory with the file name "BOX-2.MIN"

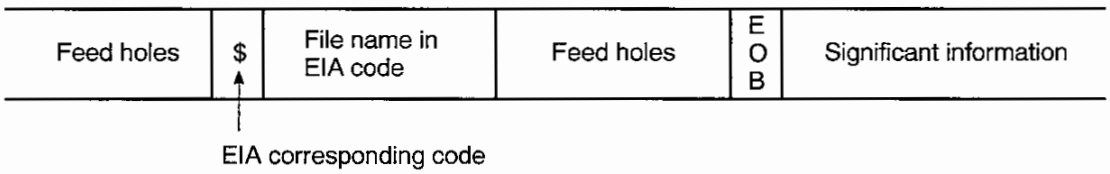
(6) The following command reads a tape which contains wrong codes up to the end while replacing them with "!".

[F1] (READ) file-name;C [WRITE]

The number of read wrong codes is counted and displayed after the completion of tape read operation. Correct them in the program edit mode.

(7) Reading of a Tape which has a File Name Punched in the EIA Code

The file name punched in the EIA code can be read if an EIA-coded character which corresponds to $ has been set at NC optional parameter (bit) No. 31.



The control recognizes the coding system of the file by the first "$" code.

The coding system employed for NC data within the significant information area is recognized by the first end-of-program code (EOB).

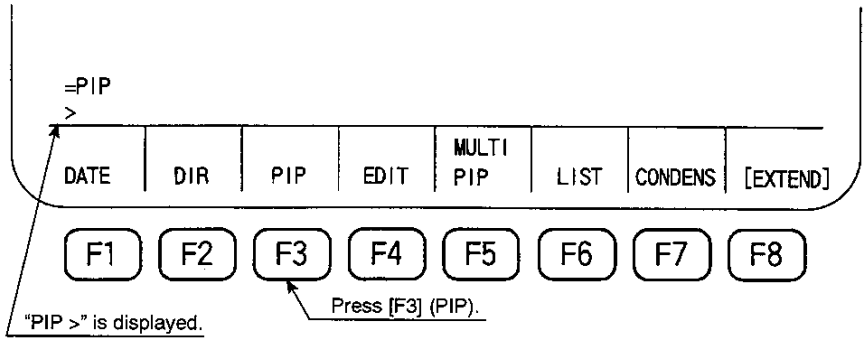
During tape punch operation, the file name is always punched in the ISO code irrespective of the coding system which is employed to punch NC data.

4-4. Duplication of Stored Program

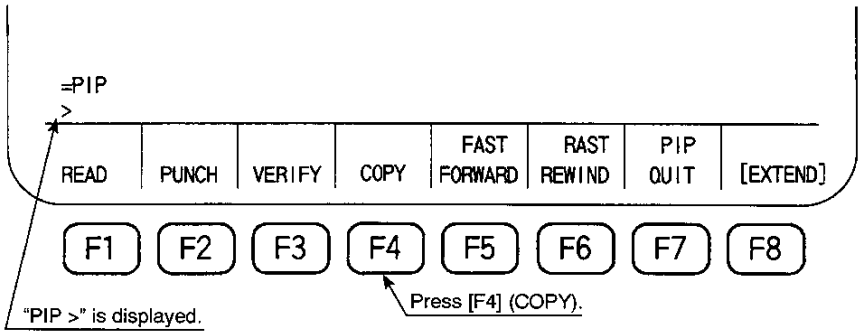
To duplicate a file in the memory (MD1:) or a floppy disk (FD0:), follow the steps below.

(1) Press function key [F3] (PIP).

The function names on the screen will change to those given in item (2) below.



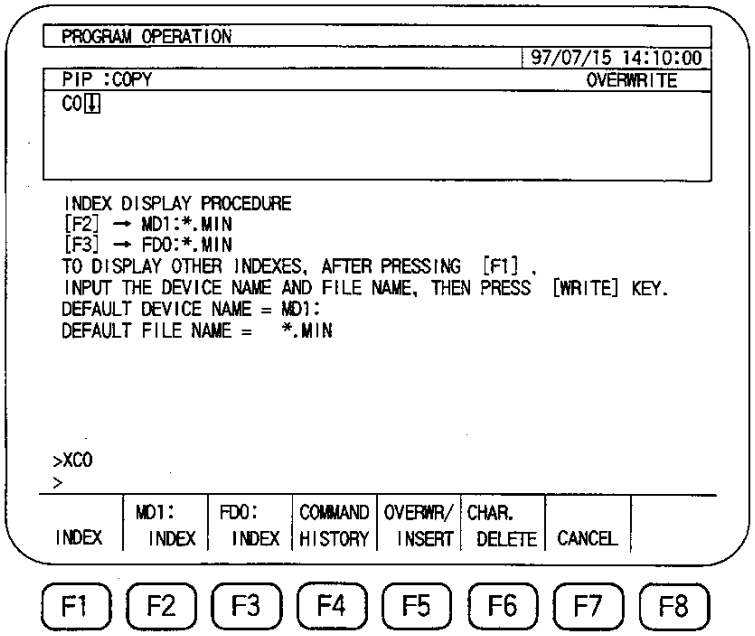
(2) Press function key [F4] (COPY).



The screen changes to the directory-selection-based file operation screen and the following is displayed on the screen.

PIP:COPY CO

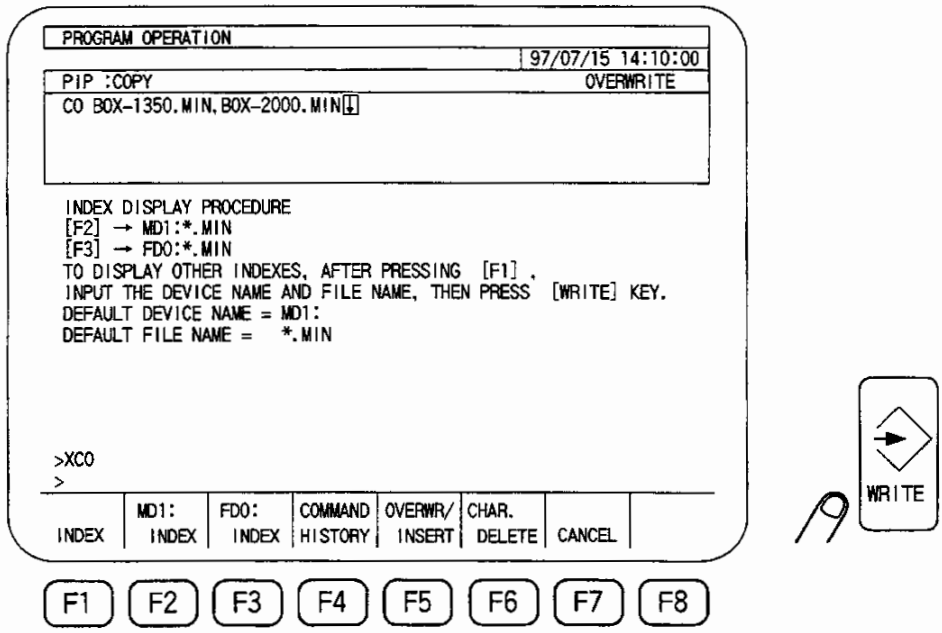
Enter the device name, MD1: or FD0:. (The default is MD1:.)



(3) Enter the file name of the file to be copy and press the WRITE key.

Example: BOX-1350.MIN, BOX-2000.MIN

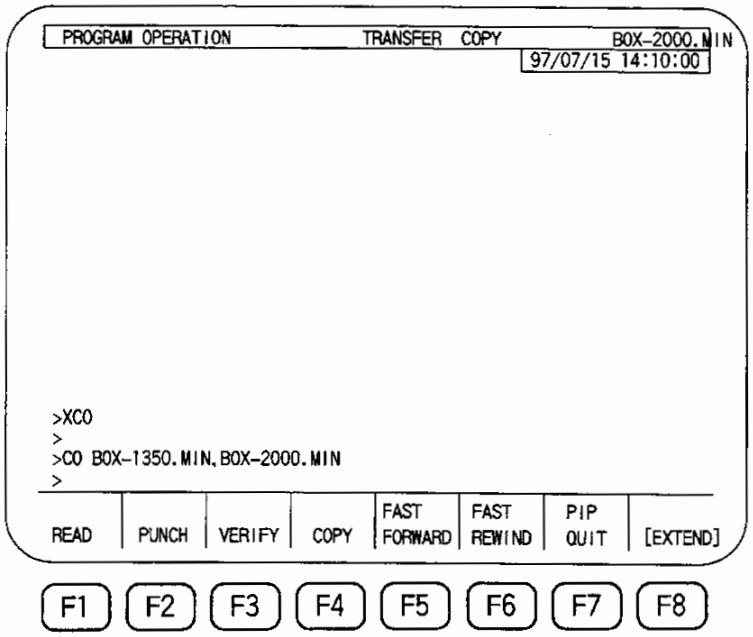
Input file name Output file name



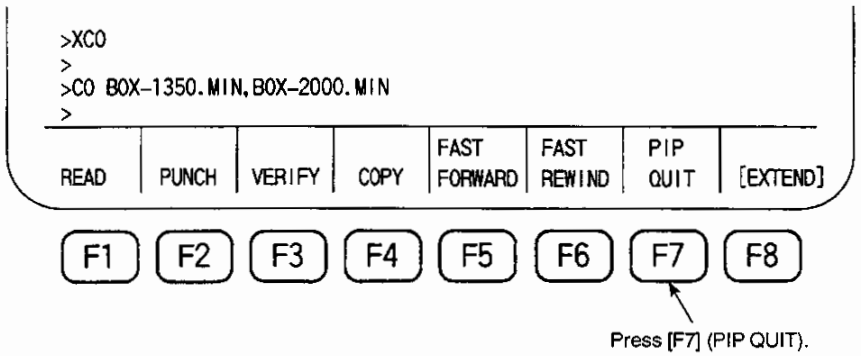
The program which has the file name "BOX-1350.MIN" is duplicated and stored in the memory with the file name "BOX-2000.MIN".

While the file is being copied, "COPY" and "file name" are displayed at the upper area of the screen.

At the completion of copying, ">" appears on the console line.



(4) Press function key [F7] (PIP QUIT).



The screen returns to the one displayed in item (1).

[Supplement]

1. When the specified file name "BOX-1350.MIN" is not found in the memory, the message "no file" will be displayed on the command line.
2. When the file name "BOX-2000.MIN" which has been specified as the output file name already exists in the memory, the following message will appear.

   BOX-2000.MIN

   file exist overwrite? (Y/N)

   To erase the currently stored program and store the duplicated one, type "Y" and press the WRITE key.
3. The output file name can be omitted when the output file name is the same as the input file name.
4. When the output file name is omitted, symbols "*" and "?" can be used in an input file name. In this case, all the corresponding files are duplicated. (Refer to Section 5, 3. "DIRECTORY".)
5. In addition to the above duplicating functions, the following functions are optionally available.

   (a) [COPY] input file name, output file name ;A

   Duplication is executed following the file which is specified as the output file name.

   (b) [COPY] input file name, output file name ;V

   The message "copy OK? (Y/N)" is displayed before starting program duplication.

   To start duplication, type "Y" and press the WRITE key.

   To abort the operation, type "N" and press the WRITE key.

Example 1: Copying A.MIN in MD1: (memory) to MD1: (memory) under the file name of B.MIN

CO␣ MD1:A.MIN,MD1:B.MIN

Example 2: Copying A.MIN in MD1: (memory) to FD0: (floppy disk) under the file name of B.MIN

CO␣ MD1:A.MIN,FD0:B.MIN

Example 3: Copying A.MIN in FD0: (floppy disk) to MD1: (memory) under the file name of B.MIN

CO␣ FD0:A.MIN,MD1:B.MIN

Example 4: Copying A.MIN in FD0: (floppy disk) to FD0: (floppy disk) under the file name of B.MIN

CO ␣ FD0:A.MIN,FD0:B.MIN

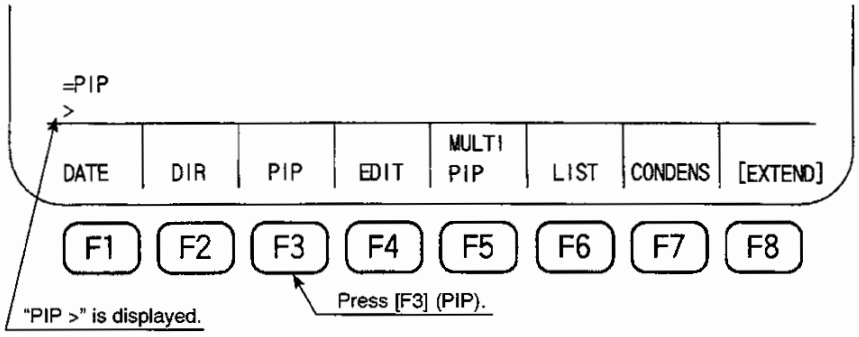
Note that the underlined device name MD1:, which is the default device name, can be omitted.

4-5. Tape Reader Operation – Fast Forward Feed

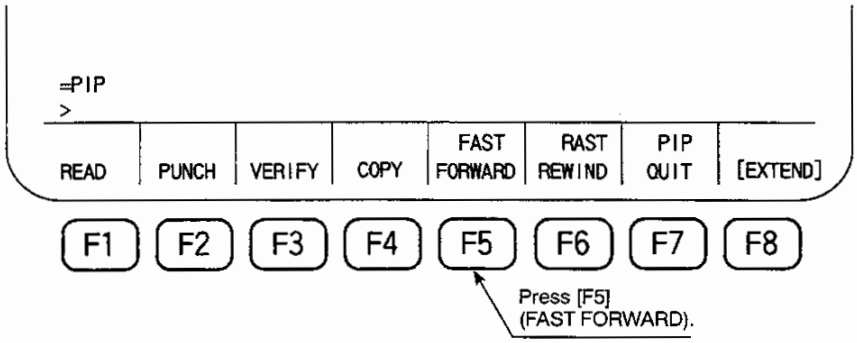
To feed the tape rapidly, follow the procedure below.

(1) Press function key [F3] (PIP).

The function names on the screen will change to those given in item (2) below.



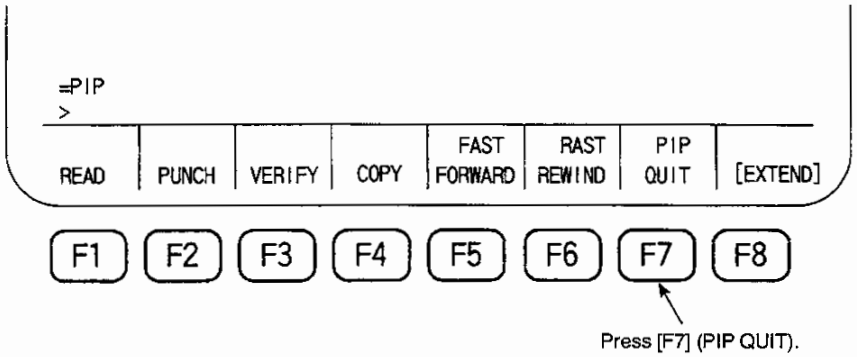
(2) Press function key [F5] (FAST FORWARD).



The prompt " > FF" will be displayed on the command line (21st line). The tape is fast forwarded to the end of the tape.

By setting corresponding data at NC optional parameter (bit) No. 1, bit 3, it is possible to select whether the control recognizes the end of a tape by feed holes or by a code. (% for ISO and ER for EIA).

(3) Press function key [F7] (PIP QUIT).

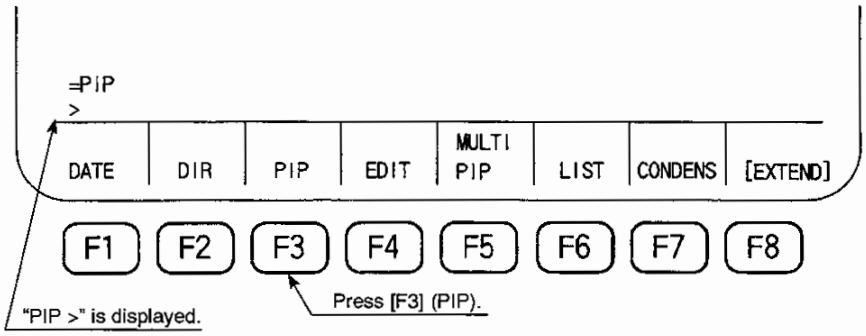


This completes verification of the punched out program data and the display mode return to the one in step (1).

4-6. Tape Reader Operation – Rewind

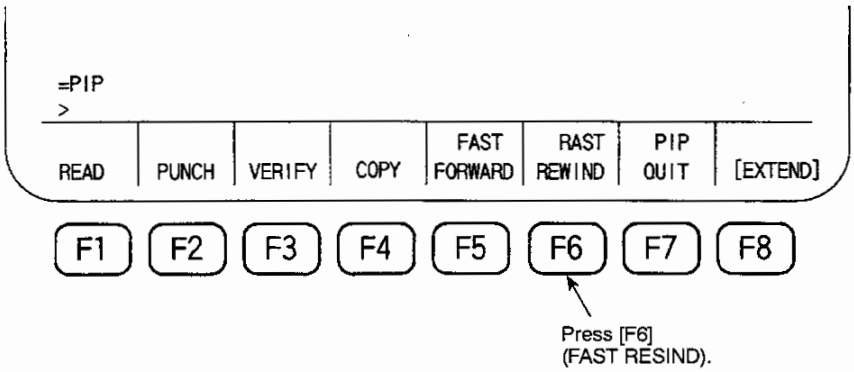
To rewind the tape, follow the procedure below.

(1) Press function key [F3] (PIP).



The function names on the screen will change to those given in item (2) below.

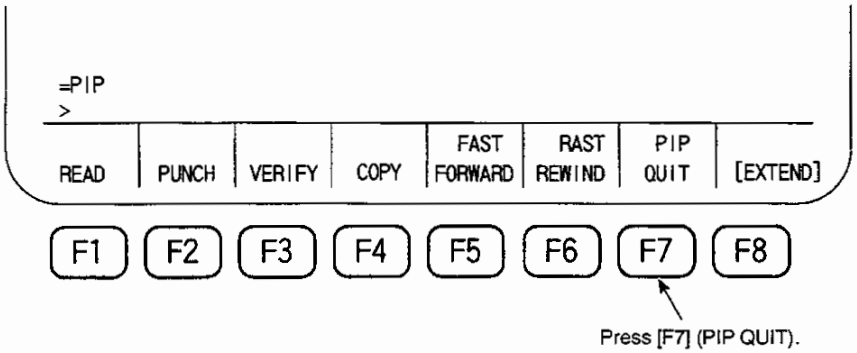
(2) Press function key [F6] (FAST REWIND).



The prompt "> FR" will be displayed on the line (21st line). The tape is rewound up to the beginning of the tape.

By setting corresponding data at NC optional parameter (bit) No. 1, bit 3, it is possible to select how the control recognizes the beginning of a tape; feed holes on a code. (% for ISO and ER for EIA.)

(3) Press function key [F7] (PIP QUIT).



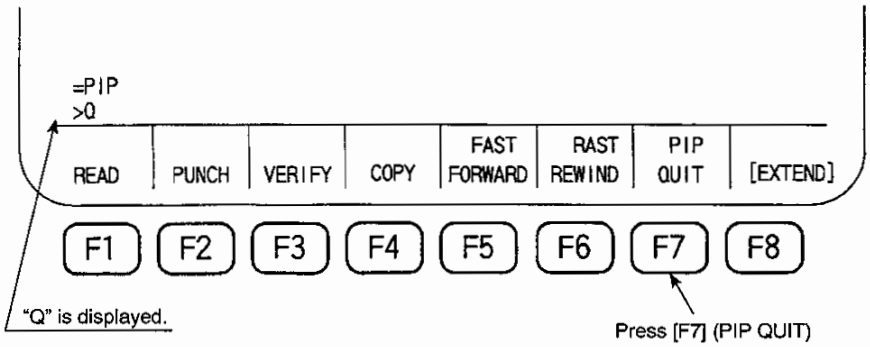
This completes verification of the punched out program data and the display mode return to the one in step (1).

4-7. PIP Quit

This sub command quits the transfer mode, and provides a return to the previous program operation mode.

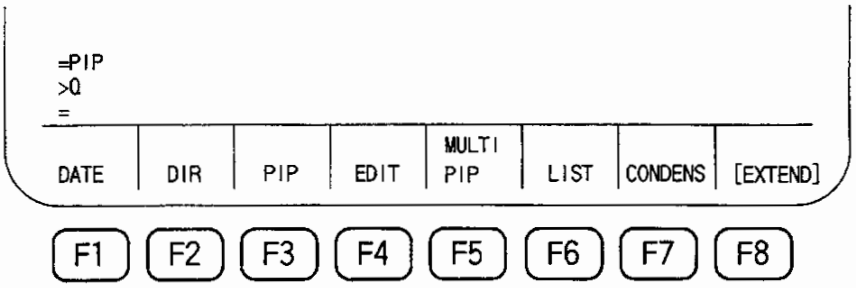
The operating procedure is indicated below.

(1) Press function key [F7] (PIP QUIT).



The prompt " > Q" will be displayed on the command line. The transfer mode is quit and the previous program operation mode is restored.

The display screen will change as shown to the right with assigned function names also changed.



5. Program Editing

In the program edit mode, modification, insertion, deletion, and others can be conducted for on programs stored in the memory.

(1) Programs are edited in units of file.

(2) Program editing-related terms are defined as follows:

(a) Edit Line

This is the line on which program edit operation is carried out.

On the display screen, the symbol ">>" appears at the left-most position of the edit line. One line on the display screen contains a maximum of 63 characters.

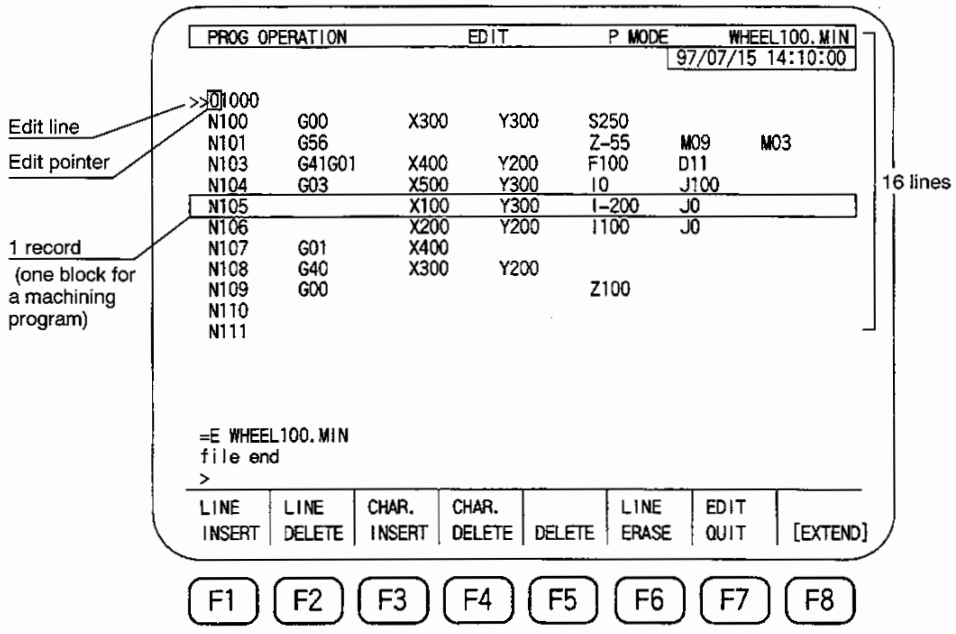
(b) Edit Pointer

This refers to the identifier indicating the character to be edited. On the display screen, such a character is displayed in the reversed display mode.

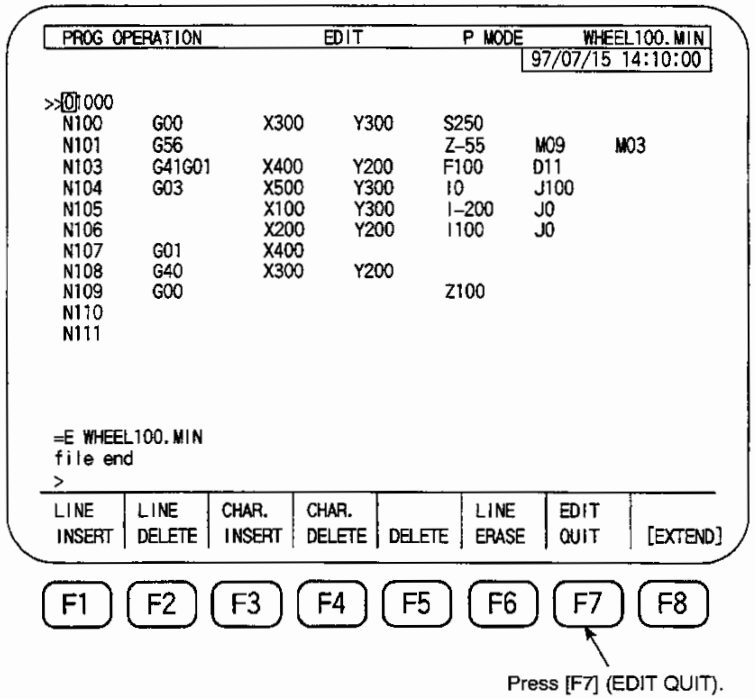
(c) Record

This is so called a block in the program. The record consists of several commands beginning with a character right after the "LF" code and ending with the next "LF" code. If commands in a block cannot be displayed in one line on the display screen, they are displayed on multiple lines with the 2nd and subsequent lines preceded by "&", indicating that the commands are continuous.

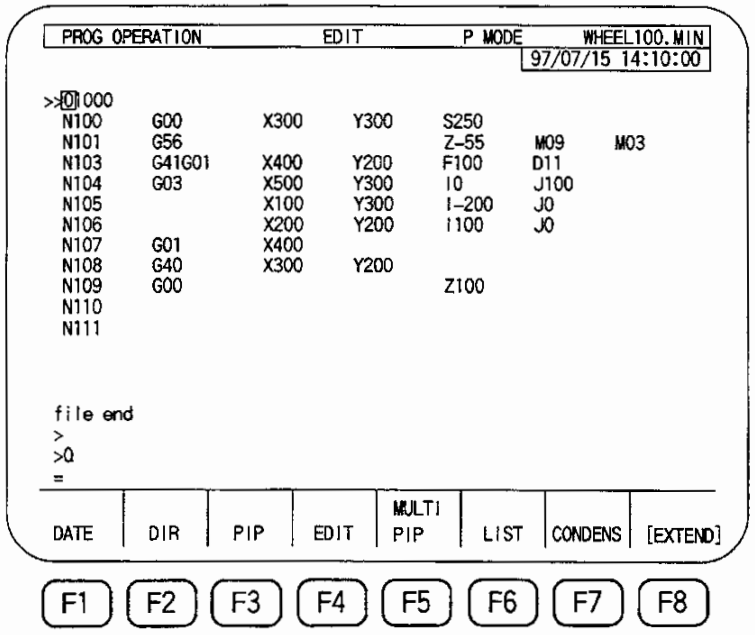
(d) The extract buffer means the buffer where commands are temporarily saved for copy or transfer operation. The buffer capacity is 64 character × 23 lines.



NOTICE : When program edit operation has been completed, press function key [F7] (PIP QUIT). Otherwise, edited data cannot be stored in the memory.



Program edit operation is complete, and the display screen as indicated to the right will be displayed on the command line.



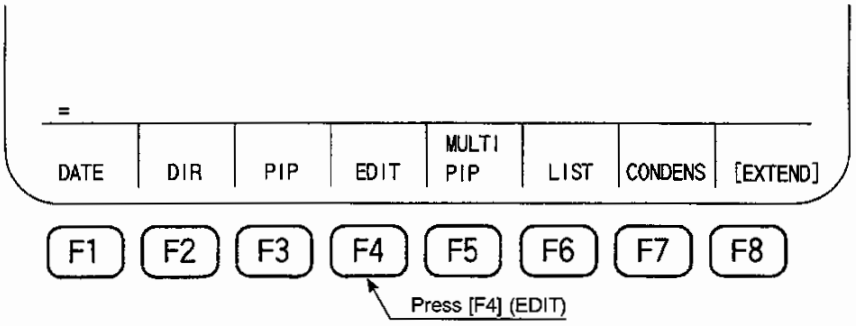
5-1. Commands Used in the Program Edit Mode

Item	Command	Functions
Insert line	INSERT LINE	Inserts a blank line right after the present edit line.
Delete line	DELETE LINE	Deletes the line including the edit pointer.
Insert character	INSERT CHARACTER	Inserts a blank space (for one character) right before the edit pointer.
Delete character	DELETE CHARACTER	Deletes the character identified by the edit pointer.
Delete	DELETE	Deletes the specified number of records (blocks) in a program.
Erase line	ERSE LINE	Erases the commands in the line which contains the edit pointer. The line remains as a blank line.
Quit	QUIT	Ends the program edit mode.
Find	FIND	Searches the specified character-string. Shifts the edit line by the specified number of lines.
Change	CHANGE	Replaces the specified character-string with the newly specified character-string.
Copy	COPY	Duplicates program data in the specified number of lines to the extract buffer. The original program data remains as it is.
Move	MOVE	Duplicates program data in the specified number of lines to the extract buffer. The original program data is deleted.
Extract	XTRACT	Inserts program data in the extract buffer before the edit pointer.
Page mode	PAGE MODE	Replaces the character located by the edit pointer with the keyed-in character.
Insert mode	INSERT MODE	Inserts the character which has been keyed i through the keyboard before the character located by the edit pointer.

5-2. Fundamental Operations Necessary for Program Editing

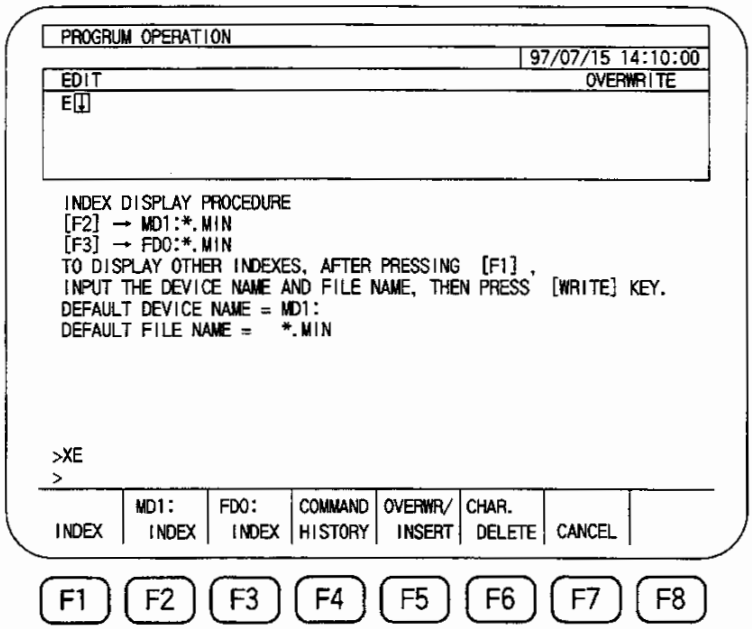
5-2-1. Readout of a Program File from the Memory

(1) Press function key [F4] (EDIT).



The screen changes to the directory-selection-based file operation screen and the following is displayed on the screen.

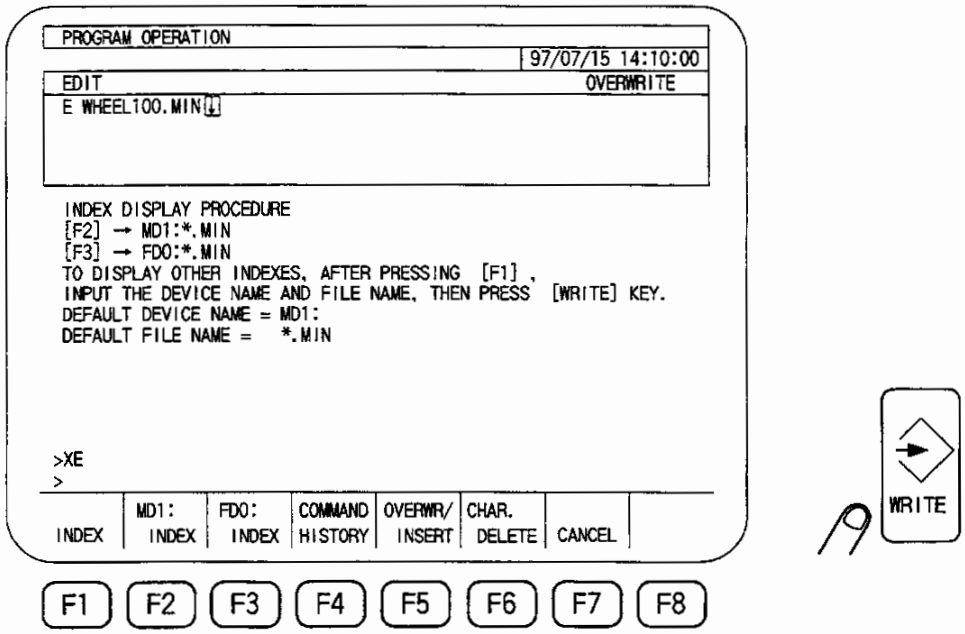
EDIT E



(2) Enter the file name of the file to be edited and press the WRITE key.

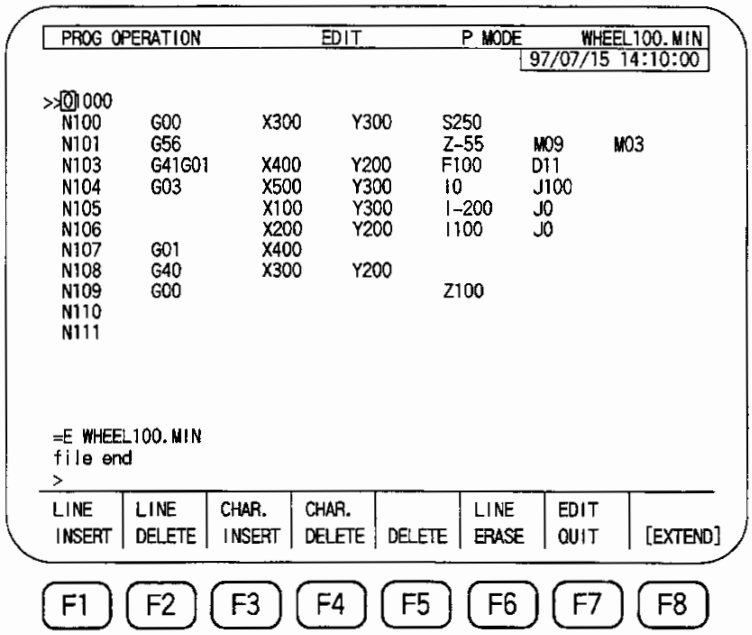
WHEEL100.MIN

When a program has been stored without specifying a file name, that is, when a program is stored with the file name "A.MIN", this step can be skipped.



Program data of the specified file is searched and read into the editing area. At the same time, program data is displayed on the display screen.

Program data of the file name "WHEEL100.MIN" is ready for editing.

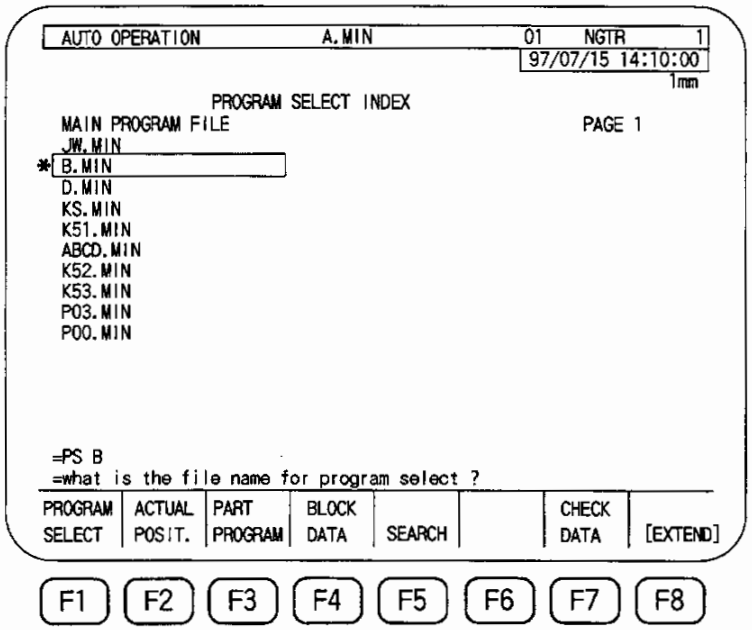


[Supplement] If the same file as the one selected for large-capacity program operation (method B, method S, method M) is edited while the selected program is not executed, program selection is canceled.

5-2-2. Readout of a Program File from the Memory Using Wild Card ("∗", "∗.∗")

(1) Key in "E ∗" or "E ∗.∗" and press the WRITE key.

(2) The list of names of stored files is displayed on the screen. Move the cursor to the required file name using the cursor and page keys, then press the WRITE key.



[Supplement]

1. An asterisk (∗) is displayed at the beginning of the file name of the file that has been created or edited last.

   When the PROGRAM EDIT INDEX screen is displayed, the cursor is positioned on the file name prefixed by an asterisk.

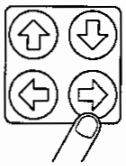
2. When there is no file where asterisk should be set, the first page of the PROGRAM EDIT INDEX screen is displayed with the cursor at the top of the file names.

3. If the same file as the one selected for large-capacity program operation (method B, method S, method M) is edited while the selected program is not executed, program selection is canceled.

5-2-3. Cursor Operations

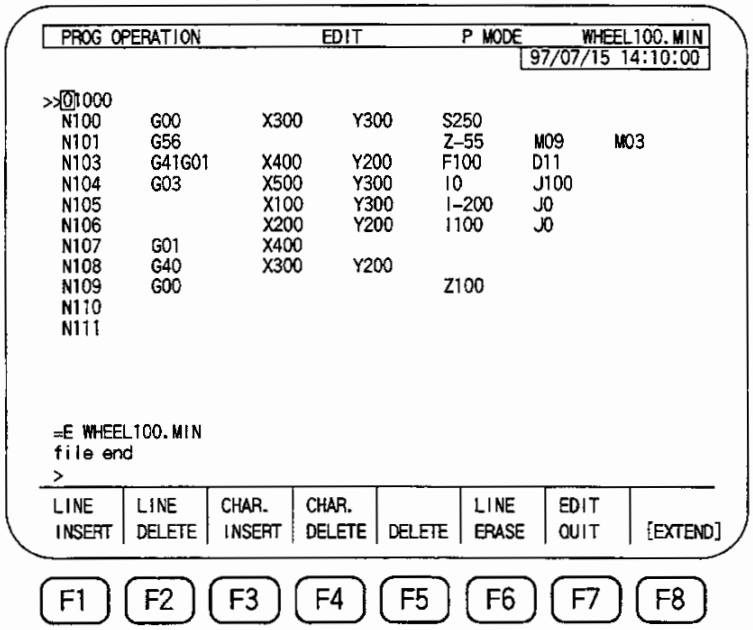
When the cursor key is pressed, the edit pointer and the edit line can be moved.

(1) Cursor Right Movement

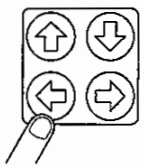


Each time the cursor key is pressed, the edit pointer (reversed display) moves to the right.

The edit pointer moves continuously while the cursor key is held down.

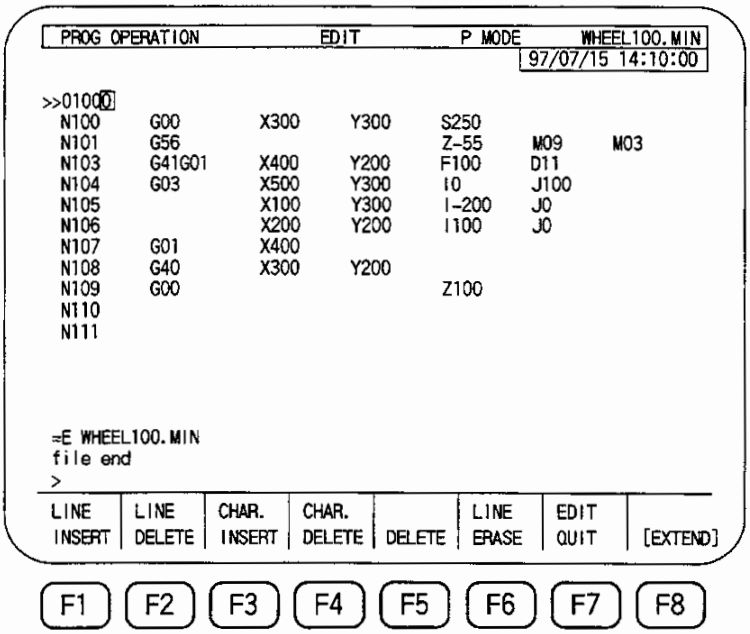


(2) Cursor Left Movement

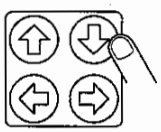


Each time the cursor key is pressed, the edit pointer (reversed display) moves to the left.

The edit pointer moves continuously while the cursor key is held down.



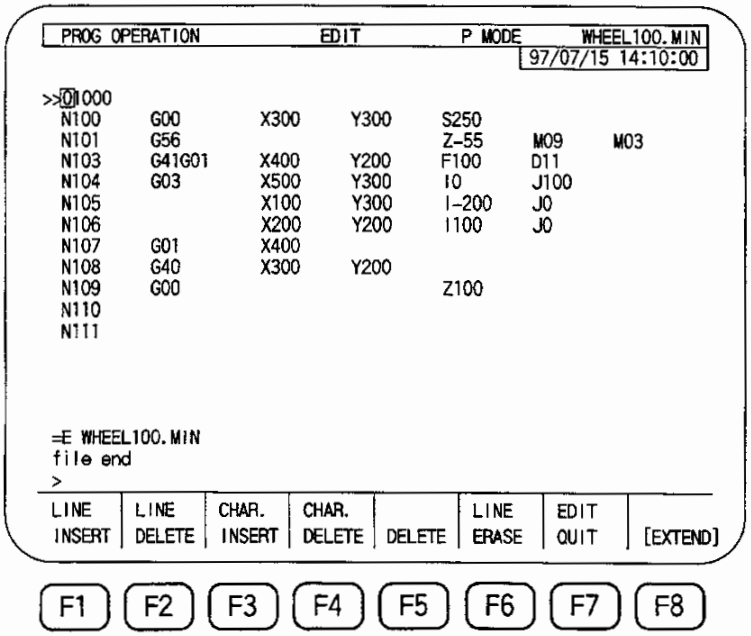
(3) Cursor Downward Movement



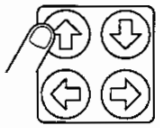
Each time the cursor key is pressed, the edit pointer (reversed display) and the edit line (>>) move down one line.

The edit pointer and the edit line move continuously while the cursor key is held down.

When the cursor key is pressed with the edit line (>>) placed at the bottom, the edit line (>>) moves to the next block (the first line in the next page).



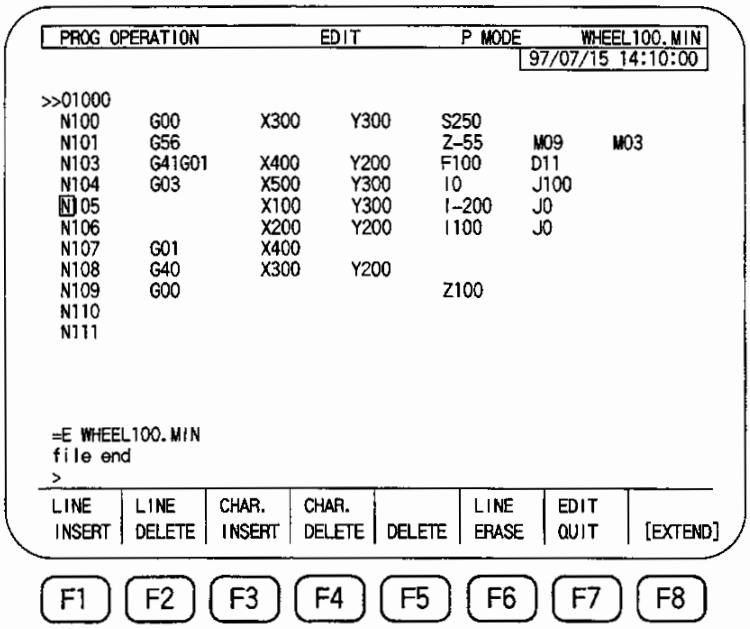
(4) Cursor Upward Movement



Each time the cursor key is pressed, the edit pointer (reversed display) and the edit line (>>) move up one line.

The edit pointer and the edit line move continuously while the cursor key is held down.

When the cursor key is pressed with the edit line (>>) placed at the top (O1000 on the display screen), the edit line (>>) does not move.

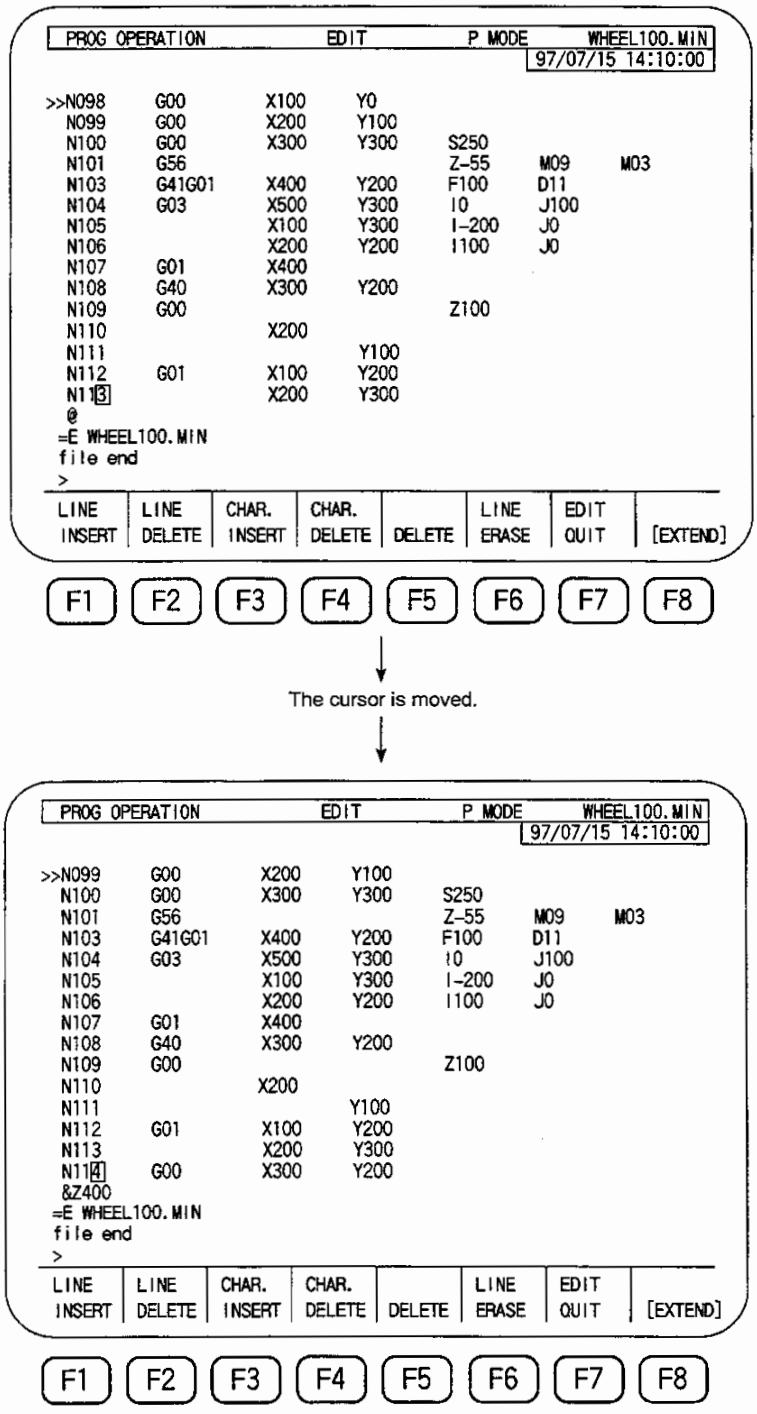


[Supplement]

1. When the cursor key is pressed continuously or held down until the edit pointer (reversed display) reaches the left-end or right-end position, the edit line (>>) moves up or down, respectively.
2. The edit pointer (reversed display) is placed on the edit line (>>). This means that the edit line and the edit pointer move together. The edit pointer moves as the edit line changes.

[Supplement] 3. If there is a record exceeding 63 characters (one block of data is not displayed within one line) and if the edit data cannot be displayed within the display area (16 lines), a blank line is automatically generated. The symbol of "@" is displayed on the automatically generated blank line so that it is distinguished from the line generated by the "one-line insertion" function.

In this processing, a blank line is generated only at the bottom of the screen and not generated at a middle or the top of the screen.



5-2-4. Page Down

When the page key (P↓) is pressed, the next page is displayed.

On the display screen, 16 lines of program data are displayed on one display page. When program data to be edited is not found on the given page, press the page keys until required data is obtained.

Positions of the edit pointer and edit line remain unchanged.

When the last part of the file has been reached while the page key is pressed, the remaining blocks are displayed on the screen. The message "file end" will appear on the command line.

5-2-5. Page Up

When the page key (P↑) is pressed, the previous page is displayed.

When the first page has been reached, the display remains unchanged even if the page key is kept pressed. The message "beginning of file" will appear on the command line.

5-3. One Line Insertion

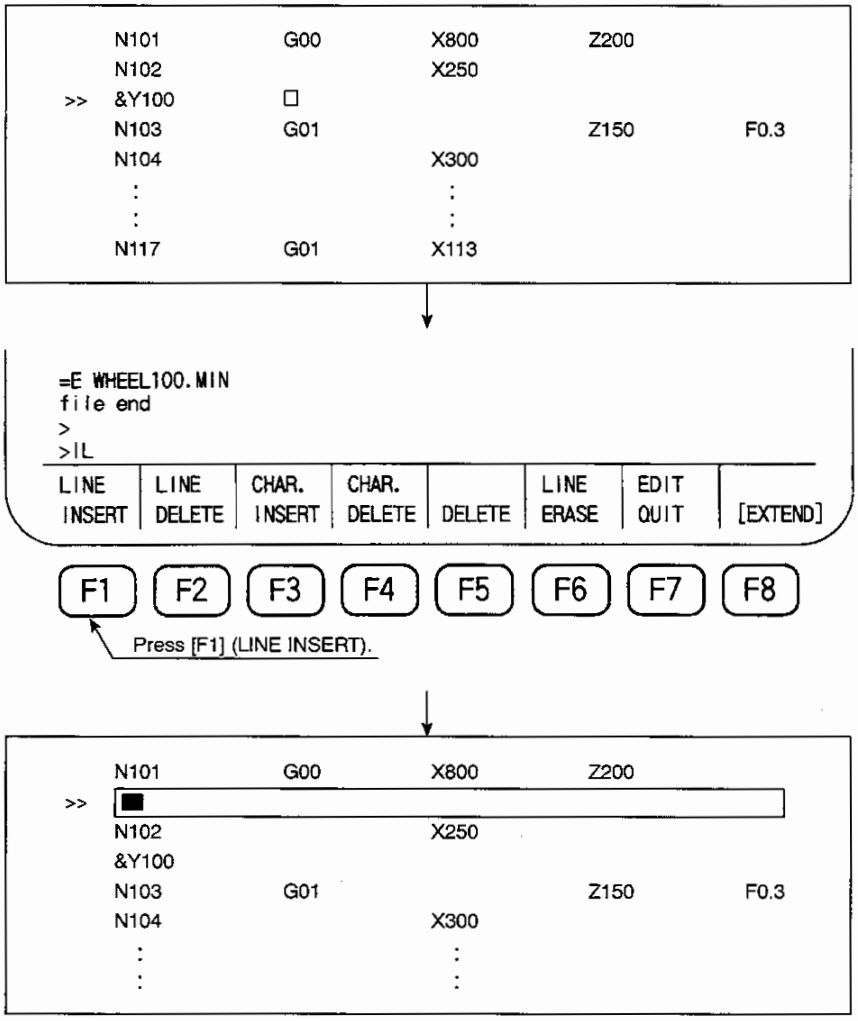
(1) This function inserts a blank line right before the edit line.

Press function key [F1] (LINE INSERT) to insert a blank line before the edit line (>>).

(2) Lines following the edit line shift down and the last line on that page disappears from the display and shifts to the next page.

(3) The edit pointer shifts to the beginning of the inserted blank line.

(4) One line insertion operation at the line which has more than 63 characters differs from ordinary one line insertion processing. (See the figure.)



(5) The prompt ">IL" will be displayed on the command line.

(6) This function is effective for inserting lines in the stored program.

5-4. One Line Deletion

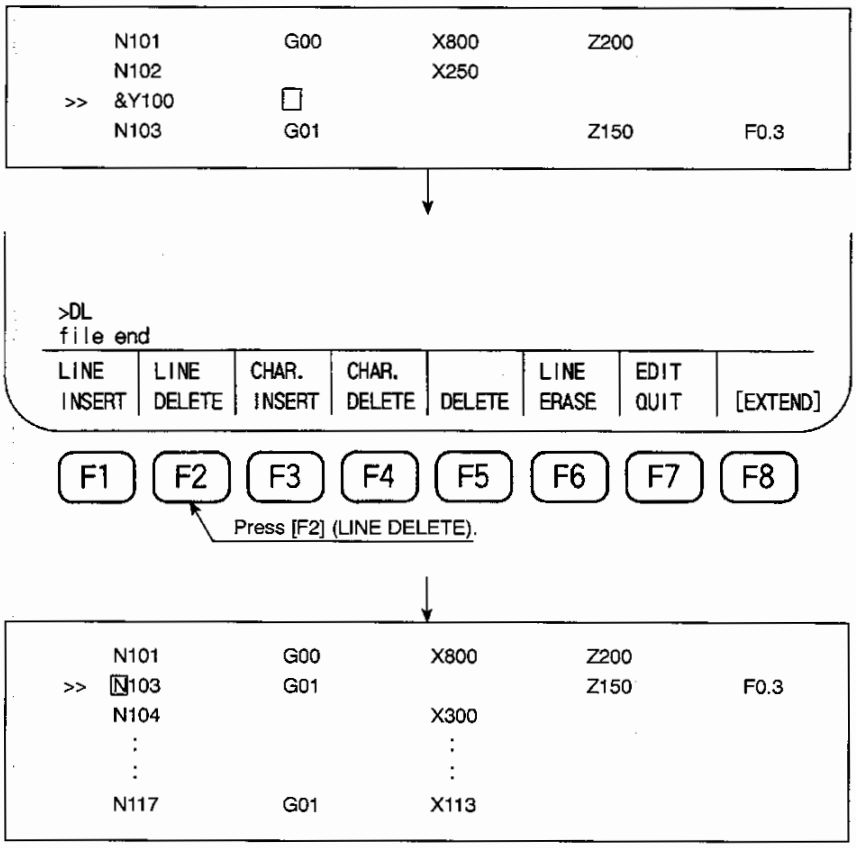
(1) This function deletes the edit line.

Press function key [F2] (LINE DELETE) to delete the edit line.

(2) Lines following the edit line shift up and the first line on the next page shifts to the current page and displayed on the last line.

(3) The edit pointer shifts to the first character of the line next to the deleted line.

(4) One line deletion operation at the line which has more than 63 characters differs from ordinary one line deletion processing. (See the figure.)



(5) The prompt ">DL" will be displayed on the command line.

(6) This function is effective for deleting an entire line in the stored program.

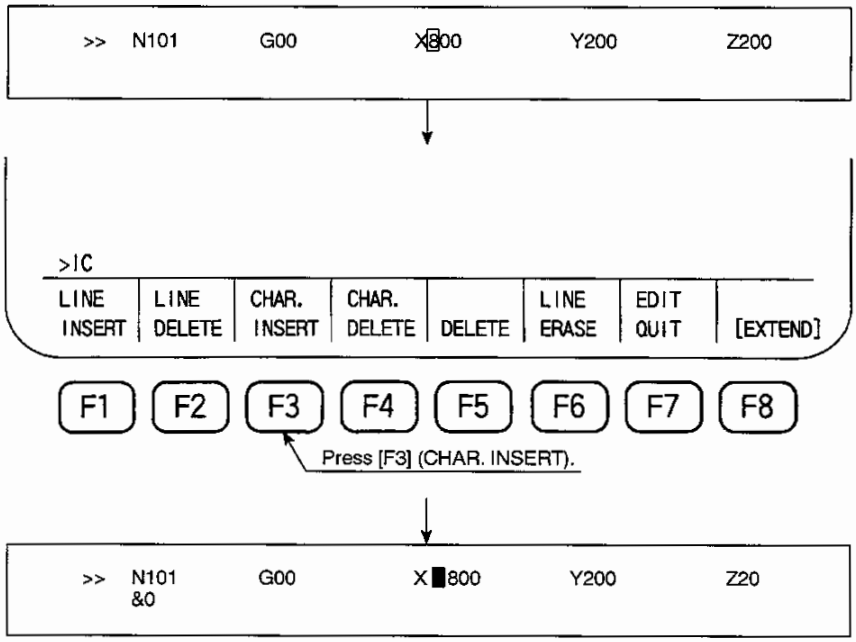
5-5. One Character Insertion

(1) This function inserts a space before the edit pointer.

Press function key [F3] (CHAR. INSERT) to insert a space right before the edit pointer.

(2) Data following the edit pointer shifts to the right when a space has been inserted.

(3) One character insertion operation at the line which has more than 63 characters differs from ordinary one character insertion processing. (See the figure.)



(4) The position of the edit pointer remains unchanged.

(5) The prompt ">IC" will be displayed on the command line.

(6) This function is effective for inserting a character (numeral).

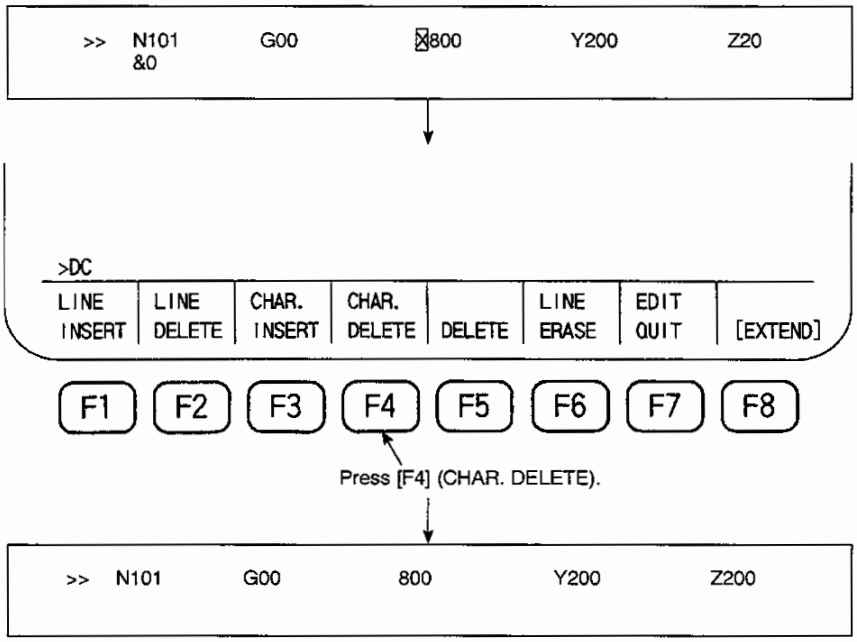
5-6. One Character Deletion

(1) This function deletes a character located by the edit pointer.

Press function key [F4] (CHAR. DELETE) to delete the character located by the edit pointer.

(2) When the character is deleted, characters following the deleted one shift to the left.

(3) One character deletion operation at the line which has more than 63 characters differs from ordinary one character deletion processing. (See the figure.)



(4) The position of the edit pointer remains unchanged.

(5) The prompt ">DC" will be displayed on the command line.

5-7. Deletion

(1) Program data in a specified range is deleted.

After specifying the number of lines to be deleted, press function key [F5] (DELETE). The specified number of lines will be deleted including the edit line (>>).

(2) The edit pointer is placed at the first character of the block which follows the final line of the deleted blocks.

(3) When the number of the specified lines to be deleted is larger than the final block of the file, all program data up to the end of the file is deleted and the line right after the final line of the file becomes the edit line. In this case, the message "file end" will appear.

(4) After program data has been deleted, the message "**RECORD DELETE" appears on the command line. Here, "**" indicates the number of the deleted lines.

(5) Lines following the deleted range will shift up.

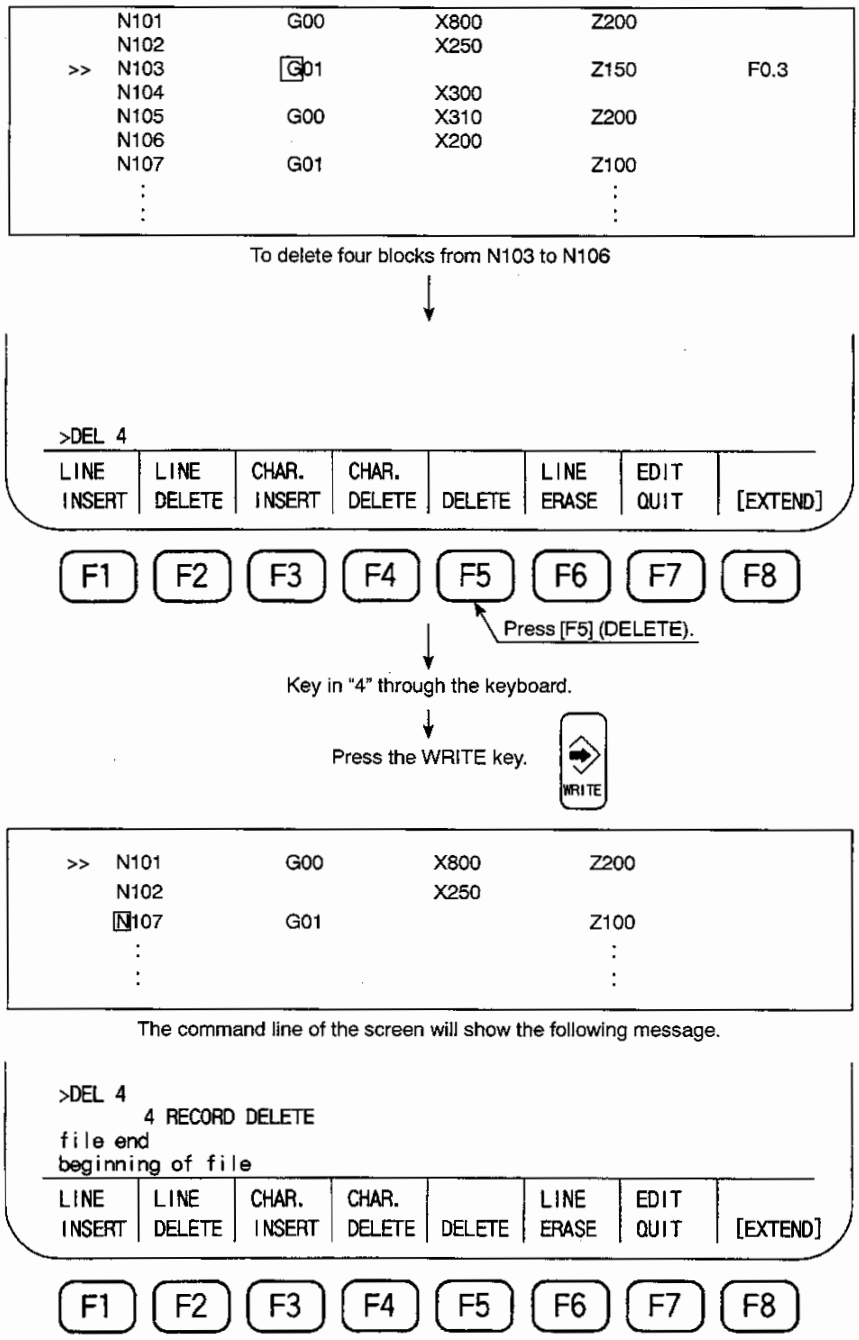
Operation:

[F5] (DELETE)-4 [WRITE]

Four lines preceding the edit line (edit line not included) are deleted.

[F5] (DELETE) [WRITE]

Only the edit line is deleted.



5-8. One Line Erasing

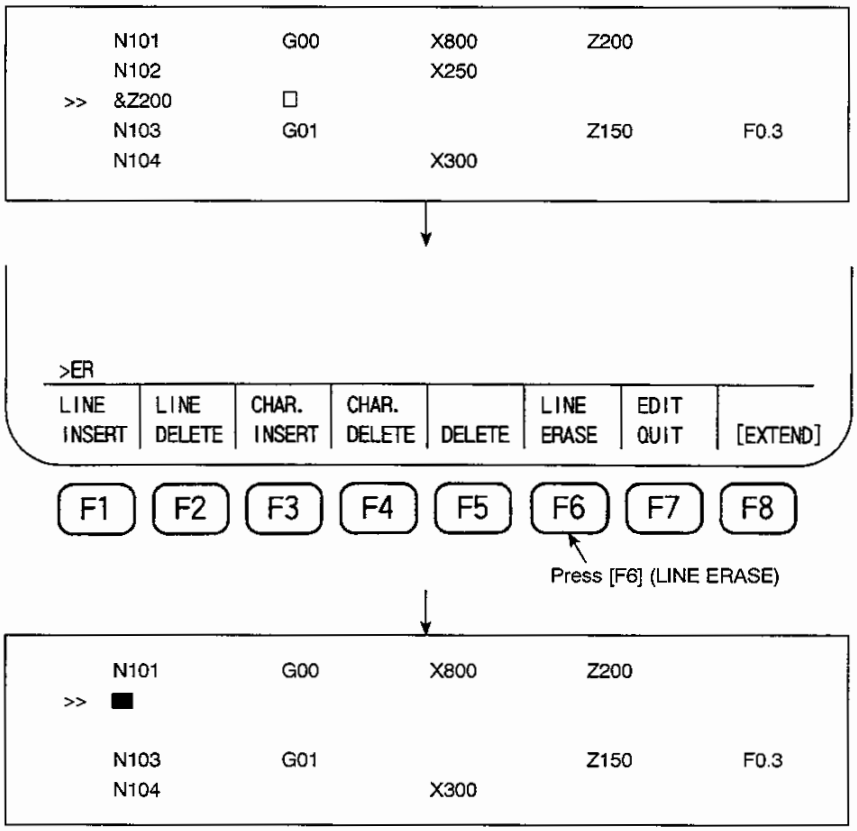
(1) This function erases program data in the edit line (>>). The blank line remains.

Press function key [F6] (LINE ERASE) to erase program data in the edit line. When data is erased, a blank line will remain.

(2) The edit pointer is placed at the first character of the erased edit line.

(3) The prompt ">ER" will be displayed on the command line.

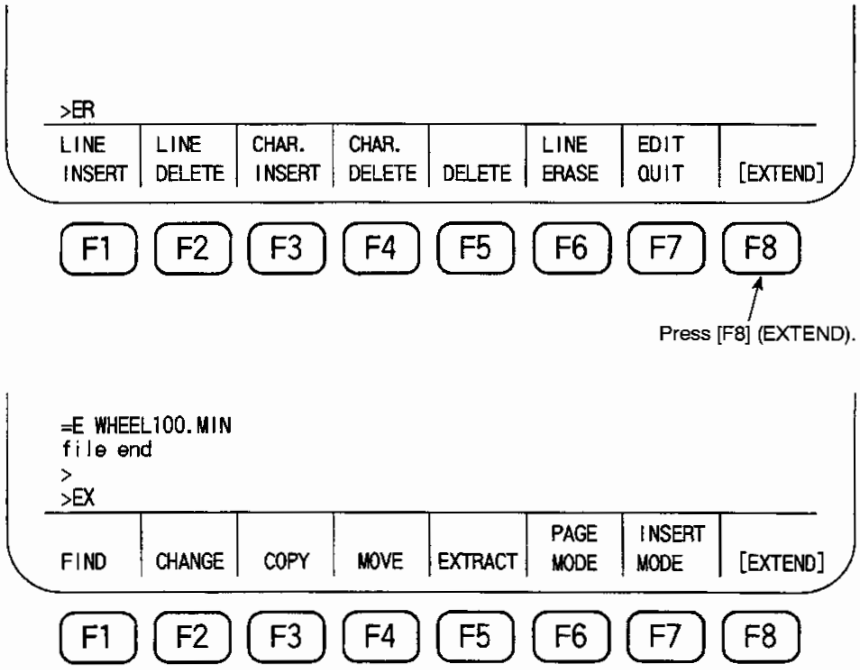
(4) One line deletion operation at the line which has more than 63 characters differs from ordinary one line deletion processing. (See the figure.)



(5) This function is effective when replacing entire program data in a block with new program data.

* Before executing operations explained in 5-9. "Find", press function key [F8] (EXTEND).

Press function key [F8] (EXTEND). The function names on the display screen will change as shown below.



5-9. Find

This function searches for a specified character-string. It is also possible to advance or return the edit pointer by the specified number of lines.

(1) Search for Character-string

Example: To search "X300" in the following program

(a) The character-string specified by keying-in operation is searched for, starting from the character which is next to the one located by the edit pointer.

(b) When the specified character-string has been found, the edit pointer stops at the first character of the character-string.

(c) To specify a character-string, key in a character before and after it. Here, the character before and after the character-string must be the same, and the following characters cannot be used.

+, −, ,, ;, :, 0 through 9, space, and characters used within the character-string

Example: /X300/

(d) The symbol "?" which specifies an arbitrary character can be used.

Example: /N?01/

This is the command to search for three-digit N codes whose lower two digits are "01".

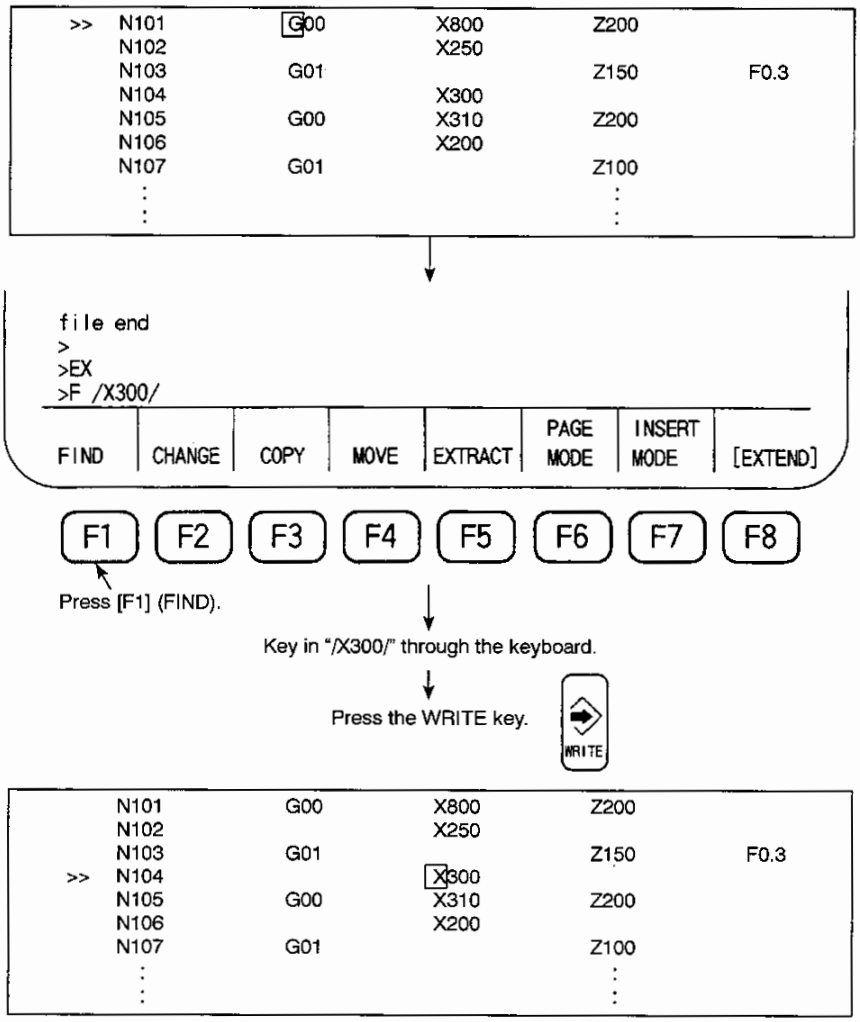
Once a character-string has been specified, it is searched for each time function key [F1] (FIND) and the WRITE key are pressed.

(e) The symbol " ␣ " in character-strings represents one character other than numbers and a decimal point.

Example: /X10␣/

With this command, character-strings such as X100, X10.5, and others are not searched for.

(f) Pressing any key on the operation panel interrupts this function at the point the key has been pressed.



(2) Edit Line Shifting

Example: When the 4th block is specified in the following program

(a) This function shifts the edit line by a specified number of lines.

(b) The edit pointer is placed at the first character of that line.

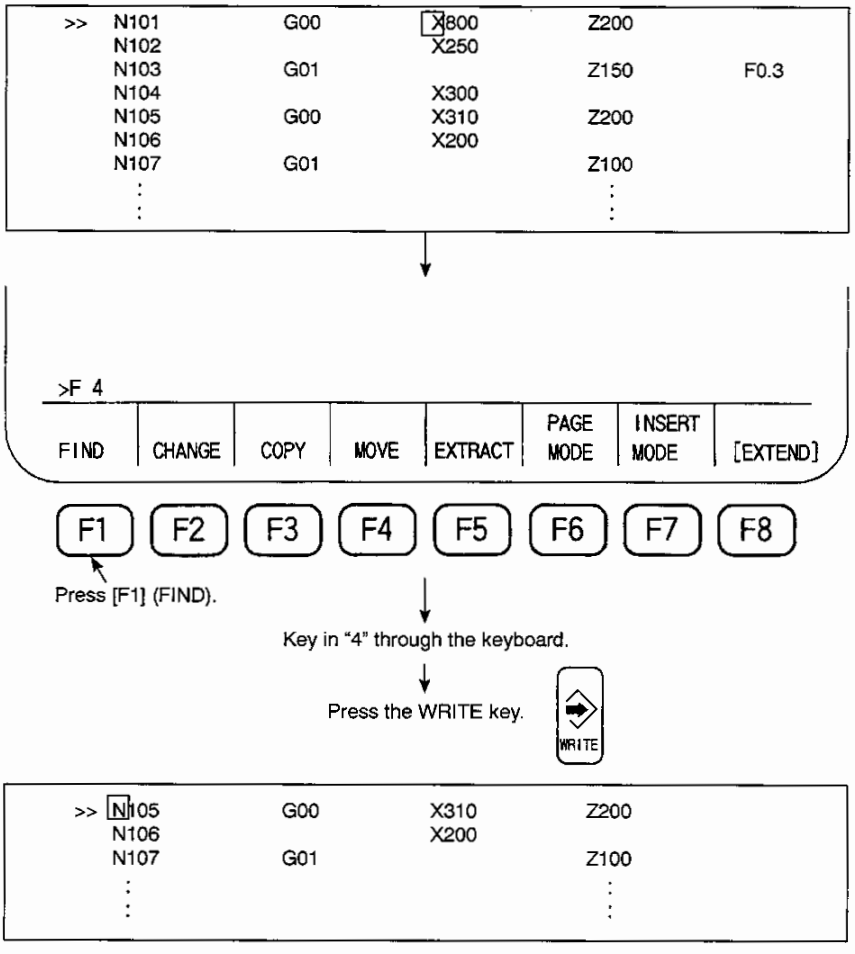
(c) On the display screen, the display changes so that the edit line is located on the first line of the screen.

(d) When the specified number is larger than the last line of the file, the edit pointer is placed in the line next to the last line. In this case, two lines from the last line are displayed on the screen, followed by the following message on the command line.

file end

(e) When a negative number is specified, the edit line shifts backward and the edit pointer is placed at the first character of the specified line.

(f) When a negative number exceeding the first line of the file is specified, the edit pointer is placed at the beginning of the file. The message "beginning of file" will be displayed on the command line.



5-10. Change

Example: To change "Z200" in N105 block to "Z210" in the following program

(1) This function replaces a specified character-string with another character-string specified.

Press function key [F2] (CHANGE) to select this function.

(2) The edit pointer is placed at the first character of the character-string which has replaced the previous character-string.

When the specified character-string is not found, the message "no character string" is displayed and the edit pointer does not move.

(3) The same delimiter as explained in 5-9 is used.

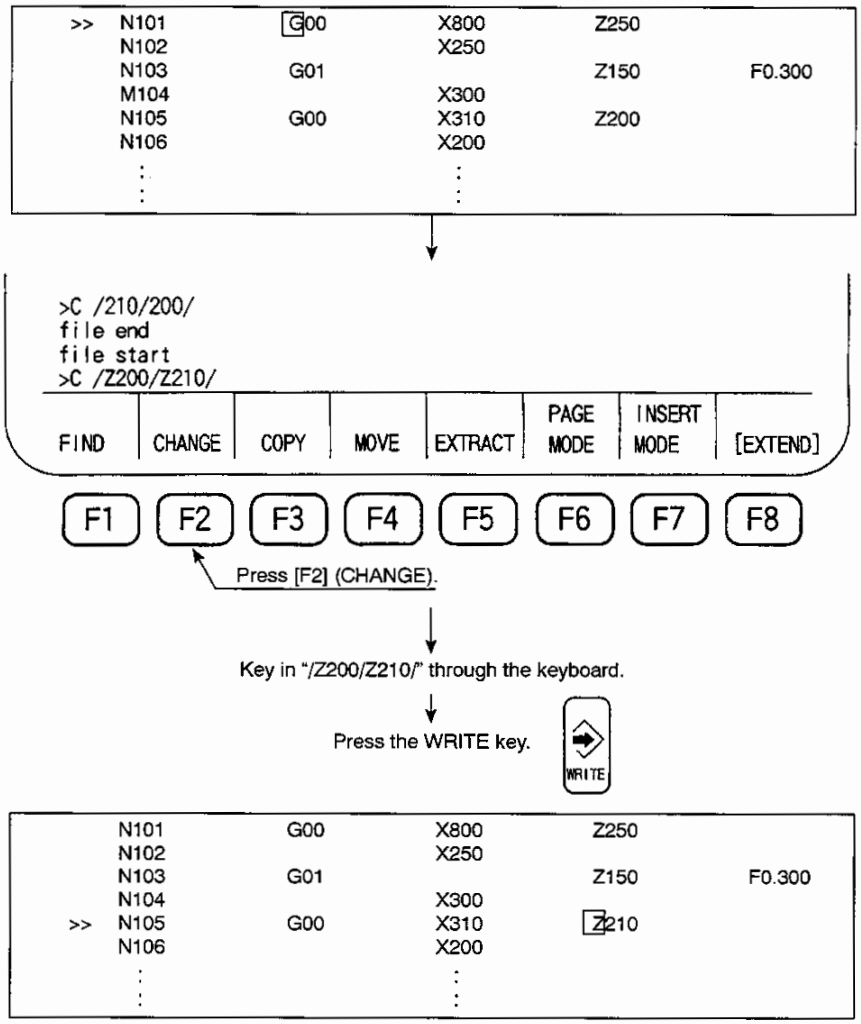
(4) The symbol "?" is used in quite the same manner as in 5-9. "Find" operation.

(5) When program data contains several same character-strings, press function key [F2] (CHANGE) and the WRITE key. The character-strings will be replaced one by one.

(6) Pressing any key on the operation panel interrupts this function at the point the key has been pressed. In this case, character-strings are not replaced.

(7) The following option code can be used:

";A" When this option code is designated, global search and replace can be executed. The character-strings are replaced at one time.



5-11. Copy, Move, and Extract

These functions are used to transfer a group of commands from one program to another or to insert the same group of commands into several different positions of a program.

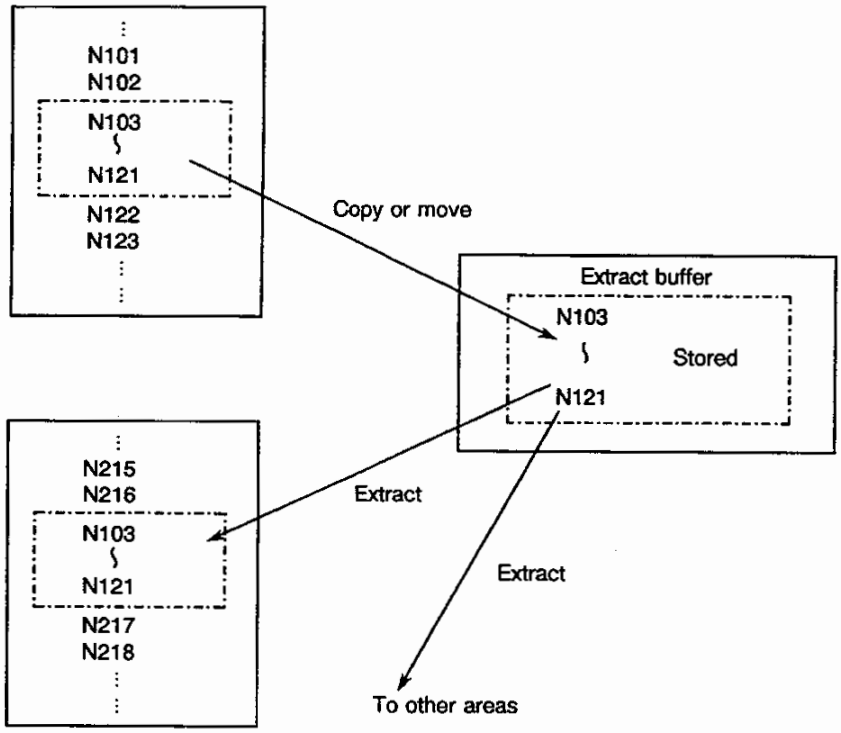


Fig. 2-1 Copy, Move, and Extract Functions

Operation sequence:

(1) Save the group of commands into the extract buffer using the COPY of MOVE command.

(2) The EXTRACT command will insert the commands saved in the extract buffer into the specified sequence.

5-11-1. Copy

This function transfers specified program data to the extract buffer.

Press function key [F3] (COPY) after the range (in terms of lines) of program data to be duplicated has been specified.

Example: To copy blocks from "N103" to "N105" in the following program

(1) Program data in the specified range which starts from the edit line (>>) is transferred to the extract buffer.

(2) The edit pointer is placed at the first character of the line that is preceded by the last line of the specified range.

(3) Program data previously registered in the extract buffer is erased.

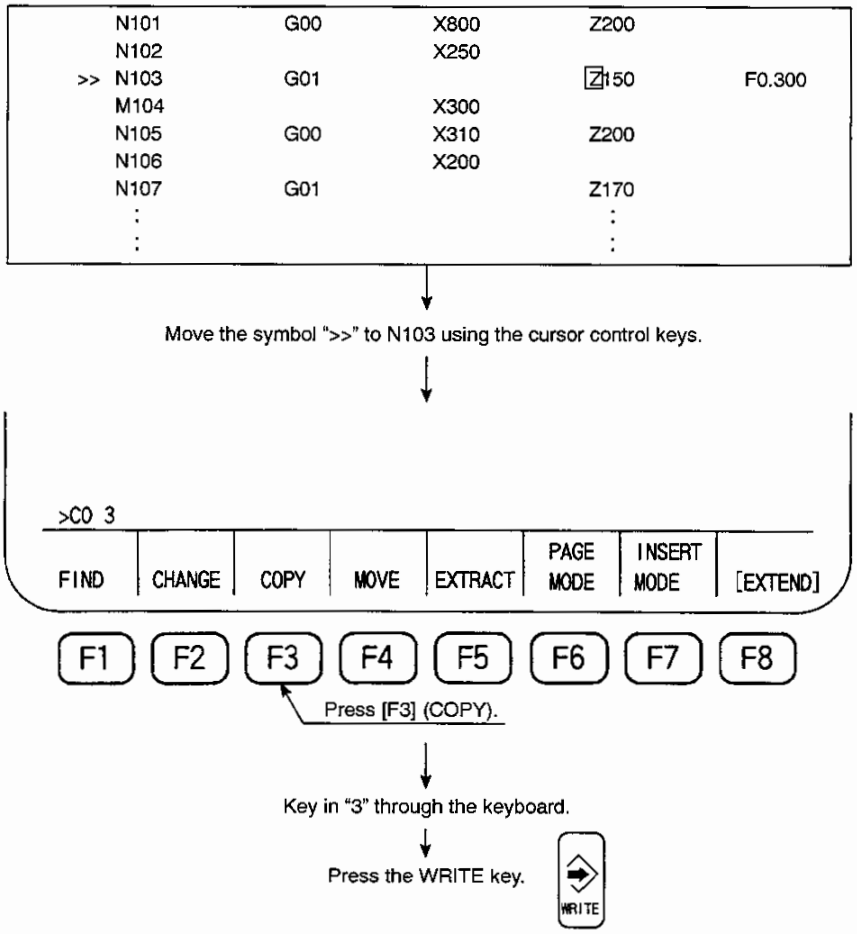
(4) When the specified number is larger than the last line of the file, program data up to the last line is transferred.

(5) When a negative number is specified, program data in the blocks preceding the edit line (edit line not included) is transferred.

When a negative number exceeding the first line of the file is specified, program data up to the first line of the file is transferred.

(6) Pressing the WRITE key without entering the number of lines causes program data in the edit line to be transferred.

(7) When an attempt has been made to transfer program data which is larger than the extract buffer, the message "extract buffer overflow" will appear on the display screen and copy operation is not executed.



5-11-2. Move

This function extracts program data in the specified range of a file and transfers it to the extract buffer.

Press function key [F4] (MOVE) after the range (in terms of lines) of program data to be transferred has been specified.

Example: To transfer blocks from "N103" to "N105" in the following program

(1) Program data in the specified range which starts from the edit line (>>) is transferred to the extract buffer.

(2) The lines transferred to the extract buffer are erased from the display screen.

(3) The edit pointer is shifted to the first character of the line next to the last line of transferred lines.

(4) Program data previously registered in the extract buffer is erased.

(5) When the specified number is larger than the last line of the file, program data up to the last line is transferred.

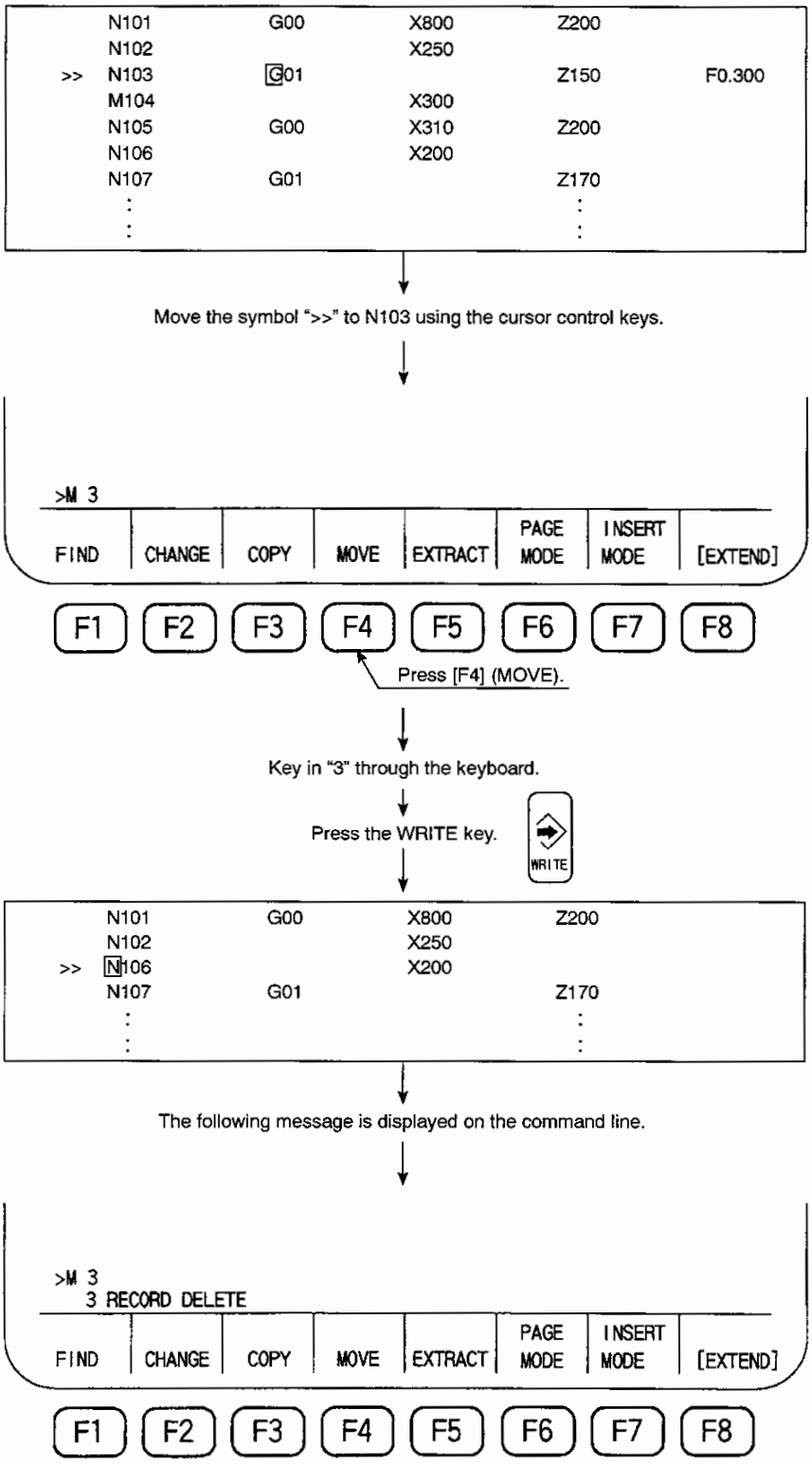
(6) After program data has been transferred, the message "**RECORD DELETE" appears on the command line. Here, "**" indicates the number of the specified lines.

(7) When a negative number is specified, program data in the blocks preceding the edit line (edit line not included) is transferred.

When a negative number exceeding the first line of the file is specified, program data up to the first line of the file is transferred.

(8) When an attempt has been made to transfer program data which is larger than the extract buffer, the message "extract buffer overflow" will appear on the display screen and move operation is not executed.

(9) Pressing the WRITE key without entering the number of lines causes program data in the edit line to be transferred.



5-11-3. Extract

This function inserts program data which is registered in the extra buffer before the edit line (>>).

Press function key [F5] (EXTRACT) and the WRITE key after the edit line has been selected.

Example: When the extra buffer data insert before the block "N203"

(1) Data in the extract buffer is inserted before the edit line (>>).

(2) Data in the extract buffer is not erased.

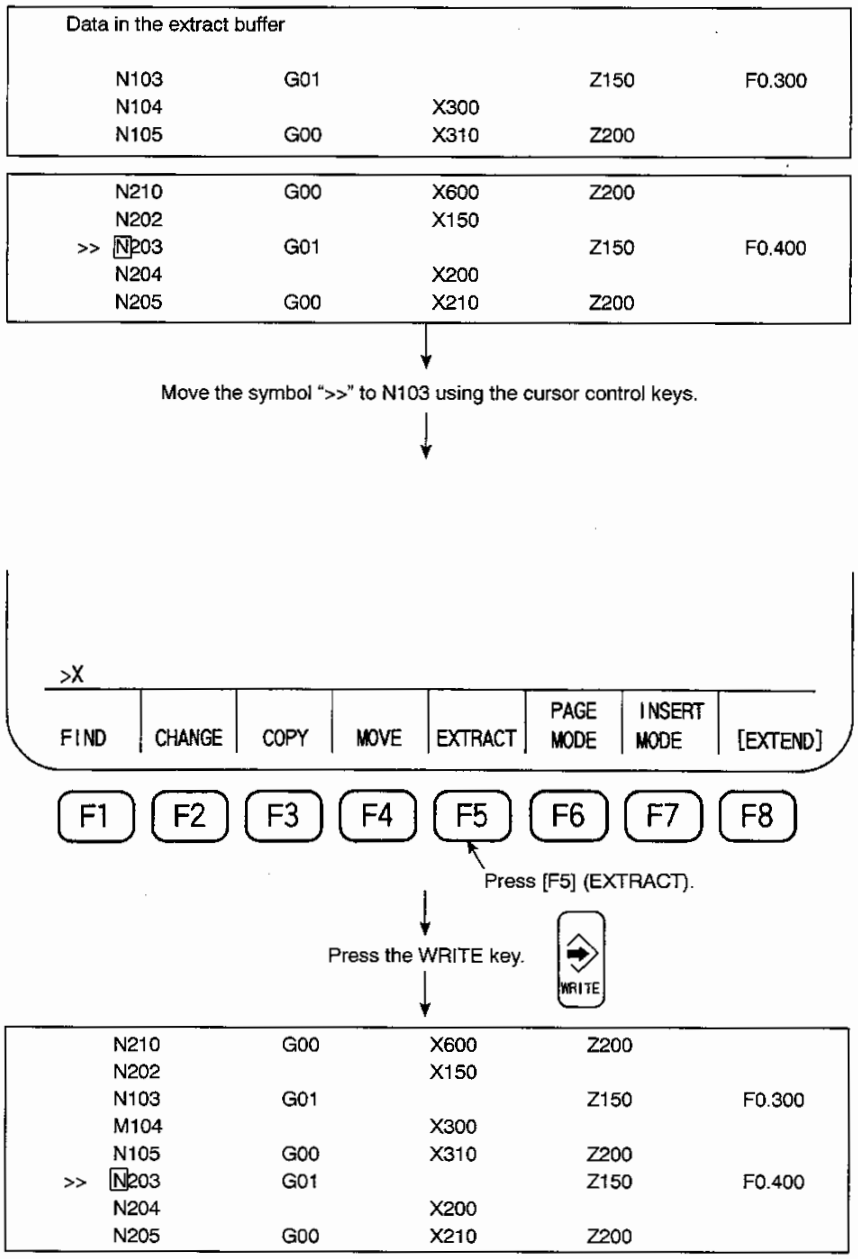
(3) The edit pointer remains at the same position.

(4) If no data is registered in the extract buffer when EXTRACT operation is attempted, the message "extract buffer empty" is displayed and data transfer is not initiated.

(5) To erase program data registered in the extract buffer, proceed as follows.

[F5] (EXTRACT);C [WRITE]

File data is not changed.



5-12. Page Mode

In the page mode (P mode), displayed screen is fixed and keying in of a character, etc. overwrites the existing screen data. For the input on the screen, insert mode (I mode) is also provided in which keyed in characters, etc. are inserted. For details of the insert mode, refer to 5-13. "Insert Mode".

This page mode is used in the following cases:

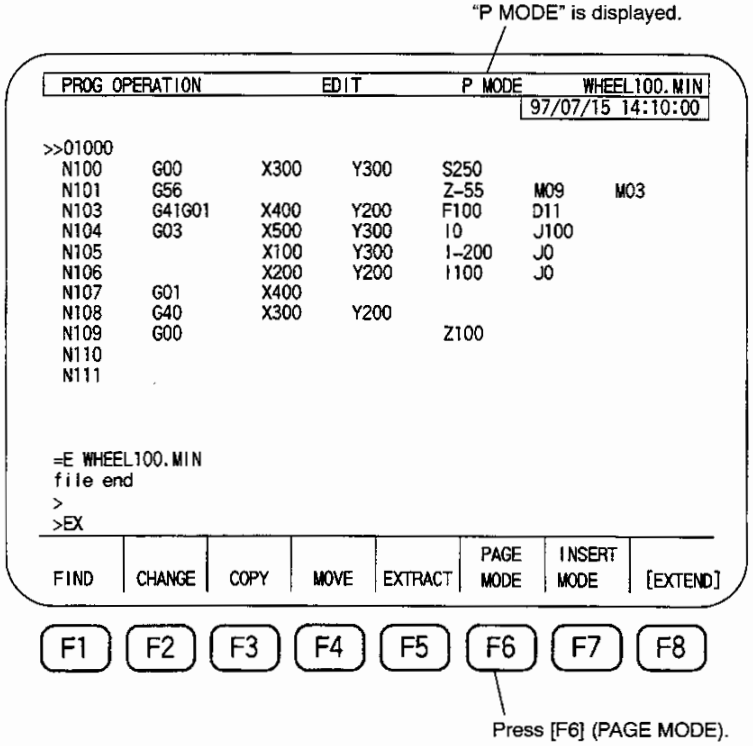
(1) creating a new file

(2) replacing one character in an existing file

(3) adding a character-string to the end of a line

The operating procedure is as indicated below.

Press function key [F6] (PAGE MODE) "P MODE" will be displayed on the 1st line of the screen.



(a) When a character is keyed in in the page mode, the cursor-located character is replaced by the keyed-in character and the cursor moves to the right. In other words, in the page mode, the cursor is moved to the right and the character (including a space) located by the cursor is replaced by a keyed-in character each time data is entered. Therefore, if an attempt has been made to assign a character-string many digits of characters, subsequent character data might be replaced.

(b) If one line has more than 63 characters, such a line is displayed in two lines on the screen with the second line preceded by "&". These lines are processed as one line. In this case, the edit pointer and the edit line move to the lower line.

(c) Each page has a total of 16 lines for edit operation.

When the WRITE key is pressed while the bottom line is designated as the edit line, 16 lines of data are shifted by one line each and a blank line is created on the 16th line. The edit line does not change and the edit pointer is placed at the beginning of that line.

(d) When the WRITE key is pressed while a line other than the bottom line is designated as the edit line, the edit line is moved to the subsequent line and the edit pointer is moved to the beginning of that line. This also applies to the insert mode.

(e) When the program cannot be displayed in one page (16 lines), press the page key (P↓) .

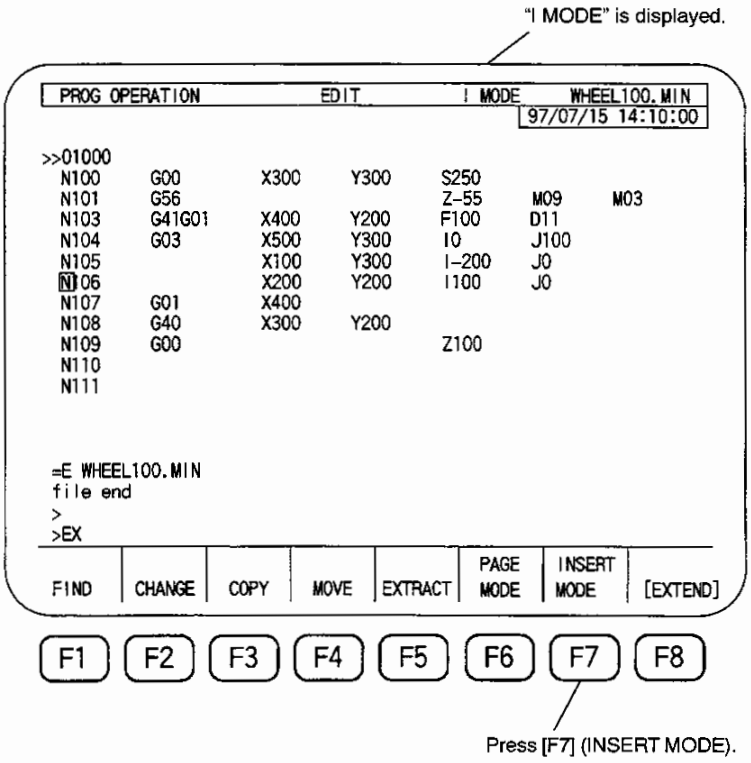
To return the display to the previous page, press the page key (P↑) .

5-13. Insert Mode

In the insert mode (I mode), keyed in characters are added to the data in the displayed file. For the input on the screen, page mode (P mode) is also provided in which keyed in characters, etc. overwrites the existing characters. For details of the page mode, refer to 5-12. "Page Mode".

The operating procedure is as indicated below.

(1) Press function key [F7] (INSERT MODE) "I MODE" will be displayed on the 1st line of the screen.



(a) Each time a character is keyed in in the insert mode, it is inserted before the edit pointer and the character-strings following the edit pointer are shifted by one character. When data is inserted successively and the currently displayed data has reached the right end, data is inserted in the next line that is preceded by "&". These lines are processed as one line.

(b) Each page has a total of 16 lines for edit operation.

When the WRITE key is pressed while the bottom line is designated as the edit line, 16 lines of data are shifted by one line each and a blank line is created on the 16th line. The edit line does not change and the edit pointer is placed at the beginning of that line.

(c) When the WRITE key is pressed while a line other than the bottom line is designated as the edit line, the edit line is moved to the subsequent line and the edit pointer is moved to the beginning of that line. This also applies to the page mode.

(d) When the program cannot be displayed in one page (16 lines), press the page key ⇩ .

To return the display to the previous page, press the page key ⇧ .

5-14. Power Failure/Shutdown during Editing

The function to avoid the file from being lost is provided even if power failure occurs or power is shut down by mistake during editing.

5-14-1. In-editing Comment

If power is shut down during editing, the following "in-editing comment" is attached to the first data block of the file having been edited.

```
'                                                    '
'                                                    '
'          "THIS FILE NEEDS EDITING AGAIN!'          '
'                                                    '
'                                                    '
'    '
'    '
'                    OKUMA MACHINERY WORKS LTD.'
```

This comment is deleted when the same file is read out from the memory.

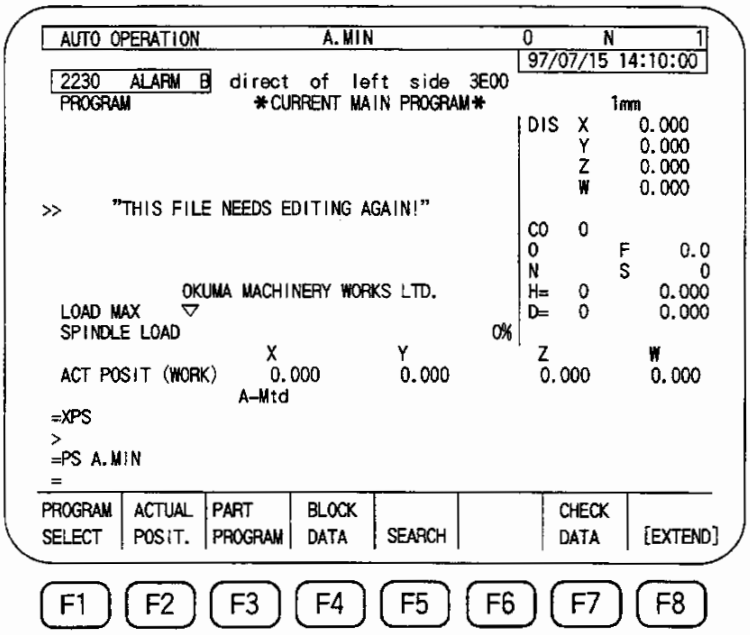
Note: This comment is not displayed on the edit screen.

5-14-2. Alarm

If the file with the "in-editing" comment is run, the following alarm occurs.

2230 Unusable: direct of left side

If this alarm message is displayed, read out the same file from the memory and complete editing.



To give warning to an operator, the following alarm is displayed on the screen when the power is turned on after the power was shut down during editing. In this case, an error file name is stored to the file of "MD0:ERROR.BAK" (or "MD0:ERROR.LOG").

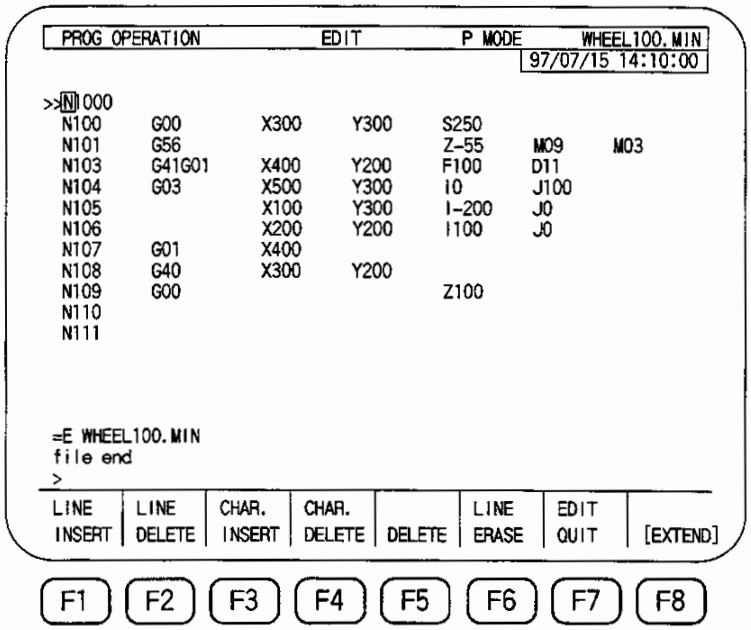
4248 Error File

5-14-3. Not-guaranteed Area Indicating Symbol

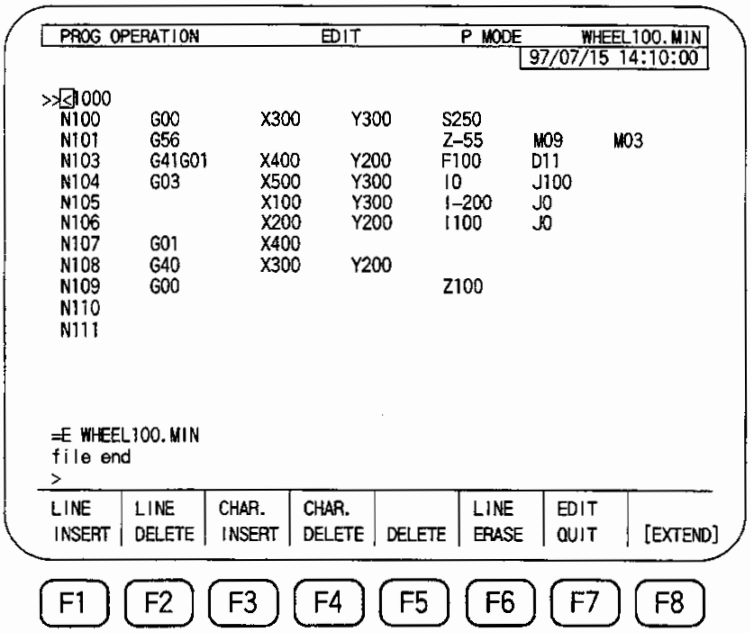
If the power is shut down during editing, the first character of the program displayed on the screen (16 lines × 63 columns) where a character was changed or added last is replaced with the not-guaranteed area indicating symbol "<".

Note that this replacement occurs only when "1" is set for NC optional parameter (bit) No. 16, bit 4.

Example: NC optional parameter (bit) No. 16, bit 4 = 0



Example: NC optional parameter (bit) No. 16, bit 4 = 1

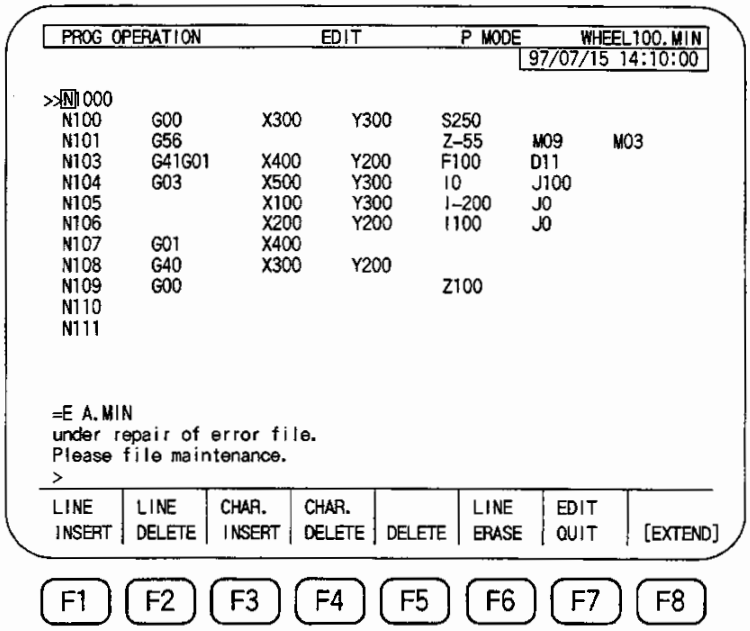


5-14-4. File Edit Starting Processing

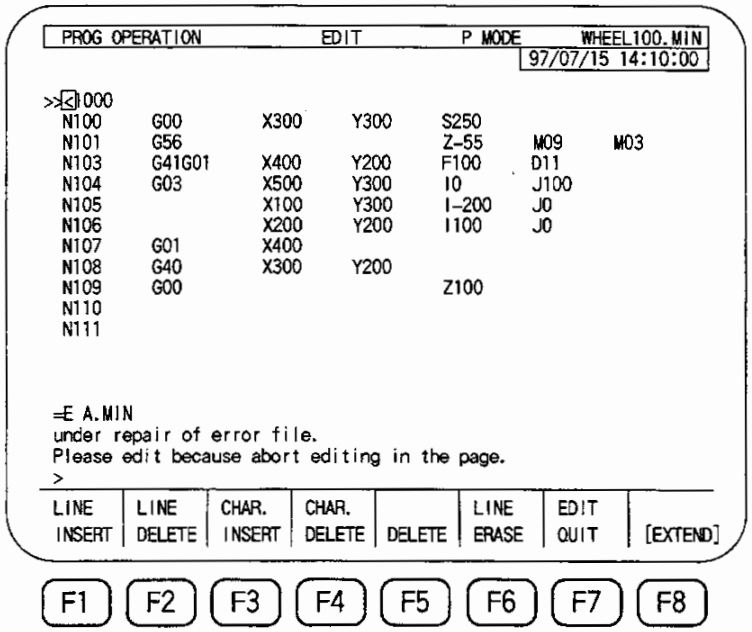
If the first data block of a file, selected for editing, is the "in-editing" symbol (see 5-14-1), the message of "under repair of error file." is displayed.

If the file includes the "not-guaranteed area" symbol (see 5-14-3), the screen where the "not-guaranteed area" symbol is included is displayed.

Example: File not including the "not-guaranteed area" symbol



Example: File including the "not-guaranteed area" symbol



6. Multi-file Transfer (MPIP)

The MPIP command is used to transfer multiple part program files at a time using the RS232C interface.

The following sub commands are provided.

Item	Command	Function
Multi-file read	MR	Reads multiple part program files from an external device and stores them to the memory.
Multi-file punch	MP	Outputs multiple part program files, stored in the memory, to a tape punch.
Multi-file verify	MV	Verifies multiple part program files, in an external device, against those in the memory.
Multi-file transfer end	Q	Quits the multi-file transfer mode.

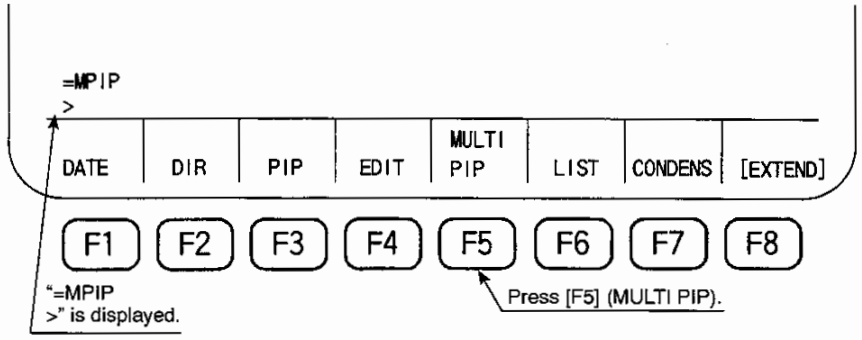
NOTICE : During file transfer processing, do not turn off the power supply. If the power supply is turned off during file transfer, the contents of file might be destroyed.

6-1. Multi-file Read

The multi-file read function reads multiple part programs from the external device and store them in the NC memory.

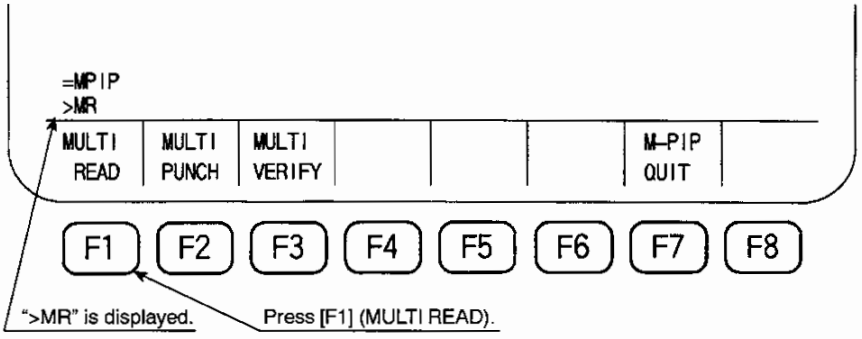
The operation procedure is indicated below:

(1) Press function key [F5] (MULTI PIP).



The function key names change as indicated in item (2).

(2) Press function key [F1] (MULTI READ).



"MR" is displayed on the console line.

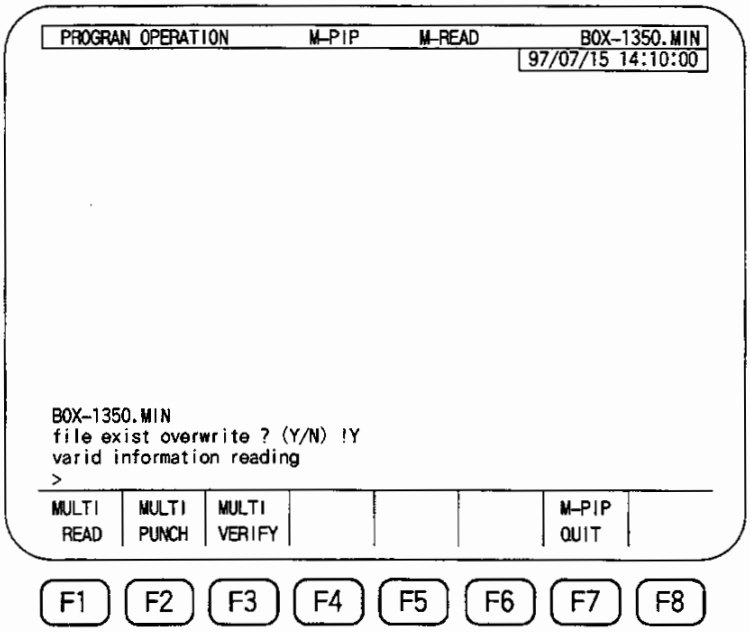
(3) Following ">MR", enter the file name of the file to be read using the keyboard and press the WRITE key.

The machining programs are read and stored in the NC memory.

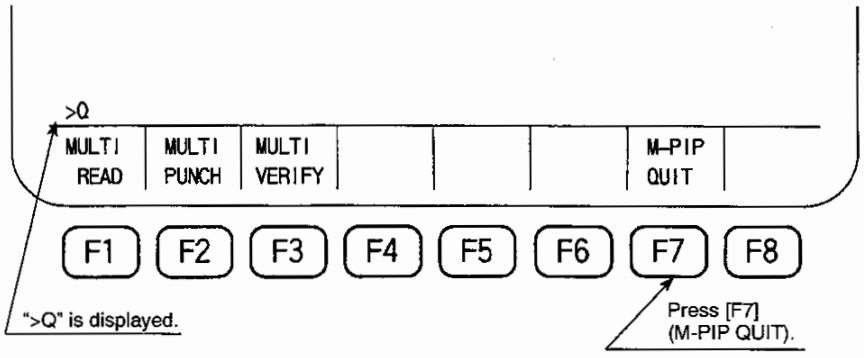
While the program is being read, "M-READ" and the file name are displayed at the upper right area of the screen.

After the start of program reading, "Valid information reading" is displayed on the console line.

At the completion of reading, ">" appears on the console line.



(4) Press function key [F7] (M-PIP QUIT).



The function key names return to those as displayed in item (1).

[Supplement]

Command format

>MP <input-device:><input-file-name><,<output-device:>><;option>WRITE

(a) input-device:

TT:, CN0:, CN1:, CN2:, CN3:, CN4:

If no input-device name is specified, the default device set for optional parameter (word) No. 57 is selected. (If "0" is set for this parameter, CN0: is selected.)

(b) input-file-name

Main file name: Alphanumerics (max. 16 characters), beginning with an alphabetical letter. Wild card ("*", "?") can be used.

Extension : Alphanumerics (max. 3 characters), beginning with an alphabetical letter. Wild card ("*", "?") can be used.

(c) output-device:

MD0:, MD1:, FD0:, FD1:, FD2:, FD3:

Default device is MD1:.

(d) option

Y: Unconditional overwrite; if the file of the same file name to be output already exists in the specified output device, the file is unconditionally overwritten in this operation.

[Supplement]

1. If the text (tape data) read from the input device does not agree with the specified input file name, it is skipped and not stored to the output device.
2. If input file name is omitted, input file name of "*.*" is assumed and all read texts are stored to the specified output device.
3. If available space in the output device becomes full during reading, an error occurs and communication is shut off. In this case, the file being read is not stored.
4. If the file of the same file name already exists in the output device while no option Y is specified, the following messages are displayed on the console line.

   A.MIN
   file exist overwrite ? (Y/N) !

   If "Y" is input, the existing file is overwritten, and if "N" is input, the text to be read is skipped and the next file is read.
5. If an output file name is specified, an error occurs.

   5213 File name, error 11
6. If the read file agrees with the file selected for DNC-B mode operation, the text to be read is skipped and the next file is read.

   5226 Main program file selecting 'A.MIN
7. If the read text already exists in the output device and if it is protected, the text to be read is skipped and the next file is read.

   'A.MIN File write protect

Example 1: >MP ∗.MIN [WRITE]

All files with extension ".MIN" are read and stored to MD1:.

Example 2: >MP BOX1???.MIN [WRITE]

All files beginning with "BOX1" and with extension ".MIN" are read and stored to MD1:. Files such as BOX1001.MIN and BOX1002.MIN are read.

Example 3: >MP [WRITE]

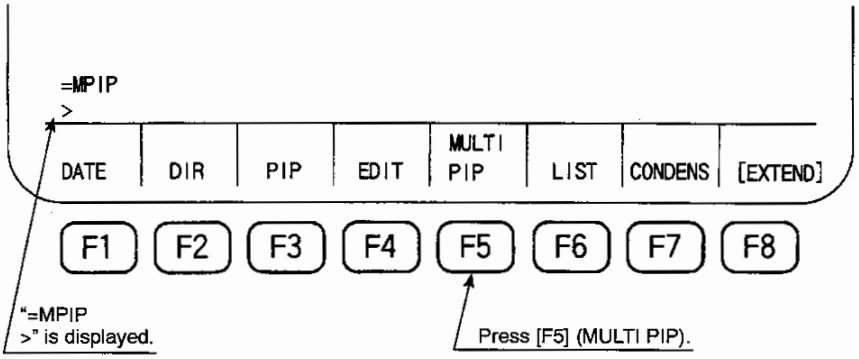
All input files are read and stored to MD1:.

6-2. Multi-file Punch

The multi-file punch function outputs multiple part programs, stored in the NC memory, to the punch device.

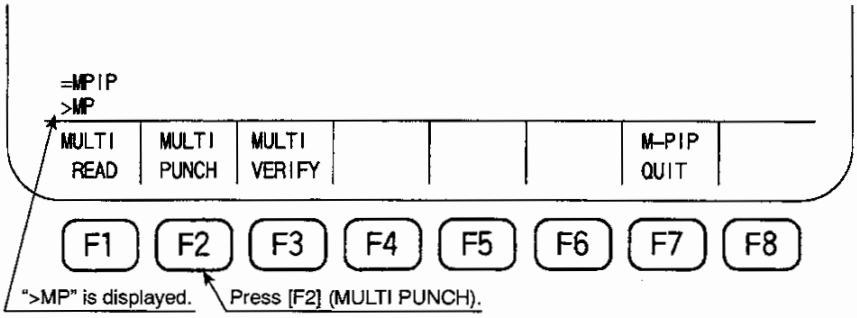
The operation procedure is indicated below:

(1) Press function key [F5] (MULTI PIP).



The function key names change as indicated in item (2).

(2) Press function key [F2] (MULTI PUNCH).



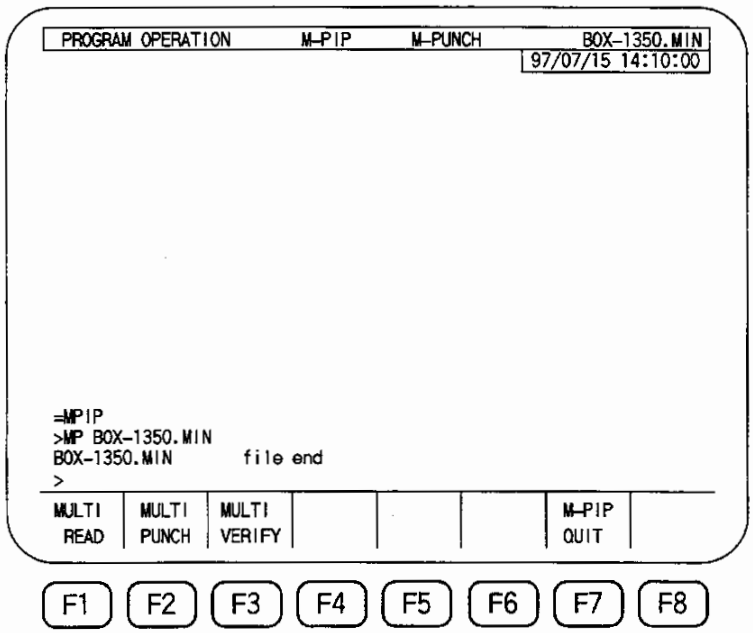
"MP" is displayed on the console line.

(3) Following ">MP", enter the file name of the file to be output to the punch device using the keyboard and press the WRITE key.

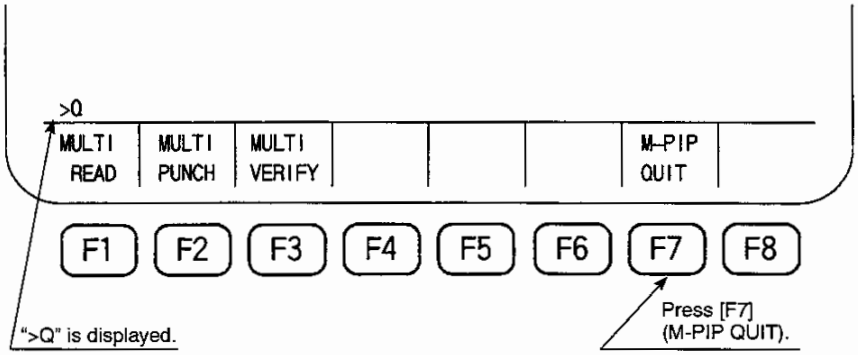
The part programs are output to the punch device.

While the program is being output to the punch device, "M-PUNCH" and the file name are displayed at the upper right area of the screen.

At the completion of output, "file end" appears on the console line, then ">" appears.



(4) Press function key [F7] (M-PIP QUIT).



The function key names return to those as displayed in item (1).

[Supplement] 1.

Command format

>MV <input-device:><input-file-name><,<output-device:>><;option>WRITE

(a) input-device:

MD0:, MD1:, FD0:, FD1:, FD2:, FD3:

Default device is MD1:.

(b) input-file-name

Main file name : Alphanumerics (max. 16 characters), beginning with an alphabetical letter. Wild card ("*", "?") can be used.

Extension : Alphanumerics (max. 3 characters), beginning with an alphabetical letter. Wild card ("*", "?") can be used.

(c) output-device:

TT:, CN0:, CN1:, CN2:, CN3:, CN4:

If no output-device name is specified, the default device set for optional parameter (word) No. 45 is selected. (If "5" is set for this parameter, CN0: is selected.)

(d) option

P: Only protected files are output.
C: Only files which are not protected are output.

2. If input file name is omitted, input file name of "*.*" is assumed and all files are output to the punch device.

3. If none of the specified files exists in the input device, file is not output.

File not found

4. If an output file name is specified, an error occurs.

5213 File name, error 11

5. If only one file is output, it does not cause an error.

Example 1: >MP *.MIN [WRITE]

All files with extension .MIN in MD1: are output.

Example 2: >MP BOX1???.MIN [WRITE]

All files beginning with "BOX1" and with extension ".MIN" in MD1: are output. Files such as BOX1001.MIN and BOX1002.MIN are output.

Example 3: >MP [WRITE]

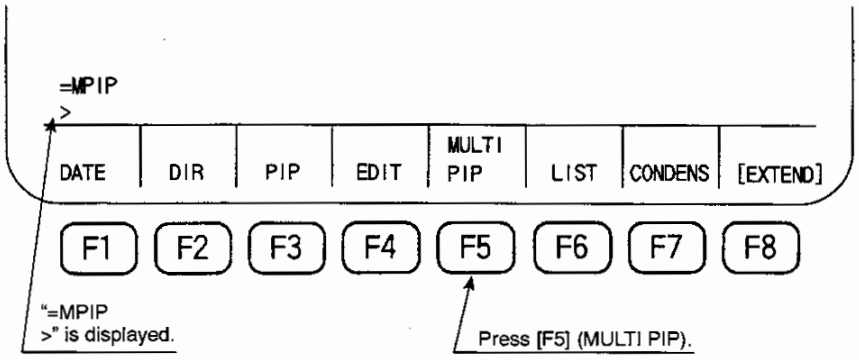
All files in MD1: are output.

6-3. Multi-file Verify

The multi-file verify function verifies multiple machining programs, stored in an external device, against those in the NC memory.

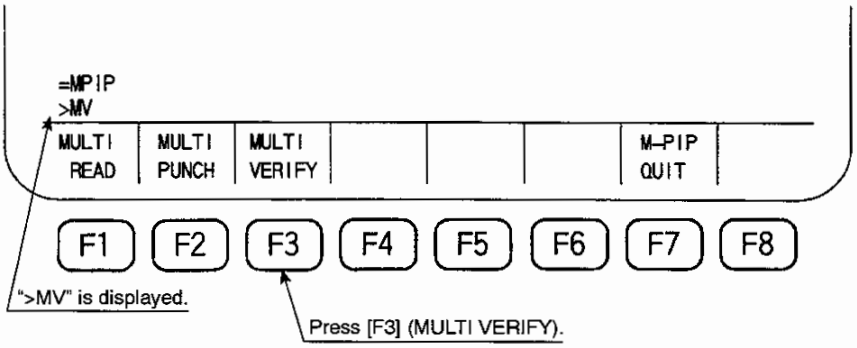
The operation procedure is indicated below:

(1) Press function key [F5] (MULTI PIP).



The function key names change as indicated in item (2).

(2) Press function key [F3] (MULTI VERIFY).

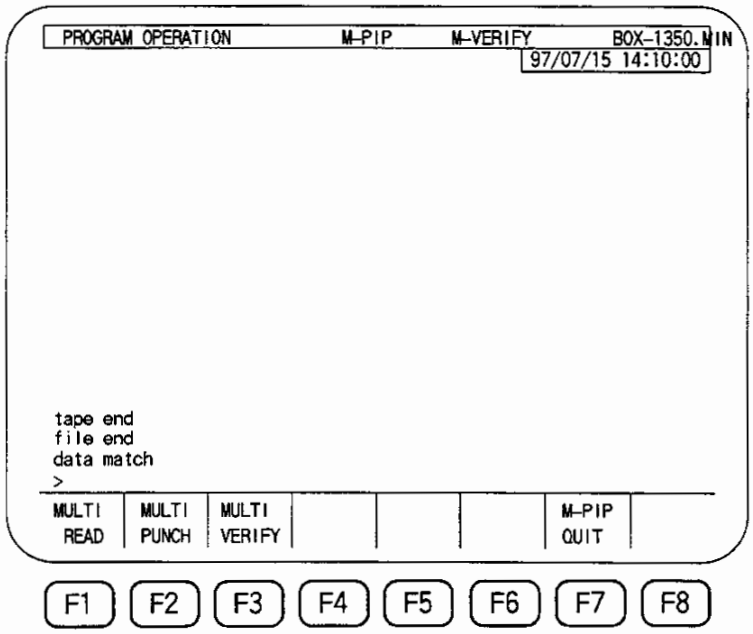


"MV" is displayed on the console line.

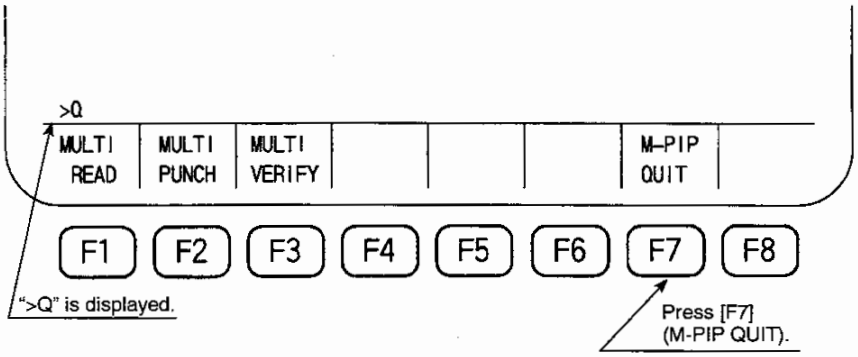
(3) Following ">MV", enter the file name of the file to be verified using the keyboard and press the WRITE key.

The specified part programs are read and compared to those stored in the NC memory.

While the program is being verified, "M-VERIFY" and the file name are displayed at the upper right area of the screen.



(4) Press function key [F7] (M-PIP QUIT).



The function key names return to those as displayed in item (1).

[Supplement] 1.

Command format

>MV <input-device:><input-file-name><,<output-device:>>WRITE

(a) input-device:

TT:, CN0:, CN1:, CN2:, CN3:, CN4:

If no input-device name is specified, the default device set for optional parameter (word) No. 57 is selected. (If "0" is set for this parameter, CN0: is selected.)

(b) input-file-name

Main file name : Alphanumerics (max. 16 characters), beginning with an alphabetical letter. Wild card ("*", "?") can be used.

Extension : Alphanumerics (max. 3 characters), beginning with an alphabetical letter. Wild card ("*", "?") can be used.

(c) output-device:

MD0:, MD1:, FD0:, FD1:, FD2:, FD3:

Default device is MD1:.

2. If the text (tape data) read from the input device does not agree with the specified file name, it is skipped and not verified.

In this case, the following message is displayed.

5210 Input file name not same α '(tape) file name'
α: Number of unmatched files

If no files match with the tape data, the following message is displayed at the end.

5210 Input file name not same error β
β: Total number of unmatched files

3. If input file name is omitted, input file name of "*.*" is assumed and those which match the read texts are verified.

4. If unmatch is found, the corresponding line is displayed on the console line with unmatch character blinking on and off.

The message "verify continuing (Y/N) !" is displayed. To continue verify, input "Y", then the program verify restarts from the next line. If "N" is input, the file containing the unmatch is skipped and program verify is executed from the next file.

For each file, the result of verify is displayed:

(a) If all data matched, the following message is displayed and the next file is continuously verified.

tape end . file end . data match .

(b) If file data remains although text (tape data) has been read to the end, the following message is displayed on the console line and the next file is continuously verified.

tape end
data match

(c) If tape data remains although file data has been read to the end, the following message is displayed on the console line and the next file is continuously verified.

5. If an output file is output, it does not cause an error.

5213 File name, error 11

Example 1: >MV *.MIN [WRITE]

Verify is made with the files which have the same file name as the input files, having extension .MIN.

Example 2: >MV BOX1???.MIN [WRITE]

Verify is made with the files which have the same file name as the input files, having extension .MIN and beginning with BOX1. The files such as BOX1001.MIN and BOX1002.MIN are examples of such files.

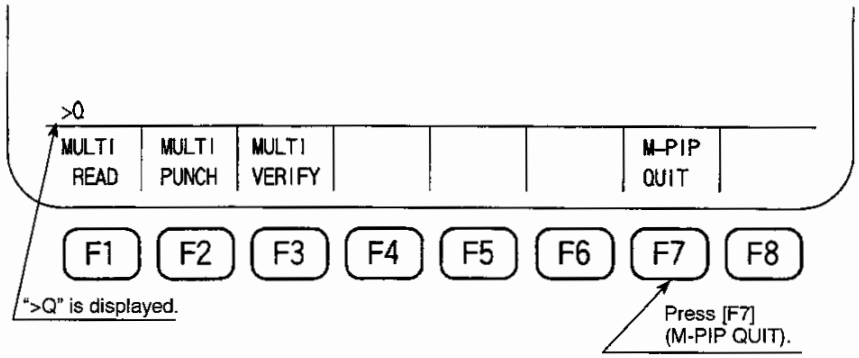
Example 3: >MV [WRITE]

Verify is made for all input files with the files having the same file name.

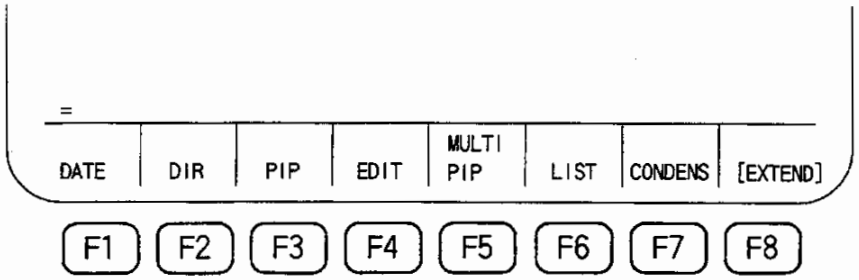
6-4. Quitting Multi-file Transfer

This function is used to quit the multi-file transfer mode and to return to the program operation mode.

(1) Press function key [F7] (MULTI QUIT).



">Q" is displayed on the console line and the system quits the multi-file transfer mode. The screen returns to the program operation mode screen and the function key names as indicated below are displayed.

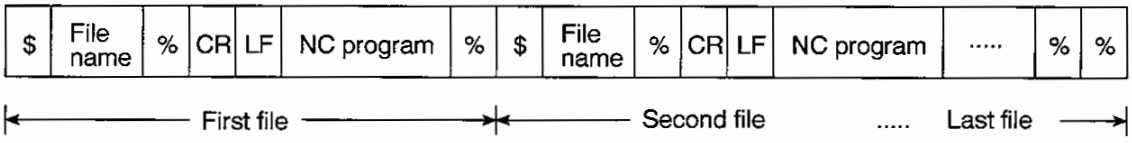


6-5. Notes on Using Multi-file Transfer Sub Commands

(1) Communication Text Format

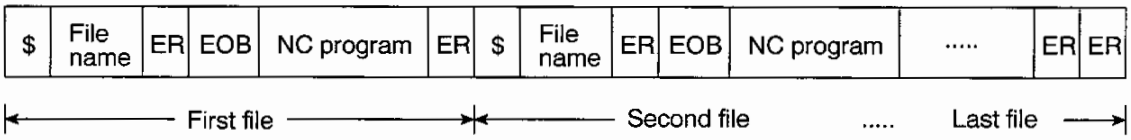
The text format used in multi-file transfer operation differs from the format used in a single file transfer operation. The format used in multi-file transfer operation is indicated below.

(a) ISO code



1) The file name is preceded by "$" symbol.
2) The data which follows "% CR LF" is regarded as the machining program.
3) The program end code is fixed to "%". (NULL code is not allowed.)
4) The end of communication code is fixed to "%%". (NULL code is not allowed.)
5) Leading and trailing feed holes (NULL or space) are not provided.

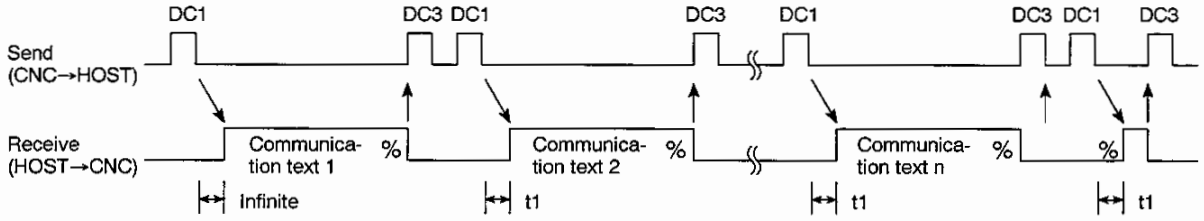
(b) EIA code



1) A file name is preceded by "$" symbol (set for optional parameter (bit) No. 31).
2) The data which follows "ER EOB" is regarded as the part program.
3) The program end code is fixed to "ER". (NULL code is not allowed.)
4) The end of communication code is fixed to "ER ER". (NULL code is not allowed.)
5) Leading and trailing feed holes (NULL or space) are not provided.

(2) Timing Chart

(a) Multi-file read and multi-file verify (CNC: master)



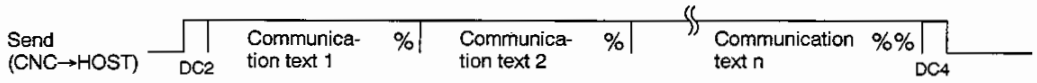
[Supplement] 1. The DC3 code is output in the following cases.

(1) Just after receiving the text file name
(2) Just before writing text name to output device (every 252 characters)
(3) Just after receiving "%" code at the end of a part program
(4) Just after receiving "%%" code which indicates the end of communication.

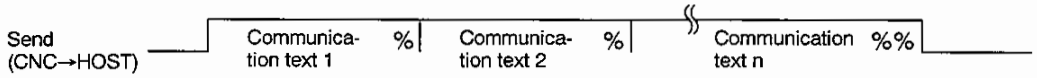
2. t1

"t1" indicates the "RS232C ready wait time" set for parameter.

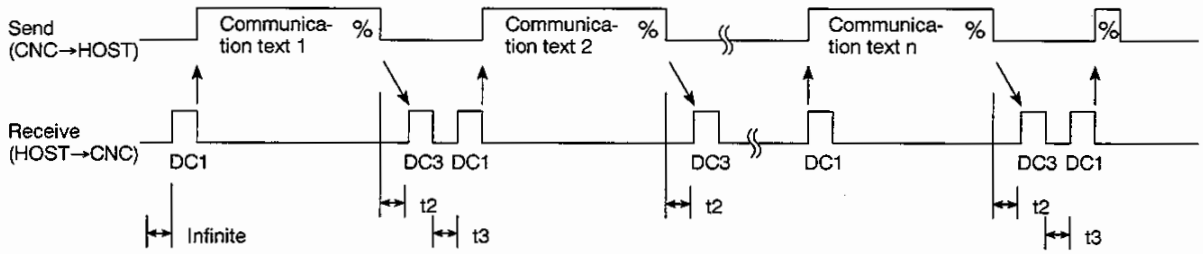
(b) Multi-file punch (CNC: master, DC2/DC4 code output)



(c) Multi-file punch (CNC: master, DC2/DC4 code not output)



(d) Multi-file punch (CNC: slave)



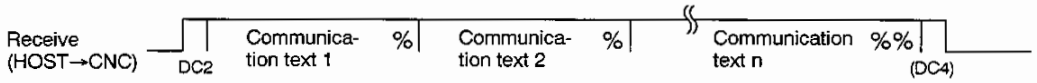
[Supplement] 1. t2

"t2" indicates the "RS232C ready wait time" set for parameter.

2. t3

"t3" indicates the "RS232C ready wait time" set for parameter.

(e) Multi-file read and multi-file verify



(3) Parameter Settings

Before connecting an external device, it is necessary to set the following parameters.

For details of parameters, refer to III "PARAMETERS".

(a) Optional parameter (bit) No. 1, 8, 12, 13, 14, 21, 22, 40

[Supplement]

1. In multi-file transfer operation, since the tape delimiter code is fixed to "%" or "ER", the parameter (No. 1, bit 3) used for this setting is not used.
2. Verify in tape reading is effective only when the input device is TR: (tape reader). Therefore, the parameter (No. 1, bit 4) used to set the device is not used in multi-file transfer operation.
3. The multi-file transfer operation supports only standard DC code. Therefore, if the parameter setting* is for "DC code control type 2" or "no DC code control", an error occurs.

   Bit 5 and 6 of No. 8, 13, 14, and 15:

   Setting should be ON for bit 5 and OFF for bit 6.

   5261 Device name error 1 'CN0'

   ↑

   Varies depending on the selected device name
4. In multi-file transfer operation, since file name punch is fixed to "yes", the parameter (No. 12, bit 2) used for this setting is not used.
5. In multi-file transfer operation, since feed hole punch is fixed to "no", the parameter (No. 12, bit 4 and bit 5) used for this setting is not used.

(b) Optional parameter (word) No. 6, 34 to 42, 45, and 57

[Supplement]

1. In multi-file transfer operation, if "5" is set in the punch device name designation (No. 45), it selects "CN0:" instead of "PP:".
2. In multi-file transfer operation, if "0" is set in the tape read device name designation (No. 57), it selects "CN0:" instead of "TR:".

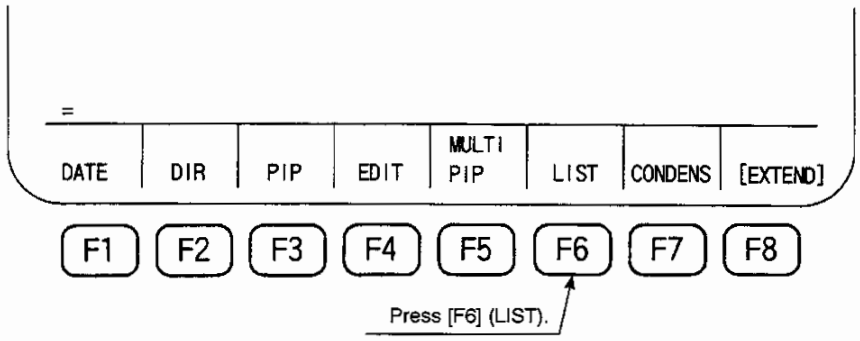
7. List

The list function outputs the list of a file to the display screen, printer, or other external device.

This section describes the details of the list function using the screen for the output device.

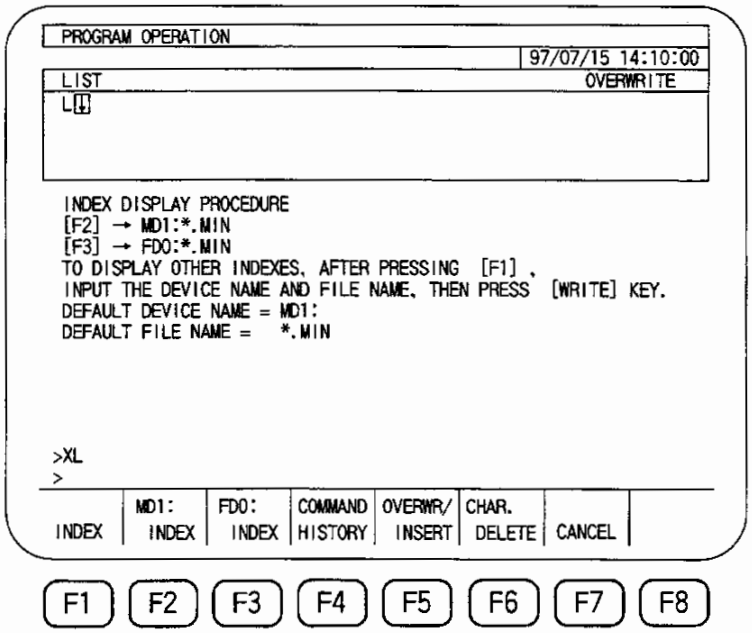
The operating procedure is indicated below.

(1) Press function key [F6] (LIST).



The screen changes to the directory-selection-based file operation screen and the following is displayed on the screen.

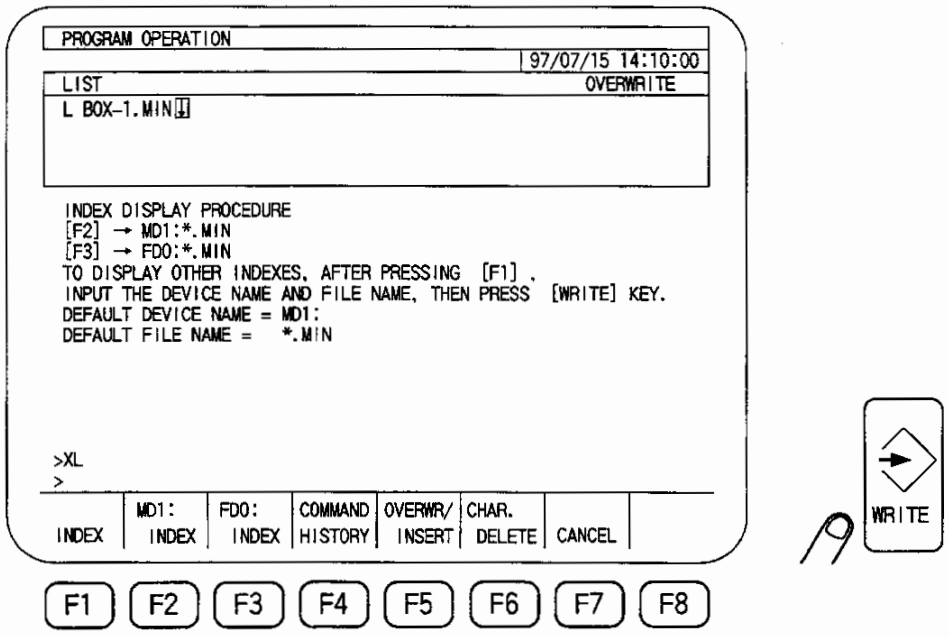
LIST
L



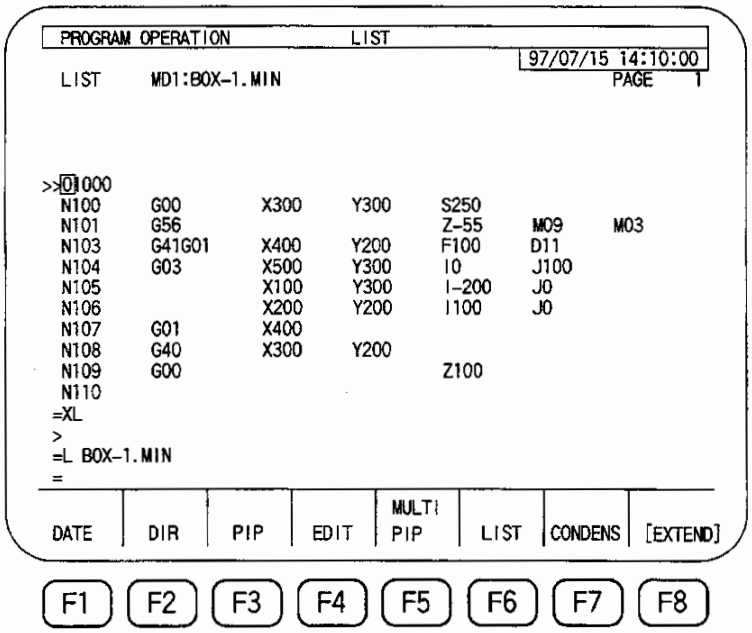
(2) Enter the file name of the file for which the list should be displayed and press the WRITE key.

Example: BOX-1.MIN

Note that it is not necessary to input the file name for the program for which file name is not specified. In other words, for outputting the list of A.MIN, input of the file name is not required.



The list of file BOX-1.MIN is output to the screen.



[Supplement] 1. The list of a file is displayed in units of 12 lines per page.

If the list cannot be displayed on one page, the "=" code which indicates that the control is waiting for next command input is not displayed on the command line and the cursor remains as it was. Possible operations and the results are as indicated below.

(a) When the BS key is pressed, the display page will advance by one.

(b) When the WRITE key is pressed, the display page will advance continuously up to the last page. To stop it, press the BS key.

(c) When the CANCEL key is pressed, the command is aborted with the display page unchanged.

Example: When the list of a file is large

(1) press function key [F6] (LIST) and the WRITE key. This will display the first page of the list.

(2) press the BS key repeatedly until the required page is obtained.

(3) press the CANCEL key to abort operation.

(4) the next function can be started with the display unchanged.

2. When a file name has not been entered, the screen will display the list of the file "A.MIN". That is, pressing the WRITE key without entering a file name has the same effect as entry of the file name "A.MIN".

3. The device name to which the list of a file is output can be specified following the file name.

Each output device is provided with a code as specified below.

Display screen on the NC operation pane	:	PN
Printer	:	PR
Teletypewriter	:	TT

Specify the code of the output device folio wing the file name with a delimiter "," placed between them. Key in ":" after the output device code.

When an output device code is not specified, the system selects the display screen on the operation panel as the output device.

Example 1: = L␣ ,PR: [WRITE]

The list of the file named A.MIN is output to the printer.

Example 2: = L␣ BOX-1.MIN,TT: [WRITE]

The list of the file named BOX-1.MIN is output to the teletypewriter.

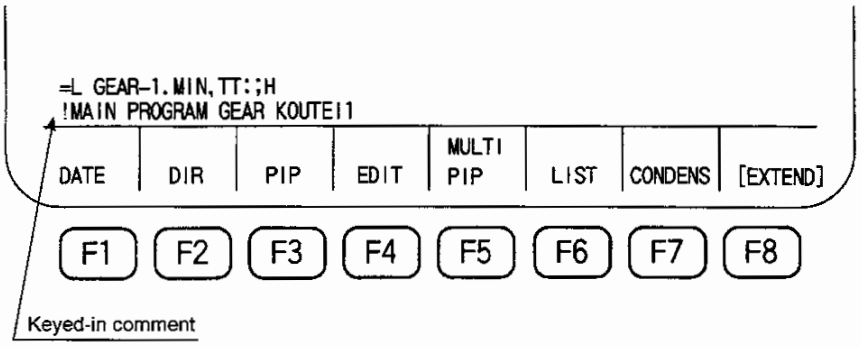
[Supplement] 4. The option code ";H" allows the operator to add a comment at the beginning of the list page. Key in ";H" following the output device.

Example: L␣ GEAR-1.MIN,TT:;H [WRITE]

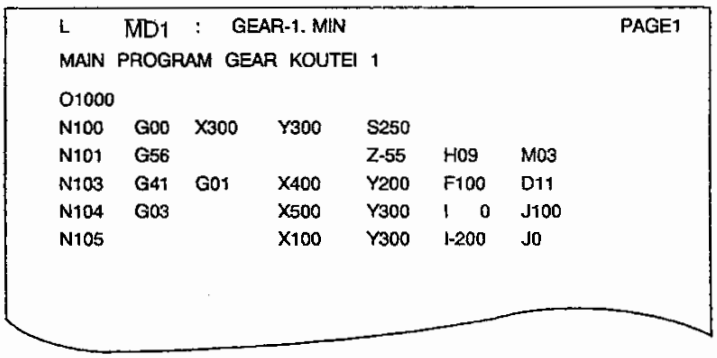
When the instructions indicated above are keyed in, the prompt "!" will appear on the command line, indicating that a comment can be entered.

A comment consisting of a maximum of 60 characters can be entered in through the keyboard.

When a command has been entered, press the WRITE key. List output will start.



List output to the teletypewriter is as shown below. The comment is output to on each list page.



8. Data Arrangement in Memory

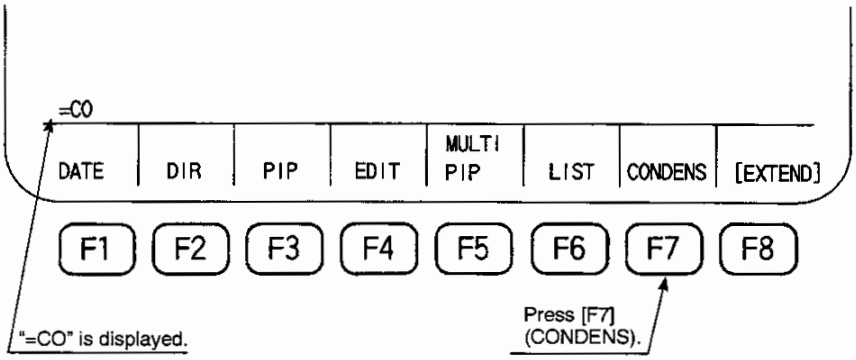
When the program stored in the memory is edited repeatedly, the unusable area in the memory will increase. This decreases the available capacity of the memory and restricts the number of programs to be stored.

This function is used to arrange data in the memory so that it can be used effectively.

The operating procedure is as indicated below.

(1) Press function key [F7] (CONDENS).

"=CO" is displayed on the console line.



(2) Press the WRITE key.

Arrangement of data in the memory will start.

After the completion of arrangement, the prompt "=" will appear on the command line.

9. Time

The NC's clock function contains counting time even when the power is turned off. Therefore, when the power is turned on, the current time is displayed.

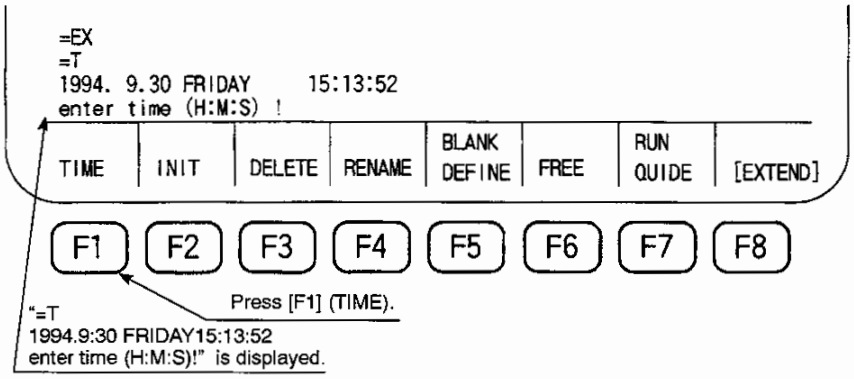
NOTICE : Since this time data is very important for the functions such as MacMan, alarm log, etc., do not change it inadvertently.

The operating procedure is as indicated below.

(1) Press function key [F1] (TIME).

The following is displayed on the console line and the system becomes ready for the input of time.

```
=T
1994.9.30 FRIDAY 15:13:52
enter time (H:M:S)!
```



(2) Key in the present time through the keyboard: hours, minute, and second, each delimited by ":".

Example: 8:30:5

(3) Press the WRITE key.

When time data has been entered correctly, the screen displays the set date, day of the week, and time.

If time data has not ben entered correctly, the screen displays "enter time (H:M:S)!" again, requesting the operator to enter correct data.

[Supplement]

1. When time data only needs to be checked and does not need to be set, simply press the WRITE key. The TIME command will terminate.
2. The data setting range is as follows.

   Hour : 0 through 23

   Minute : 0 through 59

   Second : 0 through 59
3. After 23-hour 59-minute 59 second, the time changes to 0-hour 0-minute 0-second and the date and the day of the week change.

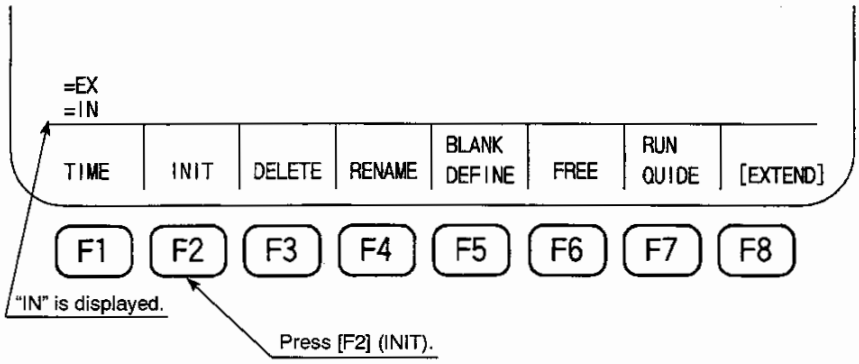
10. Initializing

This function initializes the storage device such as memory and floppy disk. When this function is activated, all the data in the storage device will be deleted.

The operating procedure is as indicated below.

(1) Press function key [F2] (INIT).

"IN" is displayed on the console line.



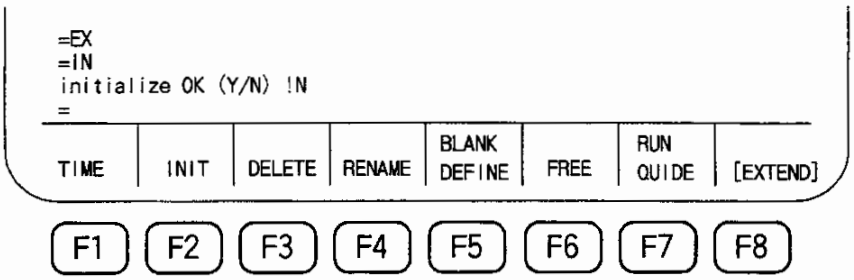
(2) Enter the device name, MD1: or FD0:.

The default is MD1:.

(3) Press the WRITE key.

The indication as shown below will appear on the screen, requiring the operator to respond.

```
=IN
Initialize OK (Y/N) !
```



(4) To initialize the device, type Y. To abort operation, type N.

(5) Press the WRITE key.

When "Y" has been typed and the WRITE key has been pressed, the storage device will be initialized.

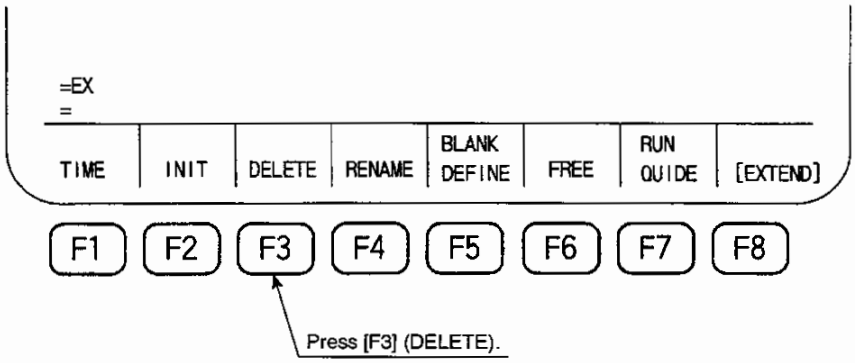
When "N" has been typed and the WRITE key has been pressed, initialization will be aborted.

11. Deletion

This function deletes the specified file in the memory (MD1:) or a floppy disk (FD0:).

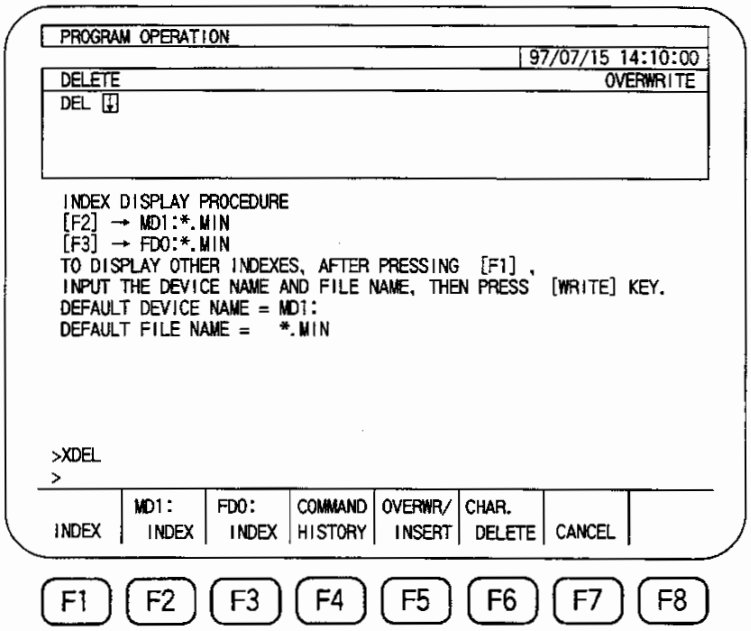
The operating procedure is as indicated below.

(1) Press function key [F3] (DELETE).



The screen changes to the directory-selection-based file operation screen and the following is displayed on the screen.

DELETE
DEL



(2) Following "DEL", enter the device name, MD1: or FD0:.

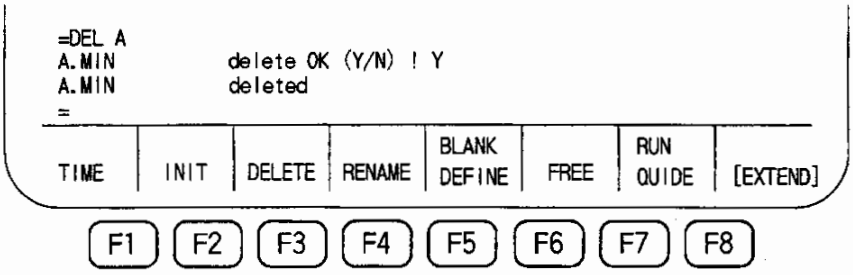
The default is MD1:.

(3) Press the WRITE key, and the following message is displayed on the console line.
A.MIN delete OK (Y/N) !

Type Y and press the WRITE key. The file of "A.MIN" is deleted and the following message appears on the screen on completion of deletion.

A.MIN deleted

To abort operation, type N and press the WRITE key.



[Supplement]

1. To delete a file other than A. MIN, specify a file name.

   The file name extension .MIN can be omitted.

   Example:

   Can be omitted

   ABC.MIN DEL ABC
   ABC.SUB DEL ABC.SUB

2. When the specified file name does not exist in the storage device, the message "no file" is displayed on the command line.

3. Symbols "?" and "*" can be used to specify a file name.

   Functions of these symbols are the same as explained in 3. "DIRECTORY".

   Example:
   - DEL * ..... Files whose file name extension is .MIN are all deleted.
   - DEL *.SUB ..... Files whose file name extension is .SUB are all deleted.
   - DEL BOX*.* ... Files whose main file name begins with BOX are all deleted.
   - DEL *.* ..... All files are deleted.
   - DEL ???.SUB ... Files whose main file name consists of up to three characters followed by the extension .SUB are all deleted.

4. Option code for file deleting operation

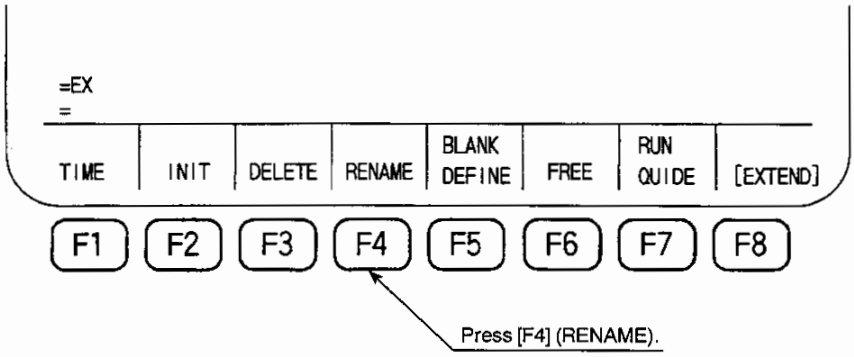
   When the code ";C" is specified following the file name, it is possible to display the file name of the file to be deleted and delete the file without confirmation.

12. Rename

This function changes the name of the file stored in the memory.

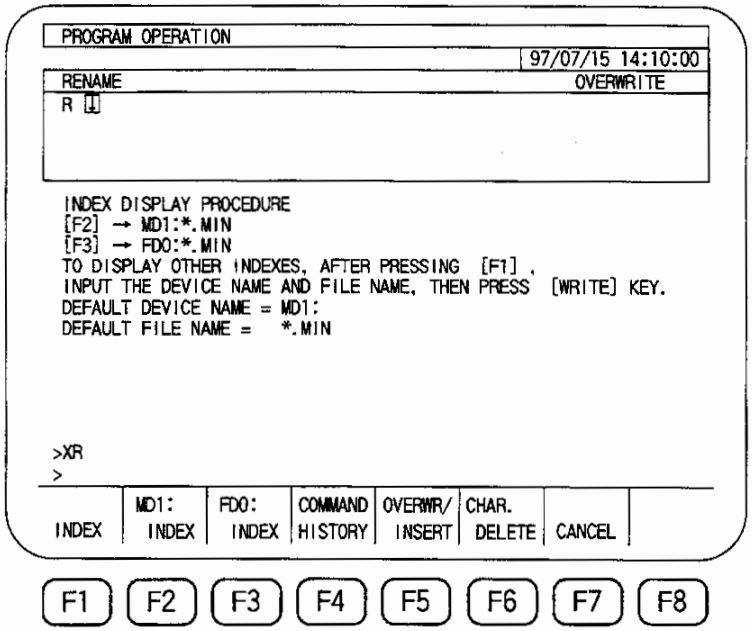
The operating procedure is as indicated below.

(1) Press function key [F4] (RENAME).



The screen changes to the directory-selection-based file operation screen and the following is displayed on the screen.

RENAME
R



(2) Following "R", first key in the current file name and then key in the new file name with a comma "," placed between them.

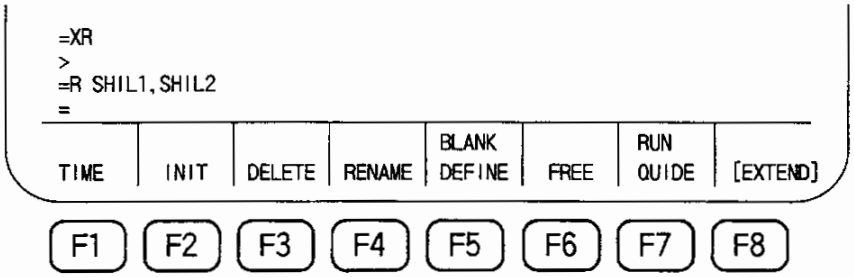
Example: R␣ SHIL1,SHIL2 — The file name is SHIL1.MIN is changed to SHIL2.MIN.

R␣ SHIL1.SUB,SHIL1.SSB — The file name SHIL1.SUB is changed to SHIL1.SSB.

R␣ SHIL1.SUB,SHIL2.SUB — The file name SHIL1.SUB is changed to SHIL2.SUB.

(3) Press the WRITE key.

This completes file name change operation.



[Supplement]

1. When the current file name specified is not found, the message "no file" is displayed on the command line and renaming operation terminates.
2. When the new file name specified already exists in the memory, the message "file exists" is displayed on the command line and renaming operation terminates.
3. Symbols "?"and "*" cannot be used to specify a file name. The error message "file name error" will be displayed on the screen if specified.

13. Free

This function displays the available capacity of the memory (MD1:) or a floppy disk (FD0:). The indication is made both in the number of sectors and bytes.

1 sector = 252 bytes

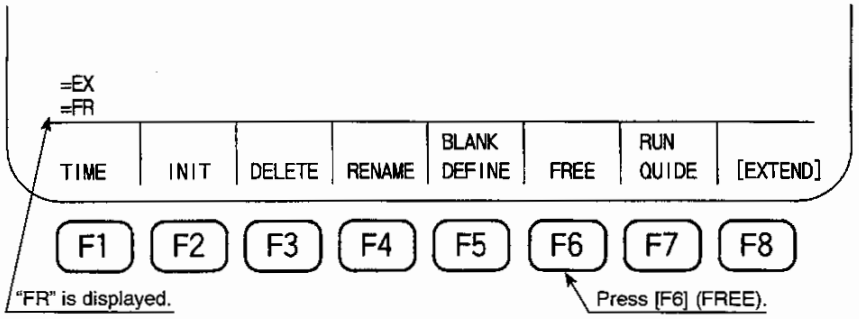
When creating a new file, all the remaining storage area cannot be used for storing program data since a file name, the number of sectors to be used, and other data are also stored together with program data.

One byte corresponds to one character.

The operating procedure is as indicated below.

(1) Press function key [F6] (FREE).

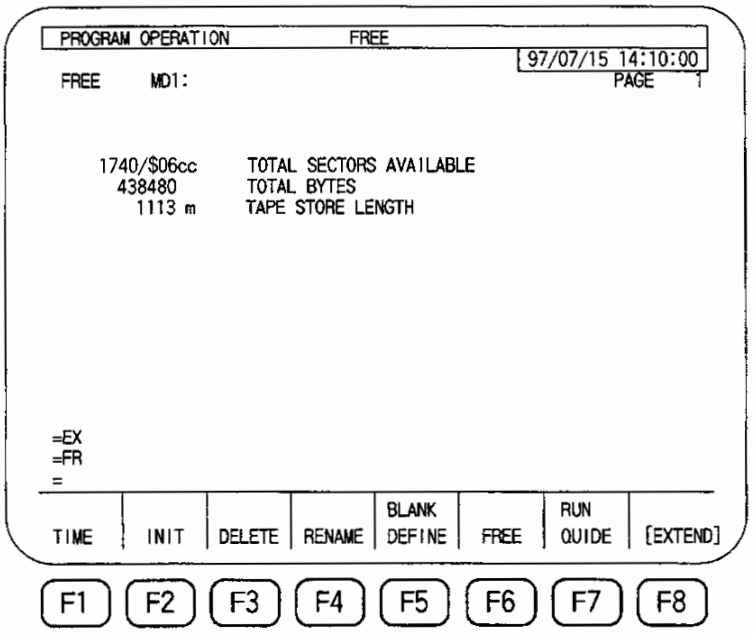
The screen displays the prompt "FR" on its console line.



(2) Following "FR", enter the device name, MD1: or FD0:.

The default is MD1:.

(3) Press the WRITE key.



Free area of the specified device (MD1: or FD0:) is displayed on the screen.

```
1740/$06CC* TOTAL SECTORS AVAILABLE
438480      TOTAL BYTES
1113 m      TAPE STORE LENGTH
```

The number preceded by the symbol "$" is a hexadecimal notation.

[Supplement] * $06CC is the hexadecimal notation of 1740.

The following option code can be used:

";C" When this option code is designated, sizes of continuous capacity available are displayed in succession.

Example: = FR;C

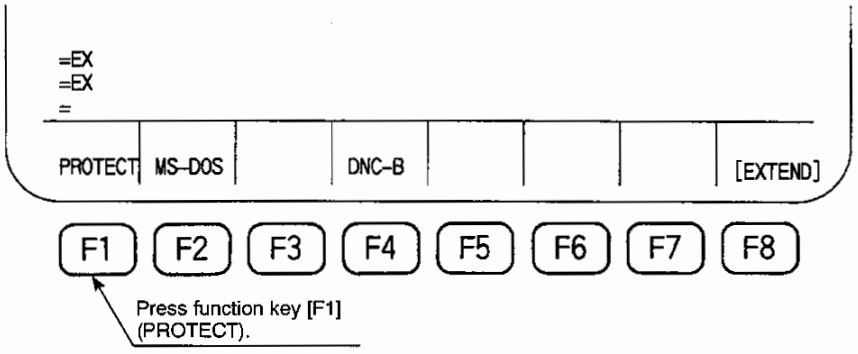
14. Protect

This function protects the specified file in the memory (MD1:) or in a floppy disk (FD0:).

When this function is activated, file operations such as editing, deleting, and renaming cannot be conducted.

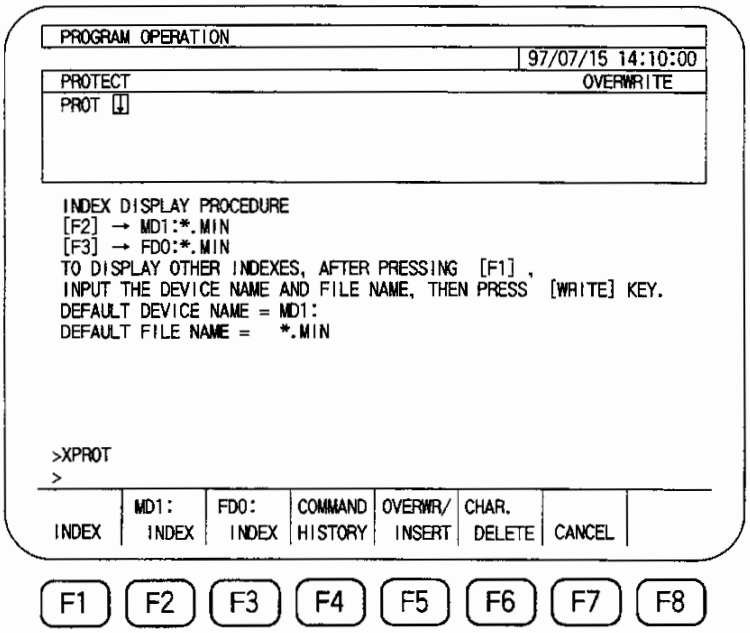
The operating procedure is as indicated below.

(1) Press function key [F1] (PROTECT).



The screen changes to the directory-selection-based file operation screen and the following is displayed on the screen.

PROTECT
PROT



(2) Following "PROT", enter the device name, file name to be protected, and option code.

Device name : MD1: or FD0:
The default is MD1:.

Option code : ;C, ;V, or ;CV
The option code can be omitted.

(3) Press the WRITE key.

[Supplement]

1. When the specified file name does not exist in the storage device, the message "no file" will be displayed on the command line.
2. Symbols "?" and "*" can be used to specify a file name.

   Functions of these symbols are the same as explained in 3. "DIRECTORY".

Option codes for file protection:

The code ";C" specified following the file name cancels file protection.

The code ";V" specified following the file name displays the following message on the command line of the display screen to allow the operator to select whether or not the specified file is protected.

FILE PROTECT OK (Y/N)?

When file protection is desired, type "Y" and press the WRITE key.

When file protection is not desired, type "N" and press the WRITE key.

The code ";CV" specified following the file name displays the following message on the command line of the display screen allow the operator to select whether or not protection of the specified file is canceled.

FILE PROTECT CANCEL (Y/N)?

When file protection needs to be canceled, type "Y" and press the WRITE key.

When file protection does not need to be canceled, type "N" and press the WRITE key.

Example 1: PROT ␣ ABC.MIN or PROT ␣ MD1:ABC.MIN

This instruction protects the file ABC.MIN registered in the memory.

Example 2: PROT ␣ BCD.MIN;C or PROT ␣ MD1:BCD.MIN;C

This instruction cancels protection of the file BCD.MIN registered in the memory.

Example 3: PROT ␣ CDE.MIN;V or PROT ␣ MD1:CDE.MIN;V

When the WRITE key is pressed following the above instruction, the prompt as indicated below will be displayed on the command line.

CED.MIN FILE PROTECT OK (Y/N)?

Type "Y" and press the WRITE key to protect the file.

Type "N" and press the WRITE key not to protect the file.

Example 4: PROT ␣ DEF.MIN;CV or PROT ␣ MD1:DEF.MIN;CV

When the WRITE key is pressed following the above instruction, the prompt as indicated below will be displayed on the command line.

DEF.MIN FILE PROTECT CANCEL (Y/N)?

Type "Y" and press the WRITE key to cancel protection of the specified file.

Type "N" and press the WRITE key not to cancel protection of the specified file.

15. Directory-selection-based File Operation Function

Operations such as writing files (part programs, etc.) to the NC and outputting files from the NC to floppy disks are collectively called "file processing". In order to execute a file processing operation, a command that describes the details of the intended processing must be created and the created command must be given to the NC.

15-1. File Processing

15-1-1. Procedure for Executing File Processing

(1) Calling Up the Command Creation Screen

Press one of the file processing function keys – for example COPY or READ – to display the command creation screen.

(2) Creating the Command

Create and edit the command on the command creation screen. Since the first part of the command (which specifies the command function) is entered automatically, the user has only to input the file name(s) and option codes.

(3) Executing the Command

With the command creation screen still displayed, press the WRITE key.

The created command is given to the NC and executed.

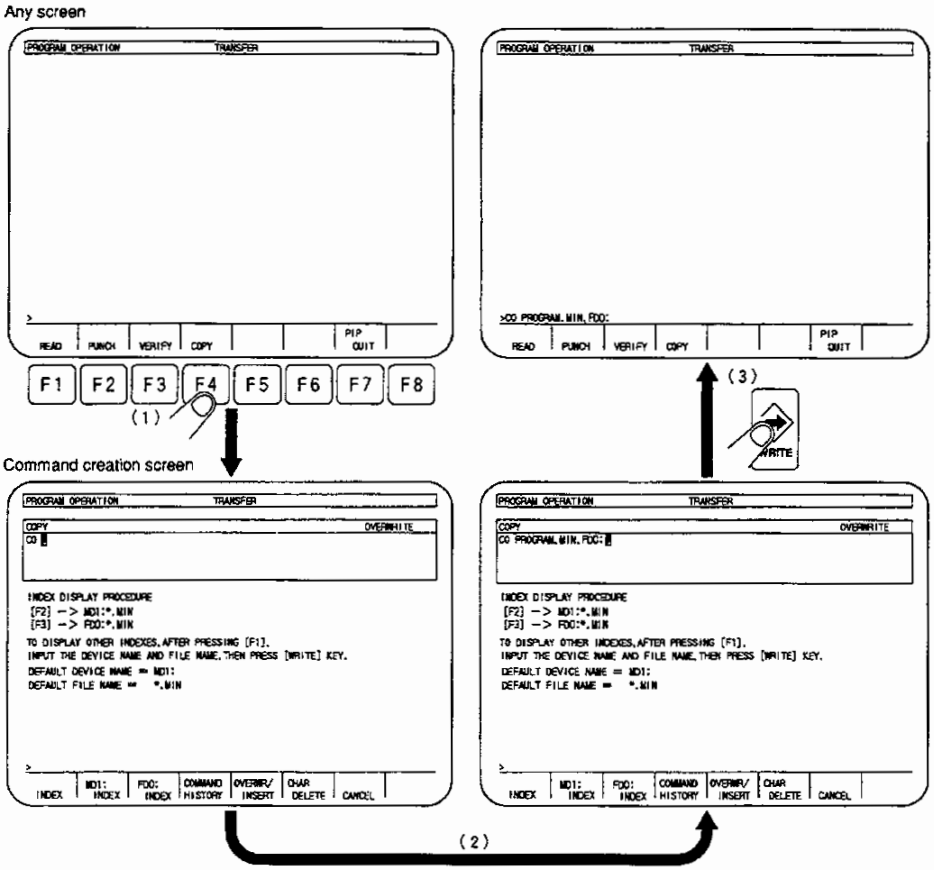


Fig. 2-2 Procedure for Executing File Processing

15-1-2. Method for Creating Commands

To delete the File "PROGRAM.MIN":
The procedure used for deleting the file by directly entering the file name

(a) Press function key [F3] (DELETE) in the PROG OPERATION mode.

The command creation screen will be displayed.

"DEL", which indicates the DELETE function, will automatically appear on the command line.

```
DEL
```

(b) Key in the file name "PROGRAM.MIN".

```
DEL  PROGRAM.MIN
```

(c) The command is now completed; press the [WRITE] key.

The created command "DELPROGRAM.MIN" will be given to the NC and the file "PROGRAM.MIN" will be deleted.

Copying the File "PROGRAM.MIN" from a Floppy Disk to the NC Memory under the File Name "S01.MIN":
The procedure used for copying the file by selecting the file name from the directory

(a) Press function key [F4] (COPY) in the PROG OPERATION mode.

The command creation screen will be displayed.

"CO", which indicates the COPY function, will automatically appear on the command line.

```
CO
```

(b) Enter the device name "FD0:" and the file name "PROGRAM.MIN".

Do this either by keying in "FD0:" and "PROGRAM.MIN" or by displaying the directory for device "FD0:" and selecting the file name "PROGRAM.MIN" from it.

For details on selecting files from directories, see 15-4, "Selecting Files From Directories (OSP Format)" or 15-5, "Selecting Files From Directories (MS-DOS Format)".

```
CO  FD0:PROGRAM.MIN
```

(c) Key in the rest of the command ", S01.MIN".

```
CO  FD0:PROGRAM.MIN,S01.MIN
```

(d) The command is now completed; press the [WRITE] key to execute it.

The created command, "CO FD0:PROGRAM.MIN,S01.MIN" will be given to the NC and file "PROGRAM.MIN" in the floppy disk will be copied to the memory under the file name "S01.MIN".

Copying the File "S01.MIN" in the NC Memory to a Floppy Disk under the File Name "PROGRAM.MIN":
The procedure used for copying the file by selecting the file name from the directory

(a) Press function key [F4] (COPY) in the PROG OPERATION mode.

The command creation screen will be displayed."CO", which indicates the COPY function, will automatically appear on the command line.

```
CO
```

(b) Key in the file name "S01.MIN" and a comma ",".

```
CO  S01.MIN,
```

(c) Enter the device name "FD0:" and the file name "PROGRAM.MIN".

Do this either by keying in "FD0:" and "PROGRAM.MIN" or by displaying the directory for device "FD0:" and selecting the file name "PROGRAM.MIN" from it.

For details on selecting files from directories, see 15-4, "Selecting Files From Directories (OSP Format)" or 15-5, "Selecting Files From Directories (MS-DOS Format)".

```
CO  S01.MIN,FD0:PROGRAM.MIN
```

(d) The command is now completed: press the WRITE key to execute it.

The created command, "CO S01.MIN,FD0:PROGRAM.MIN" will be given to the NC and file "S01.MIN" will be copied to the floppy disk under the file name "PROGRAM.MIN".

If Input Error is Found:

If an error is found in the created command, move the edit pointer to the location of the error and correct the character.

(a) Assume that the following erroneous command has been keyed in instead of "CO PROGRAM.MIN,S01.MIN" due to a typing error:

```
CO  PROGTAM.MIN,S01.MIN
```

(b) Using the cursor keys, move the edit pointer "_" to the character to be corrected, "T".

```
CO  PROGTAM.MIN,S01.MIN
```

(c) Key in "R".

For details on editing commands, see 15-2, "Creating and Editing Commands".

```
CO  PROGRAM.MIN,S01.MIN
```

(d) The command has now been corrected; press the WRITE key to execute it.

Executing a Command Similar to the Command Previously Executed:

When executing the command "CO PROGRAM.MIN,FD0:S02.MIN" after the execution of the similar command "CO PROGRAM.MIN,FD0:S01.MIN", the new command can be created following the procedure indicated below using the previously executed command.

Create the required command by editing the previous command.

(a) Press function key [F4] (COPY) in the PROG OPERATION mode.

The command creation screen will be displayed.

"CO", which indicates the COPY function, will automatically appear on the command line.

```
CO
```

(b) Key in the file name "PROGRAM.MIN" and a comma ",".

```
CO  PROGRAM.MIN,
```

(c) Enter the device name "FD0:" and the file name "S01.MIN".

Do this either by keying in "FD0:" and "S01.MIN" or by displaying the directory for device "FD0:" and selecting the file name "S01.MIN" from it.

For details on selecting files from directories, see15-4, "Selecting Files From Directories (OSP Format)" or 15-5, "Selecting Files From Directories (MS-DOS Format)".

```
CO  PROGRAM.MIN,FD0:S01.MIN
```

(d) The command is now completed: press the WRITE key to execute it.

The created command, "CO PROGRAM.MIN,FD0:S01.MIN" will be given to the NC and file "PROGRAM.MIN" will be copied to the floppy disk under the file name "S01.MIN".

(e) Press function key [F4] (COPY) in the PROG OPERATION mode once more.

```
CO
```

(f) Read the previous command.

For details on how to do this, refer to 15-3, "Use of the Previous Command".

```
CO  PROGRAM.MIN,FD0:S01.MIN
```

(g) Using the cursor keys, move the edit pointer "_" to the character to be changed, "1".

```
CO  PROGRAM.MIN,FD0:S01MIN
```

(h) Key in "2".

```
CO  PROGRAM.MIN,FD0:S02MIN
```

(i) The command is now completed; press the WRITE key to execute it.

The created command, "CO PROGRAM.MIN,FD0:S02.MIN" will be given to the NC and file "PROGRAM.MIN" will be copied to the floppy disk under the file name "S02.MIN".

15-1-3. Command Execution

(1) To Execute a Command

To execute the command that is currently displayed in lines 4 to 7 of the command creation screen, press the WRITE key. The screen will revert to its original condition and the command will be executed.

The created command will be saved as the "command history".

(2) To Abort Execution of a Command

To abort execution of the command currently displayed in lines 4 to 7 of the command creation screen, press function key [F7] (CANCEL). The screen will revert to its original condition and the command will not be executed.

The created command will not be saved as the "command history".

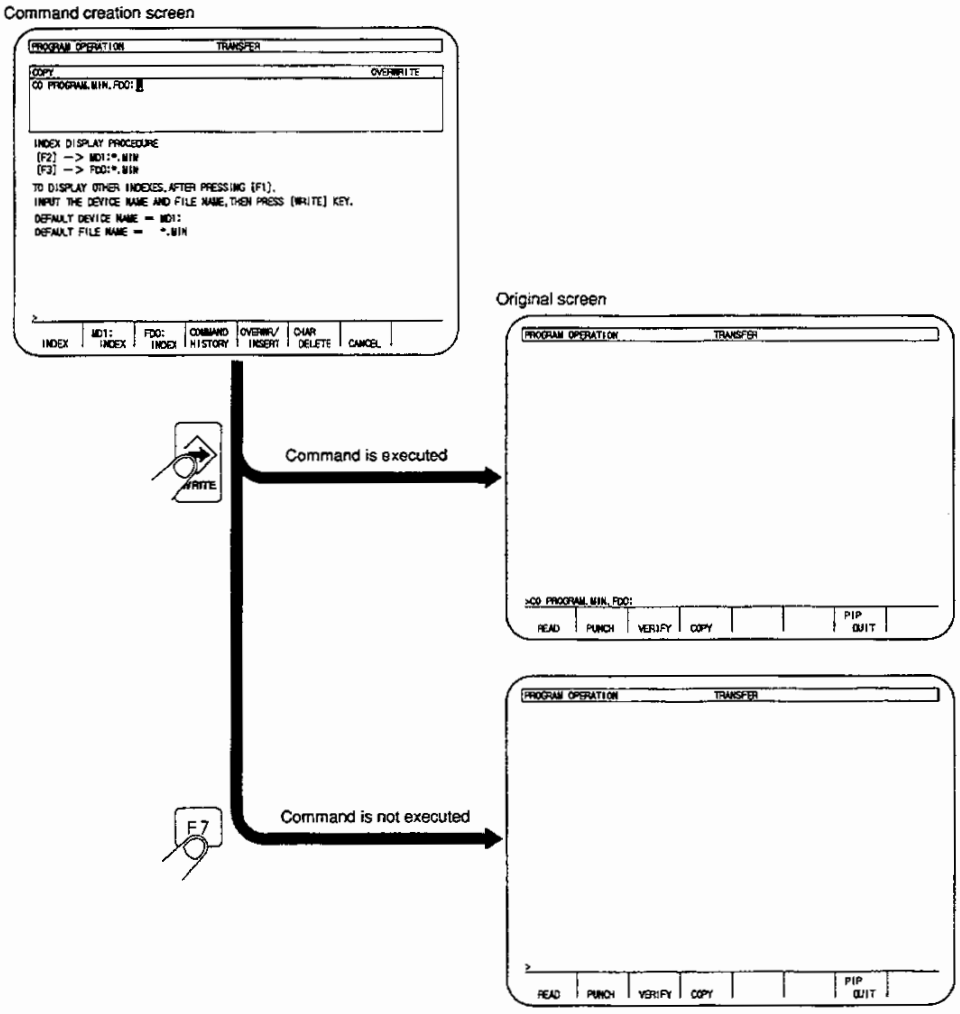
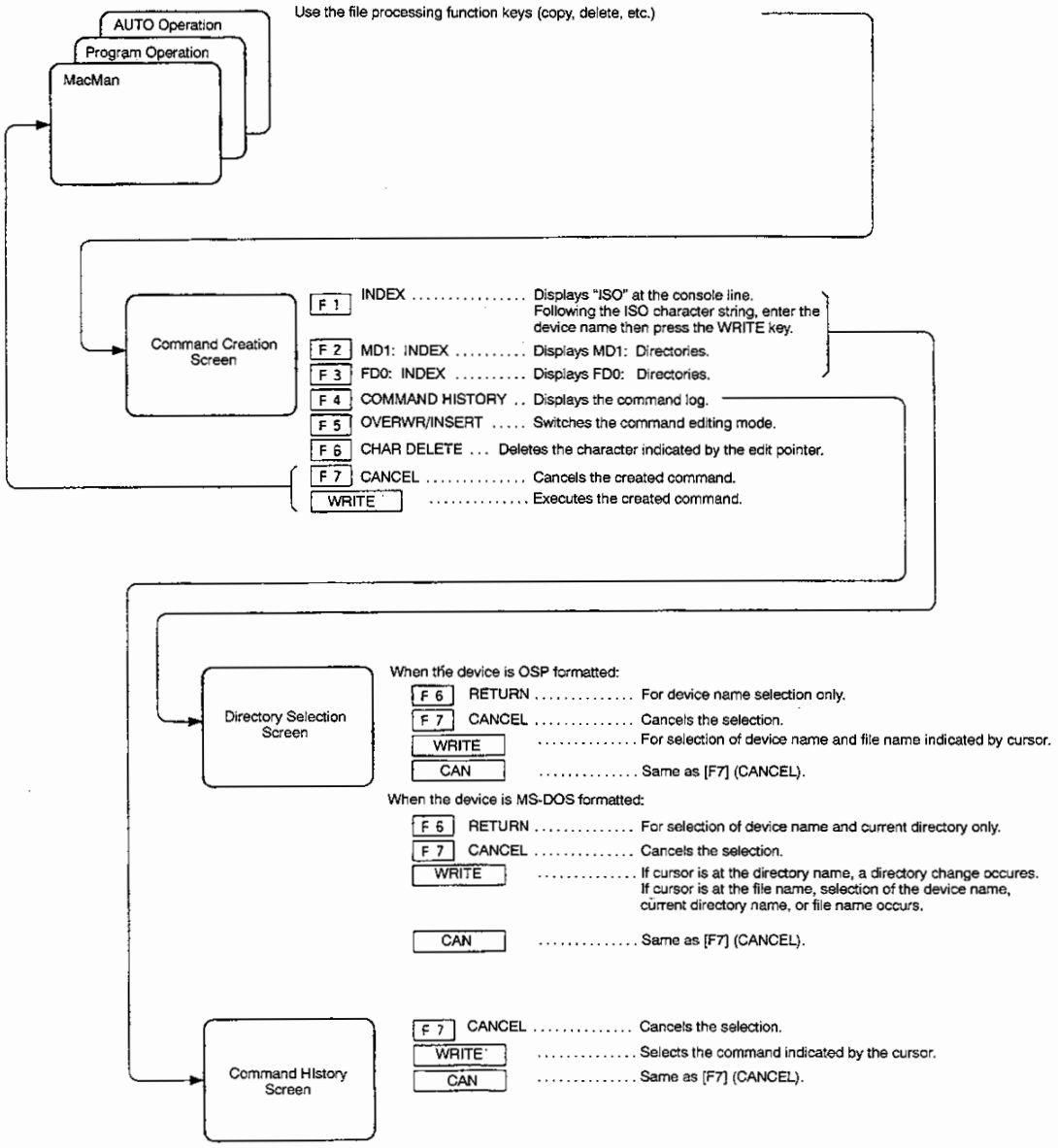


Fig. 2-3 Command Creation Screen

15-1-4. Operation Transition



15-2. Creating and Editing Commands

15-2-1. Command Creation Screen

Lines 4 to 7 : The command is created and edited here.

Characters keyed in are entered at the position of the edit pointer. When a character is entered, the edit pointer moves to the next character space.

The downward-pointing arrow "↓" indicates the end of the command. Up to 255 characters can be entered.

The character string being entered to create a command can be modified by moving the edit pointer with the cursor keys.

Lines 9 to 15 : The procedure for displaying directories is shown below.To display a directory, press one of the following function keys:

[F1] (INDEX), [F2] (MD1: INDEX), [F3] (FD0: INDEX)

[F2] → MD1: ∗.MIN

If the [F2] (MD1: INDEX) key is pressed, the directory of MD1 related files (machining programs) with an extend name of "MIN" will be displayed.

[F3] → FD0: ∗.MIN

If the [F3] (FD0: INDEX) key is pressed, the directory of the "FD0" floppy disk files (machining programs) with an extend name of "MIN" will be displayed.

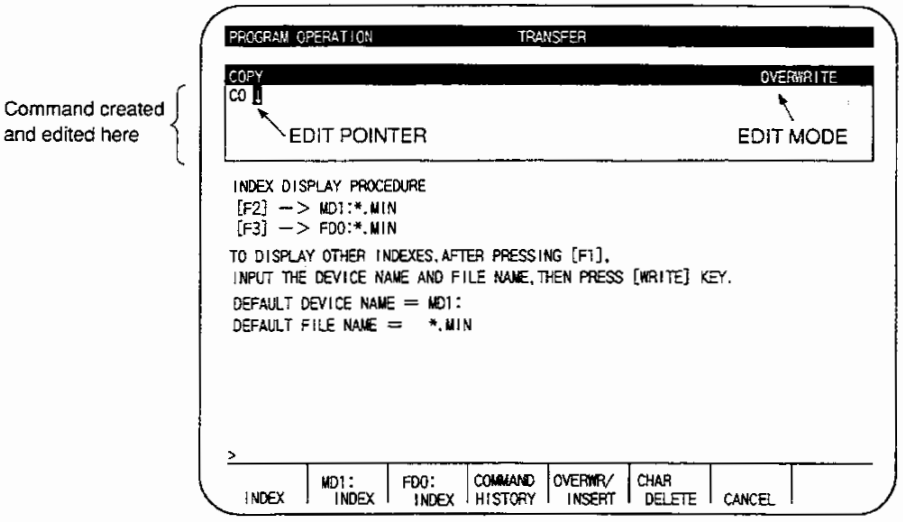


Fig. 2-4 Command Creation Screen

15-2-2. Operation of the Edit Pointer

(1) Moving the Edit Pointer to the Right

The edit pointer will move one space to the right every time the right cursor key is pressed.

When the edit pointer is at the right end of a line, pressing the right cursor key will cause it to move to the left end of the next line, unless it is on the final (7th) line, in which case it will not move.

(2) Moving the Edit Pointer to the Left

The edit pointer will move one space to the left every time the left cursor key is pressed.

When the edit pointer is at the left end of a line, pressing the left cursor key will cause it to move to the right end of the next line, unless it is on the uppermost (4th) line, in which case it will not move.

(3) Moving the Edit Pointer Downward

The edit pointer will move one line downward every time the "down" cursor key is pressed, unless it is on the final (7th) line, in which case it will not move.

(4) Moving the Edit Pointer Upward

The edit pointer will move one line upward every time the "up" cursor key is pressed, unless it is on the uppermost (4th) line, in which case it will not move.

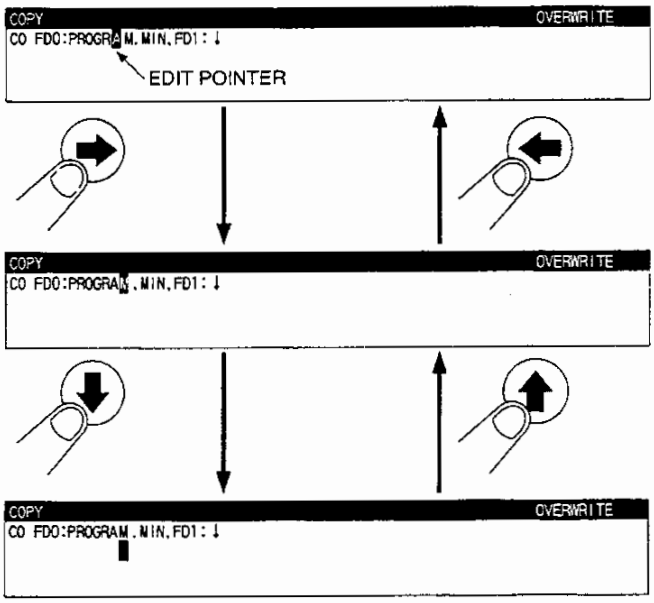


Fig. 2-5 Operation of Edit Pointer

15-2-3. Editing Modes

Lines 4 to 7 of the command creation screen have two editing modes, function key [F5] (OVERWR/INSERT).

Immediately after displaying the command creation screen, the overwrite mode will be effective.

(1) Overwrite Mode

The overwrite mode is used to fix the command displayed in lines 4 to 7 of the command creation screen in order to overwrite a character or characters in the command.

In the example shown below, "1" is entered at the position of the edit pointer and the edit pointer moves to the position of the next character ":". Note that in this case none of the characters has moved.

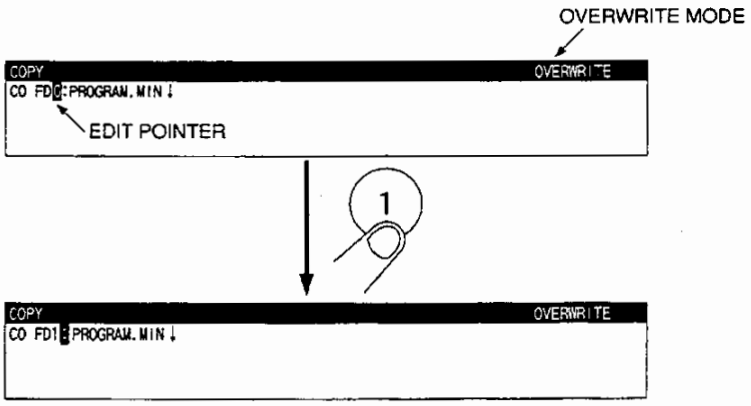


Fig. 2-6 Editing Modes (Overwrite Mode)

(2) Insert Mode

The insert mode is used to insert additional characters into the command displayed in lines 4 to 7 of the command creation screen.

In the example shown below, the character string to the right of the edit pointer – "AM.MIN" – moves to the right to accommodate the character "R" as it is inserted at the left of the edit pointer.

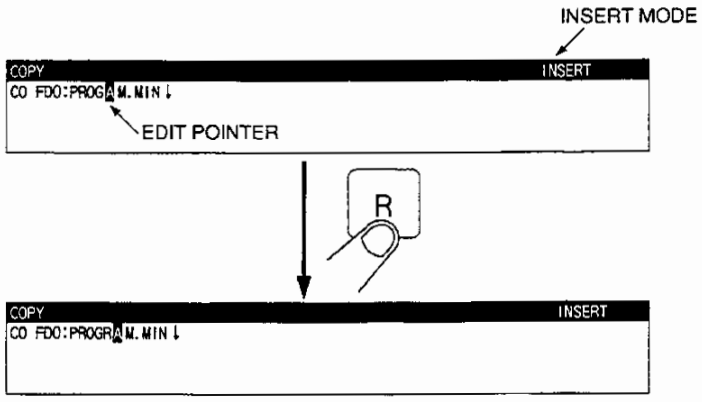


Fig. 2-7 Editing Modes (Insert Mode)

(3) Switching between Editing Modes

To change the editing mode, press function key [F5] (OVERWR/INSERT). If the overwrite mode is currently effective the insert mode will become effective, and if the insert mode is currently effective the overwrite mode will become effective.

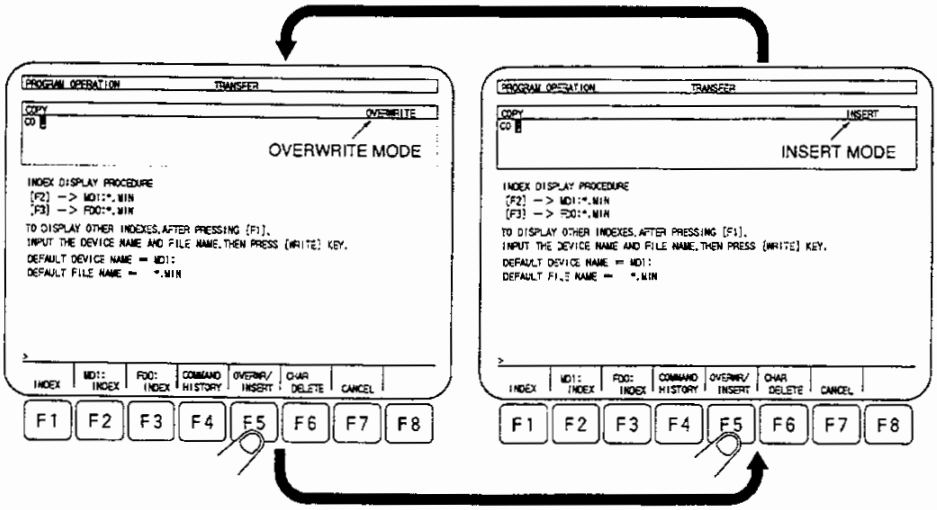


Fig. 2-8 Switching between Editing Modes

15-2-4. Deleting Characters

(1) Function Key [F5] (CHAR DELETE)

Use of this key deletes a single character at the position of the edit pointer, whereupon the character string to the right of the deleted character shifts one place to the left to close the space. The edit pointer remains at the same position.

In the example shown below, the character "A" located by the edit pointer is deleted and the character string ":PROGRAM.MIN" to the right of the edit pointer moves one place to the left to close the space.

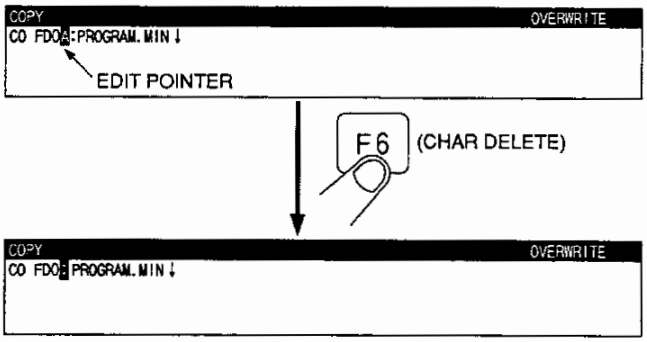


Fig. 2-9 Deleting Characters (Function Key [F5])

(2) BS Key (Backspace Key)

Use of this key deletes a single character to the left of the edit pointer and causes the character string that starts at the position of the edit pointer to move one place to the left to close the space.

In the example shown below the character "A" to the left of the edit pointer is deleted and the character string ":PROGRAM.MIN" that starts at the position of the edit pointer shifts one place to the left.

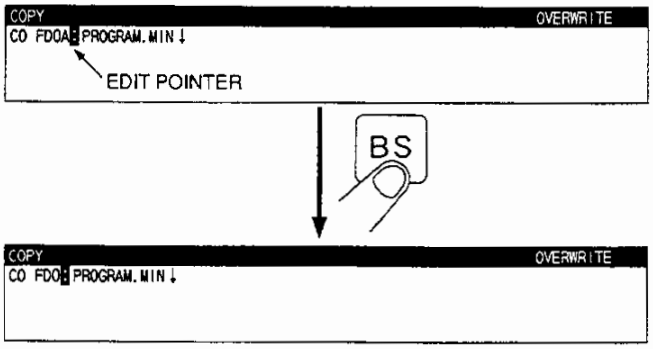


Fig. 2-10 Deleting Characters (BS Key)

15-2-5. Notes on Creating and Editing Commands

(1) Maximum Command Length

The downward-pointing arrow symbol "↓" signifies the end of the command and the maximum command length of 255 characters is reached when this symbol is at the right end of the seventh line.

When the "insert" editing mode is effective, it is not possible to key in a character at any position when this limit has been reached.

(2) Automatic Space Insertion

When a character is keyed in while the edit pointer is located to the right of the downward-pointing arrow "↓", spaces are automatically inserted up to the position where that character is keyed in.

When the BS key is pressed while the edit pointer is located to the right of the downward-pointing arrow "↓", the edit pointer moves to the position of the downward-pointing arrow.

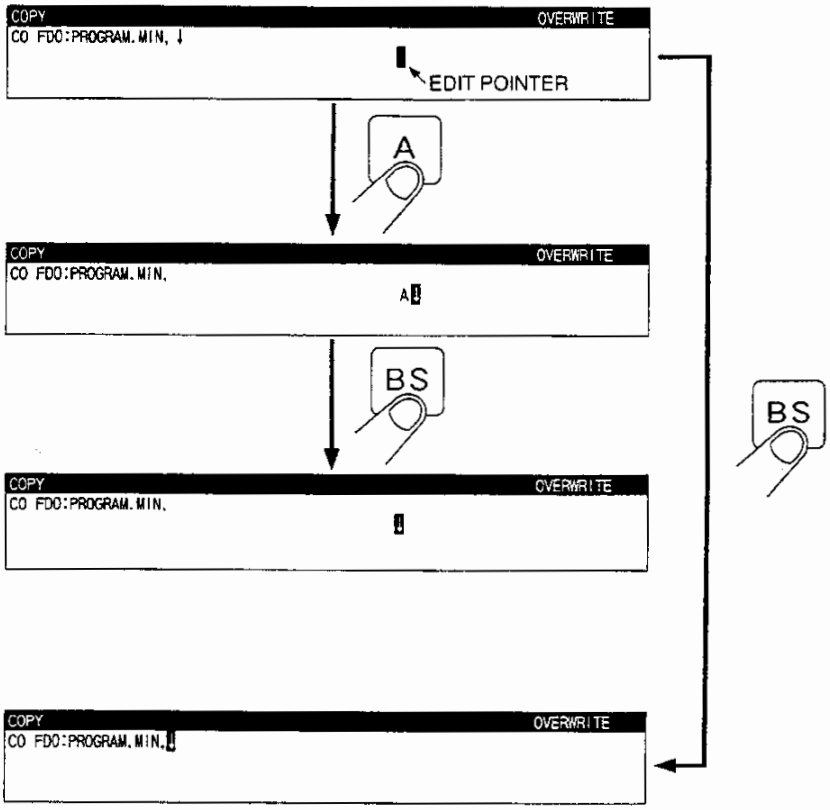


Fig. 2-11 Automatic Space Insertion

15-3. Use of the Command History

The last 5 commands which have been used are stored as the "command log". Previously created commands can therefore by used again by selecting them from the command log. They can also be revised before they are used.

(1) At the command creation screen, press function key [F4] (COMMAND HISTORY) to switch to the command history screen.

(2) Use the cursor control keys to move the cursor to the desired command.

(3) Press the WRITE key.

The system will return to the Command Selection screen, and the selected command will be read into lines 4 to 7. To execute the command as it is, press the WRITE key.

If reading to the command selection screen is not required, press the [F7] (CANCEL) key at the command history screen. The system will return to the command selection screen without reading the selected command.

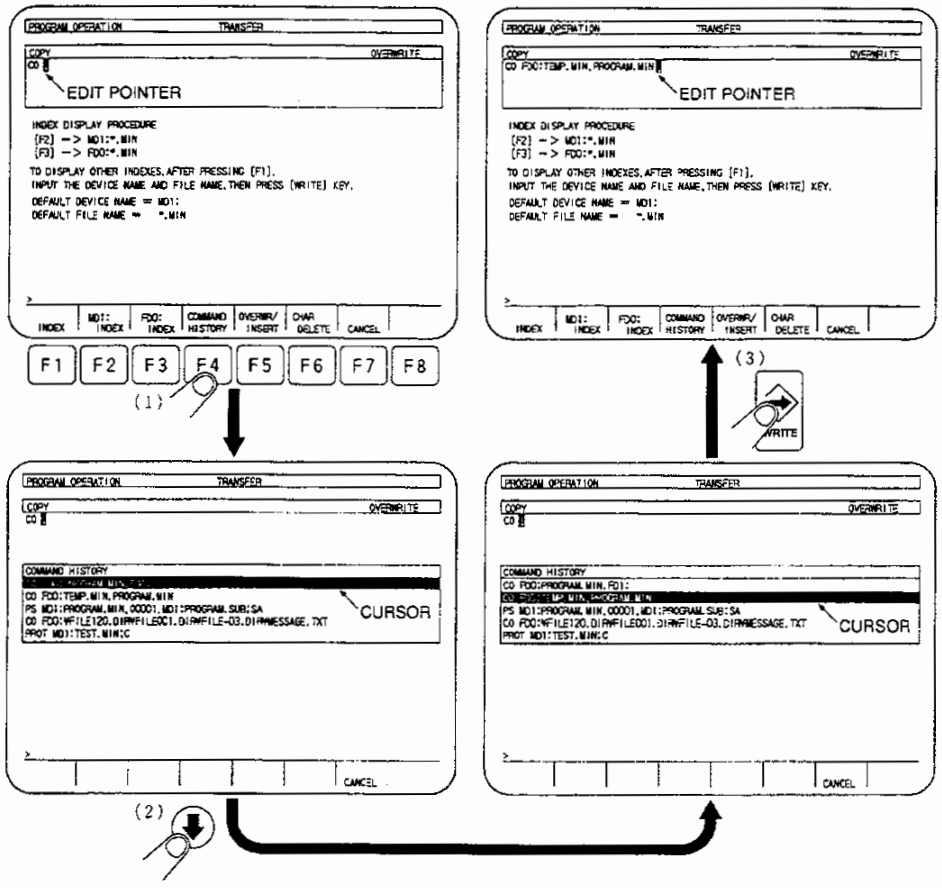


Fig. 2-12 Use of the Command History

15-4. Selecting Files From Directories (OSP Format)

15-4-1. Procedure for Selecting Files from Directories

(1) At the Command Creation screen, press one of the following function keys:

[F1] (INDEX), [F2] (MD1: INDEX), [F3] (FD0:INDEX)

If function key [F1] (INDEX) is pressed, "ISO" will be displayed at the console line. Following the "ISO" character string, enter the desired device name and file name, then press the WRITE key.

(2) At the directory selection screen, use the cursor keys to locate the cursor at the file name of the file to be selected.

(3) Press the WRITE key.

The display will return to the command creation screen and the device name and file name selected with the cursor are entered at the position of the edit pointer.

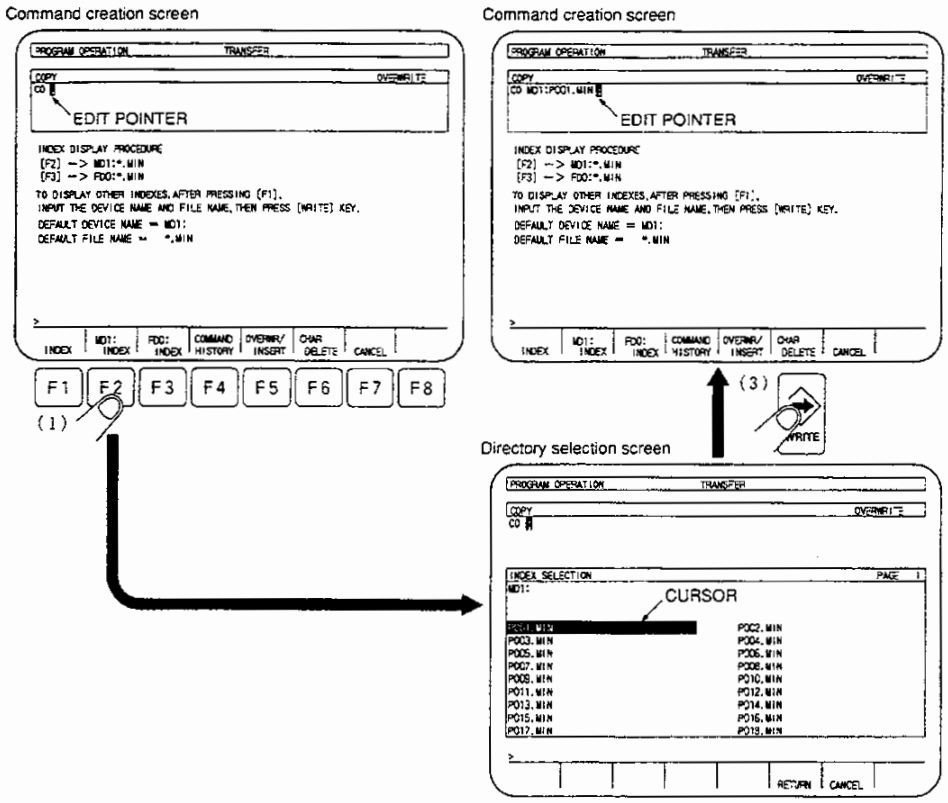


Fig. 2-13 Selecting a File from Directory

15-4-2. Directory Selection Screen

If the selected device is OSP format, the directory selection screen will take the form shown below.

For its appearance when the selected device is MS-DOS format, refer to 15-5, "Selecting Files From Directories (MS-DOS Format)".

Lines 4 to 7 : The command being created is displayed here.

The selected file name is entered at the position of the edit pointer. The edit pointer cannot be moved by pressing the cursor keys.

Line 9 : The device name for the displayed directory is displayed here.

Lines 12 to 20 : The directory is displayed here.

Move the cursor to the file name to be selected by using the cursor keys.

If no file name is displayed, it means that the selected device does not contain files.

Up to 18 file names are displayed on each screen. If there are more than 18 registered files in a directory, the page up/down keys can be used to display other pages.

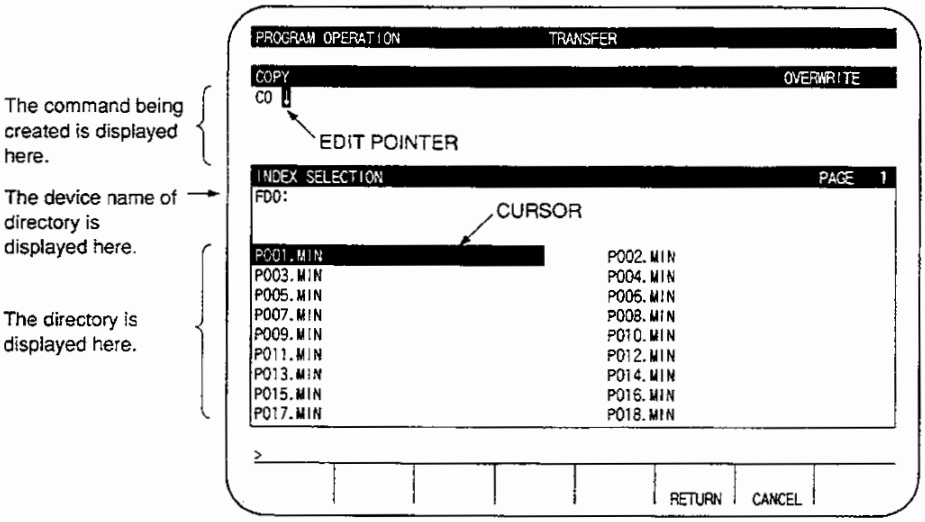


Fig. 2-14 Directory Selection Screen

15-4-3. Cursor and Page Operations

(1) Moving the Cursor to the Right

Each time the "right" cursor key is pressed, the cursor moves to the file name which is adjacent and to the right, or below and to the left, with respect to the current cursor position. If the cursor is located at the final file name in the directory, it moves to the first file name in the directory.

(2) Moving the Cursor to the Left

Each time the "left" cursor key is pressed, the cursor moves to the file name which is adjacent and to the left, or above and to the right, with respect to the current cursor position. If the cursor is located at the first file name in the directory, it moves to the final file name in the directory.

(3) Moving the Cursor Downward

Each time the "down" cursor key is pressed, the cursor moves to the file name directly below the current position. If the cursor is located at the final file name in the directory, it moves to the first file name in the directory.

(4) Moving the Cursor Upward

Each time the "up" cursor key is pressed, the cursor moves to the file name directly above the current position. If the cursor is located at the first file name in the directory, it moves to the final file name in the directory.

(5) Changing Pages

Up to 18 file names cam be displayed on the directory selection screen. If there are more than 18 files registered in the directory, other pages can be displayed by pressing the page up/down keys.

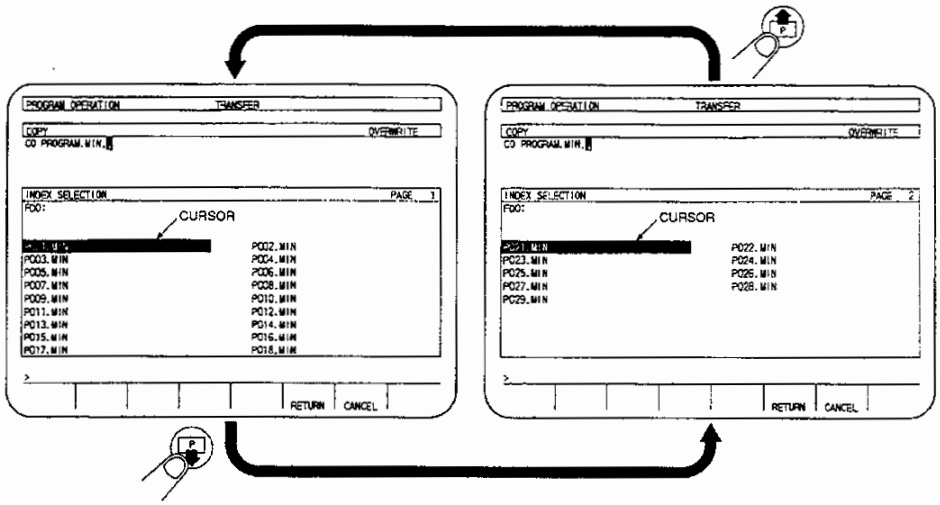


Fig. 2-15 Cursor and Page Operations

15-4-4. Function Key [F6] (RETURN), [F7] (CANCEL) and Cancel Key

When function key [F6] (RETURN) key is pressed, the command creation screen is displayed and the device name only is entered at the position of the edit pointer. The file name that was at the cursor position is not entered.

When function key [F7] (CANCEL) or the Cancel key is pressed, the command creation screen is displayed and neither the device name nor the file name at the cursor position are entered on it.

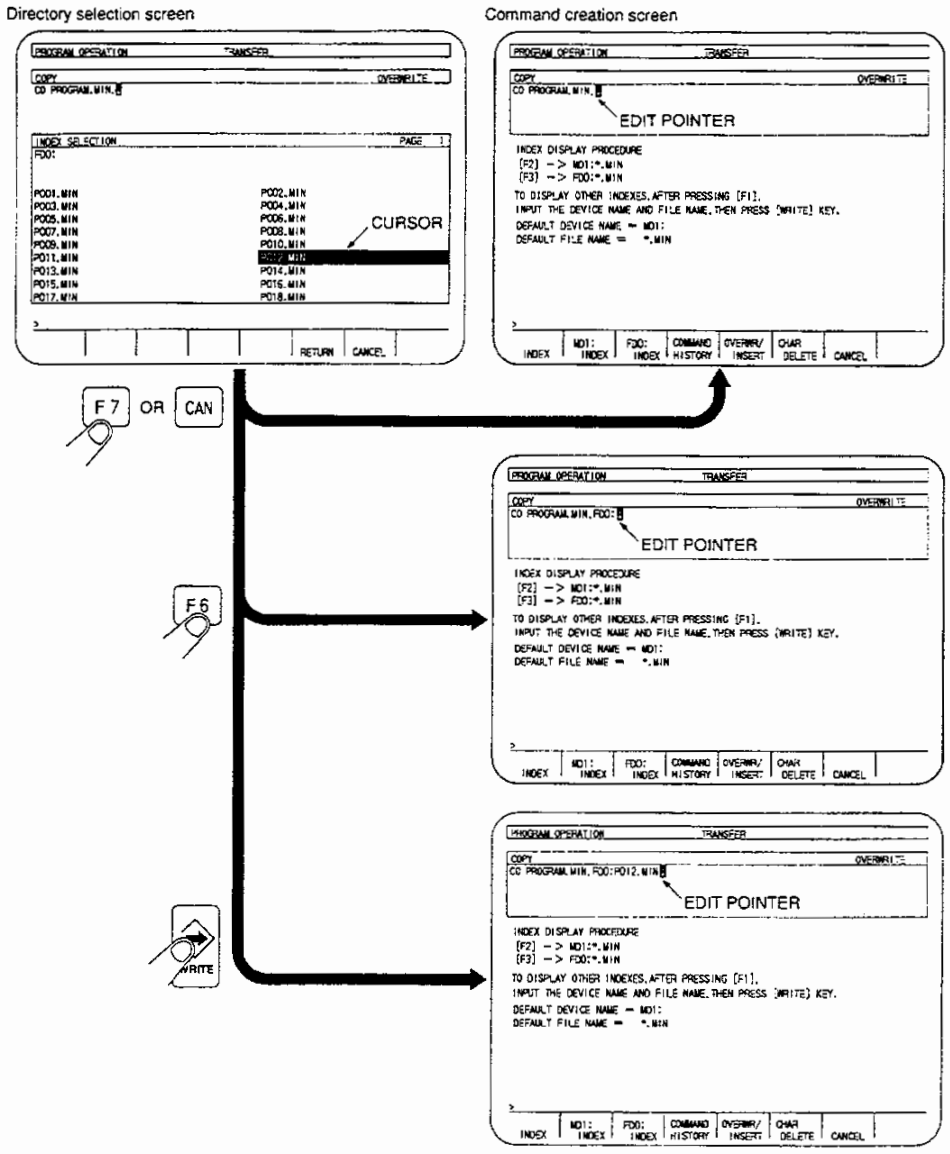


Fig. 2-16 Function Key [F6] (RETURN) and Cancel Key

15-4-5. Effects of the Editing Modes

(1) Overwrite Mode

In the overwrite mode, the positions of characters in the character string are fixed and the file name selected from the directory is written over the part of the character string that starts at the position of the edit pointer.

(2) Insert Mode

In the insert mode, the part of the character string that starts at the position of the edit cursor shifts to the right as the file name selected from the directory is inserted to the left of the edit pointer.

If the command length is caused to exceed 255 characters by adding the file name, the 256th and subsequent characters are deleted.

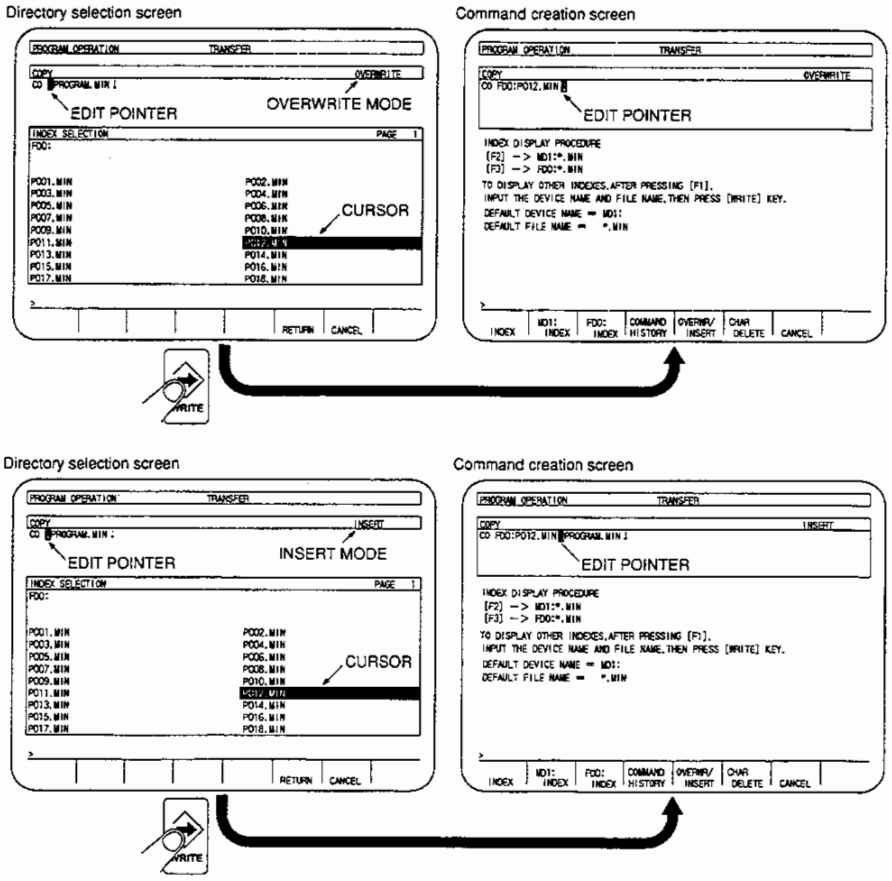


Fig. 2-17 Effects of the Editing Modes

15-4-6. Directory Display Method

(1) To Display NC Memory "MD1:" Directory

Press function key [F2] (MD1: INDEX).

The input examples given below show how to designate which file directory is to be displayed.

[F2] → MD1: ✳.MIN

When function key [F2] (MD1: INDEX) is pressed, the directory (in NC memory) for MD1: related files with extend names of "MIN" (work programs) will be displayed.

[F2] → MD1: ✳.SDF

When function key [F2] (MD1: INDEX) is pressed, the directory (in NC memory) for MD1: related files with extend names of "SDF" (schedule programs) will be displayed.

[F2] → MD1: ✳.✳

When function key [F2] (MD1: INDEX) is pressed, the directory (in NC memory) for all MD1: related files will be displayed.

(2) To Display Floppy Disk "FD0:" Directory

Press function key [F3] (FD0: INDEX).

The input examples given below show how to designate which file directory is to be displayed.

[F3] → FD0: ✳.MIN

When function key [F3] (FD0: INDEX) is pressed, the directory (in floppy disk) for FD0: related files with extend names of "MIN" (work programs) will be displayed.

[F3] →FD0: ✳.SDF

When function key [F3] (FD0: INDEX) is pressed, the directory (in floppy disk) for FD0: related files with extend names of "SDF" (schedule programs) will be displayed.

[F3] → FD0: ✳.✳

When function key [F3] (FD0: INDEX) is pressed, the directory (in floppy disk) for all FD0: related files will be displayed.

(3) To Display Other Directories

When function key [F1] (INDEX) is pressed, "ISO" will be displayed at the console line. Following the "ISO" character string, enter the desired device name and file name, then press the [WRITE] key. The following examples apply when an OSP formatted floppy disk is being used.

>ISO MD1: [WRITE]

The directory for the default file name at the MD1: device will be displayed.

The default file name is indicated at the directory display procedure.

>ISO FD0: [WRITE]

The directory corresponding to device "FD0:" is displayed.

```
>ISO  FD*:  [WRITE]
```

The message "ERROR IN SPECIFIED DEVICE NAME." is displayed on the console line and the directory selection screen is displayed.

It is not allowed to use wild card "*" or "?" when specifying a device name.

```
>ISO  FD0:*.* [WRITE]
```

The directory of all files in floppy "FD0:" is displayed.

The same happens if any of the following are specified as the file name: "*", "*.", ".*", ". ".

```
>ISO  FD0:*.MIN [WRITE]
```

The directory of all files in floppy "FD0:" with the extension name "MIN" is displayed.

```
>ISO  FD0:???.MIN [WRITE]
```

The directory of all files in floppy "FD0:" whose main file name consists of three or fewer alphanumeric characters and whose extension name is "MIN" is displayed.

```
>ISO  FD0:ABC.*  [WRITE]
```

The directory of all files in floppy "FD0:" whose main file name is "ABC" is displayed.

The same would happen if the specified file name were "ABC" or "ABC.".

```
>ISO  FD0:ABC.?? [WRITE]
```

The directory of all files in floppy "FD0:" whose main file name is "ABC" and whose extension name consists of no more than two alphanumeric characters is displayed.

```
>ISO  FD0:MS*.TXT [WRITE]
```

The directory of all files in floppy "FD0:" whose main file name starts with "MS" and whose extension name is "TXT" is displayed.

```
>ISO  FD0:MS??.TXT [WRITE]
```

The directory of all files in floppy "FD0:" whose main file name starts with "MS" and comprises a total of no more than 4 alphanumeric characters, and whose extension name is "TXT" is displayed.

```
>ISO  FD0:ABC.MIN [WRITE]
```

The file "ABC.MIN" in floppy "FD0:" is displayed (assuming this file exists in the device).

```
>ISO  FD0:123.* [WRITE]
```

```
>ISO  FD0:ABCDEFG123456789.* [WRITE]
```

The message "ERROR IN SPECIFIED FILE NAME." is displayed.

In the OSP format, main file names must start with a letter of the alphabet and consist of a total of no more than 16 alphanumeric characters.

```
>ISO  FD0:*.123 [WRITE]
```

```
>ISO  FD0:*.ABCD [WRITE]
```

The message "ERROR IN SPECIFIED FILE NAME." is displayed.

In the OSP format, extension names must start with a letter of the alphabet and consist of a total of no more than three alphanumeric characters.

```
>ISO  FD0:\ABC\*.*  [WRITE]
```

If a path name is specified although the device to be selected is OSP format, the message "PATH NAME CANNOT BE SPECIFIED IN THIS DEVICE." will be displayed on the console line.

15-5. Selecting Files From Directories (MS-DOS Format)

When working with the MS-DOS format – for example in the machining management mode and MS-DOS file convert – it is possible to display the directories of MS-DOS format floppy disks.

15-5-1. Procedure for Selecting Files from Directories

(1) At the Command Creation screen, press one of the following function keys:

[F1] (INDEX), [F2] (MD1: INDEX), [F3] (FD0:INDEX)

If function key [F1] (INDEX) is pressed, "ISO" will be displayed at the console line. Following the "ISO" character string, enter the desired device name, path name, and file name, then press the WRITE key.

(2) At the directory selection screen, use the cursor keys to locate the cursor at the file name of the file to be selected.

(3) Press the WRITE key.

The display will return to the command creation screen and the device name, current directory name, and file name selected with the cursor, are entered on it at the position of the edit pointer.

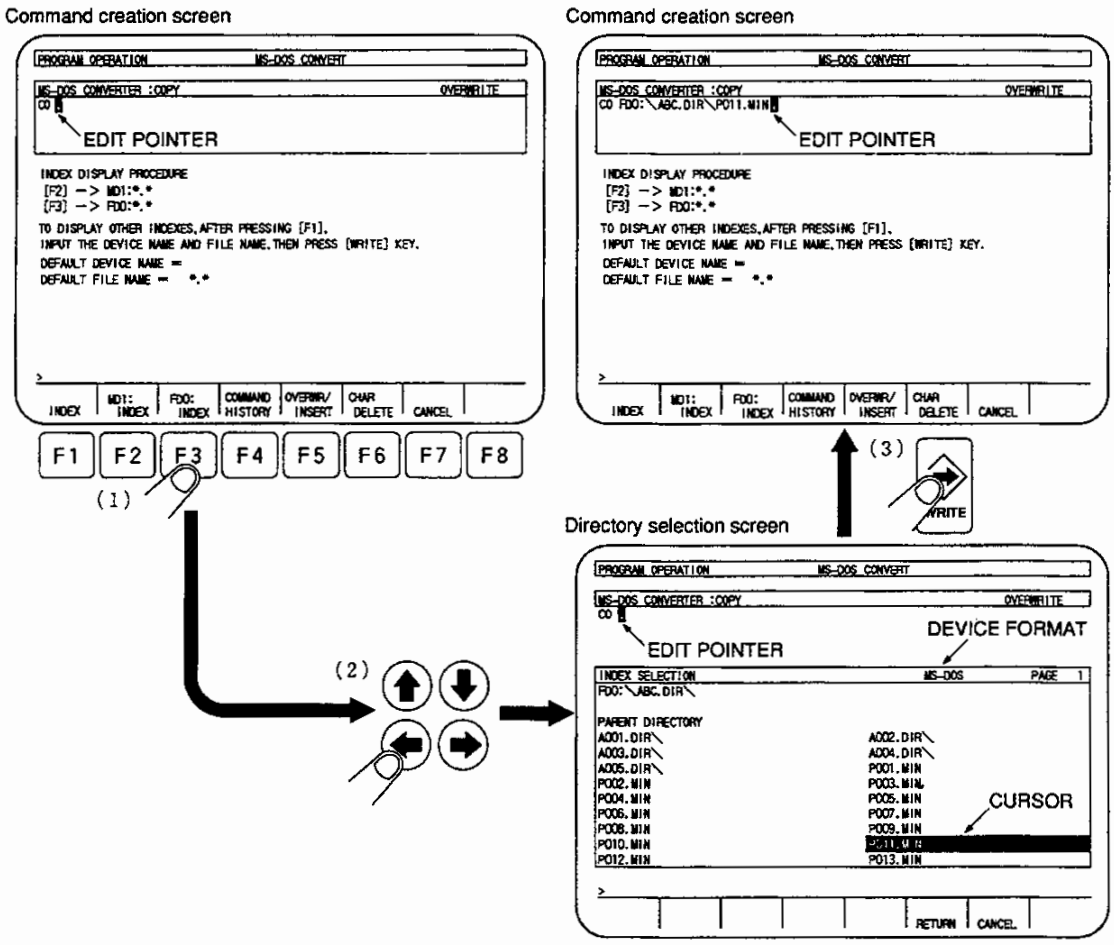


Fig. 2-18 Procedure for Selecting Files from Directories

15-5-2. Directory Selection Screen (for MS-DOS Format Devices)

Lines 4 to 7 : The command being created is displayed here.

The selected file name is entered at the position of the edit pointer. The edit pointer cannot be moved by pressing the cursor keys.

Line 8 : If the device is MS-DOS format, "MS-DOS" is displayed here.

Line 9 : The device name for the displayed directory, and the current directory name, are displayed here.

Line 11 : Normally, "PARENT DIRECTORY" is displayed here.

To change the directory to the parent directory, locate the cursor at "PARENT DIRECTORY" and press the [WRITE] key.

Lines 12 to 20 : The directory is displayed here.

File names and directory names are displayed ("\" is appended at the end of directory names).

If no file name is displayed, it means that the selected device does not contain files.

When the cursor is located at a file name and the WRITE key pressed, the selected file name is entered at the position of the edit pointer.

When the cursor is located at a directory name and the WRITE key pressed, the directory changes to the selected directory.

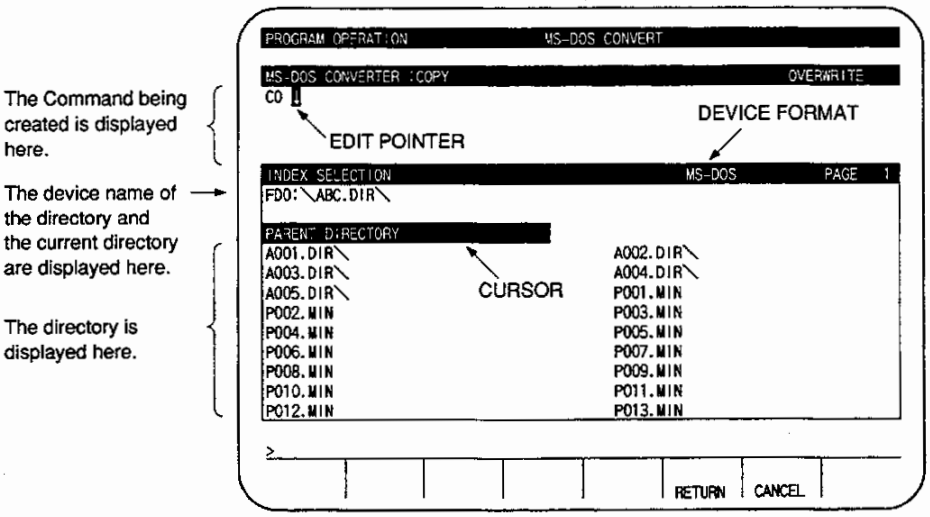


Fig. 2-19 Directory Selection Screen (for MS-DOS Format Devices)

15-5-3. Changing the Directory

The directory can be changed by locating the cursor at the required directory name and pressing the WRITE key.

If the cursor is located at "PARENT DIRECTORY" and the WRITE key pressed, the directory changes to the parent directory.

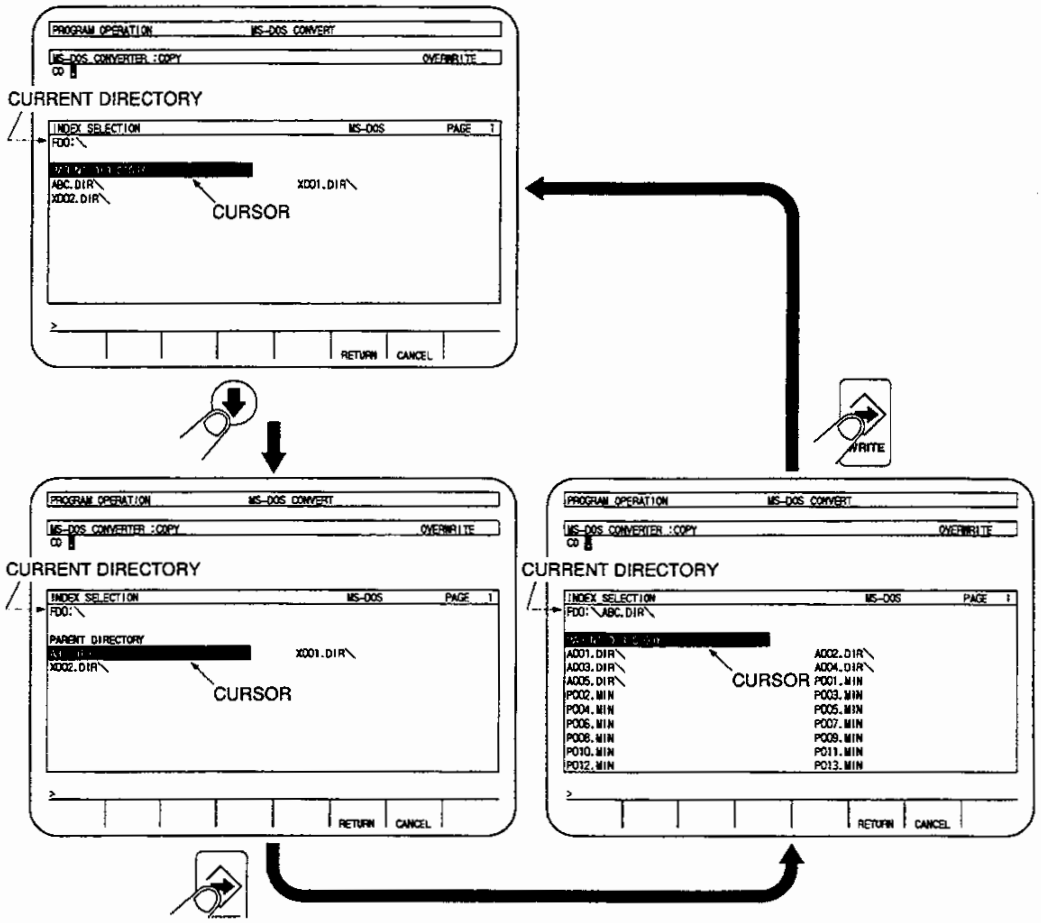


Fig. 2-20 Changing the Directory

15-5-4. Function Key [F6] (RETURN), [F7] (CANCEL) and Cancel Key

When function key [F6] (RETURN) is pressed, the command creation screen is displayed and the device and current directory names are entered at the position of the edit pointer. The file name that was at the cursor position is not entered.

When function key [F7] (CANCEL) or the Cancel key is pressed, the command creation screen is displayed and the device name, current directory name and the file name at the cursor position are not entered on it.

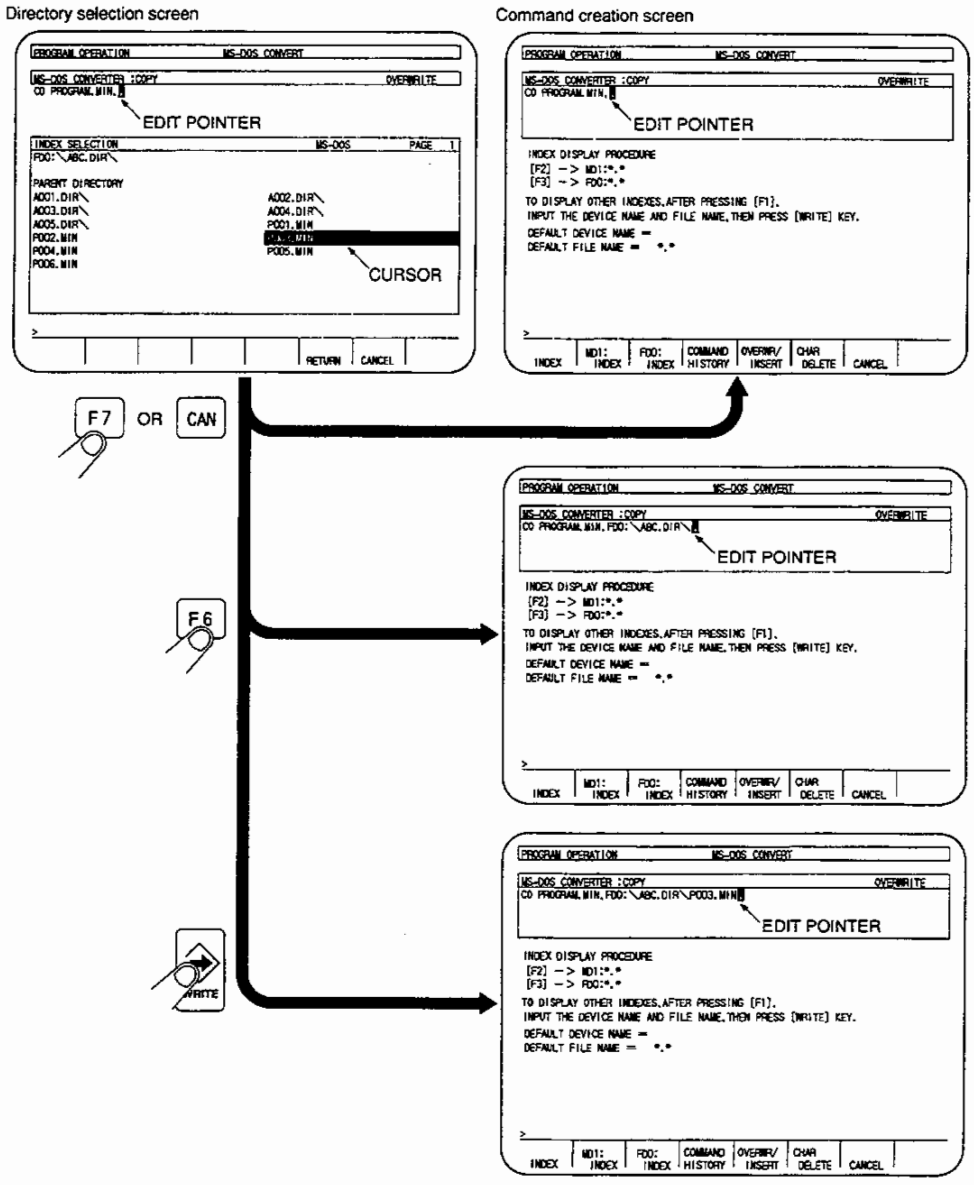


Fig. 2-21 Function Key [F6] (RETURN) and Cancel Key

15-5-5. Directory Display Method

(1) To Display Floppy Disk "FD0:" Directory

Press [F3] function key (FD0: INDEX).

The input examples given below show how to designate which file directory is to be displayed.

(2) When function key [F1] (INDEX) is pressed, "ISO" will be displayed at the console line.

Following the "ISO" character string, enter the desired device name, path name, and file name, then press the [WRITE] key. The following examples apply when an MS-DOS formatted floppy disk is being used.

```
>ISO  FD0:  [WRITE]
```

The directory for the default path name and file name at the FD0: device will be displayed.

The default file name is indicated at the directory display procedure.

The default path name used at the MS-DOS file convert function is route directory "\". The default path name used at the MacMan mode can be designated as desired at the environment setting operation.

(3) When a path name is entered before pressing the WRITE key:

```
>ISO  FD0:\ABC\      [WRITE]
```

(Absolute path designation)

The directory for the FD0: device, "\ABC\" path name, and default file name will be displayed.

If the path "\ABC\" does not exist in the device, the message "SPECIFIED PATH DOESN'T EXIST." is displayed on the console line.

```
>ISO  FD0:ABC\      [WRITE]
```

(Relative path designation)

A path name which doesn't begin with "\" is interpreted as a relative path from the default path name.

```
>ISO  FD0:\*.*\ [WRITE]
```

The message "ERROR IN SPECIFIED PATH NAME." is displayed on the console line.

The wild cards "*" and "?" cannot be used in any of the directory names that make up a path name.

```
>ISO  FD0:\ABC.1234\ [WRITE]
```

```
>ISO  FD0:\123456789.ABC\ [WRITE]
```

The message "ERROR IN SPECIFIED PATH NAME." is displayed on the console line.

The following restrictions apply to the directory names that make up path names: the main directory name must comprise no more than eight alphanumeric characters and the extension must comprise no more than three alphanumeric characters.

```
>ISO  FD0:\ABC\123456789.ABC
```

```
>ISO  FD0:\ABC\ABC.1234
```

The message "ERROR IN SPECIFIED FILE NAME." is displayed on the console line.

If a path name is specified, the format is taken to be MS-DOS and therefore the main file name must consist of no more than eight alphanumeric characters and the extension name must consist of no more than three alphanumeric characters.

SECTION 3 DATA INPUT/OUTPUT OPERATION

1. NC Program Input/Output Function Using MS-DOS Format Floppy Disk

The MS-DOS format I/O function enables input and output of NC part programs using MS-DOS format 3.5-inch floppy disks.

(1) Program input and output using this function is possible with the following MS-DOS formats:

- 3.5-inch 2DD floppy disks (640 KB/720 KB)
- 3.5-inch 2HD floppy disks (1.20 MB)
- 3.5-inch 2HD floppy disks (1.23 MB)
- 3.5-inch 2HD floppy disks (1.44 MB)

[Supplement] 1. "MS-DOS" is a trademark of the Microsoft Corporation.

2. Even if a 3.5-inch floppy disk can be read and written to at an MS-DOS-compatible personal computer, it may not be possible to read and write to the disk using this function if its format is not a regular one conforming to published MS-DOS literature.

1-1. Operation Overview

The MS-DOS format I/O function indicates the operation (1) and (2) in the illustration given below.

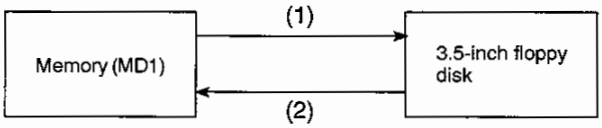


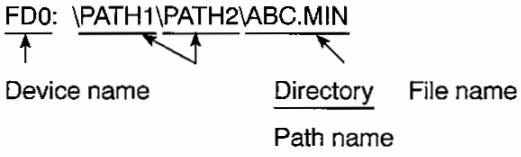
Fig. 3-1 Operation Overview

(1) In the program operation mode, part programs and other NC data stored in the NC memory are copied to a floppy disk using the copy command.

(2) In the program operation mode, part programs and other NC data saved in the floppy disk are copied to the NC memory using the copy command.

1-2. Specifying MS-DOS File Names

MS-DOS file names are specified in the way shown below.



[Supplement] 1. The reverse slash "\" is used as the delimiter between directory names (the "\" following the device name can be omitted).

2. It is not normally necessary to specify a device name when handling NC files but it is essential to specify one for MS-DOS files.

[Supplement]

3. The total length of the sequence "device name:path-name\file name" must not exceed 64 characters.
4. The length of the path-name must not exceed 47 characters.
5. The file name consists of a main file name (with a maximum length of 8 characters) and an extension name (with a maximum length of 3 characters), and a period "." is used as a delimiter between the main file name and extension. The file name must begin with a letter of the alphabet and the characters that follow it can only be numerals, letters of the alphabet, "." or "-".

1-3. Command List

The list of commands used for the MS-DOS format I/O function are given below.

Item	Command	Function Outline
Directory	DIR	Displays an MS-DOS format directory.
Copying*	COPY	Copies files from MS-DOS format to OSP format and vice versa.
Renaming*	RENAME	Used to change specified file names in the MS-DOS format.
Deletion*	DELETE	Used to delete specified files in the MS-DOS format.
Remaining capacity	FREE	Indicates the remaining memory capacity in the MS-DOS format.
File protection*	PROTECT	Prohibits updating the information of specified files in the MS-DOS format.
Program im-put*	IN	Program Input Work program files are input from the MS-DOS formatted floppy disk to the memory disk while deleting any "%" codes.
Program out-put*	OUT	Work program files are output from the memory disk to an MS-DOS formatted floppy disk. If option "E" is selected, only the "%" record will be added at the beginning and end of the output files.
MS-DOS Quit	QUIT	Used to quit MS-DOS.

The commands indicated by an asterisk (*) are executed on the directory-selection-based file operation screen. The following explanation gives basic information on using these commands. In addition to the basic information given below, there are various functions including the function to display the registered part program files in batch. For details of the functions, refer to Section 2, 15. "Directory-selection-based File Operation Function".

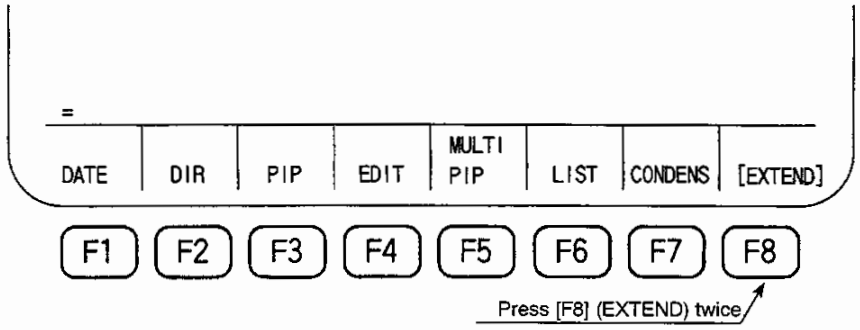
Operation for the commands is described below.

Since all of these commands are executable in the MS-DOS mode, the procedure to set the MS-DOS mode is explained first. Description of the individual commands is given assuming that the MS-DOS has been set.

Procedure used to set the MS-DOS operation mode:

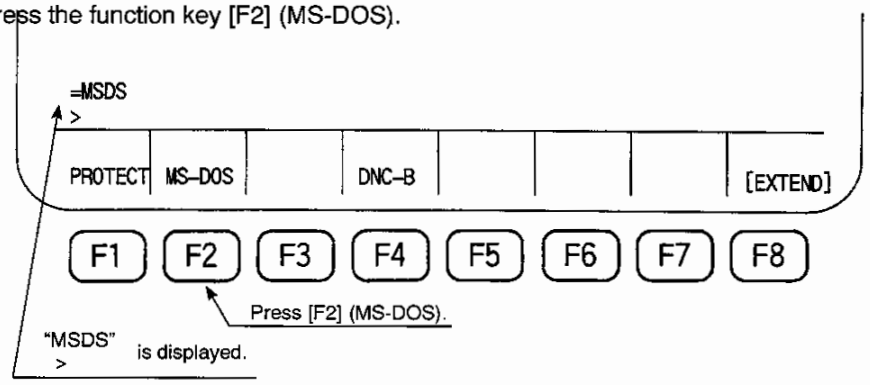
(1) Press the EDIT AUX mode selection key to select the PROG OPERATION mode.

(2) Press the function key [F8] (EXTEND) twice.

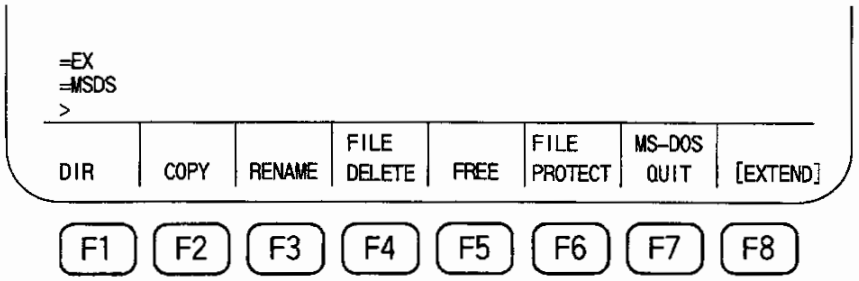


The function names on the screen will change to those given in item (3) below.

(3) Press the function key [F2] (MS-DOS).

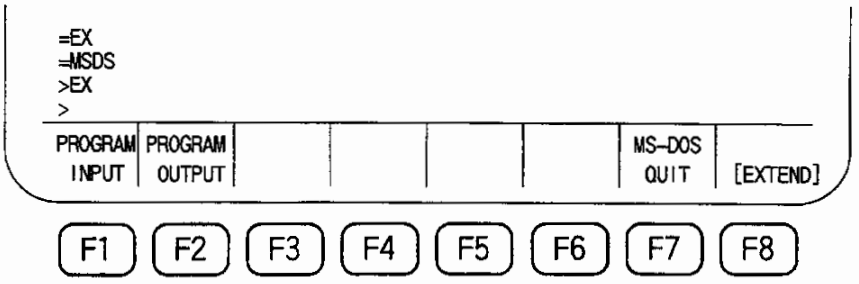


The function names on the screen will change as indicated to the right.



Press function [F8] (EXTEND).

The function names on the screen will change as indicated to the roght



The commands are explained below.

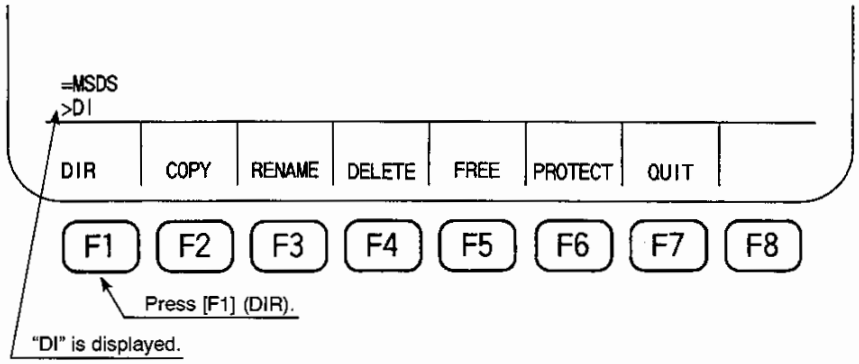
1-4. DIR (directory)

This function is used to display a list of the files and directories saved in an MS-DOS format floppy disk (FD0:).

The operating procedure is indicated below.

(1) Press function key [F1] (DIR).

"DI" is displayed on the command line.



(2) Enter the device name following ">DI" for the device which stores the files.

Example 1: The following command displays all the directory names and file names in the MS-DOS format floppy disk designated as device "FD0:".

>DI FD0:

Example 2: The following command displays all the directory names and file names in the directory "PATH" of the disk designated as device "FD0:".

>DI FD0:PATH (or alternatively, >DI FD0:\PATH)

Example 3: The following command displays all the directory names and file names under the directory "PATH1" which is under the directory "PATH" of the disk designated as device "FD0:".

>DI FD0:PATH\PATH1

Example 4: The following command format displays all the directory names and file names that start with the character string "F0" in the directory "PATH" of the disk designated as device "FD0:".

>DI FD0:PATH\F0*

(3) Press the WRITE key.

[Supplement]

1. The use of the wild cards "*" and "?" is only valid for files; an error will occur if either of these symbols is used with a device name or directory name (path name).

2. A maximum of 12 file names and directory names can be displayed on each screen.

   If it is not possible to display all the directory and file names on a single screen, the symbol "=" (the command prompt) will not be displayed on the command line and the cursor display will remain unchanged. In this condition:

   (a) Pressing the BS key will scroll the screen forward one page.

   (b) Pressing the WRITE key will scroll the display continuously in page units until the end of the directory is reached (press BS to stop scrolling part way through).

   (c) Pressing the CAN key will terminate execution of the command and leave the currently displayed page.

3. "<DIR>" displayed in the sector column indicates that the entry is a directory.

4. If a file name includes a character other than those indicated below, such a character is replaced with "?" to be displayed.

   Space, !, ", #, $, %, &, ', (,), *, +, –, ., /, 0 to 9, :, ;, <, =, >, ?, @, A to Z, [, ¥,], ^, _, a to z, {, |, }, ~

5. The following options can be specified after the file name. They must be preceded by a semicolon ";".

   ;P (file protected state is displayed following the date)

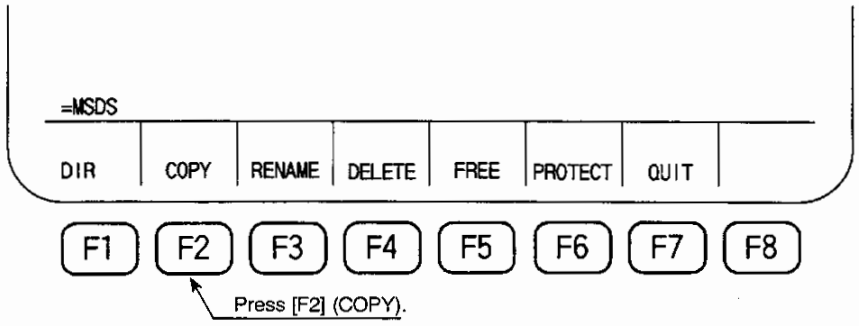
   00 : Not protected
   01 : File protected

1-5. COPY (copying)

This function copies files from the MS-DOS format to the OSP format and vice versa.

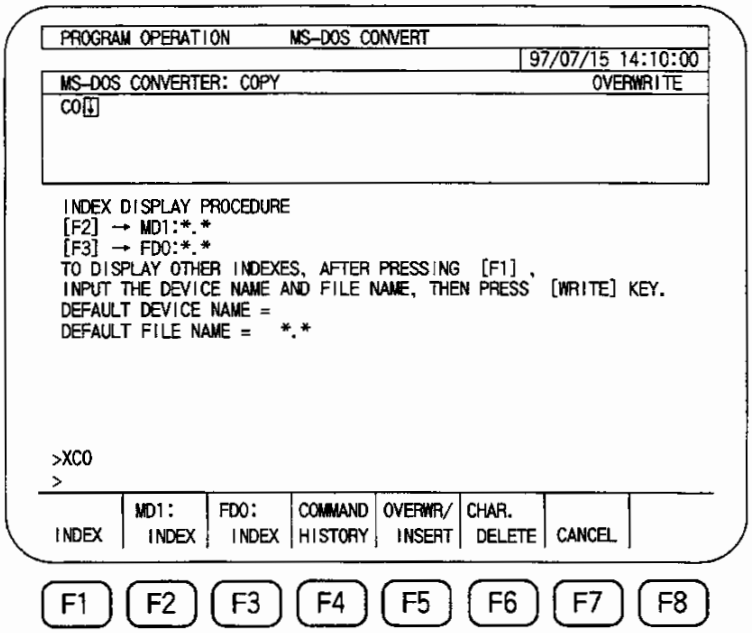
The operating procedure is indicated below.

(1) Press function key [F2] (COPY).



The screen changes to the directory-selection-based file operation screen and the following is displayed on the screen.

MS-DOS CONVERTER: COPY
CO



(2) Enter the device name, path name, and file name of the program to be copied.

(a) Use the following command format when copying from MS-DOS format to OSP format:

>CO <device name>:<path name + file name or path name> <device name>:<file name>

If a path name is specified as the copying source, all the files (excluding directories) listed in the directory indicated by that path name will be copied.

(b) Use the following command format when copying from OSP format to MS-DOS format:

>CO <device name>:<file name> <device name>:<path name + file name or path name>

If a path name is specified as the copying destination, the file (or files) is (are) copied into the directory indicated by that path name.

Example 1: The following command copies A.MIN in FD0: (MS-DOS) to MD1: (OSP) under the file name B.MIN.

>CO FD0:A.MIN,MD1:B.MIN

Example 2: The following command copies all files in the directory "PATH" of FD0: (MS-DOS) to MD1: (OSP).

>CO FD0:PATH*,MD1:

or

>CO FD0:PATH,MD1:

Example 3: The following command copies all FD0: (MS-DOS) files whose main file names start with the letter C and comprise three characters or less to MD1: (OSP).

>CO FD0:C??.MIN,MD1:

Example 4: The following command copies MAIN files (files without their extension names) from FD0: (MS-DOS) to MD1: (OSP).

>CO FD0:MAIN,MD1:

When this command is used "MIN" is automatically appended as the extension name of the destination file, so that the file name is MAIN.MIN.

Example 5: The following command copies A.MIN of MD1: (OSP) to FD0: (MS-DOS) under the name "B.MIN".

>CO MD1:A.MIN,FD0:B.MIN

Example 6: The following command copies A.MIN of MD1: (OSP) to FD0 (MS-DOS) under the name "C.MIN" under the directory "PATH".

>CO MD1:A.MIN,FD0:PATH\C.MIN

Example 7: The following command copies A.MIN of MD1: (OSP) to FD0: (MS-DOS) under the same file name as it had in the copying source.

>CO MD1:A.MIN,FD0:

Example 8: The following command copies all files whose file names start with "A" in MD1: (OSP) to the directory "PATH" of FD0: (MS-DOS).

>CO MD1:A*,FD0:PATH

(3) Press the WRITE key.

[Supplement]

1. The COPY function can only be used to copy between the OSP format and MS-DOS format. Attempts to copy from OSP to OSP or from MS-DOS to MS-DOS will result in an error.
2. This function has no default device name and it is therefore essential to specify the device name.
3. If no destination file name is specified it is made the same as the source file name.
4. Contiguous OSP format files cannot be overwritten. If an attempt is made to do this the message "file attribute unsame" is displayed.
5. If the specified destination file name already exists, the message "file exist overwrite? (Y/N)" will be displayed. To overwrite the file, enter "Y"; to abort the writing operation, enter "N".
6. If the copied file name contains any characters other than those listed below, these characters will all be replaced by question marks:

   Space, !, ", #, $, %, &, ', (,), +, –, ., /, 0 to 9, :, ;, <, =, >, ?, @, A to Z, [, \,], ^, _, a to z, {, |, }, -

NOTICE

: (1) Copying from OSP format to MS-DOS format is possible for ASCII data files but if this operation is attempted with a binary data file the message "file attribute unsame" is displayed and the copying operation is terminated.

Both ASCII data files and binary data files can be copied from MS-DOS format to OSP format, but binary data files may not be copied accurately.

(2) When copying from MS-DOS format to OSP format, if the MS-DOS file has no extension name, "MIN" is automatically appended to the OSP file name as a default. Similarly, when copying from OSP format to MS-DOS format, the extension name for the MS-DOS file will be "MIN" if no extension name is specified.

(3) The following option can be specified. It must be preceded by a semicolon ";".

;V Specifies use of the following request for confirmation for each of the files specified for copying:

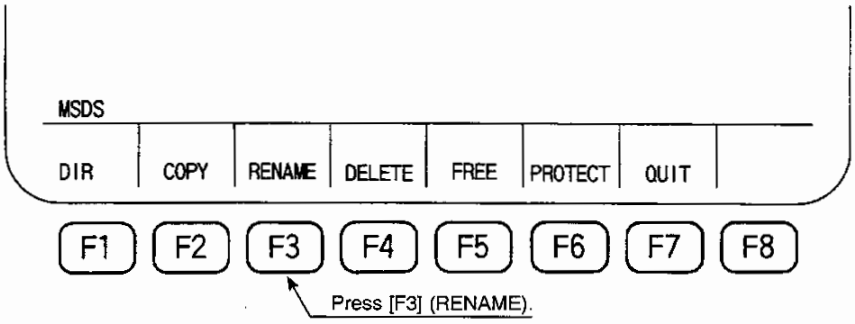
copy OK? (Y/N)

To copy the file, enter "Y"; to abort the copying operation, enter "N".

1-6. RENAME (renaming)

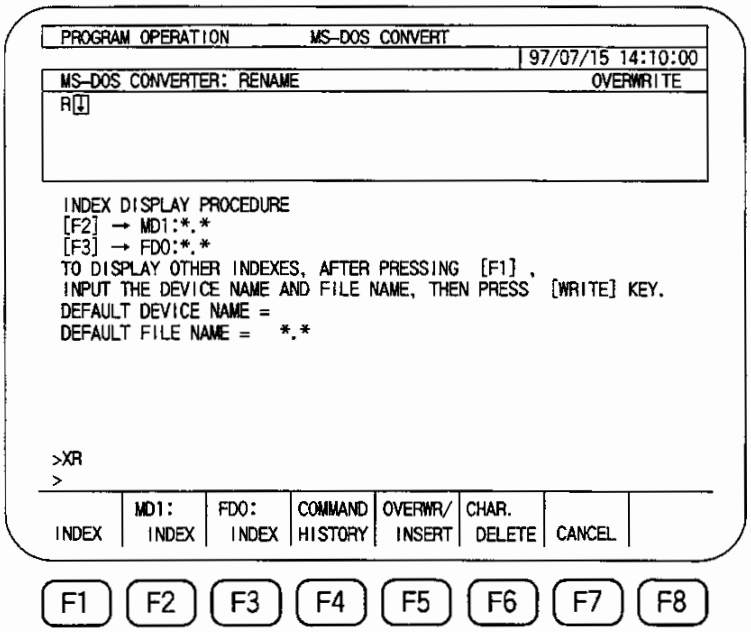
This function is used to change the name of an MS-DOS format file. The operating procedure is indicated below.

(1) Press function key [F3] (RENAME).



The screen changes to the directory-selection-based file operation screen and the following is displayed on the screen.

MS-DOS CONVERTER: RENAME
R



(2) Enter the file name (including the device name and path name) of the MS-DOS format file whose name is to be changed and the file name (not including the device name and path name) that it is to be changed to.

Example: The following command changes the file name FD0:PATH\PATH1\FILE to the file name FD0:PATH\:PATH1:FILE1.

>R FD0:PATH\PATH1\FILE,FILE1

(3) Press the WRITE key.

[Supplement]

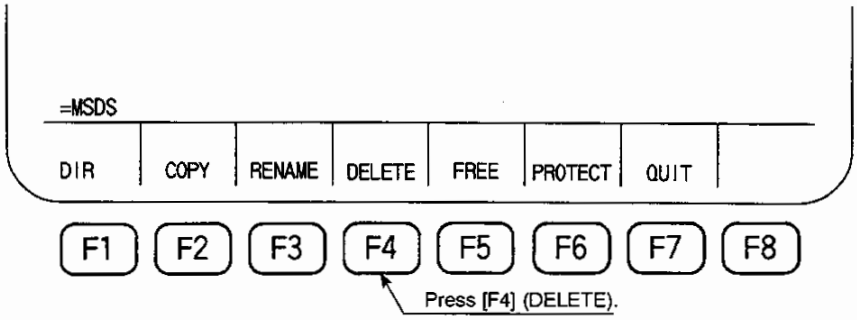
1. If the specified file (current file name) does not exist in the floppy disk, the message "no file" is displayed on the console lines and the renaming operation is terminated.
2. If a file with the same name as that specified for the file after the change already exists in the floppy disk, the message "file exist" is displayed on the console lines and the renaming operation is terminated.
3. The wild cards "*" and "?" cannot be used in the file names (their use will cause an error).
4. Specify only the file name (with no device name or path name) for the file name after the change. An error will occur if a device name or path name is specified.
5. If the specified file is a directory, the message "directory" is displayed on the console lines and the renaming operation is terminated.

1-7. DELETE (delete)

This function is used to delete MS-DOS format files.

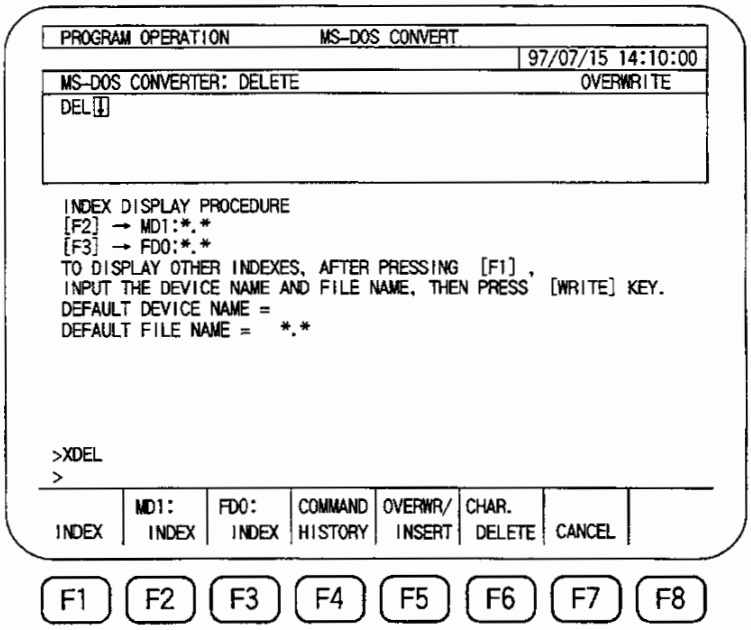
The operating procedure is indicated below.

(1) Press function key [F4] (DELETE).



The screen changes to the directory-selection-based file operation screen and the following is displayed on the screen.

MS-DOS CONVERTER: DELETE
DEL



(2) Enter the file name (including the device name and path name) of the MS-DOS format file that is to be deleted.

Example 1: The following command deletes the file FILE.MIN in device "FD0:".

>DEL FD0:FILE.MIN

Example 2: The following command deletes the file FILE2.MIN in the directory "PATH" of device "FD0:".

>DEL FD0:PATH\FILE2.MIN

Example 3: The following commands delete all files in the directory "PATH" of device "FD0:".

>DEL FD0:PATH*.*

or

>DEL FD0:PATH

In this case, because a directory has been specified as the file name to be deleted, all the files contained in that directory ("PATH"), except directories, will be deleted.

In order to make this clear, the request for confirmation "delete OK? (Y/N)" is displayed on the console lines.

(3) Press the WRITE key.

[Supplement]

1. The wild cards "*" and "?" can be used in the file name (wild cards cannot be used in path names).
2. If no option is specified deletion is executed unconditionally (unless it is a path name that is specified for deletion).
3. Directories cannot be deleted.
4. Files protected by the file protection function cannot be deleted.
5. The following option can be specified. It must be preceded by a semicolon ";".

   ;V Specifies the use of a request for confirmation when an attempt is made to delete a file.

   To delete the file, enter "Y"; to abort the deleting operation, enter "N".

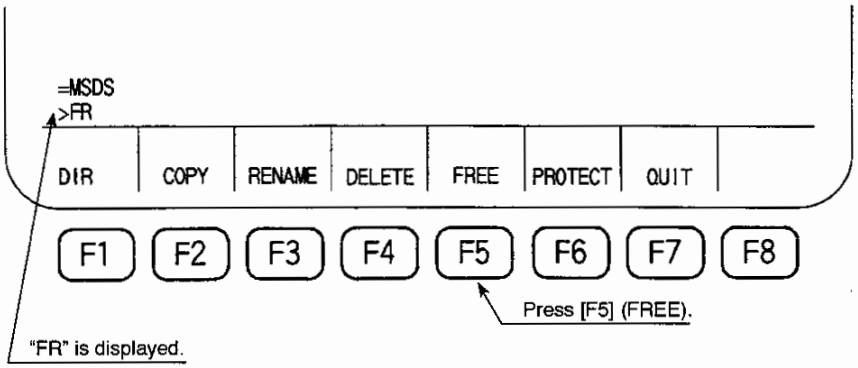
1-8. FREE (free)

This function displays the available capacity in an MS-DOS format floppy disk.

The operating procedure is indicated below.

(1) Press function key [F5] (FREE).

"FR" is displayed on the command line.



(2) Enter the device name.

Example: The following command displays the available capacity of device "FD0:".

>FR FD0:

(3) Press the WRITE key.

[Supplement] Never specify any more than a device name in the command.

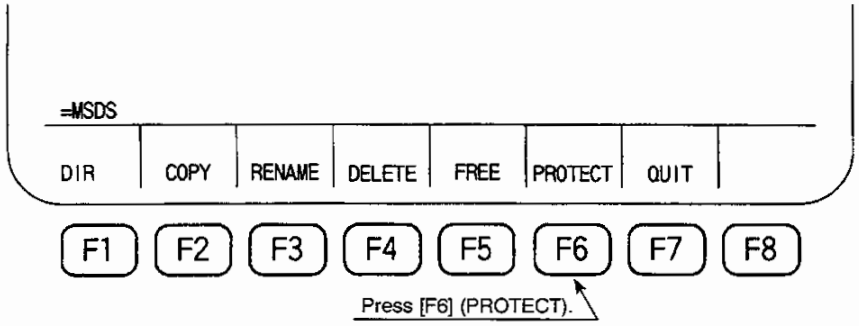
1-9. PROTECT (protect)

This function establishes, and cancels, write protection for MS-DOS files (it is equivalent to the ATTRIB function in MS-DOS).

When a file is protected it cannot be renamed, deleted, or overwritten by copying.

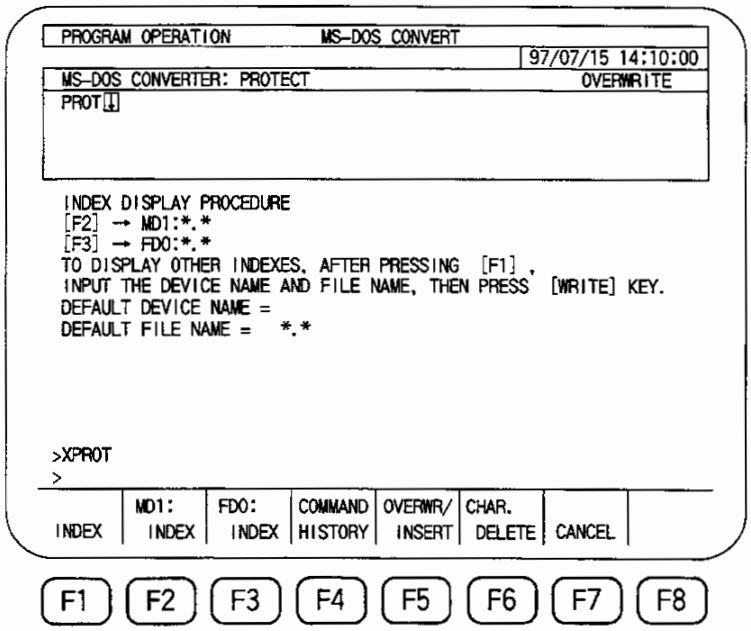
The operating procedure is indicated below.

(1) Press function key [F6] (PROTECT).



The screen changes to the directory-selection-based file operation screen and the following is displayed on the screen.

MS-DOS CONVERTER: PROTECT
PROT



(2) Enter the file name (including the device name and path name).

Example 1: The following command protects the file FILE.MIN in device "FD0:".

```
>PROT FD0:FILE.MIN
```

Example 2: The following command protects all files with the extension name MIN in device "FD0:".

```
>PROT FD0:*.MIN
```

Example 3: The following command cancels protection for the file FILE.MIN in device "FD0:".

```
>PROT FD0:FILE.MIN;C
```

Example 4: The following command protects all files in the directory "PATH" of device "FD0:".

```
>PROT FD0:PATH\*.*
```

(3) Press the WRITE key.

[Supplement]

1. The wild cards "*" and "?" can be used in file names.
2. If the specified file is a directory, the message "directory" is displayed on the console lines and the file protection operation is terminated.
3. If the option V (;V) is not specified, files will be protected (or have their protection canceled) unconditionally.
4. The following options can be specified. They must be preceded by a semicolon ";".

   ;C Cancels file protection.

   ;V Specifies use of a request for confirmation of whether or not the file may be protected (or have its protection canceled).

   If the file may be protected or file protection may be canceled, enter "Y"; to abort the file protection or protection cancellation operation, enter "N".

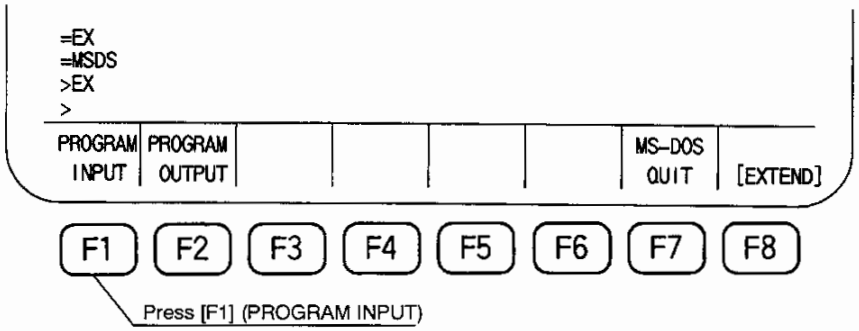
1-10. Special Input/Output Function For Work Program Files

1-10-1. Program Input

Work program files are input from the MS-DOS formatted floppy disk to the memory disk while deleting any "%" codes which may exist within, or at the beginning of the files.

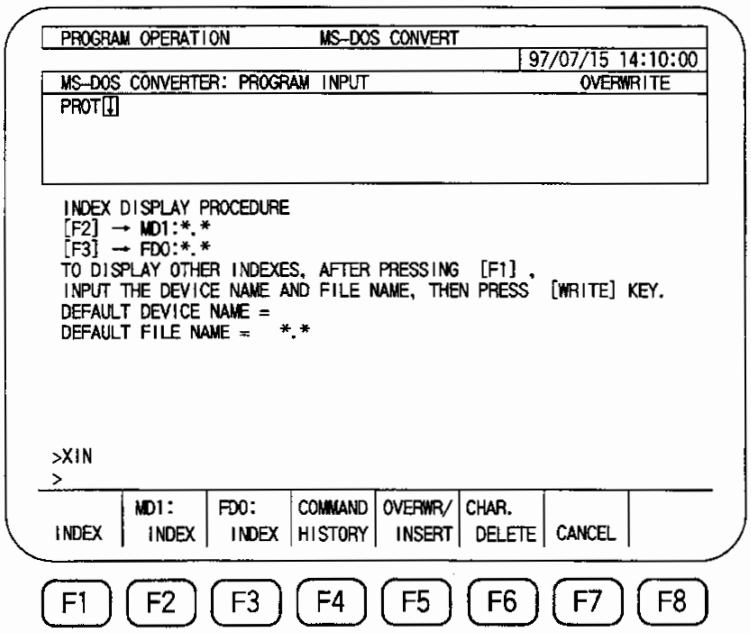
The operation procedure is indicated below.

(1) Press function key [F1] (PROGRAM INPUT)



The screen changes to the directory-selection-based file operation screen and the following is displayed on the screen.

MS-DOS CONVERTER: PROGRAM INPUT
IN



(2) Enter the device name, path name, and file name for the work program which is to be input.

IN <MS-DOS format device name:> <MS-DOS format path name + file name, or file name>, <OSP format device name:> <OSP format file name>; <option>

With the exception of the following points, operation is identical to the COPY function.

- In order be executed as a work program, the "%" codes within, or at the beginning of the files, are deleted.
- "FD0:", "FD1:", "FD2:", and "FD3:" may be designated as the

  If no device name is designated, "FD0:" will be adopted.

  If any device name other than those shown above is designated, an error will occur.
- "MD0:", "MD1:", and "MD∗:" (∗ = A-H) may be designated as the

  If no device name is designated, "MD1:" will be adopted.

  If any device name other than those shown above is designated, an error will occur.

Example:

IN ABC.MIN	→	CP FD0:ABC.MIN, MD1: + % codes deleted
IN ABC.DIR\	→	CP FD0:ABC.DIR\, MD1: + % codes deleted
IN FD0:\∗.MIN	→	CP FD0:\∗.MIN,MD1: + % codes deleted
IN ABC.DIR\ABC.MIN, ;V	→	CP FD0:ABC.DIR\ABC.MIN, MD1: ; V → + % codes deleted
IN MD1:ABC.MIN	→	× (Error)
IN FD1:ABC.MIN,FD0:	→	× (Error)

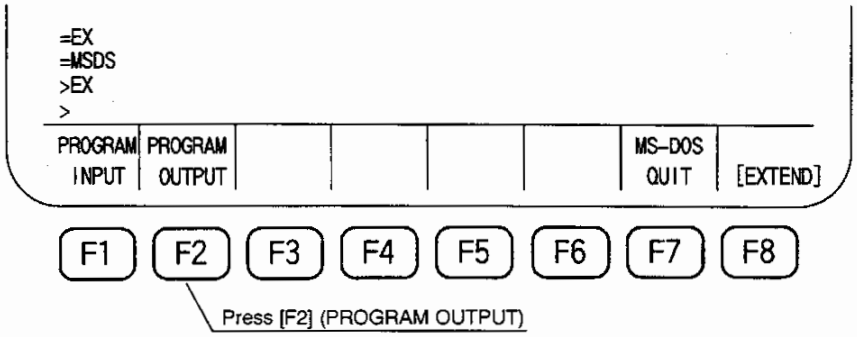
1-10-2. Program output

Work program files are output from the memory disk to an MS-DOS formatted floppy disk.

If option "E" is selected, only the "%" record will be added at the beginning and end of the output files.

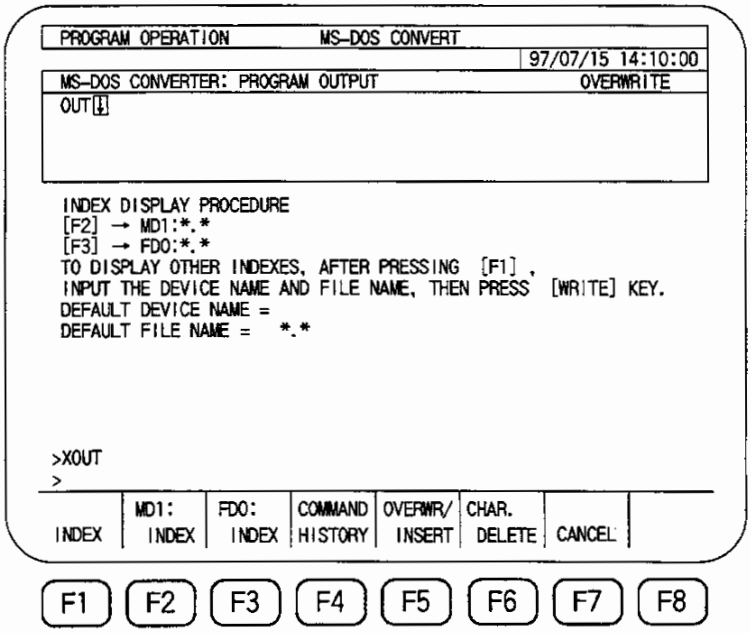
The operation procedure is indicated below.

(1) Press function key [F2] (PROGRAM OUTPUT)



The screen changes to the directory-selection-based file operation screen and the following is displayed on the screen.

MS-DOS CONVERTER: PROGRAM OUTPUT
OUT



(2) Enter the device name, path name, and file name for the work program which is to be output.

OUT <OSP format device name:> <OSP format file name>, <MS-DOS format device name:> <MS-DOS format file name>; <option>

With the exception of the following points, copying occurs in the same manner.

- "MD0:", "MD1:", and "MD∗:", (∗: A to H) may be designated as the

  If no device name is designated, "MD1:" will be adopted.

  If any device name other than those shown above is designated, an error will occur.

- "FD0:", "FD1:", "FD2:" and "FD3:", may be designated as the

  If no device name is designated, "FD0:" will be adopted.

  If any device name other than those shown above is designated, an error will occur.

- Option "E" may be designated. If designated, only the "%" record will be added at the beginning and end of the output files.

Example:

OUT ABC.MIN	→	CP MD1:ABC.MIN, FD0:
OUT ABC.MIN;E	→	CP MD1:ABC.MIN,FD0: + % codes deleted
OUT MD1:∗.MIN;V	→	CP MD1:∗.MIN,FD0:;V
OUT MD1:∗.MIN;VE	→	CP MD1:∗.MIN,FD0:;V + % codes deleted
OUT ABC.MIN,ABC.DIR\	→	CP MD1:ABC.MIN,FD0:ABC.DIR\
OUT ABC.MIN,ABC.DIR\;E	→	CP MD1:ABC.MIN,FD0:ABC.DIR\ + % codes deleted
OUT FD0:ABC.MIN	→	× (Error)

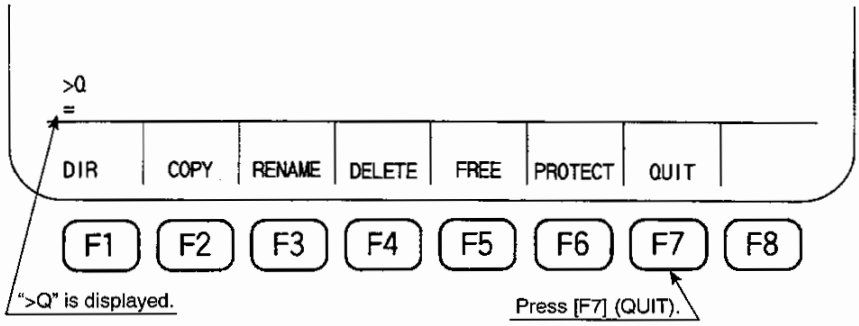
1-11. Quitting MS-DOS

This function quits the MS-DOS operation mode.

(1) Press function key [F7] (QUIT).

">Q" is displayed on the command line.

"=" will be displayed to indicate the completing of quit.



1-12. Character Codes

(1) Carriage Return Character

In MS-DOS the carriage return character comprises two bytes for CR and LF ($0D, $0A).

In NC there is only LF ($A).

The NC converts carriage return characters internally.

(2) File End Character

In MS-DOS the character ^Z ($1A) that indicates the end of a file is normally appended at the end of each file. There are cases in which this character is not appended.

If this character appears part way through a file, all the data following it is ignored.

(3) Treatment of Non-ASCII Characters etc. by NC

Some codes that are not used in ASCII (most significant bit = 1) are used for European languages. The NC cannot handle non-ASCII codes like these. When a file is read into the NC, any non-ASCII codes that it contains (including control codes other than the carriage return code) are replaced by question marks "?".

In addition, since the file end character may appear as the second byte of a two-byte character, the NC cannot determine whether it is the file end character or a second byte. The file end character is therefore ignored.

1-13. Miscellaneous Cautions

(1) If the destination file name in a copying operation already exists, the existing file is normally overwritten. However, if for some reason the copying operation cannot be completed normally and the copy of the source file cannot be created, this will mean that the existing file (which was being overwritten) is deleted. If this happens, the error message indicating the cause of the copying failure is displayed, then the following message is displayed on the console lines:

"<deleted file name> deleted"

Note, however, that – depending on the timing of the deletion of the existing file and the creation of the new one – this message can sometimes be displayed even when the file is successfully overwritten.

(2) When copying a file from the MS-DOS format to the NC, if the file name specified in the NC is the same as that of a program that is currently selected for automatic operation, and the program selection method was B, S, or M, an error will occur.

Similarly, an error will also occur if a file being processed by the schedule program automatic update function is specified.

(3) The floppy disk used with the MS-DOS format I/O function must be MS-DOS formatted.

An error will occur if a floppy disk that is not MS-DOS formatted is used. (But note that, for copying, either the source or destination must be OSP format.)

(4) Specifications such as "*A.MIN", where the wild card is used as the first character, are treated in the same way as "*.MIN".

(5) If a directory is specified when using the DIR, COPY, or DELETE function, all the files contained in that directory will be subject to the specified operation. If a directory is specified for the RENAME or PROTECT function the message "directory" will be displayed on the console lines and the operation will be aborted because it is only possible to rename or protect one file at a time.

(6) Meaning of the wild card "*" under different functions

DIR : Both "*" and "*.*" specify all file names with and without extension names.

DELETE : "*" specifies file names without extension names and "*.*" specifies file names with extension names only.

PROTECT : "*" specifies file names without extension names and "*.*" specifies file names with extension names only.

COPY : "*" specifies file names without extension names and "*.*" specifies file names with extension names only.

2. OSP Format I/O Function

The OSP format I/O function makes input/output of the part programs using an OSP format 3.5-inch floppy disk.

2-1. Operation Overview

The "OSP format I/O function" means operations (1) (2) (3) and (4) in the illustration below.

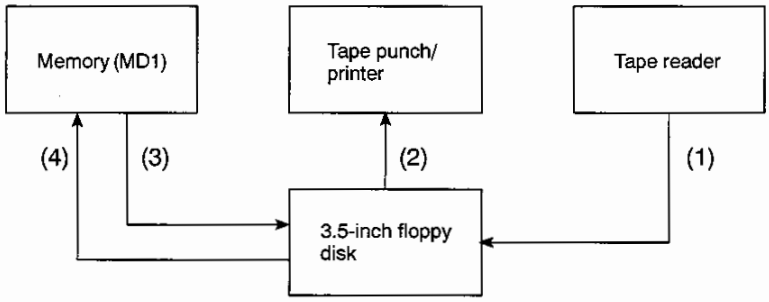


Fig. 3-2 Operation Overview

(1) A part program on paper tape can be read directly into a 3.5-inch floppy disk by using the READ command in the PIP (transfer) mode, which is accessed from the PROG OPERATION mode.

(2) A part program can be output from the 3.5-inch floppy disk to the tape punch or printer in the following manner:

(a) A part program stored in a 3.5-inch floppy disk can be output directly to a tape punch to punch out a paper tape by using the PUNCH command in the PIP mode of the PROG OPERATION mode.

(b) Similarly, a part program stored in a 3.5-inch floppy disk can be output directly to a printer to create a process sheet by using the LIST command.

(c) The file names of part programs stored in a 3.5-inch floppy disk can be output directly to a printer to create a directory of file names by using the DIR command.

(3) Part programs stored in the memory of the NC can be copied to a 3.5-inch floppy disk by using the COPY command in the PIP mode of the PROG OPERATION mode.

(4) Part programs stored in a 3.5-inch floppy disk can be copied to the memory of the NC by using the COPY command in the PIP mode of the PROG OPERATION mode.

2-2. Operation Commands

(1) The table given below indicates which command can be used with which input/output devices.

Command \ Peripheral Device		Sector Device	Tape Reading Device	Tape Punching Device	Printing Device
F2 DIR		Input			Output
F3 PIP	F1 READ	Output	Input		
	F2 PUNCH	Input		Output	
	F3 VERIFY	Output Input	Input		
	F4 COPY	Input Output			
F5 FREE		Input			Output
F6 LIST		Input			Output
F2 INIT		Output			
F3 DELETE		Output			
F4 RENAME		Output			
F1 PROTECT		Output			

[Supplement] For the operation of the commands, refer to Section 2 "PROGRAM OPERATION".

(2) Peripheral Device Classification and Abbreviations

Sector devices

MD1: → User memory
FD0: → 3.5-inch floppy disk
FD1: → 3.5-inch floppy disk

Tape reading devices

TR: → Tape reader
CN0: → Tape reader connected at RS232C channel 0
CN1: → Tape reader connected at RS232C channel 1
CN2: → Tape reader connected at RS232C channel 2
CN3: → Tape reader connected at RS232C channel 3

Tape punching devices

CN0: → Tape punch connected at RS232C channel 0
CN1: → Tape punch connected at RS232C channel 1
CN2: → Tape punch connected at RS232C channel 2
CN3: → Tape punch connected at RS232C channel 3

Printing devices

CN: → Console
PN: → NC operation panel
CN0: → Printer connected at RS232C channel 0
CN1: → Printer connected at RS232C channel 1
CN2: → Printer connected at RS232C channel 2
CN3: → Printer connected at RS232C channel 3

(3) The default devices are indicated below.

For sector devices	MD1:	
Tape reading devices	TR:	(This automatic selection can be changed by setting NC optional parameter (word) No. 57.)
Tape punching devices	CN0	(This automatic selection can be changed by setting NC optional parameter (word) No. 45.)
Printing devices	PN:	

The default device for a tape reading device or tape punching device can be changed by changing the parameter settings.

(4) If the output NC program name is not specified, the input program name is assigned to the output program.

(5) If the input NC program name is not specified, the name assigned will be A.MIN unless an NC program name is specified on the tape, in which case that name will be used.

2-3. Types of Floppy Disk

(1) 3.5-inch Floppy Disks

Type	Recommended Maker	Format for OSP
2DD 80 track 135 TPI	TDK 3M Hitachi Maxell	9 sectors/track 512 bytes/sector
2HD 80 track 135 TPI		18 sectors/track 512 bytes/sector

(2) Supplement

(a) Since the NC creates files in the OSP format (a file management system exclusive to OSP), it cannot write to or read the 3.5-inch floppy disks containing files created in the format on another computer.

(b) New 3.5-inch floppy disks must be initialized before they can be used.

(c) The storage capacity of each type of 3.5-inch floppy disk, expressed in terms of the equivalent tape length, is indicated in the table below.

Floppy Disk Type	3.5-Inch	
	2DD	2HD/2HC
Storage Capacity (tape length) [m]	1840	3770

3. Tape Punch Interface

(1) An RS232C serial interface is provided to allow connection of a tape punch.

Connecting a peripheral device such as a tape reader or tape punch that also has an RS232C serial interface to this RS232C interface enables bulk transfer of NC part program data.

When the RS232C interface is used for connecting a tape punch, it is necessary to set the parameters so that communication is possible between the NC and the external device (tape punch).

(2) There are two methods for data transfer using RS232C - the normal BTR (behind tape reader) method and a method using DC code control - and the method for connection to the peripheral device differs according to which of these is used.

3-1. Operation Commands

(1) The table given below indicates which command can be used with which input/output devices.

Command \ Peripheral Device		Sector Device	Tape Reading Device	Tape Punching Device	Printing Device
F2 DIR		Input			Output
F3 PIP	F1 READ	Output	Input		
	F2 PUNCH	Input		Output	
	F3 VERIFY	Output Input	Input		
F5 FREE		Input			Output
F6 LIST		Input			Output

[Supplement] For the operation of the commands, refer to Section 5 "PROGRAM OPERATION".

(2) Peripheral Device Classification and Abbreviations

Sector devices

MD1: → User memory
FD0: → 3.5-inch floppy disk
FD1: → 3.5-inch floppy disk

Tape reading devices

TR: → Tape reader
CN0: → Tape reader connected at RS232C channel 0
CN1: → Tape reader connected at RS232C channel 1
CN2: → Tape reader connected at RS232C channel 2
CN3: → Tape reader connected at RS232C channel 3

Tape punching devices

CN0: → Tape punch connected at RS232C channel 0
CN1: → Tape punch connected at RS232C channel 1
CN2: → Tape punch connected at RS232C channel 2
CN3: → Tape punch connected at RS232C channel 3

Printing devices

CN: → Console
PN: → NC operation panel
CN0: → Printer connected at RS232C channel 0
CN1: → Printer connected at RS232C channel 1
CN2: → Printer connected at RS232C channel 2
CN3: → Printer connected at RS232C channel 3

(3) If no device name is specified, the following selections are made automatically.

For sector devices	MD1:	
For tape reading devices	TR:	(This selection can be changed by setting NC optional parameter (word) No. 57.)
For tape punching devices	CN0:	(This selection can be changed by setting NC optional parameter (word) No. 45.)
For printing devices	PN:	

The default device for a tape reading device or tape punching device can be changed by changing the parameter settings.

(4) If no output NC program name is specified, the same name as the input NC program name is automatically assigned.

(5) If no input NC program name is specified, the name "A.MIN" will be automatically assigned unless a program name is designated on the tape, in which case that name will be used.

3-2. Parameter Settings

Set the following parameters before connecting a peripheral device.

After setting the parameters, press function key [F7] (BACKUP) and on completion of the backup operation switch the power off and then back on again.

The old parameter settings will remain valid if the power is not switched off and back on.

(1) NC optional parameter (bit) No.1

Bit No. / Parameter No.	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
1	Special tape codes ignored	Special tape code alarm	Tape rewind	Tape read verify	Tape delimiter code: % (ER)	Tape TV check	Automatic tape code recognition	Tape coding system

(a) bit 0 Tape coding system

= 1 : Tape code set to ISO code (Initial value = 1)

= 0 : Tape code set to EIA code

(b) bit 1 Automatic tape code recognition

= 1 : Tape code automatically recognized (Initial value = 1)

= 0 : Tape code not automatically recognized

The codes used for tape punching and tape verification depend on the combination of the settings made for bit 0 and bit 1.

bit 1	bit 0	Contents
1	1	In "READ" and "VERIFY" operations, EIA and ISO tape codes are automatically recognized. In "PUNCH" operations, program data is punched in the ISO code.
1	0	In "VERIFY" operations, EIA and ISO codes are automatically recognized. In "PUNCH" operations, program data is punched in the EIA code.
0	1	In "VERIFY" operations, the control assumes that the coding system is ISO. (If the tape code is not ISO, an error occurs.) In "PUNCH" operations, program data is punched in the ISO code.
0	0	In "VERIFY" operations, the control assumes that the coding system is EIA. (If the tape code is not EIA, an error occurs.) In "PUNCH" operations, program data is punched in the EIA code.

(c) bit 2 Tape TV check

The tape TV check is a check on the number of characters of tape data in each block of the program.

It is checked that the number of codes from the code following one LF (EOB) to the next LF (EOB) is an even number.

bit 2	Contents
0	In "READ" operations, no TV check is performed. In "PUNCH" operations, the number of characters per block is not adjusted.
1	In "READ" operations, it is checked if the number of characters in each block is an even number; if it is an odd number, an alarm occurs. In "PUNCH" operations, a space is added if necessary to make the number of characters in one block an even number.

(Initial value = 0)

(d) bit 3 Tape delimiter code %/ER

Sets whether or not the %/ER code is used instead of tape feed to mark the end of program information on the tape.

bit 3	Contents
0	Tape feed is taken to indicate the end of program data.
1	The % (ER) code is taken to indicate the end of program data.

(Initial value = 0)

[Supplement] The data up until the second appearance of an CR, and LF or EOB on the tape is ignored.

(e) bit 4 Tape reading verification

Sets whether or not the program information is automatically verified when a tape is read.

bit 4	Contents
0	Verification is not performed on completion of a "READ" operation.
1	Verification is performed on completion of a "READ" operation.

(Initial value = 0)

[Supplement] File names are not verified.

(f) bit 5 Tape rewind

Sets whether or not the tape is rewound after reading (if verification is not performed).

bit 5	Contents
0	Operation stops after the tape has been read.
1	The tape is rewound after it has been read.

(Initial value = 0)

(g) bit 6 Special code alarm

Sets whether or not special codes ($20 to $5F, HT) trigger an alarm.

(h) bit 7 Special code store

Sets whether or not special codes are stored.

bit 7	bit 6	Contents
*	1	An alarm occurs when a special code is read.
1	0	Special codes are read but not stored.
0	0	Special codes are read normally.

(Initial values: bit 6 = 1, bit 7 = 0)

(2) NC optional parameters (bit) No. 8, 13, 14, 21, 22

Used to set the RS232C data handled by the channels used.

NC optional parameter (bit) No.	Channel	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0	
No. 8	CN0 :	File name read/not read	DC code control TYPE 2	Standard DC code control	8-bit JIS/ 7-bit JIS	Even/ odd parity	Parity check performed/ not performed	Ready signal setting	1-bit/ 2-bit stop bit	
No. 13	CN1 :									
No. 14	CN2 :									
No. 21	CN3 :									
		0	0	0	0	0	0	1	0	Initial value

Explanation of settings for parameter (bit) Nos. 8, 13, 14, 21, 22

(a) bit 0 RS232C stop bit check

= 0 : 2 stop bits

= 1 : 1 stop bit

(b) bit 1 Determines whether or not the RS232C interface uses the "EXT-INT" signal as the ready signal.

= 0 : The "EXT-INT" signal is used as the ready signal.

= 1 : The "EXT-INT" signal is not used as the ready signal.

(c) bit 2 RS232C parity check (determines whether or not a parity bit is appended to 8-bit data)

= 0 : Parity check not performed

= 1 : Parity check performed

(d) bit 3 RS232C even/odd parity

= 0 : Odd parity

= 1 : Even parity

(e) bit 4 RS232C 8-bit/7-bit JIS

= 0 : 7-bit JIS

= 1 : 8-bit JIS

(f) bits 5, 6 Specify the DC code control conditions.

bit 6	bit 5	Contents
0	0	No DC code control
1	0	No DC code control
0	1	Standard DC code control
1	1	DC code control TYPE 2

(g) bit 7 Required file name output in DNC-A mode (special specification)

= 0 : Required file name not output
= 1 : Required file name output

(3) NC optional parameter (bit) No. 12

(a) bit 2 Specifies whether or not the file name is punched out.

bit 2	Contents
0	The file name is punched out.
1	The file name is not punched out.

(Initial value = 0)

(b) bit 3 Specifies the end of record code when punching in the ISO coding system.

bit 3	Contents
0	CR, LF is output.
1	Only LF is output.

(Initial value = 0)

(c) bit 4 Specifies the code used for tape feed during punching.

bit 4	Contents
0	The NULL code is output.
1	The SPACE code is output.

(Initial value = 0)

(d) bit 5 Specifies whether or not feed holes are punched during tape punching.

bit 5	Contents
0	Feed holes are punched.
1	Feed holes are not punched.

(Initial value = 0)

(4) NC optional parameters (bit) No. 27 to 31, 49 to 51

(a) These parameters are used to set special EIA codes.

Parameter No.	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
No. 27	Sets the punch holes for the EIA code that represents "=".							
No. 28	Sets the punch holes for the EIA code that represents "*".							
No. 29	Sets the punch holes for the EIA code that represents "[".							
No. 30	Sets the punch holes for the EIA code that represents "]".							
No. 31	Sets the punch holes for the EIA code that represents "$".							
No. 49	Sets the punch holes for the EIA code that represents "#".							
No. 50	Specifies an irregular code.							
No. 51	Specifies the regular code (ISO) corresponding to the irregular code.							
	0	0	0	0	0	0	0	0

Initial value

(b) In both the EIA and ISO coding systems, it is possible to have one code treated as another in program reading and program punching.

(c) Set a code which is to be treated as another code (i.e. an irregular code) for optional parameter (bit) No. 50 and the regular code that corresponds to this irregular code for optional parameter (bit) No. 51.

The regular code must be set in the ISO coding system.

1) If an irregular code is encountered during reading it is read as the corresponding regular code.

2) If the regular code corresponding to an irregular code occurs during punching, the irregular code is punched.

(5) NC optional parameters (word) No. 1, No. 2

Parameter No.	Item	Contents	Factory Set Initial Value	Setting Range
1	Tape feed holes in punching	For punchout in the PIP holes in (transfer) mode, tape feed hole areas are punched out before and after program punch out. The number of feed holes is set by this parameter.	600	1 to 10000
2	Defaults of tape lengths in divided punching	A file of machining programs which is too long to be stored in a roll of paper tape is divided into smaller files to be punched out. The lengths of the divisions are set by this parameter. The divisions are closed at the breaks of each block, so that the actual tape length is slightly different from the setting. A divided punchout gives the beginning of each tape part a file name. Note that the setting does not include the lengths corresponding to the file name and feed hole.	180 m (590 ft)	1 to 300 m (3.3 to 984 ft)

(6) NC optional parameters (word) No. 6, 39, 40, 41, 42

Set the baud rates for channels CN0: to CN3:.

NC Optional Parameter (word) No.	Channel	Contents	Initial Value
No. 6	CN0 :	Any of the following baud rates can be set: 110, 150, 200, 300, 600, 1200, 2400, 4800, 9600, 19200,	600 baud
No. 39	CN1 :		
No. 40	CN2 :		
No. 41	CN3 :		

(7) NC optional parameters (word) No. 34, 35, 36, 37, 38

Set the ready completion waiting times for channels CN0: to CN3:.

NC Optional Parameter (word) No.	Channel	Setting Range (Unit: Seconds)	Contents	Initial Value
No. 34	CN0 :	1 to 9999	This is the waiting time between output of DC1 (tape reader start) or the cessation of data reception and reception of data; or the waiting time (when CTS and DSR are ON) until the RS232C ready completed status comes into effect. If there is no response within this time an alarm occurs.	10 seconds
No. 35	CN1 :			
No. 36	CN2 :			
No. 37	CN3 :			

(8) NC optional parameter (word) No. 45

Used to select the punch channel for data transfer.

Setting for No. 45	Peripheral Device		Initial Value
0	CN0 : (TT:)	[RS232C]	0 (This selects CN0:)
1	CN1 :	[RS232C]	
2	CN2 :	[RS232C]	
3	CN3 :	[RS232C]	

(9) NC optional parameter (word) No. 57

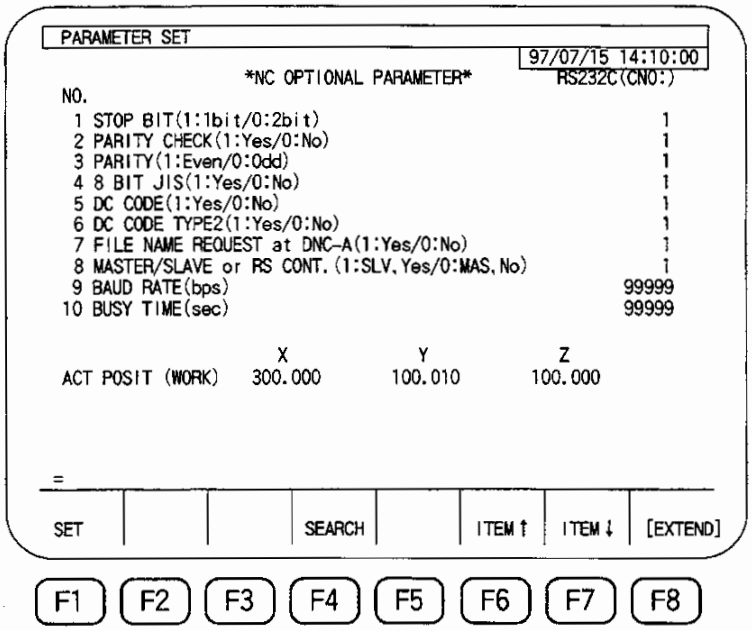
Used to select the read channel for data transfer.

Setting for No. 57	Peripheral Device		Initial Value
0	TR :	[Standard tape reader]	0 (This selects TR:)
1	CN0 :	[RS232C]	
2	CN1 :	[RS232C]	
3	CN2 :	[RS232C]	
4	CN3 :	[RS232C]	
5	CN4 :	[RS232C]	

(10) NC optional parameter RS232C (CN0:)

This screen displays the parameters to be used for the tape punch interface function, which are allocated to NC optional parameter (bit) and NC optional parameter (word). Note that they are only for CN0: device and it is necessary to set the parameters for the individual NC optional parameter (bit) and NC optional parameter (word) screens for other devices.

When the following parameters are set, the corresponding NC optional parameters are set accordingly. Conversely, if NC optional parameters are set, the corresponding parameters shown below are set accordingly.



(a) 1 STOP BIT (1:1bit/0:2bit) (NC optional parameter (bit) No. 8, bit 0)

RS232C stop bit check

= 0 : Stop bit 2

= 1 : Stop bit 1

(b) 2 PARITY CHECK (1:Yes/0:No) (NC optional parameter (bit) No. 8, bit 2)

RS232C parity check (sets whether or not a parity bit is added to 8-bit data)

= 0 : No parity

= 1 : Parity check

(c) 3 PARITY (1:Even/0:Odd) (NC optional parameter (bit) No. 8, bit 3)

RS232C odd parity scheme

= 0 : Odd parity

= 1 : Even parity

(d) 4 8 BIT JIS (1:Yes/0:No) (NC optional parameter (bit) No. 8, bit 4)

RS232C 8-bit JIS

= 0 : 7-bit JIS

= 1 : 8-bit JIS

(e) 5 DC CODE (1:Yes/0:No) (NC optional parameter (bit) No. 8, bit 5)

DC code control

= 0 : Controlled by DC code

= 1 : Not controlled by DC code

(f) 6 DC CODE TYPE2 (1:Yes/0:No) (NC optional parameter (bit) No. 8, bit 6)

DC code control type 2

= 0 : DC code control type 2 is not executed.

= 1 : DC code control type 2 is executed.

6 DC CODE TYPE2	5 DC CODE	Description
0	0	Controlled by DC code
1	0	Not controlled by DC code
0	1	Standard DC code control
1	1	DC code control type 2

(g) 7 FILE NAME REQUEST at DNC-A (1:Yes/0:No) (NC optional parameter (bit) No. 8, bit 6)

Request file name output at DNC-A (option)

= 0 : Request file name is not output

= 1 : Request file name is output

(h) 8 MASTER/SLAVE or RS CONT. (1:SLV, Yes/0:MAS, No)
(NC optional parameter (bit) No. 40, bit 0)

Master/slave station designation or RS control designation

= 0 : Master station or without RS control

= 1 : Slave station or with RS control

(i) 9 BAUD RATE (bps) (NC optional parameter (word) No. 6)

Selection of baud rate from 110, 150, 200, 300, 600, 1200, 2400, 4800, 9600, and 19200.

Initial value: 600

(j) 10 BUSY TIME (sec) (NC optional parameter (word) No. 34)

Sets the delay time until data receiving or RS232C getting ready (CTS and DSR ON) after sending DC1 (tape reader start) or interruption of data receive. If there is no response within the set length of time, an alarm occurs.

Setting range: 1 to 9999 sec.

Initial value: 0

3-3. Tape Format

3-3-1. Input Format

(1) ISO Coding System

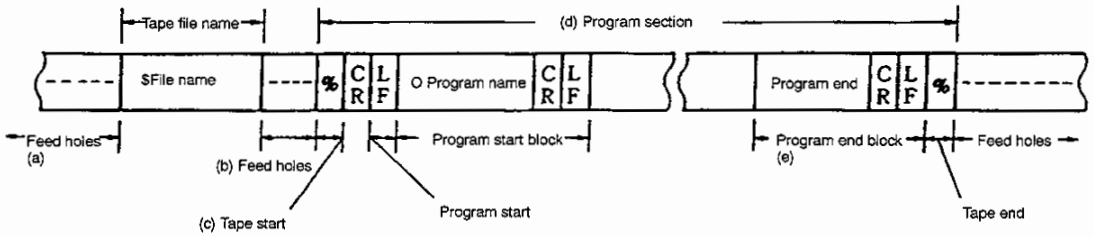


Fig. 3-3 Input Format (ISO Coding System)

(2) EIA Coding System

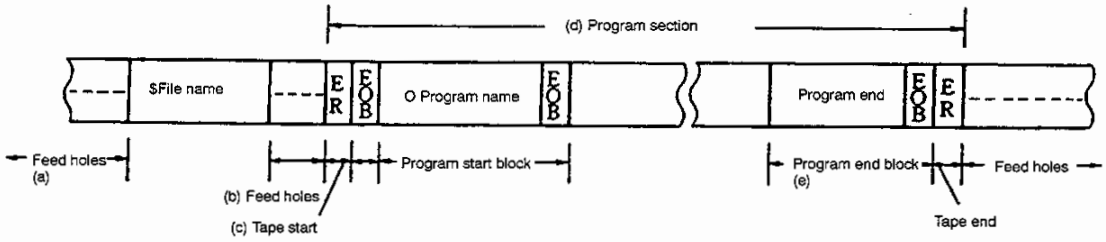


Fig. 3-4 Input Format (EIA Coding System)

(a) Feed holes (in ISO coding: NUL or SPACE, in EIA coding: BLANK or SPACE)

(b) Input the file name after the "$" symbol.

If no file name is specified, the same file name as that specified for the output NC program name will be automatically selected. If no output NC program name is specified, the name set will be "A.MIN".

(c) Feed holes

(d) Start and end the program section with the % (ER) code.

(e) Always include M02 or M30, or END, or RTS in the program end block.

[Supplement] Codes that cannot be set in the EIA coding system can be replaced by codes that can be set so that they can be read. For details, see Section 6, 3-3-3, "EIA Special Codes".

3-3-2. Output Format

(1) ISO Code

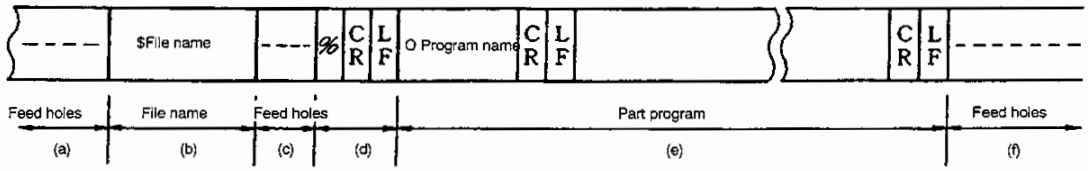


Fig. 3-5 Output Format (ISO Code)

(2) EIA Code

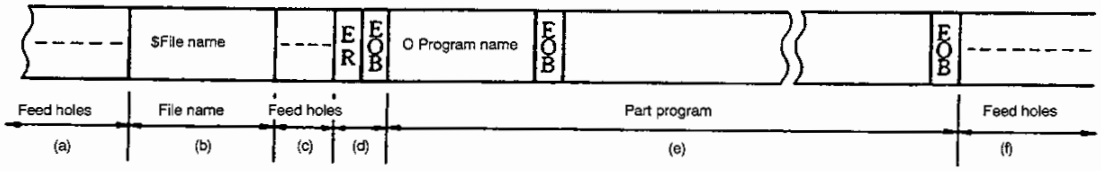


Fig. 3-6 Output Format (EIA Code) (1)

(a) 600 tape feed holes are punched in the tape leader section.

The number of feed holes to be punched out can range, as needed, from 1 to 10000 with a parameter.

For details, consult III, "PARAMETERS".

(b) The file name is punched out following the "$" code. (Program data is punched out in the ISO coding system.)

(c) 50 tape feed holes are punched out.

The number of the tape feed holes cannot be changed.

(d) Either of the following is punched out.

%, CR, and LF

ER and EOB

(e) The part program data is punched out following the program name (number).

(f) The same number of tape feed holes as in a) are punched out in the tape trailing section.

[Supplement] 1. When the program data is punched out in the EIA code, the presence of a code not available in the EIA coding system causes an error. Tape punching-out halts and an error message is given on the display screen.

When the tape delimiting code is the "%" (ER) code, i.e., when bit 3 of parameter No. 1 of NC optional parameter (bit) is 1, the "%" code or "ER" is punched out before feed holes.

2. The part program is split and punched out, if it si too long to be contained in one paper tape roll. Paper tape length may be changed from 1 to 300 meters (3 to 984 feed) using the NC optional parameter (word) No. 2.

As the format, the file name is also punched out, for the second tape and so on. Since the tape ends with "CR" or "LF", actual tape length is somewhat difference from the tape length set using the parameter.

When designating paper tape punch out operation on more than one paper taper roll, specify option D in the following format:

P ␣ <file-name>, <device-name>:;D

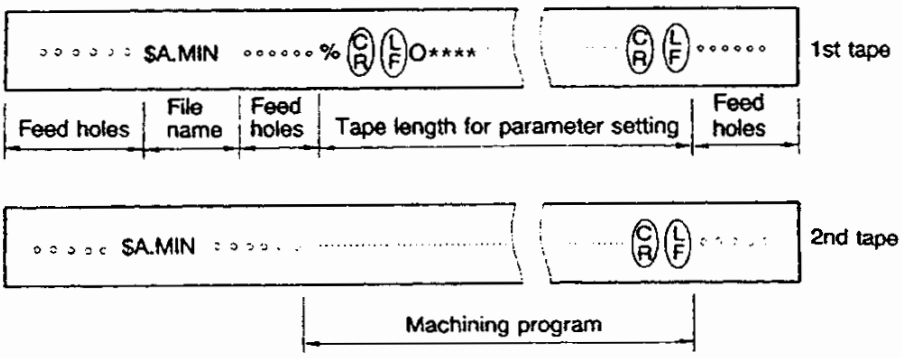


Fig. 3-7 Output Format (EIA Code) (2)

3-3-3. EIA Special Codes

(1) There are some characters, such as "=" and "*", that are not represented by codes in the EIA coding system. To make it possible to use these characters when creating an EIA program tape, other characters are sometimes temporarily substituted for them.

(2) When a program tape created in this way is read into the NC, the substituted characters must be converted back to "=" and "*" by using editing functions.

(3) This troublesome procedure is made easier by setting EIA special codes for the characters for which substitution is necessary in advance; the control then automatically substitutes the appropriate characters when a program is input from or output to tape.

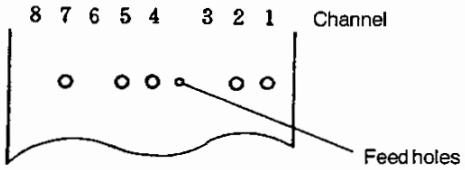
(a) Setting the EIA special codes

1) Special codes can be set for the following 6 characters:

=, *, [,], $, #

2) Special codes are set as bit patterns in NC optional parameters (bit) No. 27 through 31 and No. 49.

Example: Suppose the puncher key "[ ]" is determined for punching the "=" code, and that the arrangement of punched holes by this key operation is as below.



Set this arrangement of punched holes by a "1" and a "0", where "1" indicating a punched hole and "0" a position not punched. Setting will be as below:

0 1 0 1 1 0 1 1

Set this at the No. 27 of NC optional parameter (bit). Repeating the same operations, set all the codes used on the NC.

[Supplement]

1. When inputting a program in the EIA coding system, if the special code "$" is input at the head of the program, the character string immediately following the "$" is read as the file name (in EIA codes) for the program.

2. When outputting a program using the EIA coding system, if the "$" special code is set the file name will be punched out in EIA codes. If the "$" special code is not set, the file name will be punched out in ISO codes.

3. There is no check to determine whether or not the bit patterns assigned to special codes already represent characters in the EIA coding system.

   Example: If the special code for the character "=" is set as 01100001 (the EIA code for "A") and "A=B" is output for punching, what will actually be punched is "AAB". When the tape is read, the data will be interpreted as "==B".

4. Special codes are only converted when commands are executed in the PIP mode.

   They are not converted in the DNC mode.

3-4. Specifications

3-4-1. RS232C Interface

(1) Communication Method

Start-stop synchronization

This is a method in which a pre-determined signal is sent at the beginning and end of a character.

The data for each character comprises the following bits (see Fig. 6-8): (A) start bit (1 bit), (B) information bits (8 bits), (C) parity bit (1 bit), (D) stop bit (2 bits).

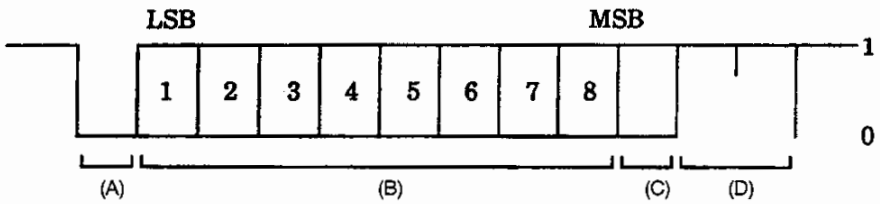


Fig. 3-8 Bit Configuration

(2) Baud Rate (BPS - baud)

110, 150, 200, 300, 600, 1200, 2400, 4800, 9600, 19200

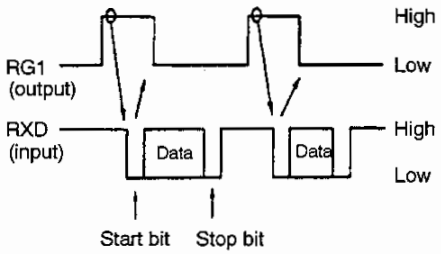
(3) Data Configuration

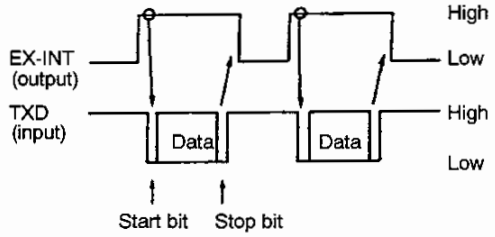
Start bit : 1 bit
Data bits : 8 bits
Parity bit : 1 bit or absent (selected by parameter setting)
Stop bits : 1 bit or 2 bits (selected by parameter setting)

(4) Parity Check (character parity)

Odd/even parity or no parity check (selected by parameter setting)

(5) Signal Descriptions

Signal Name	Direction	Details
FG	—	Protective grounding
TXD	Output	Send data Data line from the NC to peripheral devices.
RXD	Input	Send data Data line from peripheral device to the NC.
RTS	Output	Request to send Comes ON when data transmission or reception starts. Thereafter, it is normally ON.
CTS	Input	Clear to send When this signal is OFF, data is not output from the NC. Used for BUSY/READY control. If this signal is not used, connect the RTS signal at the NC.
DSR	Input	Data set ready Indicates that the peripheral device is in the communication enabled status. If this signal goes OFF during data communication, an error will occur at the NC. This signal cannot be used to execute BUSY/READY control. If this signal is not used, connect it to DTR at the NC side.
SG	—	Connection for signals
RG1	Output	Data request (register 1) This signal is used to execute receive BUSY control at the NC side. It comes ON when the NC is in the reception enabled status and data transfer from a peripheral device is requested. It goes OFF on reception of a start bit from the peripheral device (it goes OFF once per character). 
RG2	Output	Register 2 Presently not used.

Signal Name	Direction	Details
SG SG SG	— — —	Grounding for signal Grounding for signal Grounding for signal
DTR	Output	Data terminal ready This signal comes ON when the NC is ready for operation. If data is transferred to the NC while this signal is OFF, it will not be read by the NC.
EX-INT	Input	External interrupt This signal is used for BUSY/READY control at the peripheral device side. When this signal is used, the following applies for transfer of each character: (1) When the signal is OFF, the NC cannot start data transfer. (2) When data transfer starts, this signal temporarily goes OFF; when it comes ON again the next data is transferred. (It goes through the sequence ON, OFF, and ON for each character).  The EXT-INT signal cannot be used for a peripheral device which has a buffer, meaning that the ready signal does not switch ON/OFF for every character. For this type of device, use the CTS signal.

3-5. Connection to Peripheral Devices

If an RS232C interface is used, a special-purpose cable must be used to connect the signals that are required by an external device since the signals used for the connection vary according to the external device.

A typical example is shown below.

3-5-1. BTR System (No DC Codes)

Example 1:

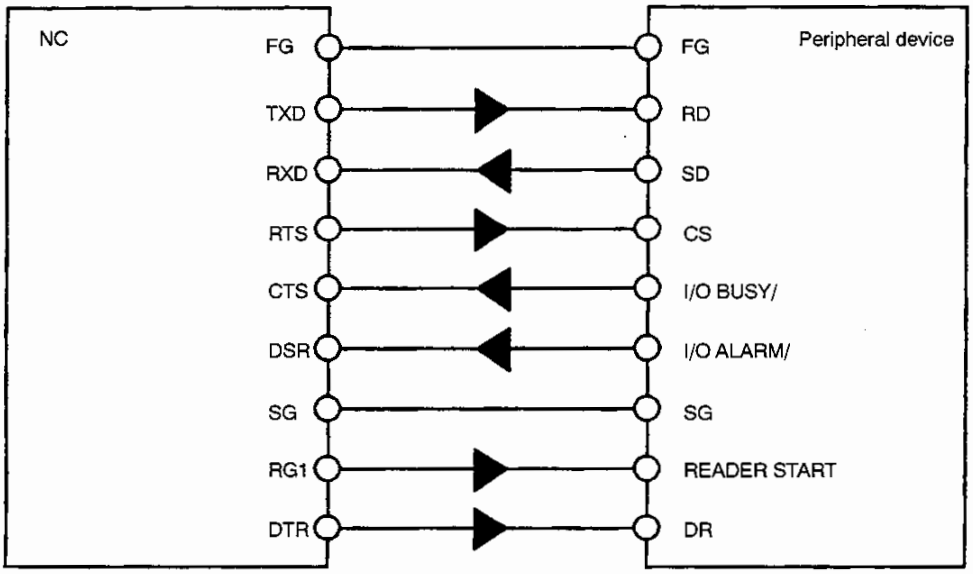


Fig. 3-9 Connection for BTR System (No DC Codes) (1)

[Supplement] Since no EXT-INT signal is used in this example, bit 1 of NC optional parameter (bit) No. 8 (No. 13, 14, 21, 22) (Ready signals of CN0: to CN4:) should be set to "1" in advance.

(1) Timing Chart for READ

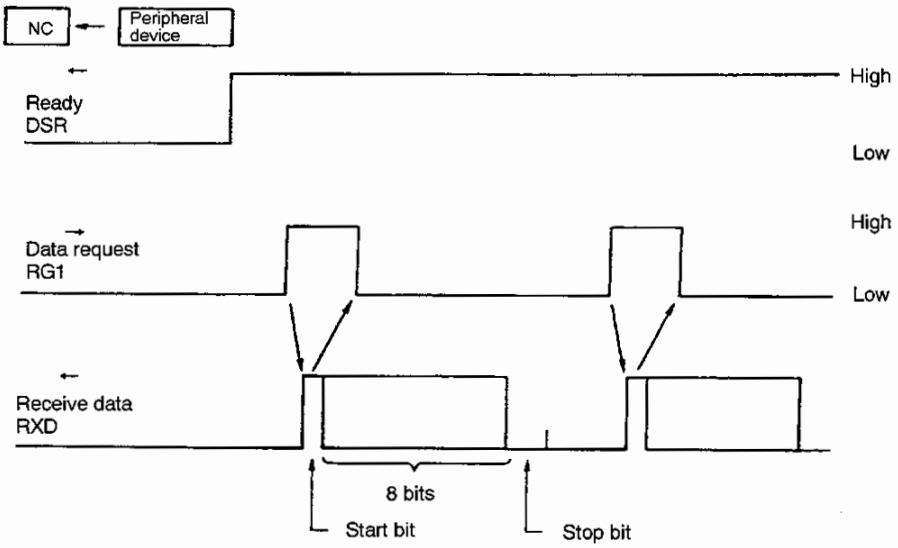


Fig. 3-10 Timing Chart for READ [BTR System (No DC Codes)]

(a) Data request signal RG1 is output from the NC.

(b) On receiving this signal, the peripheral device transfers serial data.

(c) The data request signal is forcibly set to the "Low" status in the interface circuit by the start bit in the received data.

(2) Timing Chart for PUNCH and LIST

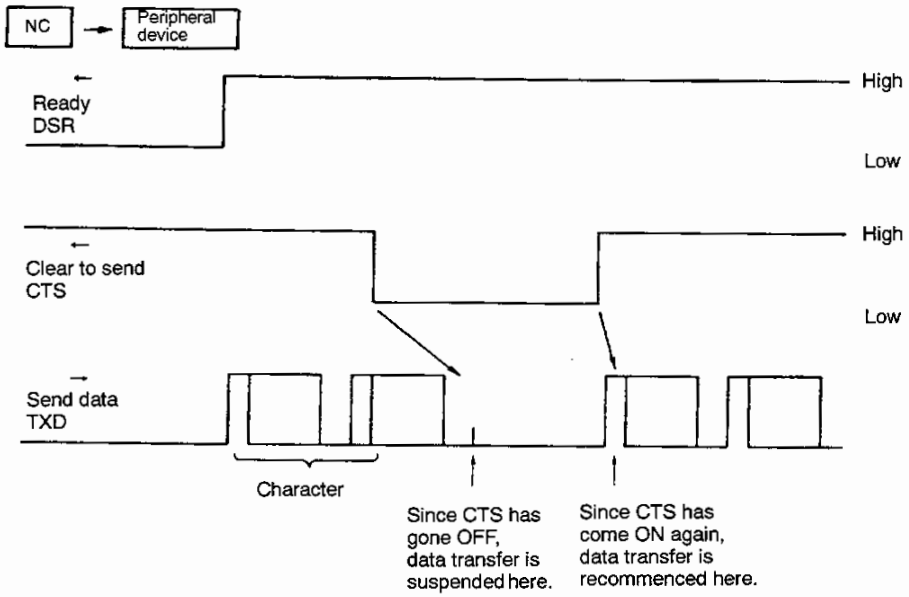


Fig. 3-11 Timing Chart for PUNCH and LIST [BTR System (No DC Codes)]

(a) While CTS is OFF, no data is sent from the NC.

(b) If CTS goes OFF during data transfer, data transfer is suspended within two characters from that point.

(c) When CTS comes ON again, data transfer is recommenced.

Example 2:

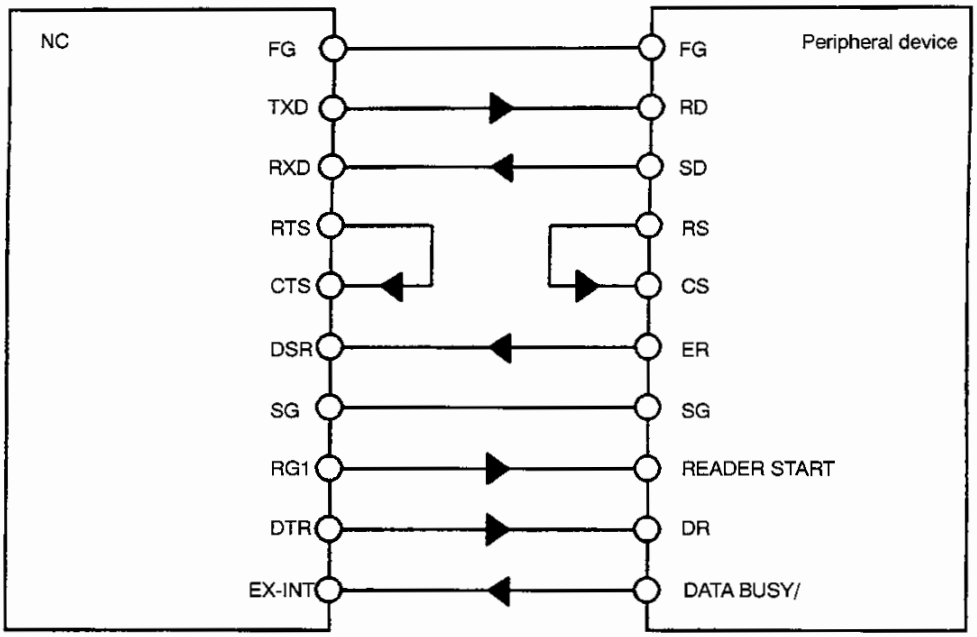


Fig. 3-12 Connection for BTR System (No DC Codes) (2)

[Supplement] Since an EXT-INT signal is used in this example, bit 1 of NC optional parameter (bit) No. 8 (No. 13, 14, 21, 22) (Ready signals of CN0: to CN4:) should be set to "0" in advance.

(3) The timing chart for READ is the same as that shown in Example 1.

(4) Timing Chart for PUNCH

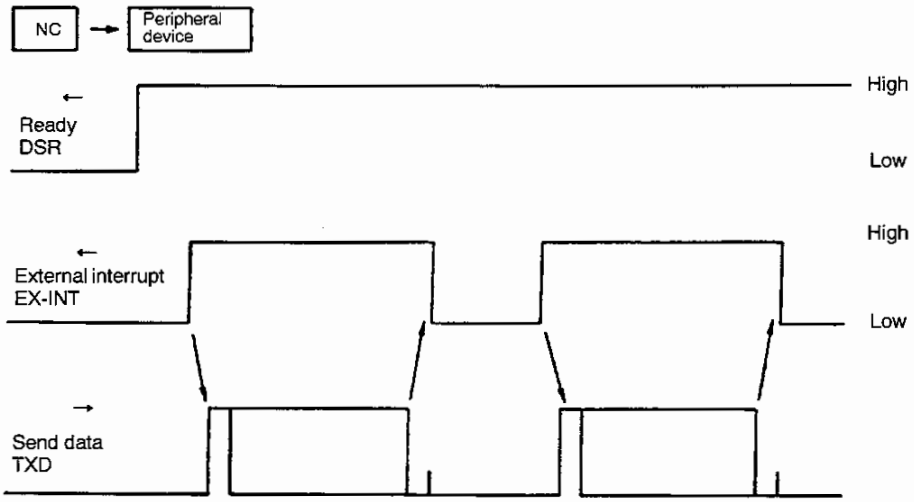


Fig. 3-13 Timing Chart for PUNCH [BTR System (No DC Codes)]

(a) When the external interrupt signal EXT-INT comes ON, data is sent from the NC.

(b) On reading the stop bit, the peripheral device forcibly sets the external interrupt signal to "Low". It is essential that the external interrupt signal be set to "Low" temporarily.

(c) On completion of processing, the peripheral device switches the EXT-INT signal ON again.

3-5-2. DC Code Control

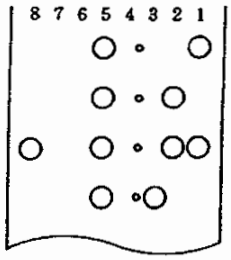
When DC code control is effective, the NC outputs DC control codes to control data transfer.

The user can select whether or not DC code control is performed by parameter setting.

The available DC control codes are DC1 through DC4, as shown below.

"DC" is the abbreviation for "device control", and these device control characters serve to start peripheral devices.

DC1 : Tape reader start →
DC2 : Tape punch start →
DC3 : Tape reader stop →
DC4 : Tape punch stop →



[Supplement]

1. Since DC control codes are automatically generated from the NC, the user does not have to write them into programs.
2. The control codes used are the ones shown above, regardless of whether the ISO or EIA coding system is used.
3. The NC unit cannot be controlled by control codes sent from the peripheral device.

Example 1:

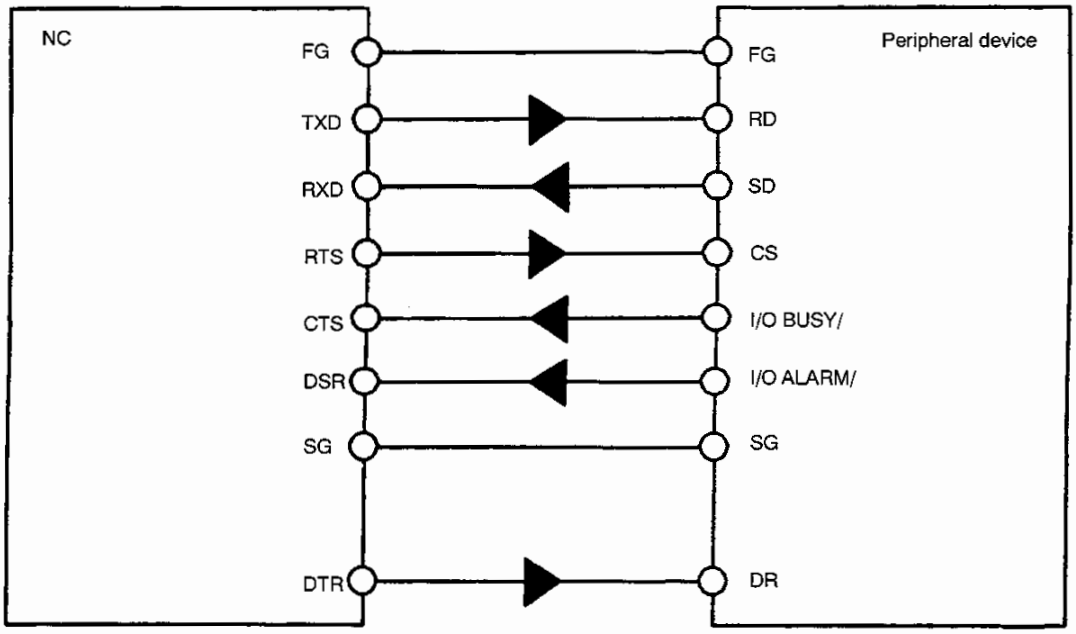


Fig. 3-14 Connection for DC Code Control

[Supplement] 4. Since no EXT-INT signal is used in this example, bit 1 of NC optional parameter (bit) No. 8 (No. 13, 14, 21, 22) (Ready signals of CN0: to CN4:) should be set to "1" in advance.

(1) Timing Chart for READ

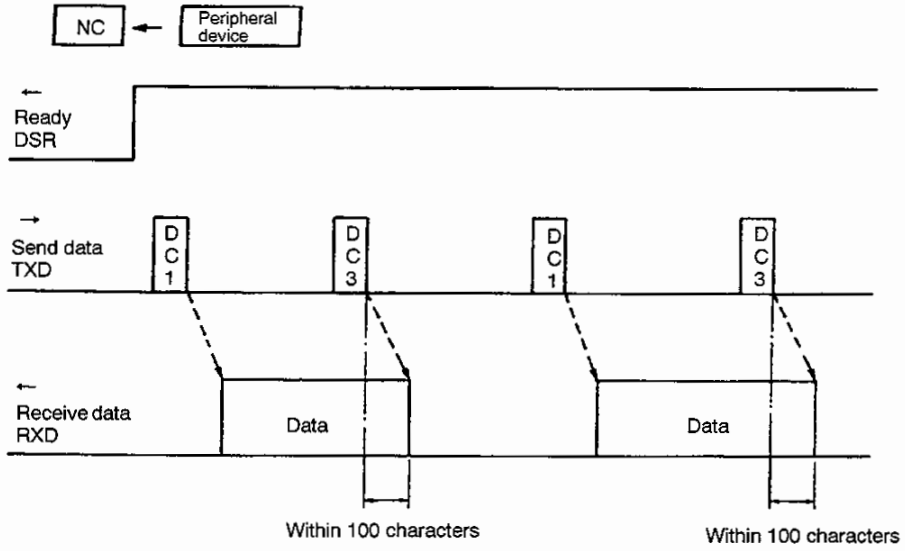


Fig. 3-15 Timing chart for READ (DC Code Control)

(a) The NC sends the DC1 code.

(b) On receiving the DC1 code, the peripheral device starts transferring data to the NC.

(c) After reading the program name, the NC sends the DC3 code.

(d) On receiving the DC3 code, the peripheral device suspends transfer of data to the NC. Data transfer stops within 100 characters after transmission of the DC3 code.

(e) When processing at the NC is completed, the NC sends the DC1 code again.

(f) On receiving the DC1 code, the peripheral device starts transferring the data immediately following the data sent in the last transfer operation.

(g) The NC sends a DC3 code and a DC1 code during reading of each 256-character section of the NC program (equivalent to a tape length of 0.65 m).

(h) The peripheral device sends the end of record code and data transfer is terminated.

(i) On completion of data reading, the NC sends the DC3 code.

(2) Timing Chart for PUNCH

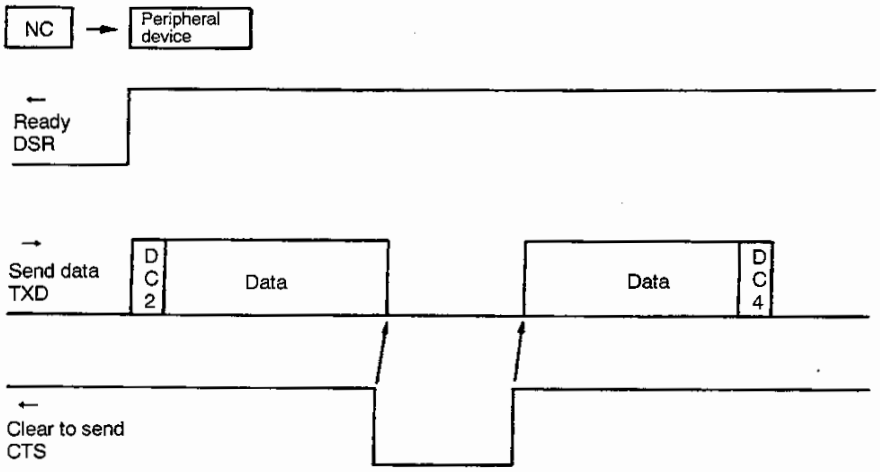


Fig. 3-16 Timing Chart for PUNCH (DC Code Control)

(a) The NC sends the DC2 code.

(b) If the CTS signal is ON, the data to be transferred is sent immediately following the DC2 code.

(c) When the CTS signal goes OFF, data transfer is suspended.

When the CTS signal comes ON again, the NC starts transferring the data following the previous transfer data.

(d) When data transfer is completed, the NC sends the DC4 code.

3-5-3. DC Code Control TYPE2

In the standard DC code control described in 3-5-2, DC codes can only be output from the NC. In TYPE2 control however, DC codes can also be output from the peripheral device.

When this type of control is used, the NC uses the four control codes DC1, DC2, DC3 and DC4, and the host computer side uses two: DC1 and DC3.

DC Code	NC	Host Computer
DC1	Enables data reading: (1) Starts data reading. (2) Cancels temporary stops.	Enables data reading: (1) Responds to DC2. (2) Cancels temporary stops.
DC2	Sent to the peripheral device at the beginning of a data transfer operation as a data reading request.	
DC3	Requests temporary stoppage of data transfer from the peripheral device.	Requests temporary stoppage of data transfer from the NC.
DC4	Terminates data transfer.	

To make TYPE2 control effective, set "1" for both the standard DC code control bit and the DC code control TYPE2 bit in the NC optional parameter (bit) for the relevant channel.

Example 1:

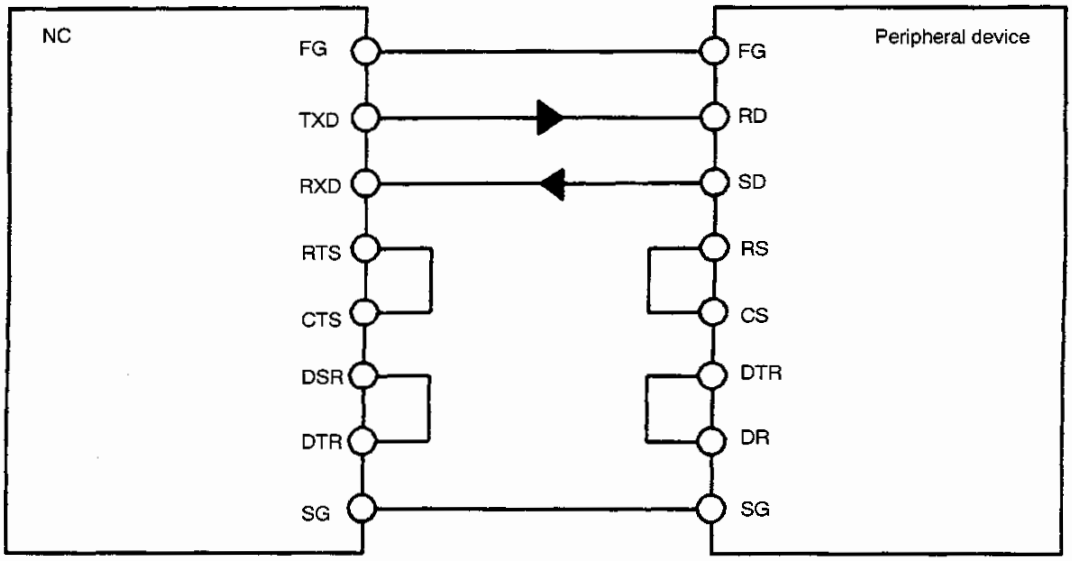


Fig. 3-17 Connection for DC Code Control TYPE2

(1) Timing Chart for READ

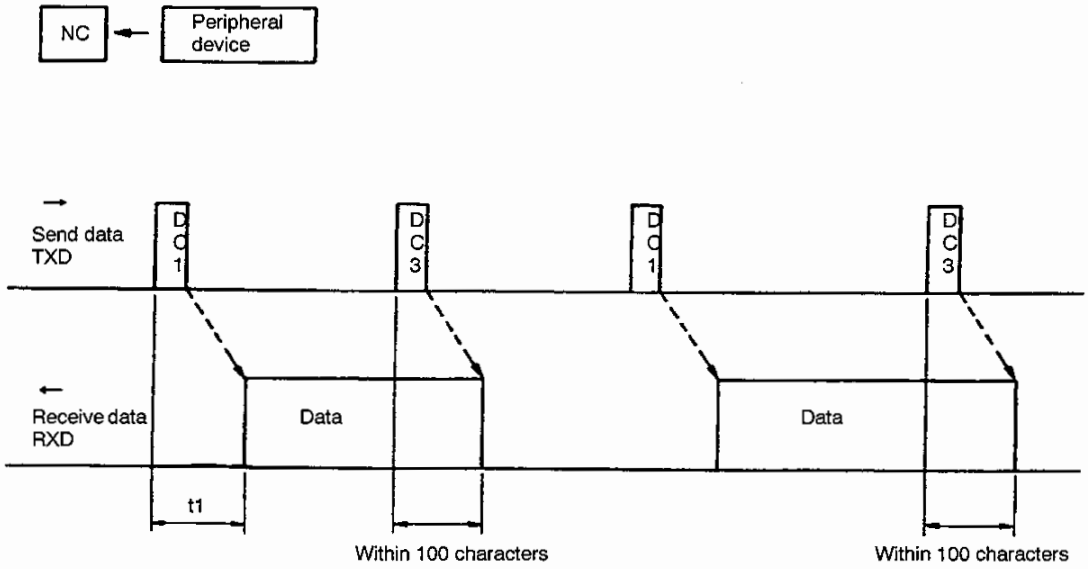


Fig. 3-18 Timing Chart for READ (DC Code Control TYPE2)

(a) The NC sends the DC1 code.

(b) On receiving the DC1 code, the peripheral device starts transferring data to the NC.

(c) After reading the program name, the NC unit sends the DC3 code.

(d) On receiving the DC3 code, the peripheral device suspends transfer of data to the NC. Data transfer stops within 100 characters after transmission of the DC3 code.

(e) When processing at the NC is completed, the NC sends the DC1 code again.

(f) On receiving the DC1 code, the peripheral device starts transferring the data immediately following the data sent in the last transfer operation.

(g) The NC sends a DC3 code and a DC1 code during reading of each 256-character section of the NC program (equivalent to a tape length of 0.65 m).

(h) The peripheral device sends the end of record code and data transfer is terminated.

(i) On completion of data reading, the NC sends the DC3 code.

(2) Timing Chart for PUNCH

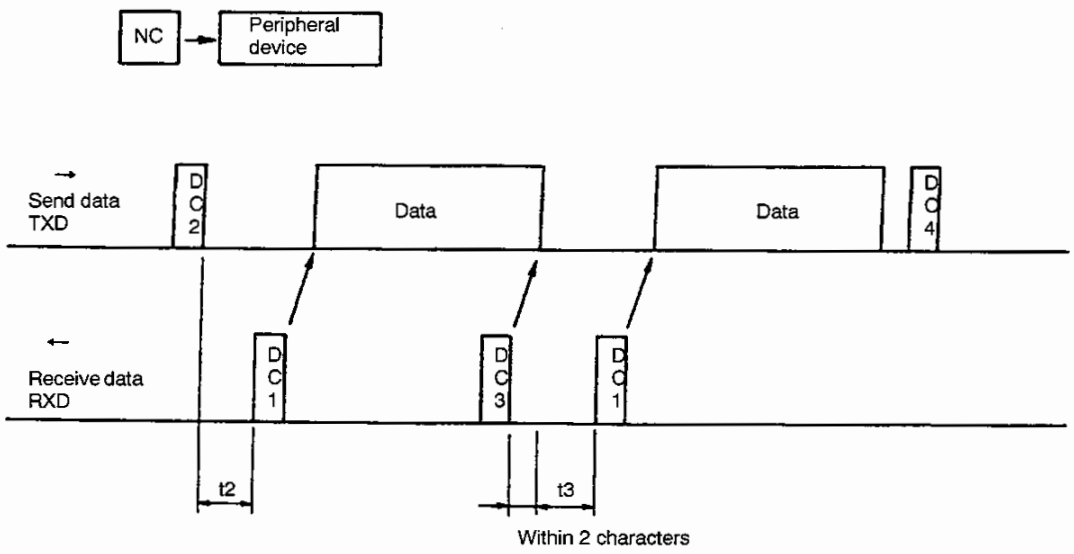


Fig. 3-19 Timing Chart for PUNCH (DC Code Control TYPE2)

(a) The NC sends the DC2 code.

(b) On receiving the DC2 code, the peripheral device sends the DC1 code to the NC.

(c) On reading the DC1 code, the NC starts transferring data to the peripheral device.

(d) If reception processing for the data transfer cannot keep pace with data reception, the peripheral device sends the DC3 code.

(e) The NC stops data transfer within 2 characters after receiving the DC3 code.

(f) After completing the processing backlog, the peripheral device sends the DC1 code again.

(g) On receiving the DC1 code, the NC starts transferring the data immediately following the data sent in the last transfer operation.

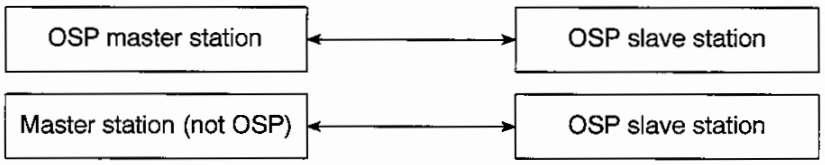
(h) The NC sends the end of record code at the beginning of the transfer data and the DC4 code when data transfer is completed.

[Supplement] If the times t1, t2 and t3 overrun the set values for the ready completion waiting times for the RS-232C channels set in the NC optional parameters (word), an RS232C device reading error occurs.

3-5-4. Slave Station Function

If an attempt is made to transfer data between two OSPs, it is normally impossible because both of the OSPs function as master stations. The slave station function allows communication between two OSPs by making one of them a slave station.

In the slave station mode, an OSP operates in the same way as a tape reader/punch.



Example 1: Example connection to a peripheral device when using the slave station function

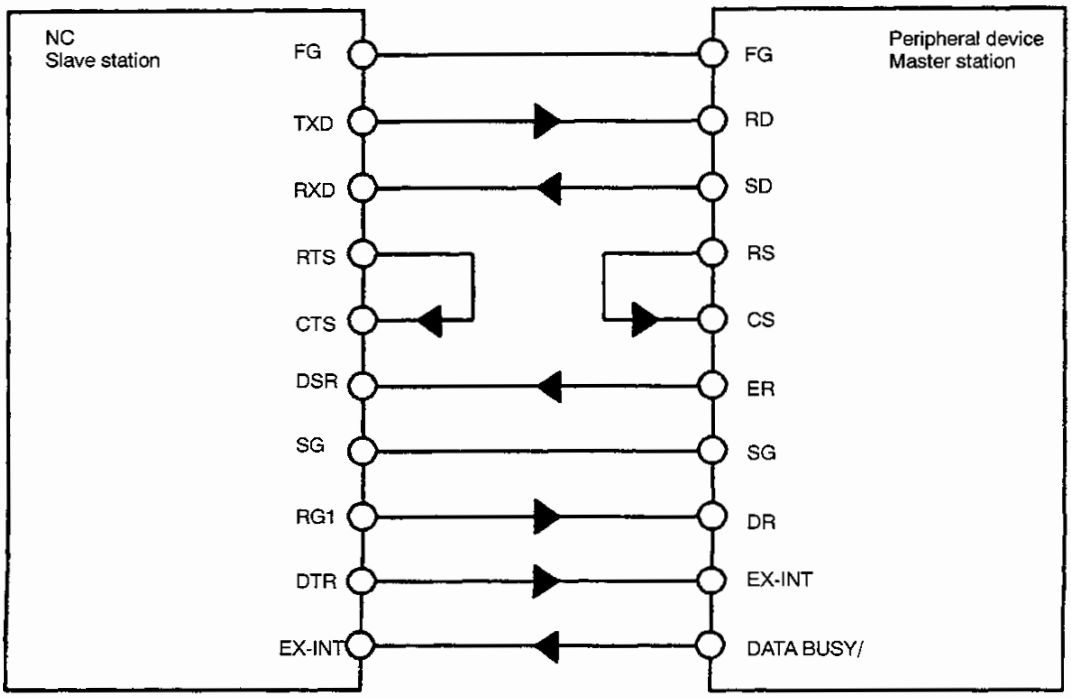


Fig. 3-20 Example Connection (1)

[Supplement] Since an EXT-INT signal is used in this example, bit 1 of NC optional parameter (bit) No. 8 (No. 13, 14, 21, 22) (Ready signals of CN0: to CN4:) should be set to "0" in advance.

(a) The timing chart for READ is the same as the one shown in 3-5-1 (Example 1).

(b) The timing chart for PUNCH is the same as the one shown in 3-5-1 (Example 2).

(c) When reading, the tape feed data following the program section is ignored.

(d) When punching, the tape feed data following the program section is not punched out.

(e) Notwithstanding c) above, if the end of record code is NULL, one character of NULL data is punched out.

Example 2: Example connection to a peripheral device when using the slave station function and DC code control

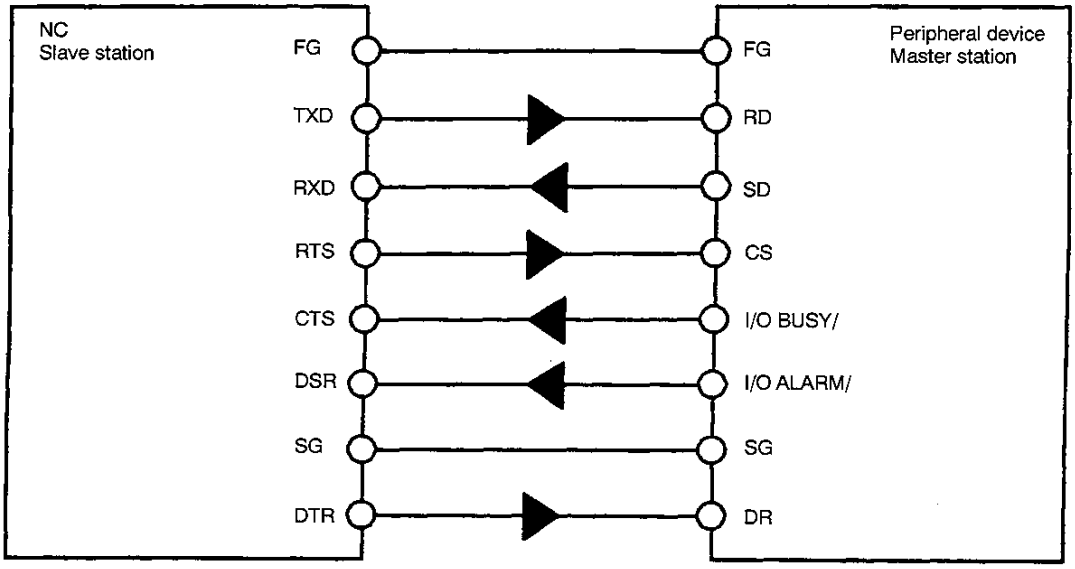


Fig. 3-21 Example Connection (2)

[Supplement] Since no EXT-INT signal is used in this example, bit 1 of NC optional parameter (bit) No. 8 (No. 13, 14, 21, 22) (Ready signals of CN0: to CN4:) should be set to "1" in advance.

(1) Timing Chart for READ

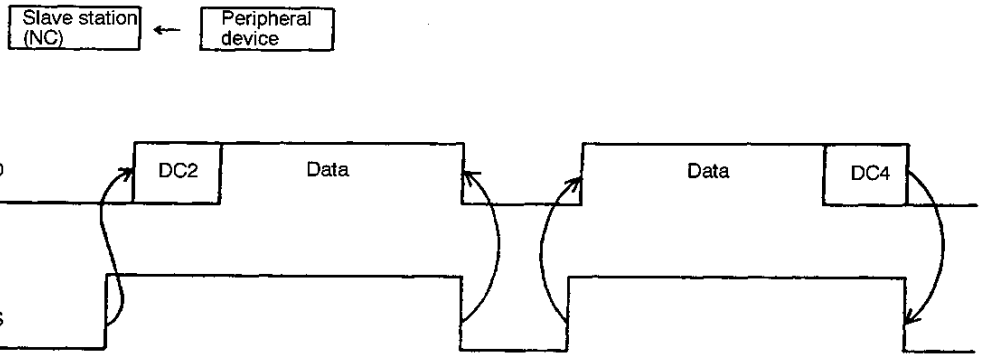


Fig. 3-22 Timing Chart for READ (Slave Station Function)

(a) When reading operation is executed at the NC, the RTS signal is switched ON.

(b) The peripheral device outputs the DC2 code.

(c) On reading the DC2 code, the NC starts data input processing.

(d) When the NC needs to stop reading temporarily to execute processing, it switches the RTS signal OFF. When this signal goes OFF, the peripheral device suspends data transfer to the NC.

(e) On completing the backlog of processing, the NC unit switches the RTS signal back ON.

When the RTS signal comes ON, the peripheral device recommences data transfer to the NC.

(f) The peripheral device outputs the DC4 code to terminate data transfer.

(g) On reading the DC4 code, the NC switches the RTS signal OFF, terminating data reading.

(2) Timing Chart for PUNCH

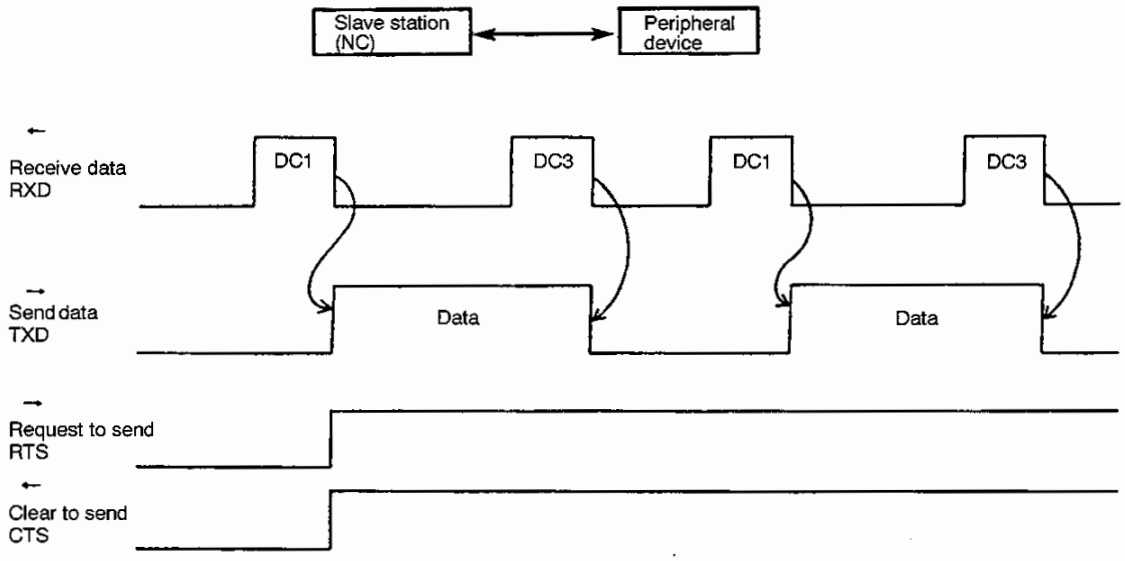


Fig. 3-23 Timing Chart for PUNCH (Slave Station Function)

(a) On reading the DC1 code sent from the peripheral device, the NC executes punch processing of the data.

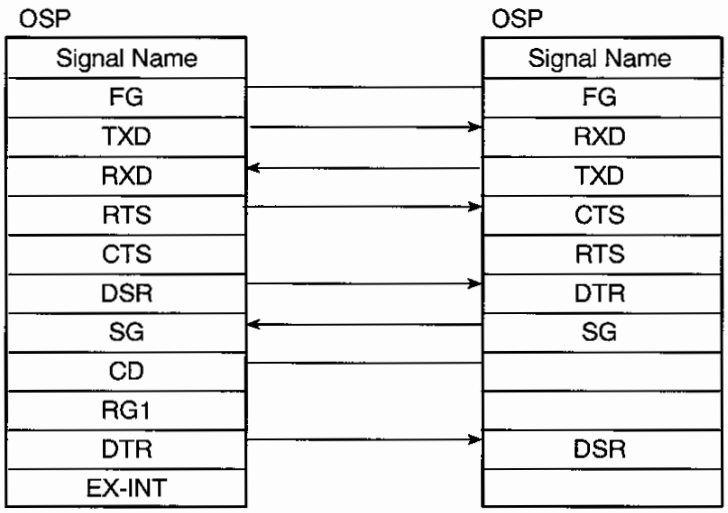
(b) On reading the DC3 code sent from the peripheral device, the NC suspends punch processing.

(c) On reading a DC1 code sent from the peripheral device again, the NC recommences punch processing.

(d) When all the data has been punched, the NC terminates punch processing on reception of the DC3 code from the peripheral device.

Example 3: Example connection between OSPs using the slave station function

Communication between two OSPs is executed by making one the master station and the other the slave station.



NC Parameters OSP

	Bit	7	6	5	4	3	2	1	0
Optional parameter (bit) No. 8	Data	0	0	1	*	0	0	1	0
	Condition Set	File name read	DC code control TYPE 2	Standard DC code control	8-bit JIS	Even parity	Parity check performed	No ready signal setting	1-bit stop bit

NC optional parameter (word) No. 6	Baud Rate
	2400

* indicates either "0" or "1" can be set.

(1) For the parameters indicated above, set the same values for the two OSPs.

(2) Set the channel used for the peripheral device by setting NC optional parameter (word) No. 45 (designation of punch device) and NC optional parameter (word) No. 57 (designation of read device) in advance.

(3) Bits 0 to 4 of NC optional parameter (bit) No. 40 are used to select master or slave status for each channel: set one of the two OSPs as the master station (set "0") and the other as the slave station (set "1").

(4) On completion of the steps above, communication between the two OSPs will be possible.

IV. PARAMETER

SECTION 1 KINDS OF PARAMETERS

With this model of NC unit, parameters are classified as indicated below and special screens are prepared for individual parameter types to allow parameter setting by directly inputting a numerical value or setting required data in units of bits, etc.

(1) Display select screen (selection for display and not-display of parameter setting screens)

(2) Common variable

(3) User parameter

(4) G/M code macro

(5) NC optional parameter (long word)

(6) NC optional parameter (word)

(7) NC optional parameter (bit)

(8) Input unit system

(9) NC optional parameter RS232C (CN0:)

(10) NC optional parameter SPINDLE (OKUMA VAC)

(11) System parameter

(12) Pitch error compensation

(13) Machine axis parameter

(14) Machine user parameter

(15) Machine system parameter

NOTICE : The kinds of parameters to be used vary depending on the specification.

SECTION 2 PARAMETER TABLE BY FUNCTION

Setting Item	Parameter to be Set	Remarks
Travel end limit	SYSTEM PARAMETER P TRAVEL LIMIT N TRAVEL LIMIT	
Programmable limit	USER PARAMETER P PROG LIMIT WRK N PROG LIMIT WRK P PROG LIMIT MC N PROG LIMIT MC	Specified by user.
Pitch error compensation	SYSTEM PARAMETER P PITCH ERR COMP N PITCH ERR COMP PITCH COMP SPAN PITCH POINT	
	NC OPTIONAL PARAMETER (WORD) NO. 33 (Number of pitch error compensation points)	
	PITCH ERROR COMP.	
In-position check amount (Exact stop check)	SYSTEM PARAMETER IN POSITION	
In-position check amount (Exact stop check at a home position command)	SYSTEM PARAMETER IN POSITION (H)	
Backlash compensation	USER PARAMETER BACKLASH	
Machine coordinate system offset value	SYSTEM PARAMETER ZERO OFFSET (MC)	
Home position	SYSTEM PARAMETER HOME POSITION 1 - 32 HOME POSITION MOVEMENT ORDER (HOMEPOSITION 1 - 32)	Setting of home position coordinate values and axis moving sequence
Uni-directional positioning	USER PARAMETER G60 OVERRUN AMP	Excess travel for uni-directional positioning
	NC OPTIONAL PARAMETER (BIT) No. 19: bit 0 to bit 5	Final positioning direction for one-directional positioning

Setting Item	Parameter to be Set	Remarks
Fixed cycle	NC OPTIONAL PARAMETER (LONG WORD) No. 1	Retraction for G73 cycle Retraction for G83 cycle (when infeed is specified by I)
	NC OPTIONAL PARAMETER (LONG WORD) No. 2	Retraction for G83 cycle (when infeed is specified by Q)
	NC OPTIONAL PARAMETER (LONG WORD) No. 11	Retraction for G76 and G87 before orientation
	NC OPTIONAL PARAMETER (BIT) No. 17: bit 0	Always keeps the fixed cycle's cycle axis at the Z-axis.
	NC OPTIONAL PARAMETER (BIT) No. 17: bit 1 & bit 2	Shift direction for fixed cycle
Tape punch	NC OPTIONAL PARAMETER (WORD) No. 1	Number of tape feed holes for tape punching
	NC OPTIONAL PARAMETER (WORD) No. 2	Individual tape length for incremental tape punching
	NC OPTIONAL PARAMETER (BIT) No. 1: bit 0	Tape code for tape punching
Puncher	NC OPTIONAL PARAMETER (WORD) No. 6	Puncher's baud rate
	NC OPTIONAL PARAMETER (BIT) No. 8: bit 0	Stop bit
	NC OPTIONAL PARAMETER (BIT) No. 8: bit 1	Sets whether the DATA READY signal is controlled by an external signal.
	NC OPTIONAL PARAMETER (BIT) No. 8: bit 2	Parity check execution
	NC OPTIONAL PARAMETER (BIT) No. 8: bit 3	Even parity

Setting Item		Parameter to be Set	Remarks
Tape reading		NC OPTIONAL PARAMETER (BIT) No. 1: bit 0 No. 1: bit 1	Code for tape reading, such as fixed tape code and automatic recognition
		NC OPTIONAL PARAMETER (BIT) No. 1: bit 2	TV check run
		NC OPTIONAL PARAMETER (BIT) No. 1: bit 3	Tape delimiter code
		NC OPTIONAL PARAMETER (BIT) No. 1: bit 4	Verifying on tape rewinding after tape reading
		NC OPTIONAL PARAMETER (BIT) No. 1: bit 5	Automatic tape rewinding after tape reading
		NC OPTIONAL PARAMETER (BIT) No. 1: bit 6	Special code as an alarm
		NC OPTIONAL PARAMETER (BIT) No. 1: bit 7	Special code neglected
		NC OPTIONAL PARAMETER (BIT) No. 2: bit 0	A block including control statements such as CALL and GOTO is handled as a block.
Offset	Cutter radius compensation	NC OPTIONAL PARAMETER (LONG WORD) No. 4	Data for compensation vector check
		NC OPTIONAL PARAMETER (LONG WORD) No. 5, No. 6	Starting/end point decelerating distance compensation corner override
		NC OPTIONAL PARAMETER (LONG WORD) No. 9	Data for errors in calculating minute arc and quasi-full circles
		NC OPTIONAL PARAMETER (WORD) No. 3	Decelerating rate for compensation corner override
		NC OPTIONAL PARAMETER (WORD) No. 4	Internal identification angle for compensation corner override
		NC OPTIONAL PARAMETER (WORD) No. 5	Decelerating rate for compensation arc's internal override
	Three-dimensional tool offset	NC OPTIONAL PARAMETER (LONG WORD) No. 7	Size of offset vector for three-dimensional tool offset
Circular interpolation		NC OPTIONAL PARAMETER (LONG WORD) No. 3	Data for circular arc check (Difference in radius between starting and end points)
		NC OPTIONAL PARAMETER (BIT) No. 20: bit 1	For single-axis command, actual position or a point on the arc is taken as the command value for the axis not programmed.

Setting Item	Parameter to be Set	Remarks
Unit system for setting	NC OPTIONAL PARAMETER (BIT) No. 9: bits 0 to 7 INPUT UNIT SYSTEM NC OPTIONAL PARAMETER (BIT) No. 3: bits 0 to 7	Change in the setting unit system
Display	NC OPTIONAL PARAMETER (BIT) No. 4: bit 4	Subprogram (SSB) not displayed
	NC OPTIONAL PARAMETER (BIT) No. 4: bit 5	Program display, indicating the remaining amount of travel
	NC OPTIONAL PARAMETER (BIT) No. 4: bit 6	4 × 4 as the size of the enlarged display characters for the actual position
	NC OPTIONAL PARAMETER (BIT) No. 5: bits 0 to 4	Check display's screen mode
	NC OPTIONAL PARAMETER (BIT) No. 5: bit 7	Current value display including the addition of manual intervention
Processing at power on	NC OPTIONAL PARAMETER (BIT) No. 4: bit 1	Automatic program selection
	NC OPTIONAL PARAMETER (BIT) No. 18: bits 0 to 6	Selection of G code which is set automatically when power supply is turned on
Processing at resetting	NC OPTIONAL PARAMETER (BIT) No. 4: bit 2	NC reset, bringing the total sum of manual intervention to 0
	NC OPTIONAL PARAMETER (BIT) No. 17: bit 3	NC reset, causing the mirror image to be normal for all axes
Workpiece geometry enlargement/reduction	NC OPTIONAL PARAMETER (BIT) No. 6: bits 0 to 5	Execution of workpiece geometry enlargement or reduction
Axis command cancel	NC OPTIONAL PARAMETER (BIT) No. 7: bits 0 to 5	Selection of the axis to be command canceled

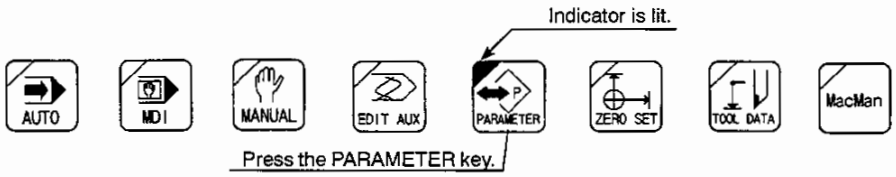
SECTION 3 DESCRIPTION OF PARAMETER AND SETTING PROCEDURE

This section describes the contents of the parameters and the parameter setting procedure to be followed in the "parameter setting" mode.

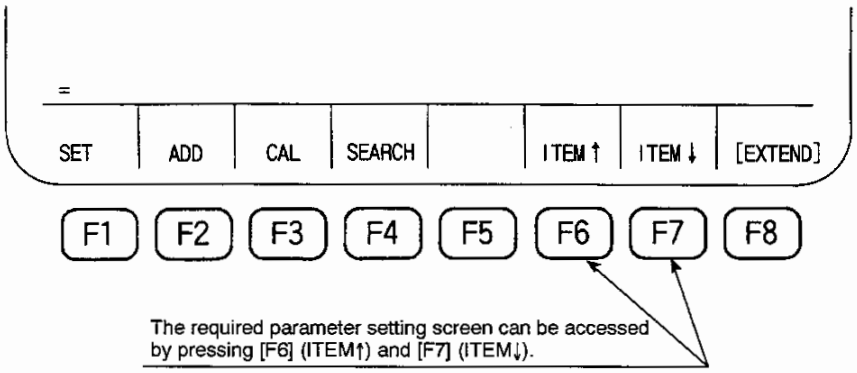
The operation procedure to select the required parameter setting screen, to select the required parameter setting page, and to move the cursor to the required data setting item is used in common to all parameter setting screens. The procedure described below should be followed to select the parameter setting screen and moving the cursor to the required data setting item for the operation explained hereafter.

(1) Operation to select the parameter setting screen

(a) Press the PARAMETER key in the MODE selection keys in the NC operation panel.



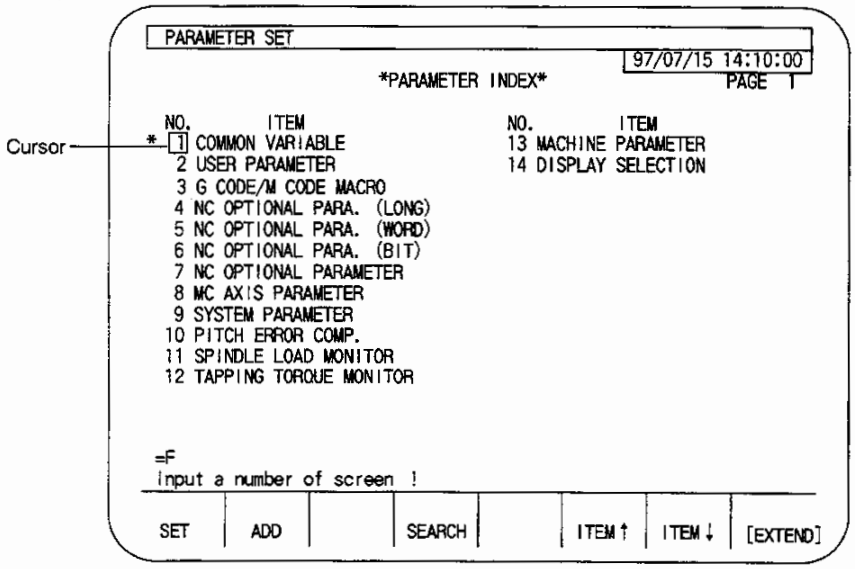
When the PARAMETER key is pressed, the indicator at the upper left part in the key is lit, and the parameter setting screen is displayed. At the same time, the function key names as indicated right are displayed.



(b) Press the function key [F6] (ITEM↑) or [F7] (ITEM↓) until the required parameter setting screen is displayed.

In addition to the methods indicated above, it is also possible to select the parameter setting screen using the PARAMETER INDEX screen. To call out the required parameter setting screen using the PARAMETER INDEX screen, press the WRITE key after pressing function key [F4] (SEARCH).

* Note that the selection of a parameter setting screen using the PARAMETER INDEX screen is not possible at the screen where machine system parameters or machine user parameters are displayed.



The required parameter setting screen can be selected in either of the following methods:

3) Input the code number of the required screen following the message "Input a number of screen!", then press the WRITE key.

4) Move the cursor to the item to be selected and press the WRITE key.

(2) Moving the cursor to the required data setting item

According the parameter kind, the number and the name of the parameters to be displayed in one page of parameter setting screen are determined. After displaying the required parameter setting screen, the cursor can be moved to the required data setting item by using the page keys (and) and the cursor control keys ( ), or by directly keying in the parameter number using the search function ([F4] (SEARCH)).

With some kind of parameters which are displayed only in one page of display, use of page keys or [F4] (SEARCH) will not be necessary.

(a) Selection by page keys and cursor control keys

1) After displaying the required parameter setting screen, change the display page by pressing the page key until the required parameter is displayed.

The function of the page keys is:

Page advance key ( ): Changes to the next page within the setting screen of the same kind of parameters.

Page return key ( ): Changes to the previous page within the setting screen of the same kind of parameters.

Move the cursor to the required data setting item using the cursor control keys.

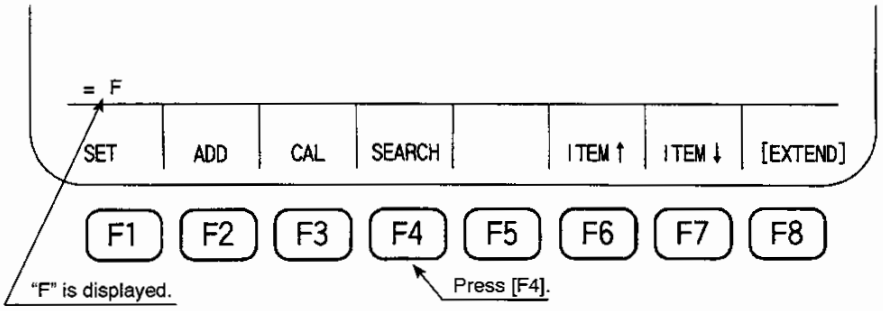
2) The function of the cursor control keys is:

Cursor right key (⇨): Moves the cursor to the right within the displayed page.
Cursor left key (⇦): Moves the cursor to the left within the displayed page.
Cursor up key (⇧): Moves the cursor up within the displayed page.
Cursor down key (⇩): Moves the cursor down within the displayed page.

(b) Selection using the search function

1) After displaying the required parameter setting screen, press [F4] (SEARCH).

"F" is displayed in the console line.



2) Key in the required parameter number following "F" and press the WRITE key.

The screen page changes to the one in which the required parameter is contained. The cursor is positioned at the data field of the specified parameter number.

Example: =F15 [WRITE]

CAUTION

: (1) After changing the parameter data, it is necessary to press the function key BACKUP.

The NC backs up the parameter data to the memory area in preset intervals. Therefore, if power is turned off just after changing the parameter data, the new setting might not be backed up. To prevent such a problem, it is recommended to back up the data by pressing the function key BACKUP.

In response to the pressing of the function key BACKUP, the NC forcibly executes backup processing and saves the data to the memory area. This backup processing is completed in several seconds.

When the BACKUP key is pressed, "BA" representing backup is displayed in the console line. After the completion of backup processing, the console line displays "=" again.

(2) Some parameters require the power to be turned off once and then turned back on.

If the data is changed for such types of parameters, the following message is displayed in the alarm line.

4217 Alarm D "Power on effective parameter set"

After changing the data for such types of parameters, press the BACKUP function key, turn off power and then turn power on again.

1. Display Select Screen (Selection for Display and Not-display of Parameter Setting Screens)

(1) The display select screen is displayed only when "14 DISPLAY SELECTION" is selected at the DISPLAY INDEX screen. Note that it is not displayed by using function keys [F6] (ITEM↑) and [F7] (ITEM↓).

To display the PARAMETER INDEX screen, press the WRITE key after pressing function key [F4] (SEARCH). Note that it is not called out from the screen where machine system parameters or machine user parameters are displayed.

(2) Move the cursor to the parameter setting screen, for which the display or not-display status should be changed then press function key [F1] (SELECT/CANCEL). A red asterisk (*) is displayed and cleared alternately each time function key [F1] (SELECT/CANCEL) is pressed.

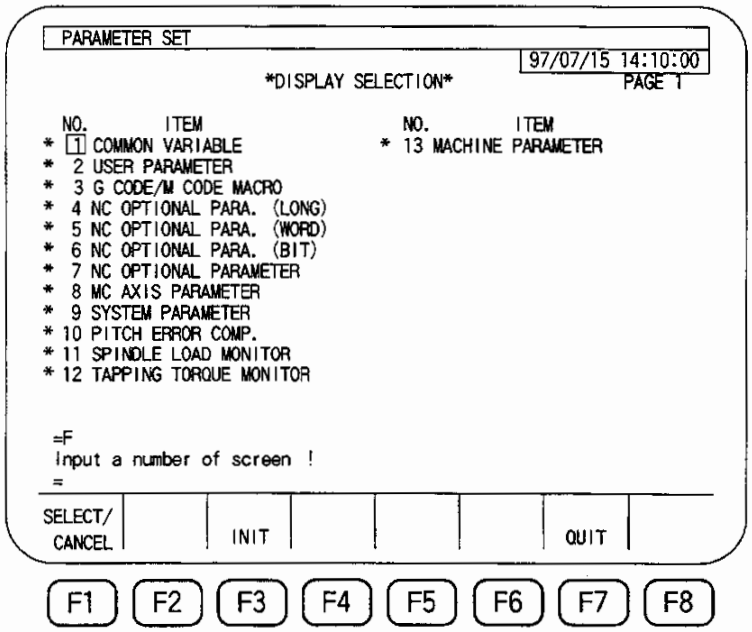
The parameter setting screens for which a red asterisk (*) is displayed can be displayed.

(3) To initialize the display/not-display setting for the parameter setting screens, press function key [F3] (INIT).

In the initial state, the following parameter setting screens are displayed.

- Common variable
- User parameter
- G code/M code macro
- NC optional parameter
- DNC-B parameter (option)
- NC run monitor (option)
- Tolerance control parameter (option)
- DNC-C parameter (option)
- Rotary axis parameter (option)
- Spindle overload monitor parameter (option)
- Tapping torque monitor parameter (option)
- Machine parameter
- Thermal displacement compensation parameter (option)

(4) The screen returns to the PARAMETER INDEX screen when function key [F7] (QUIT) is pressed.



2. Common Variables

The common variables are referenced and updated in common from the schedule program, main programs and subprograms. The procedure to set the common variable data is explained below.

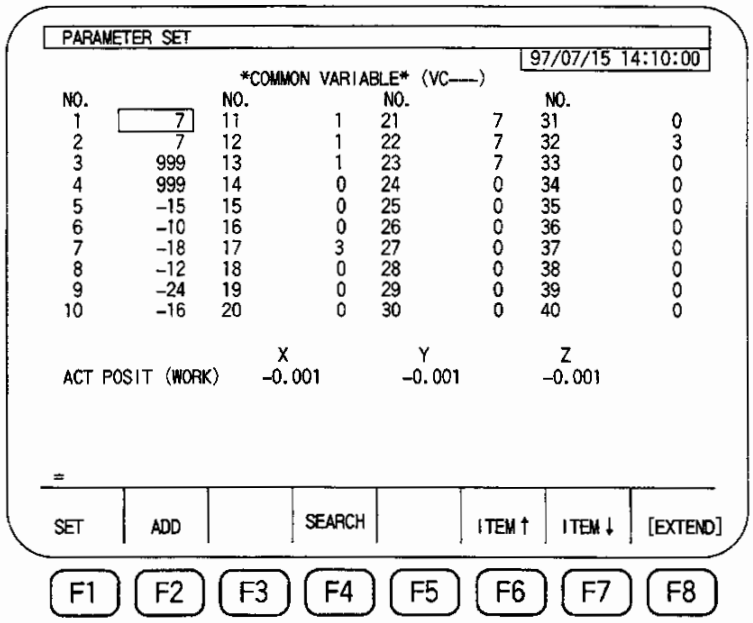
Procedure:

(1) Select the COMMON VARIABLE setting screen.

The standard specification provides 200 sets of common variables ranging from VC1 to VC200; optionally, 1000 sets of common variables are available in the range from VC1 to VC1000. One page of the COMMON VARIABLES screen displays 40 sets of the common variables.

If the common variable for which the data should be set is not displayed on the current page, change the page until the required common variable appears by pressing the page keys. Then, move the cursor to that parameter by pressing the cursor control keys.

It is also possible to move the cursor to the required common variable by using the search function, [F4] (SEARCH).



(2) Setting

(a) If the value to be set is known:

Press [F1] (SET) and key in the value from the keyboard.

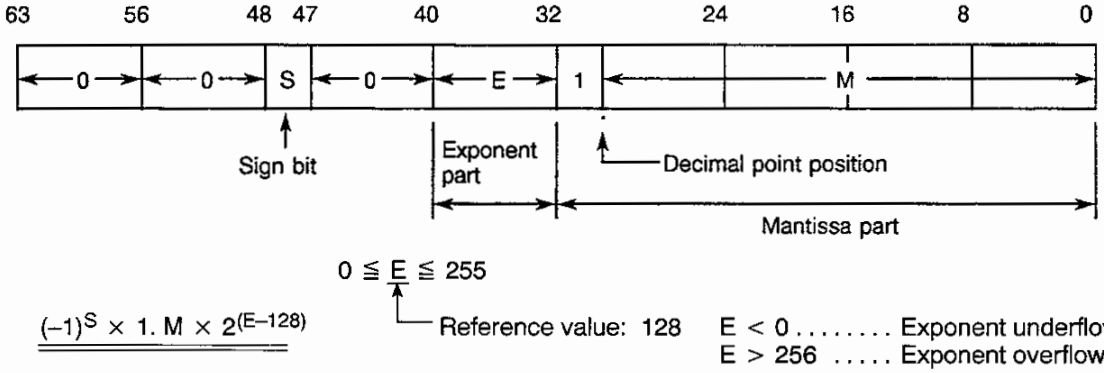
(b) If the value is already set and the value to be added to or subtracted from the existing value is set:

Press [F2] (ADD) and key in the value to be added to or subtracted from the present setting.

(3) Press the WRITE key.

The data on which the cursor is placed is updated according to the keyed in value.

[Supplement] Up to eight digits of data elements may be entered. Internally, they are floating point numbers which are eight bytes long.



$0 \leqq E \leqq 255$

$(-1)^S \times 1.M \times 2^{(E-128)}$

Reference value: 128

$E < 0$ ..... Exponent underflow
$E > 256$ ..... Exponent overflow

Key in "$*$" as entry data and press the WRITE key. This results in setting EMPTY. The EMPTY data is displayed as EMPTY($*$).

(4) For the standard specification, the data is backed up for all of 200 sets of common variables. For the optional specification, the data is backed up for 400 sets of common variables among 1000 sets of them.

3. User Parameters

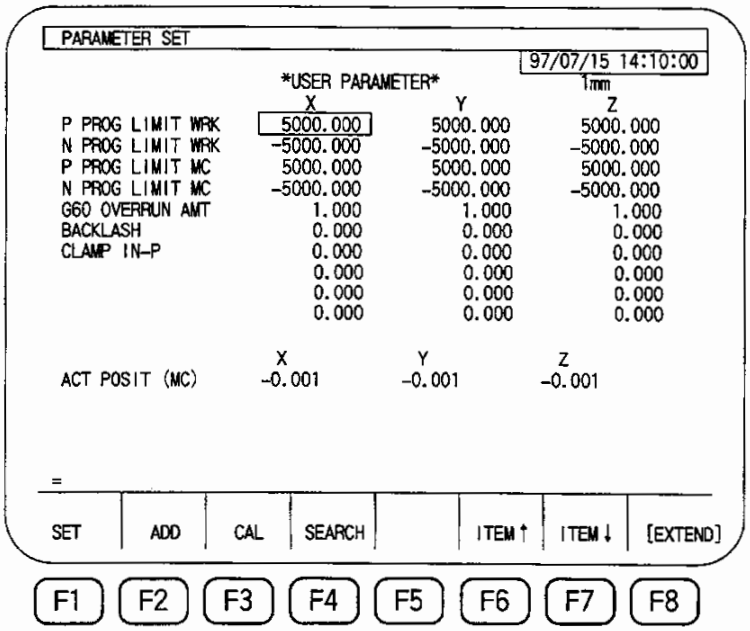
The following user parameters are available.

No.	Display Screen	Contents	Initial Setting Value	Setting Range	Setting Unit
1	P PROG LIMIT WRK	Software-based P-directional and N-directional travel end limits disclosed to users. Displayed in the work coordinate system.	Depends on machine specification	-99999999 to +99999999	Selected unit system
2	N PROG LIMIT WRK		Same as above	-99999999 to +99999999	Selected unit system
3	P PROG LIMIT MC	Software-based P-directional and N-directional travel end limits disclosed to users. Displayed in the machine coordinate system.	Same as above	-99999999 to +99999999	Selected unit system
4	N PROG LIMIT MC		Same as above	-99999999 to +99999999	Selected unit system
5	G60 OVERRUN AMT	Amount of a jump in uni-directional positioning. The direction in which positioning is made is set by the NC optional parameter (bit), No. 19.	1000	0 to 30000	Selected unit system
6	BACKLASH	Backlash compensation amounts for individual axes are set.	0	-1000 to 1000	Selected unit system
7	CLAMP IN-P	Clamp in-position width for each axis. (If the setting is "0", clamp in-position check is not carried out.)	0	0 to 1000	Selected unit system

The P PROG LIMIT WRK and P PROG LIMIT MC display the same data in the coordinate values in the work and machine coordinate systems. If either of the data is changed, the data of the other parameter is changed accordingly. Similarly, if either of the data is set in the program using G22, both of the parameter data are changed.

This is also true for N PROG LIMIT WRK and N PROG LIMIT MC.

<Setting procedure>



(1) Display the USER PARAMETER screen and move the cursor to the required parameter by using the cursor control keys or by using [F4] (SEARCH).

To set the data for additional axes (5th and later axes), display the next page by pressing [F5] (AXIS CHANGE) and move the cursor to the data setting item in the same manner.

(2) Setting

(a) If the value to be set is known:

Press [F1] (SET) and key in the value from the keyboard.

(b) If the value is already set and the value to be added to or subtracted from the existing value is set:

Press [F2] (ADD) and key in the value to be added to or subtracted from the present setting.

(c) If the value is to be set newly as a relative value in reference to the actual value:

Press [F3] (CAL) and key in the relative value of the position to be set in reference to the actual position.

Note that this setting cannot be used for setting the data for BACKLASH, CLAMP IN-P, and G60 OVERRUN AMT.

(3) Press the WRITE key.

The data on which the cursor is placed is updated according to the keyed in value.

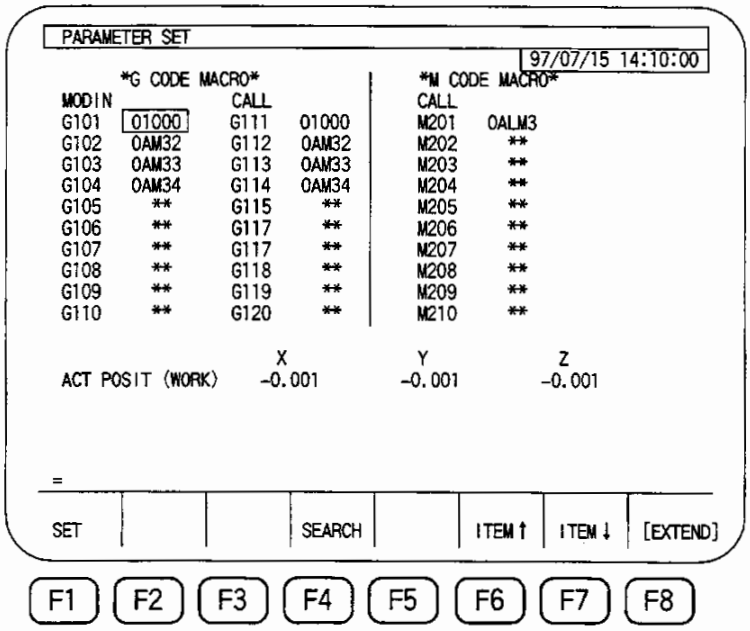
In the setting for P/N PROG LIMIT:

If the set data is outside the travel end limit set for the system parameters, an error message is displayed and the set data is ignored.

4. G/M Code Macro

Program name of the programs used as G code macro (G100 to G120) and M code macro (M201 to M210) should be set.

Setting procedure is indicated below.



(1) Select the G/M CODE MACRO setting screen and move the cursor to the data setting position either by using the cursor control keys or by using the search function [F4] (SEARCH).

(2) Press [F1] (SET), and "S" appears in the console line. Key in the program name following "S".

To clear the program name, key in "*".

(3) Press the WRITE key.

The program name on which the cursor is positioned is changed to the newly keyed in program name.

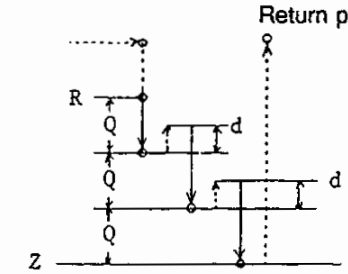
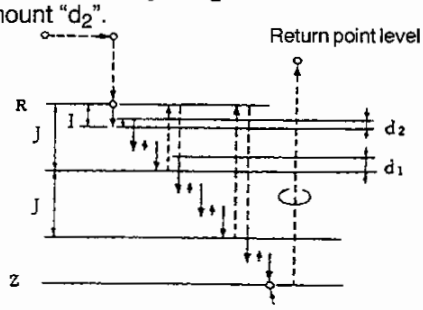
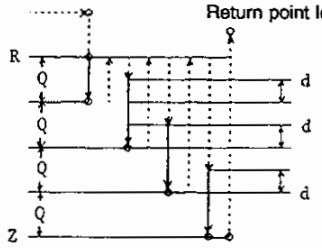
On the screen, "**" is displayed if program name is not registered.

NOTICE

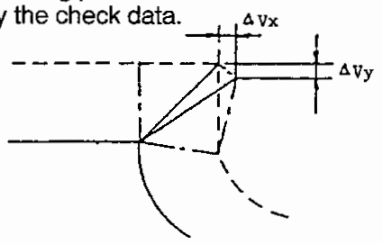
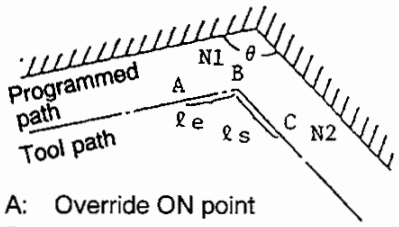
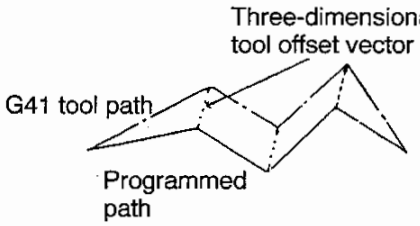
: A program name which is set at OO000 to OO999 will result in an alarm. The OO000 and following are intended for use by the maker subprograms only, users are not allowed to use them.

5. NC Optional Parameter (Long Word)

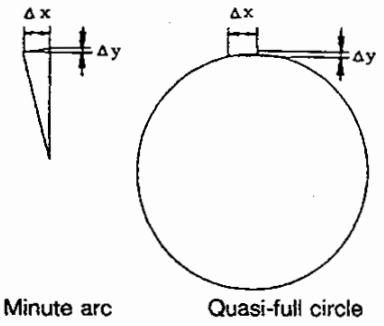
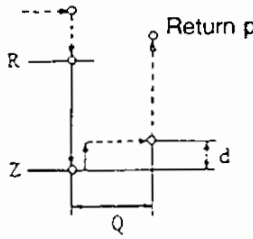
For optional parameter (long word), those listed below are available. The parameter numbers given in the following table are keyed to the numbers displayed on the OPTIONAL PARAMETER (LONG WORD) screen.

Parameter No.	Item	Contents	Initial Setting Value	Setting Range
1*1	Retraction in G73 cycle (high-speed deep hole)	In G73 cycle, Z-axis is infed by "Q", retracted to level "d" and then infed by "Q+d". Set this retraction amount "d". 	500	0 to 10000 (μm)
	Retraction in G83 cycle (deep hole)	In G83 cycle, if infeed distance is set for "I", Z-axis is infed by "I", retracted to level "d_2" and then infed by "I+d_2". Set this retraction amount "d_2". 		
2*1	Retraction in G83 cycle (deep hole)	In G83 cycle, Z-axis is infed by "Q", retracted to level "R" in a rapid feedrate, and then positioned to the level "d" higher than the previously infed level. Infeed by "Q+d" is made after that. Set this retraction amount "d". 	1000	0 to 1000 (μm)
3*1	Arc check data	An alarm will occur if, in an arc command, the difference in radius between the starting point and the end point is greater than the preset level, set by the check data.	20	2 to 200 (μm)

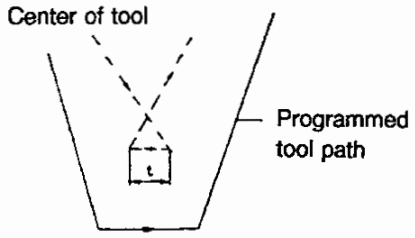
*1 In 0.1 μm unit specification, the initial setting value and the setting range are ten times those in mm unit specification.

Parameter No.	Item	Contents	Initial Setting Value	Setting Range
4*1	Cutter radius compensation vector check data	For an extremely small corner movement, if ΔVx ≦ ΔV and ΔVy ≦ ΔV, then ignores the rear moving point for movement. The ΔV is set by the check data. 	50	0 to 5000 (μm)
5	Decelerating distance at end point for cutter radius compensation corner override	 A: Override ON point B: N1 positioning point C: Override OFF point N1: X_ Y_ F1 N2: X_ Y_ F2 ℓe: Decelerating distance at corner's end point ℓs: Decelerating distance at corner's starting point	0	0 to 99999999 (μm)
6	Decelerating distance at starting point for cutter radius compensation corner override		0	0 to 99999999 (μm)
7	Three-dimensional tool offset vector size	 Vector component in Xp-axis direction: Vx = i × r/p Vector component in Xp-axis direction: Vy = j × r/p Vector component in Xp-axis direction: Vz = k × r/p where, i, j, & k : Values specified by I, J and K respectively. r : Tool offset value corresponding to the tool offset number specified by D. p : Parameter-set Value; for 0, the following equation applies. $p = \sqrt{i^2 + j^2 + k^2}$	0	–99999999 to +99999999 (μm)

*1 In 0.1 μm unit specification, the initial setting value and the setting range are ten times those in mm unit specification.

Parameter No.	Item	Contents	Initial Setting Value	Setting Range
9*1	Error data resulting from cutter radius compensation calculation for minute circular arcs and quasi-full circles in cutter radius compensation mode	 Minute arc Quasi-full circle ($\Delta X \leqq \Delta V, \Delta Y \leqq \Delta V$) (a) Minute arc The horizontal and vertical distances between the starting point and the end point of a circular arc are smaller than the setting. (b) Quasi-full circle A circular arc which is almost a full circle. The horizontal and vertical distances of the gap of the arc are smaller than the setting. The setting ΔV is given by the error data. The end point of a minute circular arc is ignored and no arc movement takes place. The end point of a quasi-full circle is ignored and the arc is handled as a full circle which begins at the starting point.	10	2 to 200 (μm)
10	Maximum feedrate clamp value	When an attempt is made to feed an axis at a rate exceeding the preset value, the axis feedrate is clamped at this value.	Depends on machine specification	0 to 200000 (mm/min)
11*1	Retraction amount in G76 (fine boring) and G87 (back boring) cycles	In the G76 and G87 cycle, the cutting tool is infed to level "Z" where a dwell of "P" seconds is carried out and then it is retracted upwards by "d". At this retracted level, the cutting tool is shifted by "Q" in the direction opposite to the tool bit. Set this retraction amount "d". 	500	0 to 10000 (μm)

*1 In 0.1 μm unit specification, the initial setting value and the setting range are ten times those in mm unit specification.

Parameter No.	Item	Contents	Initial Setting Value	Setting Range
12*1	Positioning point for RMILI (inner round milling)	Sets the distance between the first positioning point for RMILI (inner round milling) and the workpiece end face.	500	500 to 5000 (μm)
13	Number of bytes for the program data transmission until the DNC-B cycle start.	Sets the number of bytes for the program data transmission until the cycle start in the DNC-B remote buffer operation mode with communication control protocol is started.	0	0 to 99999999 (bytes)
14	Feedrate change value in the fixed cycle	Sets the feedrate value when the rapid feedrate is changed to a cutting feedrate in the fixed cycle.	20000	1 to 20000 (μm/min)
15	Spindle index zero	Spindle index zero offset is set to be used for E command in the synchronized tapping mode.	Depends on machine specification.	0 to 359999 (1/1000 deg.) or 0 to 3599999 (1/10000 deg.) *2
16	Spindle IN-P check value	Spindle (C-axis) IN-P check value is set.	Depends on machine specification.	0 to 359999 (1/1000 deg.) or 0 to 3599999 (1/10000 deg.) *2
17	Spindle index angle at rapid feedrate	Spindle position deduction amount is set to be used for E command in the synchronized tapping mode.	Depends on machine specification.	0 to 359999 (1/1000 deg.) or 0 to 3599999 (1/10000 deg.) *2
18*1	Tolerance for the interference with cutter radius compensation	When the programmed tool path is different from the actual tool path as shown in the figure below, a tool interference error is generated while the tool does not interfere with the workpiece. To avoid this, set the tolerance range ("t" in the figure below) for interference. Interference error will not be generated when the gap between the programmed tool path and the actual tool path is within the tolerance range. 	0	0 to 99999999 (μm)

*1 In 0.1 μm unit specification, the initial setting value and the setting range are ten times those in mm unit specification.

*2 Setting unit: VAC control unit (1/1000° or 1/10000°)

Parameter No.	Item	Contents	Initial Setting Value	Setting Range
19	Spindle orientation offset value	Sets the offset amount during spindle orientation with the VAC.	0	0 to 359999 (1/1000 deg.) or 0 to 3599999 (1/10000 deg.) *2
20	Spindle index position check range	With the VAC, if spindle position is shifted from the completion of spindle indexed position beyond the preset range, it causes an alarm. This range is set for this parameter.	0	0 to 20000 (1/1000 deg.) or 0 to 200000 (1/10000 deg.) *2
22*1	F1 digit feed accel./decel. constant	Sets the acceleration/deceleration data for the F1 digit feed (parameter type)	0	0 to 4000000
23	Motor continuous rating	Sets the spindle motor continuous rating. (This value varies according to the motor capacity.)	0	110 to 99999999 (W)
25*1	Circular radius R command error check amount	If the error between the radius at the start and end point of the arc and the specified radius (R) is smaller than the preset value, the specified center of the arc is taken as the center for the start and end point of the arc. This value is set for this parameter.	0	0 to 1000 (μm)
28	3-D arc command PQR permissible error	Designates the arc shape's permissible error amount when the P,Q,R commands are used as normal line vector commands.	0	0 to 99999999
30	Safety door interlock	Sets the maximum feedrate of the axes to be moved while the operator's door is open.	2000	1 to 2000 (mm/min)
33	Synchronization position shift amount (μm)	The difference between the master axis command and the slave axis command (SRSCON) is automatically set as the synchronization position shift amount if this value is "0" when the power is turned on.	0	Automatic setting
34	Cutting start point for RMILO (outer round milling)	Sets the distance between the cutting start point for RMILO (outer round milling) and the workpiece end face.	0	–99999999 to +99999999 (μm)
35	Cutting start point for RMILI (inner round milling)	Sets the distance between the cutting start point for RMILI (inner round milling) and the workpiece end face.	0	–99999999 to +99999999 (μm)

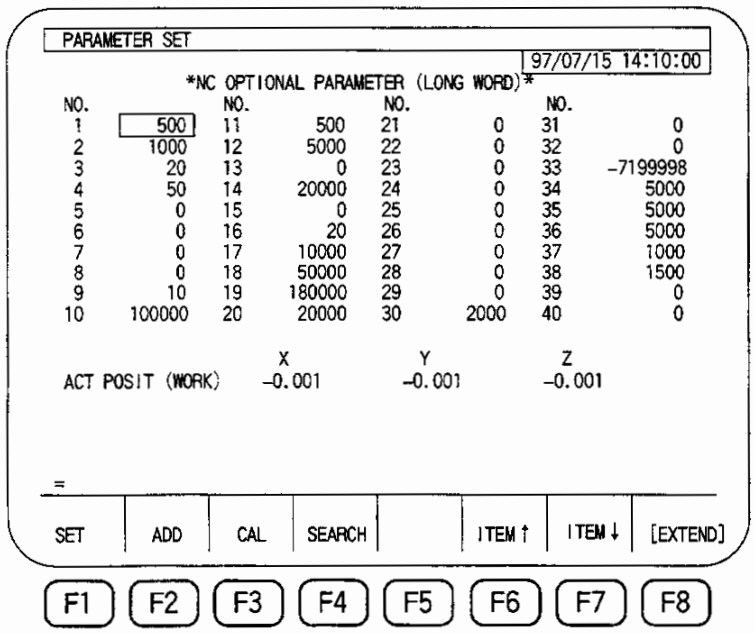
*1 In 0.1 μm unit specification, the initial setting value and the setting range are ten times those in mm unit specification.

*2 Setting unit: VAC control unit (1/1000° or 1/10000°)

Parameter No.	Item	Contents	Initial Setting Value	Setting Range
36	Z-axis cutting position	For I-MAP B specifications, this parameter sets the tool's OD for convex solid profiles at a position (Z-cut position) away from the cutting allowance. Standard setting amount: 5000	0	–99999999 to +99999999 (μm)
37	Approach position	For I-MAP B specifications, this parameter sets the approach position for concave solid profiles. Standard setting amount: 1000	0	–99999999 to +99999999 (μm)
38	Travel width at pick operation	For I-MAP B specifications, this parameter sets the travel width at pick operation for irregular solid profiles. Standard setting amount: 1500	0	–99999999 to +99999999 (μm)
41	Upper limit feedrate value	Sets the upper limit feedrate value to be used for T1 time constant changing processing.	200000	0 to 200000 (mm/min)
43	Minimum gaging tool length for automatic tool length offset/ breakage detection	Sets the minimum length of the tools for which the corresponding function will be used. (used by gaging MSB)	60	1 to 999 (mm)
44	Maximum tool length	Sets the maximum length of tool to be used. (used by gaging MSB)	0	0 to 999 (mm)

*1 In 0.1 μm unit specification, the initial setting value and the setting range are ten times those in mm unit specification.

The data setting procedure for NC optional parameter (long word) is indicated below.



(1) Display the NC OPTIONAL PARAMETER (LONG WORD) screen and move the cursor to the required parameter by using the cursor control keys or by using [F4] (SEARCH).

(2) Setting

(a) If the value to be set is known:

Press [F1] (SET) and key in the value from the keyboard.

(b) If the value is already set and the value to be added to or subtracted from the existing value is set:

Press [F2] (ADD) and key in the value to be added to or subtracted from the present setting.

(c) If the value is to be set newly as a relative value in reference to the actual value:

Press [F3] (CAL) and key in the relative value of the position to be set in reference to the actual position.

For parameters for which the math function is not valid, pressing of [F3] (CAL) is ignored, and this operation cannot be used.

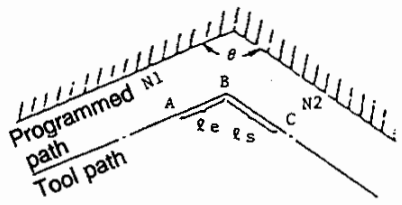
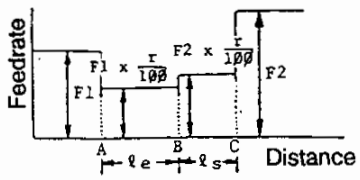
(3) Press the WRITE key.

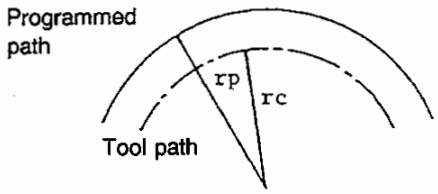
The data on which the cursor is placed is updated according to the keyed in value.

6. NC Optional Parameter (Word)

The following optional parameter (words) are available.

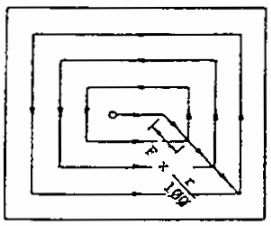
For NC optional parameter (word), those listed below are available. The parameter numbers given in the following table are keyed to the numbers displayed on the NC OPTIONAL PARAMETER (WORD) screen.

Parameter No.	Item	Contents	Initial Setting Value	Setting Range
1	Tape feed holes in punching	For a punchout in the PIP (transfer) mode, there is a tape feed before the program is punched out, which is followed by tape feed. The number of feed holes is set by this parameter.	600	1 to 10000 (holes)
2	Defaults of tape lengths in divided punching	A file of part programs which is too long to be stored in a roll of paper tape is divided into smaller files to be punched out. The lengths of the divisions are closed at the breaks of each block, so that the setting is slightly different from the actual tape length. A divided punchout gives the beginning of each tape part a file name. Note that the setting does not include the lengths corresponding to the file name and feed holes.	180	1 to 300 (m)
3	Decelerating ratio of cutter radius compensation corner override	 N1 X_Y_ F1 N2 X_Y_ F2 A : Override ON point B : N1 positioning C : Override OFF point r : Decelerating ratio θ : Corner's internal identification angle 	100	1 to 100 (%)
4	Internal identification angle of cutter radius compensation corner override		90	1 to 179 (deg)

<table>
<tr><th>Parameter No.</th><th>Item</th><th>Contents</th><th>Initial Setting Value</th><th>Setting Range</th></tr>
<tr><td>5</td><td>Decelerating ratio of cutter radius compensation arc's internal override</td><td> 

Generally, the feedrate during cutter radius compensation is controlled so that the tool center path gets the specified speed. Parameter setting, however, provides and override which permits the feedrate on the programmed path to get the specified speed although it is limited to circular arc's inside cutting.
(a) When rc/rp × 100 ≧ Parameter setting
Actual feedrate = Specified speed × rc/rp
(b) When rc/rp × 100 < Parameter setting
Actual feedrate = Specified speed × (Parameter setting/100)</td><td>100</td><td>1 to 100 (%)</td></tr>
<tr><td>6*</td><td>NC baud rate for RC232C Channel 0</td><td>This parameter sets the baud rate of the RS232C interface when used for the puncher.
<table>
<tr><th>Baud rate</th></tr>
<tr><td>110</td></tr>
<tr><td>150</td></tr>
<tr><td>300</td></tr>
<tr><td>600</td></tr>
<tr><td>1200</td></tr>
<tr><td>2400</td></tr>
<tr><td>4800</td></tr>
<tr><td>9600</td></tr>
<tr><td>19200</td></tr>
</table>
If a baud rate other than the value indicated above is set, the baud rate closest to and smaller than the setting is selected.</td><td>600</td><td>110 to 19200 (bps)</td></tr>
</table>

Parameters indicated by an asterisk (*) require turning off the power supply once after setting new data, then turn it on again.

<table>
<tr><th>Parameter No.</th><th>Item</th><th>Contents</th><th>Initial Setting Value</th><th>Setting Range</th></tr>
<tr><td>7</td><td>Override in pocket milling (spiral type) corner cutting</td><td>Pocket milling (spiral type) PMILR
 
In the movement illustrated above, this parameter specifies the override of the feedrate of the 45-degree cut.
Actual feedrate = Specified speed × (r/100)
This value of r is set by the parameter.</td><td>100</td><td>1 to 100 (%)</td></tr>
<tr><td>8</td><td>Magazine pot number for touch probe</td><td>This parameter specifies the magazine pot number for storing the touch probe.</td><td>0</td><td>1 to number of magazine pots</td></tr>
<tr><td>9</td><td>Imaginary spindle rpm for machine lock</td><td>This parameter specifies the imaginary spindle speed for the machine lock mode operation.</td><td>2000</td><td>1 to 8000 (min^{-1}) (rpm)</td></tr>
<tr><td>11</td><td>Designation of operation method</td><td>This specifies the operation method to be selected when option designation is not given at the time program selection is made.
<table><tr><th>Setting</th><th>Operation Method</th></tr><tr><td>0</td><td>Normal operation (method A)</td></tr><tr><td>1</td><td>Large volume operation (method B)</td></tr><tr><td>2</td><td>Operation without branching and subprograms (method S)</td></tr></table></td><td>1</td><td>0 to 3</td></tr>
<tr><td>13</td><td>Schedule program auto update</td><td>Sets whether or not the automatic updating of the schedule is effective or ineffective.
0: Ineffective
1: Effective</td><td>0</td><td>0 to 1</td></tr>
<tr><td>16</td><td>Number of bytes in one block for batch output in DNC-B mode</td><td>This specifies the number of bytes in one block when NC program is reverse-transmitted in protocol A.</td><td>0</td><td>0 to 4000 (bytes)</td></tr>
<tr><td>18</td><td>STM answer back time over check period</td><td>After the execution of S, T, or M command, if no answer back is given within a time set for this parameter, an alarm occurs.
Whether this STM answer back time over check is made effective or ineffective is set for NC optional parameter (bit) No. 15, bit 5.</td><td>120</td><td>0 to 120 (min)</td></tr>
</table>

Parameter No.	Item	Contents	Initial Setting Value	Setting Range
19	In-position time over check period	If all axes do not arrive within in-position zone within the preset duration after the completion of calculation, an alarm occurs. This duration is set. Whether the in-position time over check function is made effective or not is determined by the setting for NC optional parameter (bit) No. 15, bit 6.	6000	0 to 6000 (× 0.1 sec)
21	Allowable number (n) of torque low for synchronized tapping	An alarm occurs when the spindle load torque exceeds the allowable value for the duration of 6.4∗n (msec) continuously while the synchronized tapping torque is monitored. Sets the allowable number (n) of low torque for the synchronized tapping.	0	0 to 32 (times)
23	File read waiting time for channel 0 in DNC-B mode	Sets the duration from file name designation (DC4 output) to the file read (DC1 output) for channel 0 with DC code control. If "0" is set, the parameter No. 34 will be used automatically.	0	0 to 9999 (sec)
24	File read waiting time for channel 1 in DNC-B mode	Sets the duration from file name designation (DC4 output) to file read (DC1 output) for channel 1 with DC code control. If "0" is set, the parameter No. 35 will be used automatically.	0	0 to 9999 (sec)
25	File read waiting time for channel 2 in DNC-B mode	Sets the duration from file name designation (DC4 output) to file read (DC1 output) for channel 2 with DC code control. If "0" is set, the parameter No. 36 will be used automatically.	0	0 to 9999 (sec)
26	File read waiting time for channel 3 in DNC-B mode	Sets the duration from file name designation (DC4 output) to file read (DC1 output) for channel 3 with DC code control. If "0" is set, the parameter No. 37 will be used automatically.	0	0 to 9999 (sec)
27	File read waiting time for channel 4 in DNC-B mode	Sets the duration from file name designation (DC4 output) to file read (DC1 output) for channel 4 with DC code control. If "0" is set, the parameter No. 38 will be used automatically.	0	0 to 9999 (sec)
33	Maximum allowable sets of screw pitch error compensation	This parameter specifies the total number of sets of pitch error compensation data of all axes.	2304	0 to 2304 (points)
34*	Ready completion waiting time for RS232C channel 0	This specifies the duration in which the RS232C channel 0 must be set ready. If it is not set ready within the time specified, an alarm occurs.	10	1 to 9999 (sec)

Parameters indicated by an asterisk (*) require turning off the power supply once after setting new data, then turn it on again.

<table>
<tr><th>Parameter No.</th><th>Item</th><th>Contents</th><th>Initial Setting Value</th><th>Setting Range</th></tr>
<tr><td>35*</td><td>Ready completion waiting time for RS232C channel 1</td><td>This specifies the duration in which the RS232C channel 1 must be set ready. If it is not set ready within the time specified, an alarm occurs.</td><td>10</td><td>1 to 9999 (sec)</td></tr>
<tr><td>36*</td><td>Ready completion waiting time for RS232C channel 2</td><td>This specifies the duration in which the RS232C channel 2 must be set ready. If it is not set ready within the time specified, an alarm occurs.</td><td>10</td><td>1 to 9999 (sec)</td></tr>
<tr><td>37*</td><td>Ready completion waiting time for RS232C channel 3</td><td>This specifies the duration in which the RS232C channel 3 must be set ready. If it is not set ready within the time specified, an alarm occurs.</td><td>10</td><td>1 to 9999 (sec)</td></tr>
<tr><td>38*</td><td>Ready completion waiting time for RS232C channel 4</td><td>This specifies the duration in which the RS232C channel 4 must be set ready. If it is not set ready within the time specified, an alarm occurs.</td><td>10</td><td>1 to 9999 (sec)</td></tr>
<tr><td>39*</td><td>Baud rate of RS232C channel 1</td><td>This parameter specifies the baud rate for RS232C channel 1.</td><td>600</td><td>110 to 19200 (bps)</td></tr>
<tr><td>40*</td><td>Baud rate of RS232C channel 2</td><td>This parameter specifies the baud rate for RS232C channel 2.</td><td>600</td><td>110 to 19200 (bps)</td></tr>
<tr><td>41*</td><td>Baud rate of RS232C channel 3</td><td>This parameter specifies the baud rate for RS232C channel 3.</td><td>600</td><td>110 to 19200 (bps)</td></tr>
<tr><td>42*</td><td>Baud rate of RS232C channel 4</td><td>This parameter specifies the baud rate for RS232C channel 4.</td><td>600</td><td>110 to 19200 (bps)</td></tr>
<tr><td>43</td><td>RS232C channel used for DNC-A channel</td><td><table><tr><th>Setting</th><th>Device Name</th></tr><tr><td>0</td><td>TT : (CN0) [RS232C]</td></tr><tr><td>1</td><td>CN1 : [RS232C]</td></tr><tr><td>2</td><td>CN2 : [RS232C]</td></tr><tr><td>3</td><td>CN3 : [RS232C]</td></tr><tr><td>4</td><td>CN4 : [RS232C]</td></tr></table></td><td>0</td><td>0 to 4 (channel)</td></tr>
<tr><td>44</td><td>Channel No. for DC code control</td><td>Sets the channel No. for DC code control in the infinite buffer operation mode.<table><tr><td>CN0 :</td><td>0</td></tr><tr><td>CN1 :</td><td>1</td></tr><tr><td>CN2 :</td><td>2</td></tr><tr><td>CN3 :</td><td>3</td></tr><tr><td>CN4 :</td><td>4</td></tr></table></td><td>0</td><td>0 to 4 (channel)</td></tr>
</table>

Parameters indicated by an asterisk (*) require turning off the power supply once after setting new data, then turn it on again.

<table>
<tr><th>Parameter No.</th><th>Item</th><th>Contents</th><th>Initial Setting Value</th><th>Setting Range</th></tr>
<tr><td>45*</td><td>Designation of punch device</td><td><table><tr><th>Setting</th><th>Device Name</th></tr><tr><td>0</td><td>TT : (CN0) [RS232C]</td></tr><tr><td>1</td><td>CN1 : [RS232C]</td></tr><tr><td>2</td><td>CN2 : [RS232C]</td></tr><tr><td>3</td><td>CN3 : [RS232C]</td></tr><tr><td>4</td><td>CN4 : [RS232C]</td></tr><tr><td>5</td><td>PP : [Parallel]</td></tr></table></td><td>0</td><td>0 to 5</td></tr>
<tr><td>46*</td><td>Designation of print data output external device name</td><td><table><tr><th>Setting</th><th>Device Name</th></tr><tr><td>0</td><td>TT : (CN0) [RS232C]</td></tr><tr><td>1</td><td>CN1 : [RS232C]</td></tr><tr><td>2</td><td>CN2 : [RS232C]</td></tr><tr><td>3</td><td>CN3 : [RS232C]</td></tr><tr><td>4</td><td>CN4 : [RS232C]</td></tr><tr><td>5</td><td>PR : [Centronics]</td></tr></table></td><td>0</td><td>0 to 5</td></tr>
<tr><td>48</td><td>Average number of sampling data sets for load display</td><td>This specifies the number (n) of load data sets to be sampled; spindle and axis load data is the average value of these sampled data sets.</td><td>16</td><td>4 to 80 (times)</td></tr>
<tr><td>50</td><td>Synchronization permissible error A</td><td>If the synchronization error between the master axis and the slave axis exceeds the value set for this parameter during operation under normal state, an alarm occurs.</td><td>0 (μm)</td><td>0 to 1000</td></tr>
<tr><td>51</td><td>Synchronization permissible error B</td><td>If the synchronization error between the master axis and the slave axis exceeds the value set for this parameter at power on state, an alarm occurs.</td><td>0 (μm)</td><td>0 to 5000</td></tr>
<tr><td>56</td><td>Automatic gauging retry counter</td><td>During automatic gauging using a touch probe, the gauging cycle is repeated if the contact of the touch probe is held ON. This parameter sets the number of times the gauging cycle should be retried.</td><td>0</td><td>0 to 10</td></tr>
</table>

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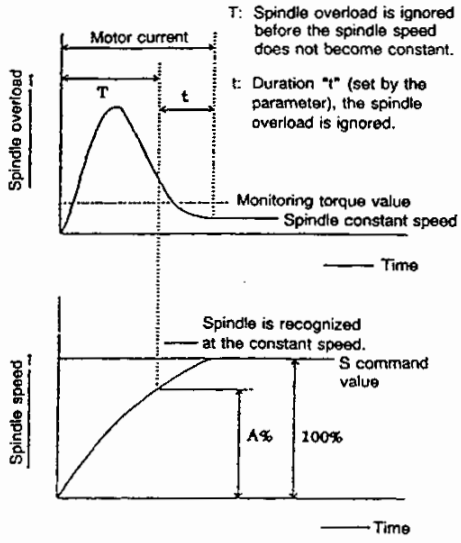
<table>
<tr><th>Parameter No.</th><th>Item</th><th>Contents</th><th>Initial Setting Value</th><th>Setting Range</th></tr>
<tr><td>57*</td><td>Designation of read device (no DC code control)</td><td>Set the default tape reading device.
<table>
<tr><th>Setting</th><th>Device Name</th></tr>
<tr><td>0</td><td>TR : Standard tape reader</td></tr>
<tr><td>1</td><td>CN0: RS232C channel 0 tape reader</td></tr>
<tr><td>2</td><td>CN1: RS232C channel 1 tape reader</td></tr>
<tr><td>3</td><td>CN2: RS232C channel 2 tape reader</td></tr>
<tr><td>4</td><td>CN3: RS232C channel 3 tape reader</td></tr>
<tr><td>5</td><td>CN4: RS232C channel 4 tape reader</td></tr>
</table></td><td>0</td><td>0 to 5</td></tr>
<tr><td>59</td><td>3-D arc projection path judgement tolerance amount</td><td>The tolerance amount used to determine whether the path obtained by projecting the 3-D arc on a plane is a line or not.</td><td>0</td><td>0 to 32767 (μm)</td></tr>
<tr><td>61</td><td>Synchronized tapping torque monitor
Spindle speed (A)</td><td rowspan="2">Synchronized tapping torque monitoring starts in the following manner
(a) Spindle overload is ignored until the spindle speed reaches A% of the S command value.
(b) When the spindle speed reaches A% of the S command value, torque monitoring starts after duration “t” (100 msec) to wait the spindle speed to be constant.
Set value of A (%) and t (100 msec).
 
</td><td>0</td><td>1 to 100 (%)</td></tr>
<tr><td>62</td><td>Synchronized tapping torque monitor
Waiting time (t)</td><td>0</td><td>1 to 1000 (× 0.1 sec)</td></tr>
</table>

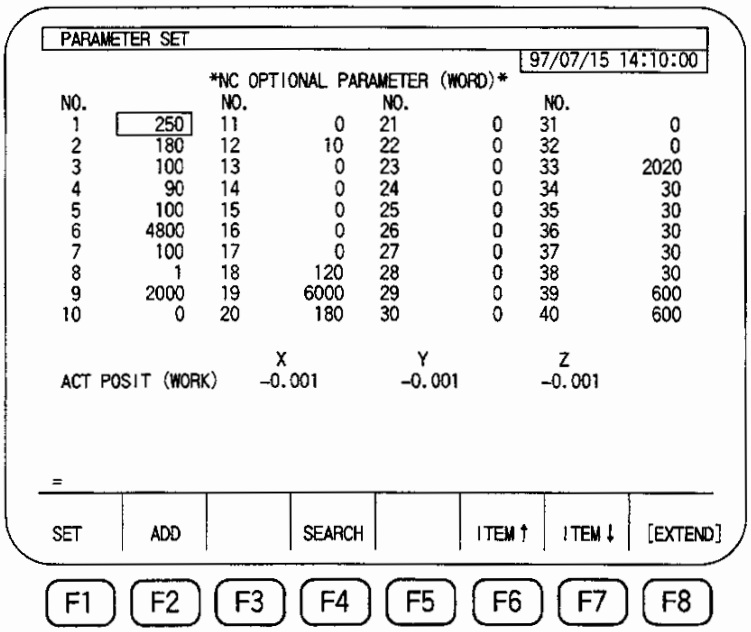
Parameters indicated by an asterisk (*) require turning off the power supply once after setting new data, then turn it on again.

<table>
<tr><th>Parameter No.</th><th>Item</th><th>Contents</th><th>Initial Setting Value</th><th>Setting Range</th></tr>
<tr><td>85</td><td>MANUAL skip feedrate clamp value</td><td>Clamping will occur when the manual skip feedrate exceeds this setting value.</td><td>0</td><td>1 to 10000 (mm/min)</td></tr>
<tr><td>101</td><td>Feedrate variation ratio during teaching IN mode</td><td>Set the feedrate variation ratio (variation ratio for each pressing of the cursor key) during the teaching IN mode applied by the cutting condition change function.</td><td>0</td><td>0 to 100 (%)</td></tr>
<tr><td>102</td><td>Spindle speed variation ratio during teaching IN mode</td><td>Set the spindle speed variation ratio (variation ratio for each pressing of the cursor key) during the teaching IN mode applied by the cutting condition change function.</td><td>0</td><td>0 to 100 (%)</td></tr>
<tr><td>103*</td><td>Designation of parameter punch out device</td><td>Set the default device name used for the parameter punch out function.
<table>
<tr><th>Setting</th><th>Device Name</th></tr>
<tr><td>0</td><td>TT: (CN0)</td></tr>
<tr><td>1</td><td>CN1: Channel 1, RS232C</td></tr>
<tr><td>2</td><td>CN2: Channel 2, RS232C</td></tr>
<tr><td>3</td><td>CN3: Channel 3, RS232C</td></tr>
<tr><td>4</td><td>CN4: Channel 4, RS232C</td></tr>
<tr><td>5</td><td>PP: Parallel puncher</td></tr>
<tr><td>6</td><td>MD1: Memory disk</td></tr>
<tr><td>7</td><td>FD0: Channel 0, 3.5" FD interface</td></tr>
<tr><td>8</td><td>FD1: Channel 0, 3.5" FD interface</td></tr>
<tr><td>9</td><td>FD2: Channel 1, 3.5" FD interface</td></tr>
<tr><td>10</td><td>FD3: Channel 2, 3.5" FD interface</td></tr>
</table></td><td>0</td><td>0 to 11</td></tr>
<tr><td>104*</td><td>Designation of device for parameter read/verify operation</td><td>Set the default device name used for the parameter read/verify function.
<table>
<tr><th>Setting</th><th>Device Name</th></tr>
<tr><td>0</td><td>TT: (CN0)</td></tr>
<tr><td>1</td><td>CN1: Channel 1, RS232C</td></tr>
<tr><td>2</td><td>CN2: Channel 2, RS232C</td></tr>
<tr><td>3</td><td>CN3: Channel 3, RS232C</td></tr>
<tr><td>4</td><td>CN4: Channel 4, RS232C</td></tr>
<tr><td>5</td><td>PP: Parallel puncher</td></tr>
<tr><td>6</td><td>MD1: Memory disk</td></tr>
<tr><td>7</td><td>FD0: Channel 0, 3.5" FD interface</td></tr>
<tr><td>8</td><td>FD1: Channel 0, 3.5" FD interface</td></tr>
<tr><td>9</td><td>FD2: Channel 1, 3.5" FD interface</td></tr>
<tr><td>10</td><td>FD3: Channel 2, 3.5" FD interface</td></tr>
</table></td><td>0</td><td>0 to 11</td></tr>
<tr><td>105</td><td>First approach speed in interactive gaging operation</td><td>Set the first approach speed in the interactive gaging operation.</td><td>0</td><td>0 to 2000 (mm/min)</td></tr>
<tr><td>110</td><td>Indexing offset amount</td><td>Sets the touch probe's indexing offset amount for one-direction gauging at the AUTO gauging function.</td><td>0</td><td>0 to 359</td></tr>
</table>

Parameters indicated by an asterisk (*) require turning off the power supply once after setting new data, then turn it on again.

Parameter No.	Item	Contents	Initial Setting Value	Setting Range
111	Puncher IF and parameter input/output	Delay period timer which sets the delay time from the point when the puncher IF and parameter input/output command ends (normal or error end), until the point when the RS switches OFF. When set to "0", RS is not switched OFF.	0	0 to 9999
112	Puncher IF and parameter input/output	Designates the amount of RS OFF time after the puncher IF and parameter input/output command ends (normal or error end). (RS switches ON when this period elapses.) Parameter Nos. 111 and 112 can be used simultaneously.	0	0 to 9999
113	Synchronous tapping return speed override	Sets the return speed override value (%) for synchronous tapping. A setting of "0" is processed as 100%.	0	1 to 200
120	Input position of the spindle pulse handle	Sets the position of the pulse handle which inputs the feed pulses for spindle operation. (1st if the setting is other than 1 to 3)	0	1 to 3

The data setting procedure for NC optional parameter (word) is indicated below.



(1) Display the NC OPTIONAL PARAMETER (WORD) screen and move the cursor to the required parameter by using the cursor control keys or by using [F4] (SEARCH).

(2) Setting

(a) If the value to be set is known:

Press [F1] (SET) and key in the value from the keyboard.

(b) If the value is already set and the value to be added to or subtracted from the existing value is set:

Press [F2] (ADD) and key in the value to be added to or subtracted from the present setting.

(c) If the value is to be set newly as a relative value in reference to the actual value:

Press [F2] (ADD) and key in the relative value of the position to be set in reference to the actual position.

For parameters for which the math function is not valid, pressing of [F2] (ADD) is ignored, and this operation cannot be used.

(3) Press the WRITE key.

The data on which the cursor is placed is updated according to the keyed in value.

7. NC Optional Parameter (Bit)

The following optional parameter (bits) are available.

For NC optional parameter (bit), those listed below are available. The parameter numbers given in the following table are keyed to the numbers displayed on the NC OPTIONAL PARAMETER (BIT) screen.

<table>
<tr><th>Parameter No.</th><th>Bit No.</th><th colspan="2">Contents</th><th>Set 1</th><th>Set 0</th><th>Initial Setting Value</th></tr>
<tr><td rowspan="8">1</td><td>0</td><td>Sets tape code</td><td rowspan="8"><table><tr><th>Sets Tape Code</th><th>Recognition Tape Code Automatically</th><th>Operating Conditions</th></tr><tr><td>1</td><td>1</td><td>In "READ" and "VERIFY", tape code is automatically recognized irrespective of ISO/EIA. In "PUNCH", ISO is used.</td></tr><tr><td>0</td><td>1</td><td>In "READ" and "VERIFY", tape code is automatically discriminated irrespective of ISO/EIA. In "PUNCH", EIA is used.</td></tr><tr><td>1</td><td>0</td><td>In "READ" and "VERIFY", ISO code is used, and wrong tape code results in an error. In "PUNCH", ISO is used.</td></tr><tr><td>0</td><td>0</td><td>In "READ" and "VERIFY", EIA code is used, and wrong tape code results in an error. In "PUNCH", EIA is used.</td></tr></table></td><td>ISO</td><td>EIA</td><td>1</td></tr>
<tr><td>1</td><td>Recognition tape code automatically</td><td>Does</td><td>Does not</td><td>1</td></tr>
<tr><td>2</td><td>Carries out a tape TV check</td><td>Does</td><td>Does not</td><td>0</td></tr>
<tr><td>3</td><td>There is a tape delimiting code.</td><td>ISO % EIA ER</td><td>Feed holes</td><td>0</td></tr>
<tr><td>4</td><td>Verifies tape during reading</td><td>Does</td><td>Does not</td><td>0</td></tr>
<tr><td>5</td><td>Rewinds tape without verifying after tape reading</td><td>Does</td><td>Does not</td><td>0</td></tr>
<tr><td>6</td><td>Handles special code (other than $20-$5F, HT) as an alarm. (DEL, BS, CR are ignored)</td><td>Does</td><td>Does not</td><td>1</td></tr>
<tr><td>7</td><td>Does not store special code (other than $20-$5F, HT). DEL, BS, CR are ignored)</td><td>Does</td><td>Does not</td><td>0</td></tr>
</table>

Parameter No.	Bit No.	Contents	Set 1	Set 0	Initial Setting Value
2	0	During automatic operation with the single block ON, a block of a control statement such as IF, GOTO or CALL usually does not come to a stop until the next block is executed. This bit is intended to select a stop or a non-stop in the particular control statement block.	Stop	Non-stop	0
	1	In multiple rotary table rotation control, rounding processing of the actual value on the work coordinate system is carried out when the control is reset.	Does	Does not	0
	2	Makes the dry run effective even for G00 (rapid feed) commands. A rapid feed command is executed at a dry run feedrate as with a cutting feed command.	Effective	Ineffective	0
	3				0
	4	Output of print function to external device is made effective.	Effective	Ineffective	0
	5	Cycle start after the mode has been switched from the automatic to setting is possible.	Possible	Impossible	0
	6	Makes fraction processing. Always set at "1".	Does	Does not	1
	7	During automatic operation with the single block OFF, does not carry out reading or arithmetic operations for any of the blocks that follow the block in process until the operation is completed. Note, however, that during cutter radius compensation, reading and arithmetic operations are carried out until the intersecting point is found (for up to three blocks). (The operation to read blocks which follow the block presently executed is called buffering.)	No buffering	Buffering	0
3	0	Selects inches or mm for length unit system *1	Inch	mm	0
	1	Selects 1 mm, 1 inch, 1 deg. and 1 sec for the input unit system.	Yes	As set by bit 2 to bit 5 and bit 7	1
	2	Selects 0.01 mm or 0.001 mm for length unit system.	0.01 mm	0.001 mm	0
	3	Selects either 0.1 mm/min and 0.01 inch/min or 1 mm/min and 0.1 inch/min for the speed input system.	0.1 mm/min 0.01 inch/min	1 mm/min 0.1 inch/mm	0
	4	Selects either 0.001 mm/rev and 0.0001 inch/rev or 0.01 mm/rev and 0.001 inch/rev for the speed input system.	0.001 mm/rev 0.0001 inch/rev	0.01 mm/rev 0.001 inch/rev	0
	5	Selects 0.01 sec or 0.1 sec for the time input unit.	0.01 sec	0.1 sec	0
	6	Selects 1 mm, 1 inch, 1 deg. and 1 sec for the unit of the data with decimal point.	Yes	As set by bit 1 to bit 5 and bit 7	0
	7	Selects 0.001 sec or 0.1 sec for the time input system. *2	0.001 sec	0.1 sec	0

*1: Setting of bit 0 is effective only when the inch/metric switchable function is selected.

*2: Unit of input time always 0.01 sec when setting of bit 5 is "1".

Parameter No.	Bit No.	Contents		Set 1	Set 0	Initial Setting Value
4	0	Selects 0.001 deg or 0.0001 deg for angle unit system.		0.0001 deg	0.001 deg	0
	1	Sets whether or not the part program selected when the power was turned off last is automatically selected when the automatic mode is established after the NC power is turned on.		Does	Does not	1
	2	In an NC reset, zeros the manual shift in manual interruption and the shift in pulse handle interruption (MANUAL SHIFT ACTUL/MANUAL SHIFT TOTAL).		Does	Does not, but as it is.	1
	3	Enables movement of the program read pointer after NC start.		Possible	Impossible	1
	4	Does not display the system subprogram (SSC, LIB) in automatic operation mode.		Does not	Does	0
	5					0
	6	Selects 4 × 4 as the character size for the enlarged display of the actual position data.		Does (4 × 4)	Does not (2 × 2 is selected)	0
	7	Selects the relative position display, in reference to the reset position, for an external position readout device.		Relative position in reference to the reset position	Amount from the origin of the work coordinate system	0
5	0	Input/output bit screen	In automatic, MDI or manual operation mode, if the check display is selected, these screens do not appear. That is, pressing the page key provides a display of screens whose bit is "0" but no display of screens whose bit is "1".	Does not display	Displays	0
	1	Specification bit screen		Does not display	Displays	0
	2	Axis data screen		Does not display	Displays	0
	3	NC/spindle diagnostic data screen		Does not display	Displays	0
	4	System & I/O variable screen		Does not display	Displays	0
	5	Index of diagnosis page is displayed by $4000.		Display by $4000	Display by $20	0
	6	Actual position data (extended characters) is displayed in reference to the origin of local coordinate system.		From local coordinate system origin	From work coordinate system origin	0
	7	To produce the current value and graphic to be displayed, adds the shift in the manual intervention or pulse handle overlap.		Does	Does not	1

Parameter No.	Bit No.	Contents		Set 1	Set 0	Initial Setting Value
6	0	Enlarges/reduces the graph for the X-axis.		Does	Does not	0
	1	Enlarges/reduces the graph for the Y-axis.		Does	Does not	0
	2	Enlarges/reduces the graph for the Z-axis.		Does	Does not	0
	3	Enlarges/reduces the graph for the 4th-axis.		Does	Does not	0
	4	Enlarges/reduces the graph for the 5th-axis.		Does	Does not	0
	5	Enlarges/reduces the graph for the 6th-axis.		Does	Does not	0
	6	Displays the current position (enlarged) on the slanted coordinate system.		Does	Does not	0
	7					0
7	0	When the AXIS COM. CANCEL switch is turned ON, the axis commands whose bit is "1" are canceled and neither arithmetic operation nor ordinary operation is carried out.	Cancel the X-axis command	Does	Does not	0
	1		Cancel the Y-axis command	Does	Does not	0
	2		Cancel the Z-axis command	Does	Does not	1
	3		Cancel the 4th-axis command	Does	Does not	0
	4		Cancel the 5th-axis command	Does	Does not	0
	5		Cancel the 6th-axis command	Does	Does not	0
	6					0
	7					0
8	0*	Stop bit of CN0: (RS232C)		1 bit	2 bit	0
	1*	Ready signal of CN0: (RS232C) (always internal READY, disregarding of the setting)		Internal READY	External READY	1
	2*	Parity check of CN0: (RS232C)		Checked	Not checked	0
	3*	Parity of CN0: (RS232C)		Even	Odd	0
	4*	8-bit JIS of CN0: (RS232C)		8-bit JIS	7-bit JIS	0
	5*	DC code control of CN0: (RS232C)		There is	There is not	0
	6*	DC code control type 2 of CN0: (RS232C)		Executed	Not executed	0
	7*	File name present in reading operation at CN0: (RS232C) in DNC-A mode		Present	Not present	0

Parameters indicated by an asterisk (*) require turning off of power supply once after setting new data. Turn it back on.

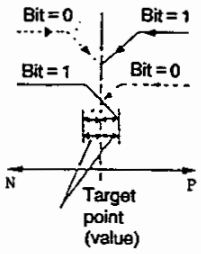
Parameter No.	Bit No.	Contents	Set 1	Set 0	Initial Setting Value
9	0	In data setting, unit system of length is either "inch" or "mm".	Inch	mm	0
	1	In data setting, unit is either minimum setting unit or 1 mm, 1 inch, 1 deg. and 1 sec.	1 mm, 1 inch, 1 deg, 1 sec	Minimum setting unit	1
	2	In data setting, unit system of length is either 0.1 μm or 0.00001 inch.	Does	Does not	0
	3	In data setting, unit system of angle is either 0.001 deg. or 0.0001 deg.	0.0001 deg.	0.001 deg.	0
	4				0
	5				0
	6	In the data setting, the decimal point indicates 1 mm, 1 inch, 1 deg. and 1 sec.	Basic unit	Bit 1 setting	0
	7				0
10	0				0
	1				0
	2				0
	3	NC file name is not output at DNC punch output.	Not output	Output	0
	4	Verify output is made at DNC punch output.	Does	Does not	0
	5*				0
	6*				0
	7				0
11	0*				0
	1	Designation of NC program data code in DNC-B method. For "Set 0", setting is made for No. 1, bit 0.	ASCII	ISO/EIA	0
	2				0
	3	End of record code for NC program transmission (DNC-B)	LF	CR, LF	0
	4	Designates the fixed cycle tool nose runoff direction at the slanted face machining function.	Slanted face coordinate system	Machine axis coordinate system	0
	5	Designation of parameter setting screen for coordinate system conversion	2nd screen	1st screen	0
	6	Gives a command for transmitting the coordinate system conversion value when the operation mode is switched to MANUAL	Does	Does not	0
	7				0

Parameters indicated by an asterisk (*) require turning off of power supply once after setting new data. Turn it back on.

Parameter No.	Bit No.	Contents	Set 1	Set 0	Initial Setting Value
12	0				0
	1				0
	2	File name output for tape punch out	Not punched	Punched	0
	3	End of record code for tape punch operation in ISO code	LF	CR, LF	0
	4	Code used for tape feed for tape punch operation	Space	NULL	0
	5	Specifies whether tape feed portion is punched.	Punched	Not punched	0
	6				0
	7				0
13	0*	Stop bit of CN1: (RS232C)	1 bit	2 bit	0
	1*	Ready signal of CN1: (RS232C)	Internal READY	External READY	0
	2*	Parity check of CN1: (RS232C)	Checked	Not checked	0
	3*	Parity of CN1: (RS232C)	Even	Odd	0
	4*	8-bit JIS of CN1: (RS232C)	8-bit JIS	7-bit JIS	0
	5*	DC code control of CN1: (RS232C)	There is	There is not	0
	6*	DC code control type 2 of CN1: (RS232C)	Executed	Not executed	0
	7*	File name present in reading operation at CN1: (RS232C) in DNC-A mode	Present	Not present	0
14	0*	Stop bit of CN2: (RS232C)	1 bit	2 bit	0
	1*	Ready signal of CN2: (RS232C)	Internal READY	External READY	0
	2*	Parity check of CN2: (RS232C)	Checked	Not checked	0
	3*	Parity of CN2: (RS232C)	Even	Odd	0
	4*	8-bit JIS of CN2: (RS232C)	8-bit JIS	7-bit JIS	0
	5*	DC code control of CN2: (RS232C)	There is	There is not	0
	6*	DC code control type 2 of CN2: (RS232C)	Executed	Not executed	0
	7*	File name present in reading operation at CN2: (RS232C) in DNC-A mode	Present	Not present	0

Parameters indicated by an asterisk (*) require turning off of power supply once after setting new data. Turn it back on.

<table>
<tr><th>Parame-ter No.</th><th>Bit No.</th><th>Contents</th><th>Set 1</th><th>Set 0</th><th>Initial Setting Value</th></tr>
<tr><td rowspan="8">15</td><td>0</td><td></td><td></td><td></td><td>0</td></tr>
<tr><td>1</td><td></td><td></td><td></td><td>0</td></tr>
<tr><td>2</td><td></td><td></td><td></td><td>0</td></tr>
<tr><td>3</td><td></td><td></td><td></td><td>0</td></tr>
<tr><td>4</td><td></td><td></td><td></td><td>0</td></tr>
<tr><td>5</td><td>Whether this STM answer back time over check is made effective or ineffective is set for NC optional parameter (word) No. 18.</td><td>Effective</td><td>Ineffective</td><td>0</td></tr>
<tr><td>6</td><td>In-position time over check function is made effective.
Set the in-position time over check time for NC optional parameter (word) No. 19.</td><td>Effective</td><td>Ineffective</td><td>0</td></tr>
<tr><td>7</td><td>In the inch system the unit system for an F command used for a rotary axis can be selected.</td><td>25.4 deg/min</td><td>1 deg/min</td><td>0</td></tr>
<tr><td rowspan="8">16</td><td>0</td><td></td><td></td><td></td><td>0</td></tr>
<tr><td>1</td><td></td><td></td><td></td><td>0</td></tr>
<tr><td>2</td><td></td><td></td><td></td><td>0</td></tr>
<tr><td>3</td><td>Sets the level of alarm which occurs if a program is selected in the background mode while a file is being accessed.</td><td>Alarm C</td><td>Alarm D</td><td>0</td></tr>
<tr><td>4</td><td>Appends a symbol “<” that indicates the range where editing is not guaranteed.</td><td>Appended</td><td>Not appended</td><td>0</td></tr>
<tr><td>5</td><td></td><td></td><td></td><td>0</td></tr>
<tr><td>6</td><td></td><td></td><td></td><td>0</td></tr>
<tr><td>7</td><td></td><td></td><td></td><td>0</td></tr>
<tr><td rowspan="8">17</td><td>0</td><td>Fixes the cycle axis for a fixed cycle, which may be any axis other than plane designation, at the Z-axis.</td><td>Does</td><td>Does not</td><td>0</td></tr>
<tr><td>1</td><td rowspan="2"><table><tr><td>Bit 1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>Bit 2</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>Shift direction</td><td>P-X</td><td>N-X</td><td>P-Y</td><td>N-Y</td></tr></table>Specifies the shift direction and axis in a fixed cycle (G76, G87).
This is effective only when bit 0 is “1”.</td><td rowspan="2">See the table at the left.</td><td rowspan="2">See the table at the left.</td><td>0</td></tr>
<tr><td>2</td><td>0</td></tr>
<tr><td>3</td><td>At a reset, clears the mirror images for all axes, providing normal conditions.</td><td>Does</td><td>Does not</td><td>0</td></tr>
<tr><td>4</td><td></td><td></td><td></td><td>0</td></tr>
<tr><td>5</td><td>External program selection is executed for main program or schedule program.</td><td>Schedule program</td><td>Main program</td><td>0</td></tr>
<tr><td>6</td><td>In external program selection operation, the selection of the same file name is not executed.</td><td>Does not</td><td>Does</td><td>0</td></tr>
<tr><td>7</td><td>If synchronized tapping specification is selected, this specifies which tapping cycle the G codes (G74, G84) call, conventional tapping cycle or synchronized tapping cycle.</td><td>Synchronized tapping cycle</td><td>Conventional tapping cycle</td><td>0</td></tr>
</table>

<table>
<tr><th>Parame-ter No.</th><th>Bit No.</th><th colspan="3">Contents</th><th>Set 1</th><th>Set 0</th><th>Initial Setting Value</th></tr>
<tr><td rowspan="8">18</td><td>0</td><td colspan="3" rowspan="8">Specified the G code to be set automatically when the power supply is turned on.
<table><tr><td rowspan="2">G17</td><td>0</td><td rowspan="2">G18</td><td>1</td><td>1</td><td rowspan="2">G19</td><td>0</td></tr><tr><td>0</td><td>0</td><td>1</td><td>1</td></tr></table></td><td>G00</td><td>G01</td><td>1</td></tr>
<tr><td>1</td><td>G18</td><td>G17</td><td>0</td></tr>
<tr><td>2</td><td>G19</td><td>G17</td><td>0</td></tr>
<tr><td>3</td><td>G56</td><td>G53</td><td>0</td></tr>
<tr><td>4</td><td>G91</td><td>G90</td><td>0</td></tr>
<tr><td>5</td><td>G95</td><td>G94</td><td>0</td></tr>
<tr><td>6</td><td>G22</td><td>G23</td><td>0</td></tr>
<tr><td>7</td><td colspan="3"></td><td></td><td></td><td>0</td></tr>
<tr><td rowspan="8">19</td><td>0</td><td>X-axis</td><td rowspan="6">One-directional positioning at a target point is carried out after an overrun is made against that point. It is possible to determine the final positioning direction on an axis base. In other words, once the N-direction is established, N-directional positioning does not involve an overrun; but P-directional positioning involves an overrun before actual positioning. if the P-direction is established, the relationship is reversed.
 

(This excess travel is set by a user parameter.)</td><td>N direction</td><td>P direction</td><td>0</td></tr>
<tr><td>1</td><td>Y-axis</td><td>Same as above</td><td>Same as above</td><td>0</td></tr>
<tr><td>2</td><td>Z-axis</td><td>Same as above</td><td>Same as above</td><td>0</td></tr>
<tr><td>3</td><td>4th-axis</td><td>Same as above</td><td>Same as above</td><td>0</td></tr>
<tr><td>4</td><td>5th-axis</td><td>Same as above</td><td>Same as above</td><td>0</td></tr>
<tr><td>5</td><td>6th-axis</td><td>Same as above</td><td>Same as above</td><td>0</td></tr>
<tr><td>6</td><td colspan="3"></td><td></td><td></td><td>0</td></tr>
<tr><td>7</td><td colspan="3"></td><td></td><td></td><td>0</td></tr>
<tr><td rowspan="7">20</td><td>0</td><td colspan="3"></td><td></td><td></td><td>0</td></tr>
<tr><td>1</td><td colspan="3">For single-axis command, actual position or a point on the arc is taken as the command value for the axis not programmed.</td><td>Any point on arc</td><td>Actual position</td><td>0</td></tr>
<tr><td>2</td><td colspan="3"></td><td></td><td></td><td>0</td></tr>
<tr><td>3</td><td colspan="3"></td><td></td><td></td><td>0</td></tr>
<tr><td>4</td><td colspan="3"></td><td></td><td></td><td>0</td></tr>
<tr><td>5</td><td colspan="3"></td><td></td><td></td><td>0</td></tr>
<tr><td>6</td><td colspan="3"></td><td></td><td></td><td>0</td></tr>
<tr><td>7</td><td colspan="3"></td><td></td><td></td><td>0</td></tr>
</table>

Parameter No.	Bit No.	Contents	Set 1	Set 0	Initial Setting Value
21	0*	Stop bit of CN3: (RS232C)	1 bit	2 bit	0
	1*	Ready signal of CN3: (RS232C)	Internal READY	External READY	0
	2*	Parity check of CN3: (RS232C)	Checked	Not checked	0
	3*	Parity of CN3: (RS232C)	Even	Odd	0
	4*	8-bit JIS of CN3: (RS232C)	8-bit JIS	7-bit JIS	0
	5*	DC code control of CN3: (RS232C)	There is	There is not	0
	6*	DC control type 2 of CN3: (RS232C)	Executed	Not executed	0
	7*	File name present in reading operation at CN3: (RS232C) in DNC-A mode	Present	Not present	0
22	0*	Stop bit of CN4: (RS232C)	1 bit	2 bit	0
	1*	Ready signal of CN4: (RS232C)	Internal READY	External READY	0
	2*	Parity check of CN4: (RS232C)	Checked	Not checked	0
	3*	Parity of CN4: (RS232C)	Even	Odd	0
	4*	8-bit JIS of CN4: (RS232C)	8-bit JIS	7-bit JIS	0
	5*	DC code control of CN4: (RS232C)	There is	There is not	0
	6*	DC code control type 2 of CN4: (RS232C)	Executed	Not executed	0
	7*	File name present in reading operation at CN4: (RS232C) in DNC-A mode	Present	Not present	0
23	0				
	1				
	2				
	3				
	4				
	5				
	6				
	7				

Parameters indicated by an asterisk (*) require turning off of power supply once after setting new data. Turn it back on.

Parameter No.	Bit No.	Contents	Set 1	Set 0	Initial Setting Value
24	0				
	1				
	2				
	3				
	4				
	5				
	6				
	7				
25	0				
	1				
	2				
	3				
	4				
	5				
	6				
	7				
26	0				
	1				
	2				
	3				
	4				
	5				
	6				
	7				
27	0	Specifies the EIA code which represents "=". Conditions of the hole, punched or not punched, when the key to be used for punching the symbol "=" is pressed are set in terms of the bit data. Set the data to conform to the odd parity scheme. This can be used in DNC-B, too. Same for following setting.	Punched	Not punched	0
	1		Punched	Not punched	0
	2		Punched	Not punched	0
	3		Punched	Not punched	0
	4		Punched	Not punched	0
	5		Punched	Not punched	0
	6		Punched	Not punched	0
	7		Punched	Not punched	0

Parameter No.	Bit No.	Contents	Set 1	Set 0	Initial Setting Value
28	0	Specifies the EIA code which represents "*".	Punched	Not punched	0
	1		Punched	Not punched	0
	2		Punched	Not punched	0
	3		Punched	Not punched	0
	4		Punched	Not punched	0
	5		Punched	Not punched	0
	6		Punched	Not punched	0
	7		Punched	Not punched	0
29	0	Specifies the EIA code which represents "[".	Punched	Not punched	0
	1		Punched	Not punched	0
	2		Punched	Not punched	0
	3		Punched	Not punched	0
	4		Punched	Not punched	0
	5		Punched	Not punched	0
	6		Punched	Not punched	0
	7		Punched	Not punched	0

Parameter No.	Bit No.	Contents	Set 1	Set 0	Initial Setting Value
30	0	Specifies the EIA code which represents "]".	Punched	Not punched	0
	1		Punched	Not punched	0
	2		Punched	Not punched	0
	3		Punched	Not punched	0
	4		Punched	Not punched	0
	5		Punched	Not punched	0
	6		Punched	Not punched	0
	7		Punched	Not punched	0
31	0	Specifies the EIA code which represents "$".	Punched	Not punched	0
	1		Punched	Not punched	0
	2		Punched	Not punched	0
	3		Punched	Not punched	0
	4		Punched	Not punched	0
	5		Punched	Not punched	0
	6		Punched	Not punched	0
	7		Punched	Not punched	0
32	0				0
	1	If even one axis is at the stroke limit in automatic or MDI mode cutting feed operation, it causes an alarm.	Alarm	Not alarm	0
	2				0
	3				0
	4				0
	5				0
	6				0
	7				0

Parameter No.	Bit No.	Contents	Set 1	Set 0	Initial Setting Value
33	0	Graphic coordinate system is made effective when NC is reset.	Effective	Ineffective	0
	1	Backup function is effective when M02 or M30 is executed.	Effective	Ineffective	0
	2	Mirror image is effective for the slant-face coordinate system.	Slant-face coordinate system	Conforms to the setting for No. 34, bit 2	0
	3	Counting of counters (work counter, NC running counter, spindle rotation counter, cutting time counter) occurs only in auto mode.	Only AUTO mode	All modes	0
	4				0
	5				0
	6				0
	7				0
34	0	Single block stop at point R level in the fixed cycle is effective.	Effective	Ineffective	
	1	MOP-TOOL function is ineffective.	Ineffective	Effective	0
	2*	Mirror image is effective for local coordinate system or work coordinate system.	Work coordinate system	Local coordinate system	0
	3	System G code macros 300 to 349 are MODIN type.	MODIN	CALL	0
	4*	System variable VINCH is made write enabled.	READ/ WRITE enabled	Only READ enabled	0
	5				0
	6*	To set whether the calculation results of the function (ROUND, FIX, FUP) are to convert numerical data into an integer with or without a decimal point when setting it for an address character.	With decimal point	Integer	0
	7				0
35	0				0
	1				0
	2				0
	3				0
	4				0
	5				0
	6				0
	7				0

Parameters indicated by an asterisk (*) require turning off the power supply once after setting new data. Turn it back on.

Parameter No.	Bit No.	Contents	Set 1	Set 0	Initial Setting Value
36	0	The unit of variables assigned to MSB is set at 0.001 mm (0.0001 in.) when bit 0 and bit 6 of NC optional parameter (bit) No. 3 are "0" and "1", respectively.	0.001 mm (0.0001 in.)	1 mm (1 in.)	0
	1	Uni-direction automatic gauging with touch probe	Does	Does not	0
	2	Automatic gauging and automatic tool length offset/broken tool detection with ring sensor	Does	Does not	0
	3	Default of the maximum tool length for automatic tool length offset/broken tool detection	Effective	Ineffective	0
	4	Chip cover interference prevention (MCV-AII using MSB)	Does	Does not	0
	5				0
	6				0
	7				0
37	0	Synchronized operation, synchronization error correction mode input	ON	OFF	0
	1	Synchronized operation, synchronized position shift amount setting	Possible	Not possible	0
	2	Semi-synchronized operation in DNC-B	Effective	Ineffective	0
	3	Function for fixing projection plane for the execution of 3D circular interpolation command (G17, G18, G19)	Effective	Ineffective	0
	4	In the rapid feed mode operation, the command causing overtravel causes an alarm	Yes	No	0
	5	Selection of PQR command method for 3-D arc	Position	Normal vector	0
	6	Selection of a main program used for machining a workpiece in the pallet pool line control (PPC)	A work number is taken as a main program file name	A work number is taken as a main program name	0
	7				0
38	0				0
	1				0
	2				0
	3				0
	4	In the slide hold operation during tolerance control mode, axis feed stops on the programmed command point in other than tolerance mode 0.	Does	Does not	0
	5	NG1 tool as replacement tool (for spare tool replacement specs.)	Does not	Dose	0
	6				0
	7				0

Parameter No.	Bit No.	Contents	Set 1	Set 0	Initial Setting Value
39	0				
	1				0
	2				0
	3*	A-axis multi-turn function is made effective.	Effective	Ineffective	0
	4*	B-axis multi-turn function is made effective.	Effective	Ineffective	0
	5*	C-axis multi-turn function is made effective.	Effective	Ineffective	0
	6	Animated graphic display	Not supported	Supported	0
	7				0
40	0*	CN0: Designation of master or slave station for RS232C IF channel (DC code) CN0: Use of RS/CS control in units of RS232C IF channels	Slave station Used	Master station Not used	0
	1*	CN1: Designation of master or slave station for RS232C IF channel (DC code) CN1: Use of RS/CS control in units of RS232C IF channels	Slave station Used	Master station Not used	0
	2*	CN2: Designation of master or slave station for RS232C IF channel (DC code) CN2: Use of RS/CS control in units of RS232C IF channels	Slave station Used	Master station Not used	0
	3*	CN3: Designation of master or slave station for RS232C IF channel (DC code) CN3: Use of RS/CS control in units of RS232C IF channels	Slave station Used	Master station Not used	0
	4*	CN4: Designation of master or slave station for RS232C IF channel (DC code) CN4: Use of RS/CS control in units of RS232C IF channels	Slave station Used	Master station Not used	0
	5				0
	6*	In read/punch operation of RPD or PIP, DC2 and DC4 codes are not input/output.	Not input/output	Input/output	0
	7*	Dummy reading and DC code control after the end of data in read operation of RPD or PIP: DC code control type 2 without end code DC3 (for the slave station, not waiting for end code DC3 in punch operation)	No DC3 code	DC3 code is used	0

Parameters indicated by an asterisk (*) require turning off the power supply once after setting new data. Turn it back on.

<table>
<tr><th>Parameter No.</th><th>Bit No.</th><th>Contents</th><th>Set 1</th><th>Set 0</th><th>Initial Setting Value</th></tr>
<tr><td rowspan="8">41</td><td>0</td><td colspan="3"></td><td>0</td></tr>
<tr><td>1</td><td colspan="3">Switches the polarity of spindle DA speed voltage command by the combination with the setting for bit 3.
<table>
<tr><th>Bit 0</th><th>Bit 1</th><th>Contents</th></tr>
<tr><td>0</td><td>0</td><td>DA speed command is output in positive voltage when the normal spindle rotation type is used.
DA speed command is output in negative voltage when the reverse spindle rotation type is used.</td></tr>
<tr><td>1</td><td>0</td><td>DA speed command is output in negative voltage when the normal spindle rotation type is used.
DA speed command is output in positive voltage when the reverse spindle rotation type is used.</td></tr>
<tr><td>0</td><td>1</td><td>DA speed command is output in positive voltage when the normal spindle rotation type is used.
DA speed command is output in positive voltage when the reverse spindle rotation type is used.</td></tr>
<tr><td>1</td><td>1</td><td>DA speed command is output in negative voltage when the normal spindle rotation type is used.
DA speed command is output in negative voltage when the reverse spindle rotation type is used.</td></tr>
</table></td><td>0</td></tr>
<tr><td>2</td><td colspan="3"></td><td>0</td></tr>
<tr><td>3</td><td colspan="3">Switches the polarity of spindle DA speed voltage command by the combination with the setting for bit 1. (See the table given in explanation for bit 1.)</td><td>0</td></tr>
<tr><td>4</td><td colspan="3"></td><td>0</td></tr>
<tr><td>5</td><td colspan="3"></td><td>0</td></tr>
<tr><td>6</td><td colspan="3"></td><td>0</td></tr>
<tr><td>7</td><td colspan="3"></td><td>0</td></tr>
</table>

<table>
<tr><th>Parame-ter No.</th><th>Bit No.</th><th>Contents</th><th>Set 1</th><th>Set 0</th><th>Initial Setting Value</th></tr>
<tr><td rowspan="8">42</td><td>0</td><td>In external program selection (4-digit BCD input), if “0” is used in higher digits, “0” is not handled as program file name.
<table><tr><th>Bit 0</th><th>Bit 1</th><th>Contents</th></tr><tr><td>0</td><td>0</td><td>All four digits are handled as program name.</td></tr><tr><td>1</td><td>0</td><td>If the second and higher digits of BCD input are all “0”, higher digits from the second digit are not handled as program name.</td></tr><tr><td>0</td><td>1</td><td>If the third and higher digits of BCD input are all “0”, higher digits from the third digit are not handled as program name.</td></tr><tr><td>1</td><td>1</td><td>If the third and higher digits of BCD input are all “0”, higher digits from the third digit are not handled as program name.</td></tr></table></td><td>As indicated in the left table.</td><td>As indicated in the left table.</td><td>0</td></tr>
<tr><td>1</td><td></td><td></td><td>0</td></tr>
<tr><td>2</td><td></td><td></td><td>0</td></tr>
<tr><td>3</td><td></td><td></td><td>0</td></tr>
<tr><td>4</td><td></td><td></td><td>0</td></tr>
<tr><td>5</td><td></td><td></td><td>0</td></tr>
<tr><td>6</td><td>Execution of special operation if the target position, specified in the rapid feed mode, is outside the limit range</td><td>Executed</td><td>Not executed</td><td>0</td></tr>
<tr><td>7</td><td></td><td></td><td></td><td></td></tr>
</table>

Parameter No.	Bit No.	Contents	Set 1	Set 0	Initial Setting Value
43	0	DNC-B method, protocol A Data at 41st to 44th byte of SAT and SET command bit 0			0
	1	Data at 41st to 44th byte of SAT and SET command bit 1			0
	2	Data at 41st to 44th byte of SAT and SET command bit 2			0
	3	Data at 41st to 44th byte of SAT and SET command bit 3			0
	4	Data at 41st to 44th byte of SAT and SET command bit 4			0
	5	Data at 41st to 44th byte of SAT and SET command bit 5			0
	6	Data at 41st to 44th byte of SAT and SET command bit 6			0
	7	Data at 41st to 44th byte of SAT and SET command bit 7			0
44	0	Data at 41st to 44th byte of SAT and SET command bit 8			0
	1	Data at 41st to 44th byte of SAT and SET command bit 9			0
	2	Data at 41st to 44th byte of SAT and SET command bit 10			0
	3	Data at 41st to 44th byte of SAT and SET command bit 11			0
	4	Data at 41st to 44th byte of SAT and SET command bit 12			0
	5	Data at 41st to 44th byte of SAT and SET command bit 13			0
	6	Data at 41st to 44th byte of SAT and SET command bit 14			0
	7	Data at 41st to 44th byte of SAT and SET command bit 15			0

Parameter No.	Bit No.	Contents	Set 1	Set 0	Initial Setting Value
46	0	G00 linear interpolation positioning is carried out.	Yes	No	0
	1	G60 linear interpolation positioning is carried out.	Yes	No	0
	2	G30 linear interpolation positioning is carried out.	Yes	No	0
	3	Liner interpolation positioning is carried out in home position movement by M code	Yes	No	0
	4	Level B alarm occurs if positioning point, specified in the linear interpolation mode, exceeds the travel limit.	Effective	Ineffective	0
	5	In manual gauging, gauging of the center of ID/OD is made in 3-point gauging mode.	Yes	No	0
	6	Auto-cycle/single is effective at the start of interactive work gauging operation.	Auto/ single effective	Auto effective	0
	7	Automatic zero point setting is carried out in interactive work gauging operation.	Carried out	Not carried out	0
48	0				0
	1	Coordinate system in which tool length offset is carried out in 3-D coordinate system conversion	Slanted coordinate system	Work coordinate system	0
	2				0
	3	In manual gaging, the center between faces (between inside faces, between outside faces) is obtained in two- or three-point gaging.	3-point gaging	2-point gaging	0
	4				0
	5	The cutter diameter compensation value set for the diameter in the tool file is taken as the compensation value of the indicated compensation number.			0
	6				0
	7				0
49	0	Specifies the EIA code which represents "#".			0
	1				0
	2				0
	3				0
	4				0
	5				0
	6				0
	7				0

Parameter No.	Bit No.	Contents	Set 1	Set 0	Initial Setting Value
50	0	Specifies an irregular code.			0
	1				0
	2				0
	3				0
	4				0
	5				0
	6				0
	7				0
51	0	Specifies a regular code (ISO code).			0
	1				0
	2				0
	3				0
	4				0
	5				0
	6				0
	7				0
54	0				0
	1				0
	2				0
	3	Input PNO one-time at parameter input/output function punch output	Not restricted to 1 time	Restricted to 1 time	0
	4	Parameter input/output function; file name is output in punch operation.	Output enabled	Output disabled	0
	5				0
	6				0
	7				0
55	0				0
	1				0
	2				0
	3				0
	4				0
	5				0
	6	Sets the display pattern on the tool list screen for tools not existing in the pot/tool table.	"---" is displayed.	"***" is displayed.	0
	7	Sets whether or not a replacing tool number is input at the interactive programming data input screen.	Input	Not input	0

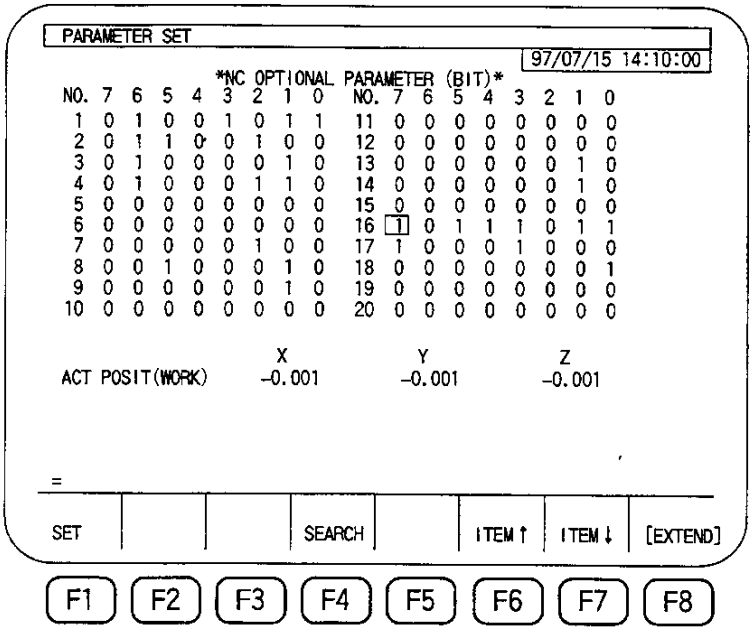
Parame-ter No.	Bit No.	Contents	Set 1	Set 0	Initial Setting Value
56	0*				0
	1				0
	2*				0
	3*				0
	4*				0
	5*	Special MTB model parameter	Specified model	Model not specified	0
	6	Display of PLC data display, ladder diagram, and data trace screens	Displayed	Not displayed	0
	7	Display of PLC check (run mode DTM screen) screen	Displayed	Not displayed	0
59	0				0
	1	The direct position sensor operation confirmation function is made effective.	Effective	Ineffective	0
	2				0
	3				0
	4	In the Z-axis return operation in the G73/G83 fixed cycle, G00 mode is replaced with G01 mode.	G01	G00	0
	5	For the PPC, this parameter sets whether or not the manual operation screen (touch panel) is displayed. (MX)	Displayed	Not displayed	0
	6				0
	7				0
60	0	In the G10/G11 mode, actual position data is calculated including the mirror image, incremental function, attachment offset, and tool length offset value.	Effective	Ineffective	0
	1	In the G10/G11 mode, actual position data is calculated including the mirror image and incremental function.	Effective	Ineffective	0
	2	In the G69/G68 mode, actual position data is calculated including the mirror image, incremental function, attachment offset, and tool length offset value.	Effective	Ineffective	0
	3				0
	4				0
	5				0
	6				0
	7				0

Parameters indicated by an asterisk (*) require turning off the power supply once after setting new data. Turn it back on.

Parameter No.	Bit No.	Contents	Set 1	Set 0	Initial Setting Value
61	0*	Sensor input 1 A-contact/B-contact switching. MSB touch sensor (touch signal)	B-contact	A-contact	0
	1*	Sensor input 2 A-contact/B-contact switching. MSB touch probe (touch signal)	B-contact	A-contact	0
	2*	Sensor input 3 A-contact/B-contact switching. MSB touch probe (CD carrier maintenance signal)	B-contact	A-contact	0
	3*	Sensor input 4 A-contact/B-contact switching. User sensor 1 (touch signal)	B-contact	A-contact	0
	4*	Sensor input 5 A-contact/B-contact switching. User sensor 2 (touch signal)	B-contact	A-contact	0
	5*	Sensor input 6 A-contact/B-contact switching. User sensor (CD carrier maintenance signal)	B-contact	A-contact	0
	6*	Sensor input 7 A-contact/B-contact switching.	B-contact	A-contact	0
	7*	Sensor input 8 A-contact/B-contact switching.	B-contact	A-contact	0
63	0	For the PPC, this parameter sets whether or not the pallet in the standby station is automatically unloaded to the setup station if machining schedule does not exist for the next pallet. (MX)	Unloaded auto-matically	Not unloaded auto-matically	0
	1				0
	2				0
	3				0
	4				0
	5				0
	6				0
	7				0

Parameters indicated by an asterisk (*) require turning off the power supply once after setting new data. Turn it back on.

The data setting procedure for NC optional parameter (bit) is indicated below.



(1) Display the NC OPTIONAL PARAMETER (BIT) screen and move the cursor to the required parameter by using the cursor control keys or by using [F4] (SEARCH).

When the search function is used by pressing [F4], the cursor is moved to the data of bit 7 of the specified parameter number. Therefore, to change the data of other bits (bit 0 to bit 6), use the cursor control keys to move the cursor to the required bit position.

(2) Setting

Press [F1] (SET) and key in the data.

Note that entry of only "0" or "1" is allowed. If other number is entered, an error occurs.

(3) Press the WRITE key.

The data on which the cursor is placed is updated according to the keyed in value.

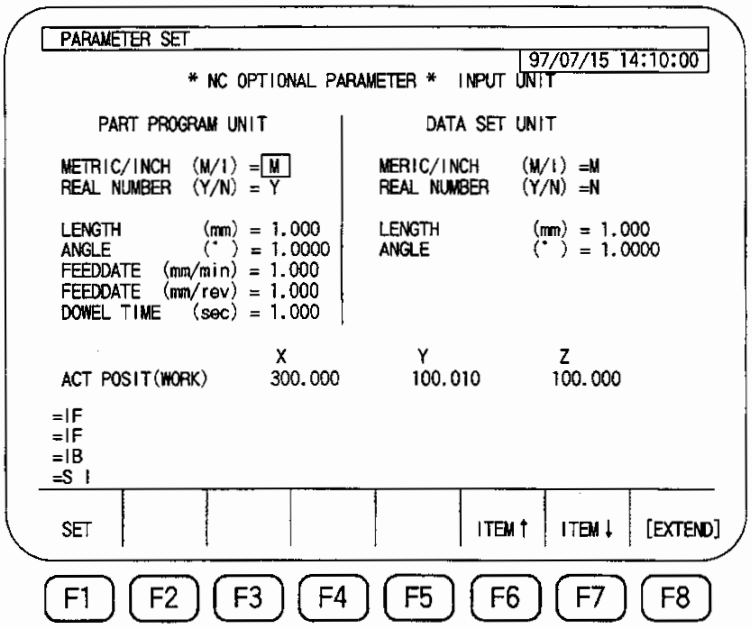
8. Unit Systems for Programming

The unit systems set by NC optional parameter (bit) No. 3, bit 0 through bit 7, and No. 9, bit 0 and bit 1, can be confirmed on the display.

Form this page, it si possible to set the unit system.

Note that the unit systems of length, angle, feedrate [mm/min (inch/min)], feedrate [mm/rev (inch/rev)] and time are determined by the combination of bit data, changing the unit systems from this page might unexpectedly change other unit systems.

The setting for REAL NUMBER (Y/N) is related with the setting for bit 6 of NC optional parameter (bit) No. 3 and No. 9.



Metric system:

Optional Parameter (Bit)													
No. 4	No. 3								Length (mm)	Angle (°)	Speed (mm/min)	Speed (mm/rev)	Time (sec)
0	7	6	5	4	3	2	1	0					
0	*	*	*	*	*	*	1	0	1	1	1	1	1
0	0	*	0	0	0	0	0	0	0.001	0.001	1	0.01	0.1
0	0	*	0	0	0	1	0	0	0.01	0.001	1	0.01	0.1
0	0	*	0	0	1	0	0	0	0.001	0.001	0.1	0.01	0.1
0	0	*	0	1	0	0	0	0	0.001	0.001	1	0.001	0.1
0	*	*	1	0	0	0	0	0	0.001	0.001	1	0.01	0.01
0	1	*	0	0	0	0	0	0	0.001	0.001	1	0.01	0.001
1	0	*	0	0	0	0	0	0	0.001	0.0001	1	0.01	0.0

Inch system:

Optional Parameter (Bit)													
No. 4	No. 3								Length (Inch)	Angle (°)	Speed (Inch/min)	Speed (Inch/rev)	Time (sec)
0	7	6	5	4	3	2	1	0					
*	0	*	*	*	*	*	1	1	1	1	1	1	1
0	0	*	0	0	0	*	0	1	0.0001	0.001	0.1	0.001	0.1
0	0	*	0	0	1	*	0	1	0.0001	0.001	0.01	0.001	0.1
0	0	*	0	1	0	*	0	1	0.0001	0.001	0.1	0.0001	0.1
1	*	*	1	0	0	*	0	1	0.0001	0.0001	0.1	0.001	0.01
1	1	*	0	0	0	*	0	1	0.0001	0.0001	0.1	0.001	0.001

An asterisk (*) in the table above indicates that setting of either "0" or "1" is allowed.

The setting procedure on the INPUT UNIT SYSTEM screen is explained below.

To change the unit system, it is recommended to change the setting on the NC OPTIONAL PARAMETER (BIT) screen.

(1) Select the INPUT UNIT SYSTEM screen and move the cursor to the required data position.

(2) Press [F1] (SET).

(a) If the data is to be set for METRIC/INCH (M/I), key in either "M" (metric) or "I" (inch).

(b) If the data is to be set for REAL NUMBER (Y/N), key in either "Y" (command in real number) or "N" (command in other than real number).

(c) If the data is to be set for dimension items (length, angle, feedrate) or time data, key in the required value in the unit system which is set for NC optional parameter (bit) No. 3 and No. 4.

(3) Press the WRITE key.

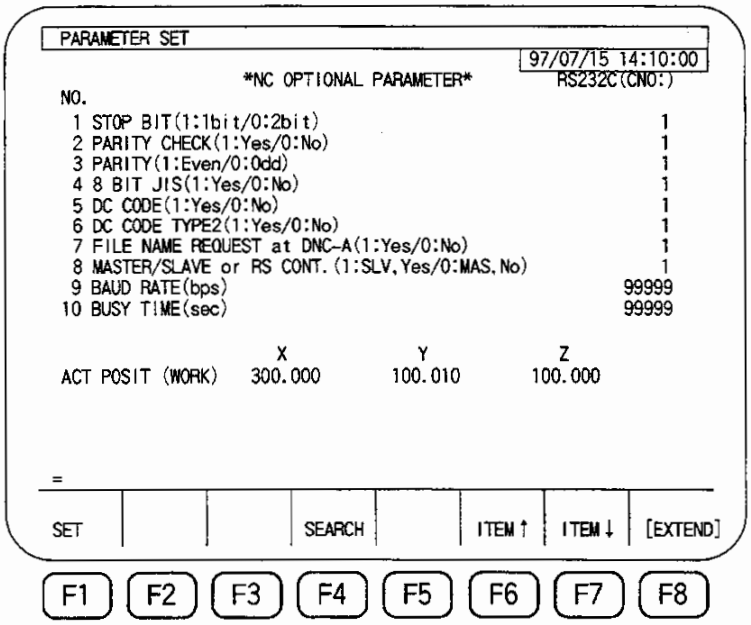
The data on which the cursor is placed is updated according to the keyed in value.

If the setting for METRIC/INCH is changed, the numerical values of length, angle, feedrate, etc. are changed accordingly.

9. NC Optional Parameter RS232C (CN0:)

This screen displays the parameters to be used for the tape punch interface function, which are allocated to NC optional parameter (bit) and NC optional parameter (word). Note that they are only for CN0: device and it is necessary to set the parameters for the individual NC optional parameter (bit) and NC optional parameter (word) screens for other devices.

When the following parameters are set, the corresponding NC optional parameters are set accordingly. Conversely, if NC optional parameters are set, the corresponding parameters shown below are set accordingly.



(1) STOP BIT (1:1bit/0:2bit) (NC optional parameter (bit) No. 8, bit 0)

RS232C stop bit check

= 0 : Stop bit 2

= 1 : Stop bit 1

(2) PARITY CHECK (1:Yes/0:No) (NC optional parameter (bit) No. 8, bit 2)

RS232C parity check (sets whether or not a parity bit is added to 8-bit data)

= 0 : No parity

= 1 : Parity check

(3) PARITY (1:Even/0:Odd) (NC optional parameter (bit) No. 8, bit 3)

RS232C odd parity scheme

= 0 : Odd parity

= 1 : Even parity

(4) 8 BIT JIS (1:Yes/0:No) (NC optional parameter (bit) No. 8, bit 4)

RS232C 8-bit JIS

= 0 : 7-bit JIS

= 1 : 8-bit JIS

(5) DC CODE (1:Yes/0:No) (NC optional parameter (bit) No. 8, bit 5)

DC code control

= 0 : Controlled by DC code

= 1 : Not controlled by DC code

(6) DC CODE TYPE2 (1:Yes/0:No) (NC optional parameter (bit) No. 8, bit 6)

DC code control type 2

= 0 : DC code control type 2 is not executed.

= 1 : DC code control type 2 is executed.

6 DC CODE TYPE2	5 DC CODE	Description
0	0	Controlled by DC code
1	0	Not controlled by DC code
0	1	Standard DC code control
1	1	DC code control type 2

(7) FILE NAME REQUEST at DNC-A (1:Yes/0:No) (NC optional parameter (bit) No. 8, bit 6)

Request file name output at DNC-A (option)

= 0 : Request file name is not output

= 1 : Request file name is output

(8) MASTER/SLAVE or RS CONT. (1:SLV, Yes/0:MAS, No)
(NC optional parameter (bit) No. 40, bit 0)

Master/slave station designation or RS control designation

= 0 : Master station or without RS control

= 1 : Slave station or with RS control

(9) BAUD RATE (bps) (NC optional parameter (word) No. 6)

Selection of baud rate from 110, 150, 200, 300, 600, 1200, 2400, 4800, 9600, and 19200.

Initial value: 600

(10) BUSY TIME (sec) (NC optional parameter (word) No. 34)

Sets the delay time until data receiving or RS232C getting ready (CTS and DSR ON) after sending DC1 (tape reader start) or interruption of data receive. If there is no response within the set length of time, an alarm occurs.

Setting range: 1 to 9999 sec.

Initial value: 0

<Procedure>

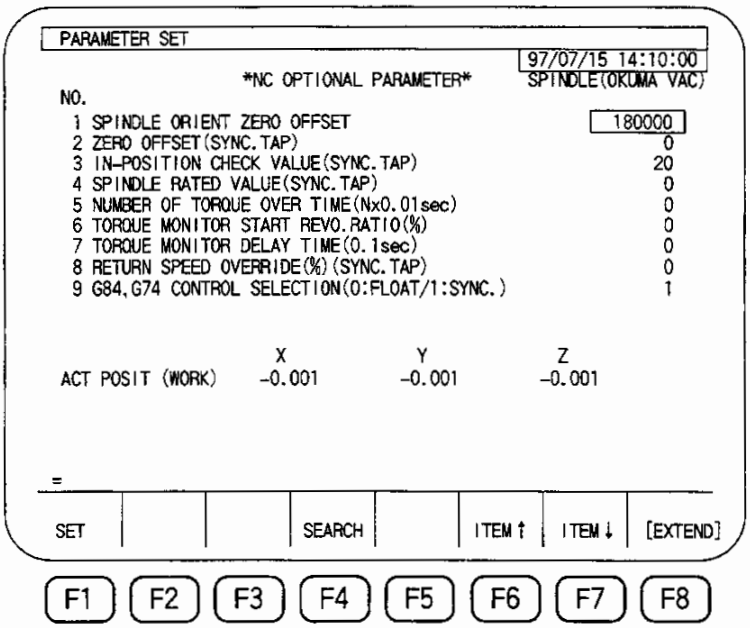
(1) Select the NC optional parameter setting screen.

(2) Move the cursor to the data to be set or changed by using the cursor keys and set or change the data.

10. NC Optional Parameter SPINDLE (OKUMA VAC)

This screen displays the parameters to be used for the high-accuracy machining function and the synchronized tapping function, which are allocated to NC optional parameter (bit), NC optional parameter (word) and NC optional parameter (long word).

When the following parameters are set, the corresponding NC optional parameters are set accordingly. Conversely, if NC optional parameters are set, the corresponding parameters shown below are set accordingly.



(1) SPINDLE ORIENT ZERO OFFSET (NC optional parameter (long word) No. 19)

Set the offset data used in spindle orientation for the spindle controlled by high-accuracy VAC.

Setting unit: VAC command unit (1/1000 (deg) or 1/10000 (deg))

Setting range: 0 to 359999 (1/1000 (deg))
0 to 3599999 (1/10000 (deg))

Initial value: 0

(2) ZERO OFFSET (NC optional parameter (long word) No. 15)

Set the machine zero for spindle orientation applied to the operation which is called out by an E command.

Setting unit: VAC command unit (1/1000 (deg) or 1/10000 (deg))

Setting range: 0 to 359999 (1/1000 (deg))
0 to 3599999 (1/10000 (deg))

For normal spindle orientation commands (RS command), orientation operation is controlled using the origin of the encoder.

(3) IN-POSITION CHECK VALUE (NC optional parameter (long word) No. 16)

Set the spindle in-position check value for synchronized tapping operation.

Setting unit: VAC command unit (1/1000 (deg) or 1/10000 (deg))

Setting range: 0 to 359999 (1/1000 (deg))
0 to 3599999 (1/10000 (deg))

(4) SPINDLE RATED VALUE (NC optional parameter (long word) No. 23)

Setting unit: W

Setting range: 110 to 99999999

Initial value: 0

(5) NUMBER OF TORQUE OVER TIME (NC optional parameter (word) No. 21)

Setting unit: times

Setting range: 0 to 32

Initial value: 0

Recommended value: 4 (times)

(6) TORQUE MONITOR START REVO. RATIO (NC optional parameter (word) No. 61)

Setting unit: %

Setting range: 0 to 100

Initial value: 0

Recommended value: 90 (%)

(7) TORQUE MONITOR DELAY TIME (NC optional parameter (word) No. 62)

Setting unit: 100 msec

Setting range: 0 to 1000

Initial value: 0

Recommended value: 2 (msec) (200 msec)

(8) RETURN SPEED OVERRIDE (NC optional parameter (word) No. 113)

Setting unit: %

Setting range: 1 to 200

Initial value: 0

* Value "0" is treated as 100%.

(9) G84, G74 CONTROL SELECTION (NC optional parameter (bit) No. 17, bit 7)

Determine the control mode of G84 and G74 specified in a part program whether they are controlled in the float tap mode or the synchronized tapping mode.

0: Controlled in the float tap mode.

1: Controlled in the synchronized tapping mode.

<Procedure>

(1) Select the NC optional parameter setting screen.

(2) Move the cursor to the data to be set or changed by using the cursor keys and set or change the data.

11. System Parameter

On the SYSTEM PARAMETER screen, the following parameters are displayed.

Note: According the machine specifications, some of the parameters listed below are not supported.

CAUTION

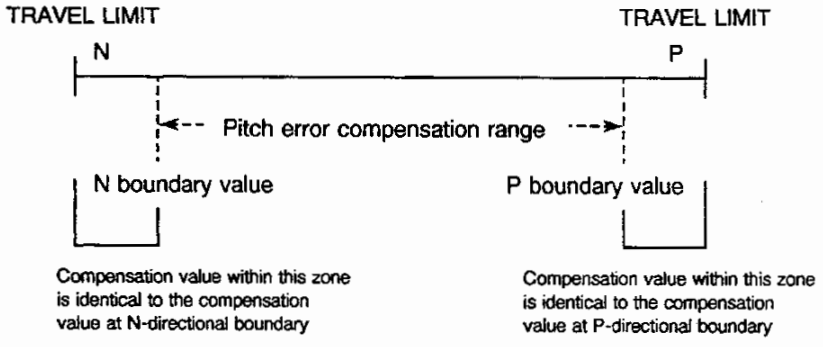
: For system parameters, values (data) specific to the individual machines are set by the machine tool manufacturer. Due to the nature of the parameter, it is not necessary to change the setting for system parameters at the user. If the setting for a system parameter must be changed, consult the machine tool manufacturer and change the setting only under the supervision of the machine tool manufacturer.

<Screen 1>

Display Screen	Contents	Initial Setting Value	Setting Range	Setting Unit
P TRAVEL LIMIT	Specifies the P (positive) direction travel end limit in the machine coordinate system.	Depends on machine specification	–99999999 to +99999999	Selected unit system
N TRAVEL LIMIT	Specifies the N (negative) direction travel end limit in the machine coordinate system.	Same as above	Same as above	Same as above
P PITCH ERR COMP	Specifies the range for pitch error compensation in the machine coordinate system. Sets the P- and N-directional boundaries. Normally, sets the value equivalent to the travel end limit. (NOTICE)	Same as above	Same as above	Same as above
N PITCH ERROR COMP		Same as above	Same as above	Same as above
IN POSITION	Sets the check data to be used in executing exact stop checks.	3	0 to 1000	Same as above
ZERO OFFSET (MACHINE)	Sets the zero offset of the machine coordinate system for each axis.	Depends on machine specification.	0 to 99999999	Same as above
IN POSITION (H)	Sets the in-position width used in positioning at the home position of each axis at the execution of home position return command.	20	0 to 1000	Same as above

NOTICE

: If P and/or N boundary value is set inside the TRAVEL LIMIT (P, N), compensation within the zone outside the boundary to TRAVEL END is carried out using the compensation value effective at the boundary.



<Screen 2>

Display Screen	Contents	Initial Setting Value	Setting Range	Setting Unit
BARRIER (Y, Z)	On horizontal machining centers, if both of Y- and Z-axis enter a certain area at the same time, they will interfere with each other. To prevent this, a barrier is set so that an alarm is triggered with axis motion halted if both of these two axes exist in the barrier zone at the same time. The setting for BARRIER sets this barrier. The setting is effective only for Y- and Z-axis.	0	–99999999 to +99999999	Selected unit system
ENCODER OFFSET*	This parameter offsets the zero-cross point of the point of the position encoder.	0	Same as above	Same as above

Parameters indicated by an asterisk (*) require turning off the power supply once after setting new data, then turn it on again.

<Screen 3>

Display Screen	Contents	Initial Setting Value	Setting Range	Setting Unit
HOME POSITION 1	When G30 is specified or if home position return command is given externally, the specified axis returns to the home position. These parameters set the coordinate values of respective home positions. (a) Home position can be set for individual axes in the machine coordinate system. (b) There are 32 sets of home position (1 to 32).	Depends on machine specification	–99999999 to +99999999	Selected unit system
HOME POSITION 2		Same as above	Same as above	Same as above
HOME POSITION 3		Same as above	Same as above	Same as above
HOME POSITION 4		Same as above	Same as above	Same as above
HOME POSITION 5		Same as above	Same as above	Same as above
HOME POSITION 6		Same as above	Same as above	Same as above
HOME POSITION 7		Same as above	Same as above	Same as above
HOME POSITION 8		Same as above	Same as above	Same as above

<Screen 4>

HOME POSITION MOVEMENT ORDER

Display Screen	Contents	Initial Setting Value	Setting Range	Setting Unit
HOME POSITION 1	Sets the axis movement order in the home position return operation at home position 1.	Depends on machine specification	0 to 3	-
HOME POSITION 2	Sets the axis movement order in the home position return operation at home position 2.	Same as above	Same as above	-
HOME POSITION 3	Sets the axis movement order in the home position return operation at home position 3.	Same as above	Same as above	-
HOME POSITION 4	Sets the axis movement order in the home position return operation at home position 4.	Same as above	Same as above	-
HOME POSITION 5	Sets the axis movement order in the home position return operation at home position 5.	Same as above	Same as above	-
HOME POSITION 6	Sets the axis movement order in the home position return operation at home position 6.	Same as above	Same as above	-
HOME POSITION 7	Sets the axis movement order in the home position return operation at home position 7.	Same as above	Same as above	-
HOME POSITION 8	Sets the axis movement order in the home position return operation at home position 8.	Same as above	Same as above	-

0: No axis movement
1: The axis moving first
2: The axis moving second
3: The axis moving third

NOTICE

: For the same home position number, the setting should be such that motion occurs sequentially, beginning from 1. If a setting which causes a motion sequence No. to be skipped is designated, that axis operation will be ignored.

Example: HOME POSITION 1

X	Y	Z
1	0	3

In this case, Z-axis operation will not occur.

Although display screens 3 and 4 above are for home positions 1 - 8, the 9 - 16, 17 - 24, and 25 - 32 screens can also be displayed by advancing the display page.

<Screen 5>

Display Screen	Contents	Initial Setting Value	Setting Range	Setting Unit
INDUCTOSYN OFFSET*	This parameter data is used for the phase of the inductosyn and absolute position encoder, and it is not effective for models not equipped with Introducsyn scale.	Depends on machine specification	–81920 to 49152	-
P INDUCTO-SYN AREA*	Sets the P (positive) direction effective range of the inductosyn in the machine coordinate system (for linear axis). (NOTICE)	0	–99999999 to +99999999	Selected unit system
N INDUCTO-SYN AREA*	Sets the N (negative) direction effective range of the inductosyn in the machine coordinate system (for linear axis). (NOTICE)	0	–99999999 to +99999999	Selected unit system

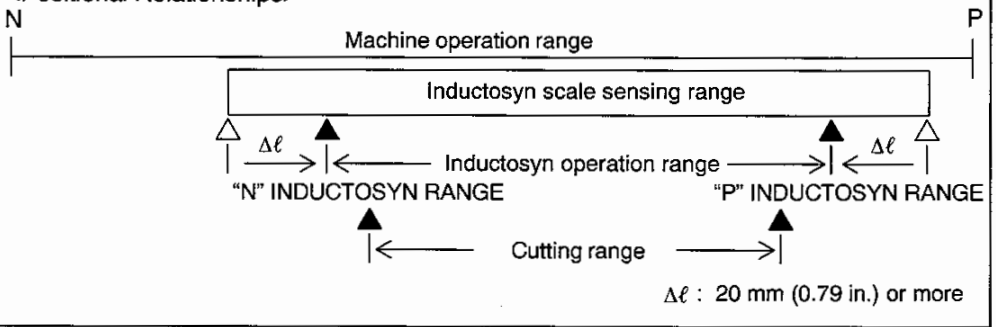
Parameters indicated by an asterisk (*) require turning off the power supply once after setting new data, then turn it on again. For the inductosyn offset, move the cursor to the axis in question and press the CAL key, and then the WRITE key.

NOTICE

: At machines with inductosyn specifications, inductosyn operation is effective through the entire normal operating range. In this case, no inductosyn setting is required (both P and N settings are designated as "0"). However, a specific inductosyn operation range can be designated if desired. In this case, the inductosyn will only operate in the designated range.

- The inductosyn offset and machine zero-point settings should be designated while inductosyn operation is enabled.
- When designating a specific inductosyn operation range, the limits should be set 20 mm (varies according to the feed axis "high-speed" setting) or more inside the actual inductosyn scale usable range.
- Switching between the inductosyn enabled/disabled statuses occurs near the inductosyn range limits, making inductosyn operation somewhat irregular at these areas. A home position setting should not be designated near the range limits.
- The normal cutting range should be designated within the inductosyn operation range.
- If the following condition is satisfied, the inductosyn will always be enabled:
  ["P" INDUCTOSYN RANGE] ≦ ["N" INDUCTOSYN RANGE]
- After data settings have been designated, press the BACKUP function key.

<Positional Relationships>



Δℓ : 20 mm (0.79 in.) or more

<Screen 6>

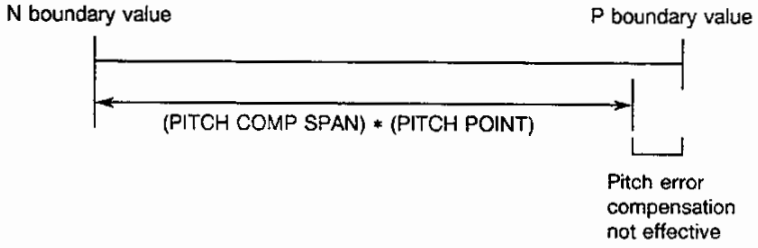
Display Screen	Contents	Initial Setting Value	Setting Range	Setting Unit
PITCH COMP SPAN*	Specifies the interval between sets of points for setting pitch error compensation data	Depends on machine specification	0 to 65535	Selected unit system
PITCH POINT*	Sets the total number of pitch points for each axis (NOTICE)	Same as above	0 to 384	-

Parameters indicated by an asterisk (*) require turning off the power supply once after setting new data, then turn it on again.

NOTICE

: If the product of the PITCH COMP SPAN and PITCH POINT is smaller than the pitch compensation range, the pitch error compensation is not effective within the area beyond the point calculated as the product of them up to the P boundary point, which will cause pitch error alarm. Therefore, pitch error compensation parameter data must be set to meet the following inequality.

(P-direction boundary) - (N-direction boundary) ≦ (Pitch comp span) × (Pitch point)



The setting procedure on the SYSTEM PARAMETER screens is explained below.

There are several pages of SYSTEM PARAMETER screen depending on the contents of the parameters. For the display contents on these pages, refer to the <SYSTEM PARAMETER screens> given later.

(1) After selecting the SYSTEM PARAMETER setting screen, select the page on which the required system parameter is displayed by pressing the page keys, then move the cursor to the data to be changed.

Note: To display or set the data for the fifth axis or later axes, press [F5] (AXIS CHANGE).

(2) Setting

(a) If the value to be set is known:

Press [F1] (SET) and key in the value from the keyboard.

(b) If the value is already set and the value to be added to or subtracted from the existing value is set:

Press [F2] (ADD) and key in the value to be added to or subtracted from the present setting.

(c) For setting newly in reference to the actual position:

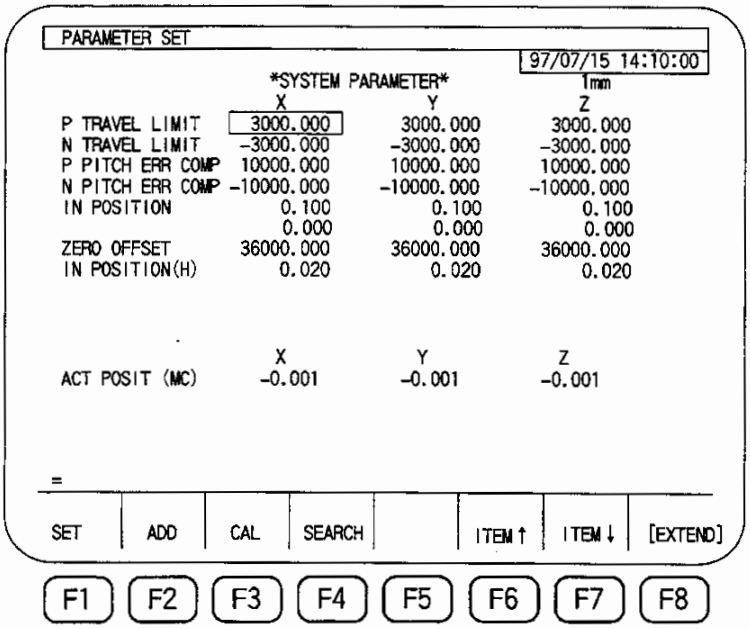
Press [F3] (CAL) and key in the incremental value from the actual position.

(3) Press the WRITE key.

The data on which the cursor is placed is updated according to the keyed in value.

(4) Back up the data and turn off the power. Then, turn on the power again.

Data back up operation: After pressing [F8] (EXTEND), press [F7] (BACKUP).



12. Pitch Error Compensation

The ball screws each have their own pitch-to-pitch errors, which may be compensated for by the setting of the pitch error compensation data.

The pitch error compensation data provides a total of 2304 values for all the axes (384 values for each axis).

Before setting the pitch error compensation value, use the following procedure:

(1) Set the P PITCH ERR COMP and N PITCH ERR COMP on screen 1 of the system parameter.

This determines the range of the screw pitch offset - from what position (N) to what position (P) in that ball screw.

(2) Set the PITCH ERR COMP SPAN on screen 6 of the system parameter.

This determines the pitch between values for the screw pitch offset.

(3) In NC optional parameter (word) No. 33, set the total number of screw pitch compensation values for all the axes.

(4) Set the PITCH POINT on screen 6 of the system parameter.

This sets the number of pitch error compensation points for individual axes (max.: 384 points per axis). Setting is possible for individual axes and it should be made in the order of X, Y, Z the 4th, the 5th and the 6th axes.

In the explanation given above, setting operation should be referred to the following sections:

For system parameter setting procedure, refer to 11. "System Parameter".

For NC optional parameter (word) setting procedure, refer to 6. "NC Optional Parameter (Word)".

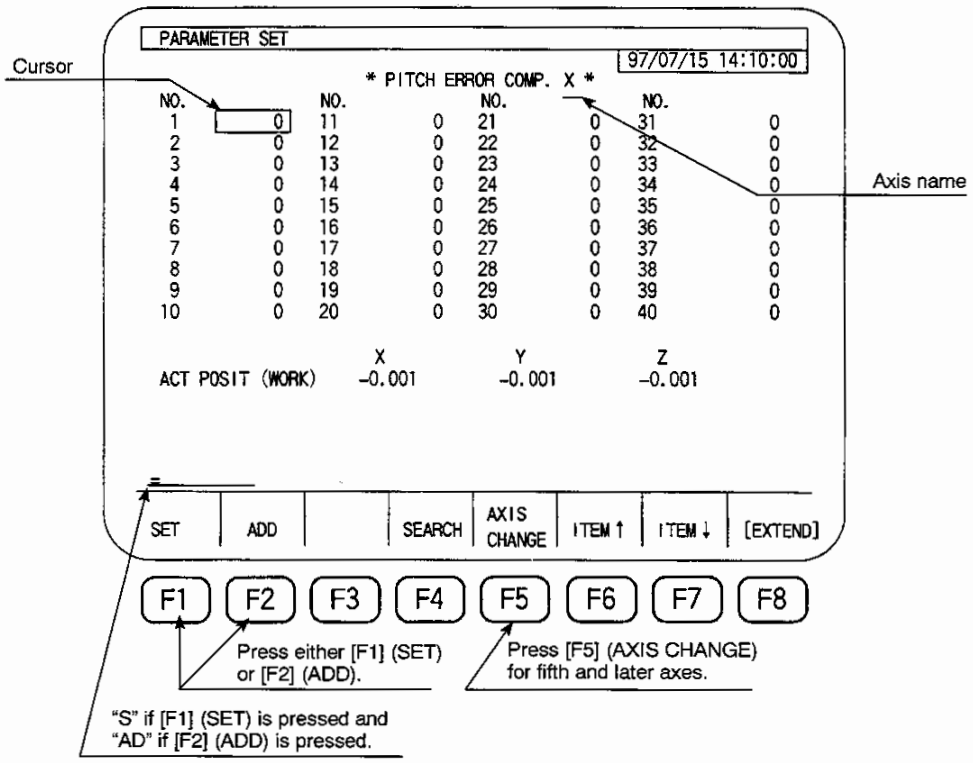
The setting procedure on the PITCH ERROR COMP. screen is explained below.

(a) Display the PITCH ERROR COMP. screen.

(b) By pressing [F5] (AXIS CHANGE) and the page keys, display the page on which the required axis and point are displayed.

Since one screen displays only one axis data, press function key [F5] (AXIS CHANGE) if it is necessary to set a different axis from the screen display. Each time that key is pressed, axes are switched as follows: X→Y→Z→X→4th→5th→6th→X→Y→Z.

Since one screen displays only 40 sets of data, press the page key if it is necessary to display No. 41 and following. Each time that key is pressed, the screen advances one page.



(c) Move the cursor to the required parameter by using the cursor control keys or by using [F4] (SEARCH).

(d) Setting

1) If the value to be set is known:

Press [F1] (SET) and key in the value from the keyboard.

When setting the same data continuously from the position where the cursor is located, the following input is used to set the data.

[offset data] * [number of points]

Example: [7] * [20]

Data of "7" μm is set for 20 points from the cursor located point.

2) If the value is already set and the value to be added to or subtracted from the existing value is set:

Press [F2] (ADD) and key in the value to be added to or subtracted from the present setting.

(e) Press the WRITE key.

The data on which the cursor is placed is updated according to the keyed in value.

(f) Back up the data and turn off the power. Then, turn on the power again.

Data back up operation: After pressing [F8] (EXTEND), press [F7] (BACKUP).

NOTICE

: For setting the pitch error compensation data, take the following points into consideration.

- For No. 1 on each axis, "0" should be set.
- Pitch variation between adjoining two points must be smaller than 16383 μm.
- If "(number of points) × (pitch compensation interval)" is very close to the travel of an axis, it is recommended to set the data for more points.

13. Machine Axis Parameter

The machine axis parameters designate the settings for data related to the machine axis. All the machine axis are listed below, though some may not be present at certain machine models.

MA axis: ATC Magazine axis 1

MB axis: ATC Magazine axis 2 (Multiple magazines)

MC axis: ATC Magazine axis 3 (Multiple magazines)

TS axis: ATC change arm rotation axis

TI axis: ATC change arm IN/OUT axis

PA axis: APC axis 1

PB axis: APC axis 2

PL axis: Multi-pallet magazine axis

AT axis: Attachment axis

AA axis: Attachment magazine axis 1

AB axis: Attachment magazine axis 2

CA axis: ATC carrier axis

CB axis: AAC (AT) carrier axis

WA axis: Crossrail (EC-W) axis

The machine axis parameters are listed below.

<Screen 1>

Display Screen Name	Contents	Factory Set Initial Value mm (in.)	Setting Range	Setting Unit
P TRAVEL LIMIT	P-directional travel end limit in the machine coordinate system	Depends on machine specification	–99999999 to +99999999	Selected unit system
N TRAVEL LIMIT	N-directional travel end limit in the machine coordinate system	Same as above	Same as above	Same as above
IN POSITION	"In-position confirmation zone" at positioning	Same as above	0.000 to 10.000	Same as above
CLAMP	"Positioning clamp confirmation zone" at positioning	Same as above	Same as above	Same as above
ZERO-POINT	Distance from encoder zero-point to control zero-point	Same as above	0.000 to 99999.999	Same as above
ENCODER OFFSET	Encoder's zero cross shift amount	Same as above	–99999.999 to 99999.999	Same as above
BACKLASH	Back lash compensation amount	Same as above	Same as above	Same as above
OVERRUN AMT	Overrun amount at single-direction positioning	Same as above	0.000 to 99999.999	Same as above

<Screen 2>

Display Screen Name	Contents	Factory Set Initial Value mm (in.)	Setting Range	Setting Unit
OFFSET 1 to 8	General purpose data used at each axis	Depends on machine specification	–99999.999 to 99999.999	Selected unit system

<Screen 3>

Display Screen Name	Contents	Factory Set Initial Value mm (in.)	Setting Range	Setting Unit
OFFSET 9 to 16	General purpose data used at each axis	Depends on machine specification	–99999.999 to 99999.999	Selected unit system

<Contents of each axis parameter>

axis	Item	Contents
MA	P TRAVEL LIMIT	Not used.
MB	N TRAVEL LIMIT	Not used.
MC	IN POSITION	Sets the in position amount.
	CLAMP	Sets the clamp width.
	ZERO-POINT	Designates the magazine's zero-point. Designates the APA setting when pot No. 1 is positioned at the tool change unit.
	ENCODER OFFSET	Sets the encoder compensation amount.
	BACKLASH	Sets the backlash amount.
	OVERRUN AMT	Not used.
	OFFSET 2	Tool unloading unit offset In order to position the magazine at the tool unloading unit, the distance from zero-point when pot No. 1 is at the tool unloading unit must be designated.

axis	Item	Contents
TS	P TRAVEL LIMIT	Sets the P stroke limit.
	N TRAVEL LIMIT	Sets the N stroke limit.
	IN POSITION	Sets the in position amount.
	CLAMP	Sets the clamp width.
	ZERO-POINT	Designates the zero-point (tool change arm's "tool grasp" position).
	ENCODER OFFSET	Sets the encoder compensation amount.
	BACKLASH	Sets the backlash amount.
	OVERRUN AMT	Not used.
	OFFSET 1	Tool change arm's "tool grasp" distance Designates the distance from the tool change arm's waiting position to its "tool grasp" position.

axis	Item	Contents
TI	P TRAVEL LIMIT	Sets the P stroke limit.
	N TRAVEL LIMIT	Sets the N stroke limit.
	IN POSITION	Sets the in position amount.
	CLAMP	Sets the clamp width.
	ZERO-POINT	Designates the zero-point (vertical spindle's tool insertion position).
	ENCODER OFFSET	Sets the encoder compensation amount.
	BACKLASH	Sets the backlash amount.
	OVERRUN AMT	Not used.
	OFFSET 1	Horizontal spindle's tool insertion position (MCR-B2/MCM-B) Designates the relative distance between zero-point and the horizontal spindle's tool insertion position.
		Protective pot's tool insertion position (MCV-A2) Designates the relative distance between zero-point and the protective pot's tool insertion position.
	OFFSET 2	Magazine's tool insertion position Designates the relative distance between zero-point and the magazine's tool insertion position.
	OFFSET 3	Tool extraction position Designates the relative distance between zero-point and the tool extraction position.
	OFFSET 4	Tool insertion position (15° tilt) Designates the relative distance between zero-point and the tool insertion position.
	OFFSET 5	Tool insertion position (30° tilt) Designates the relative distance between zero-point and the tool insertion position.
	OFFSET 6	Tool insertion position (45° tilt) Designates the relative distance between zero-point and the tool insertion position.
	OFFSET 7	Tool insertion position (60° tilt) Designates the relative distance between zero-point and the tool insertion position.
	OFFSET 8	Tool insertion position (75° tilt) Designates the relative distance between zero-point and the tool insertion position.

axis	Item	Contents
PA	P TRAVEL LIMIT	Not used.
	N TRAVEL LIMIT	Not used.
	IN POSITION	Sets the in position amount.
	CLAMP	Sets the clamp width.
	ZERO-POINT	Designates the shifter's zero-point.
	ENCODER OFFSET	Sets the encoder compensation amount.
	BACKLASH	Sets the backlash amount.
	OVERRUN AMT	Not used.
	OFFSET 1	APC axis travel enabled position Designates the APC shifter axis position where X- and B- axis travel are enabled.
	OFFSET 2	Shifter HP confirmation position Designates the shifter stop position during a shifter ADVANCE when the X-, Z-, and B- axis are not at their home positions.

axis	Item	Contents
PL	P TRAVEL LIMIT	Not used.
	N TRAVEL LIMIT	Not used.
	IN POSITION	Sets the in position amount.
	CLAMP	Sets the clamp width.
	ZERO-POINT	Designates the pallet magazine's zero-point.
	ENCODER OFFSET	Sets the encoder compensation amount.
	BACKLASH	Sets the backlash amount.
	OVERRUN AMT	Not used.

axis	Item	Contents
CA	P TRAVEL LIMIT	Sets the P stroke limit.
	N TRAVEL LIMIT	Sets the N stroke limit.
	IN POSITION	Sets the in position amount.
	CLAMP	Sets the clamp width.
	ZERO-POINT	Designates the carrier's zero-point.
	ENCODER OFFSET	Sets the encoder compensation amount.
	BACKLASH	Sets the backlash amount.
	OVERRUN AMT	Not used.
	OFFSET 1	Vertical spindle tool insertion position Designates the relative distance from zero-point to the vertical spindle's tool insertion position.
	OFFSET 2	Horizontal spindle tool insertion position Designates the relative distance from zero-point to the horizontal spindle's tool insertion position.
	OFFSET 3	Magazine tool insertion position Designates the relative distance from zero-point to the magazine's tool insertion position.
	OFFSET 4	Tool extraction position Designates the relative distance from zero-point to the spindle's tool extraction position.
	OFFSET 5	Attachment tool change position Designates the relative distance from zero-point to the attachment tool change position.

axis	Item	Contents
CB	P TRAVEL LIMIT	Sets the P stroke limit.
	N TRAVEL LIMIT	Sets the N stroke limit.
	IN POSITION	Sets the in position amount.
	CLAMP	Sets the clamp width.
	ZERO-POINT	Designates the AT carrier's zero-point.
	ENCODER OFFSET	Sets the encoder compensation amount.
	BACKLASH	Sets the backlash amount.
	OVERRUN AMT	Not used.
	OFFSET 1	AT carrier wait position Designates the attachment carrier's waiting position.

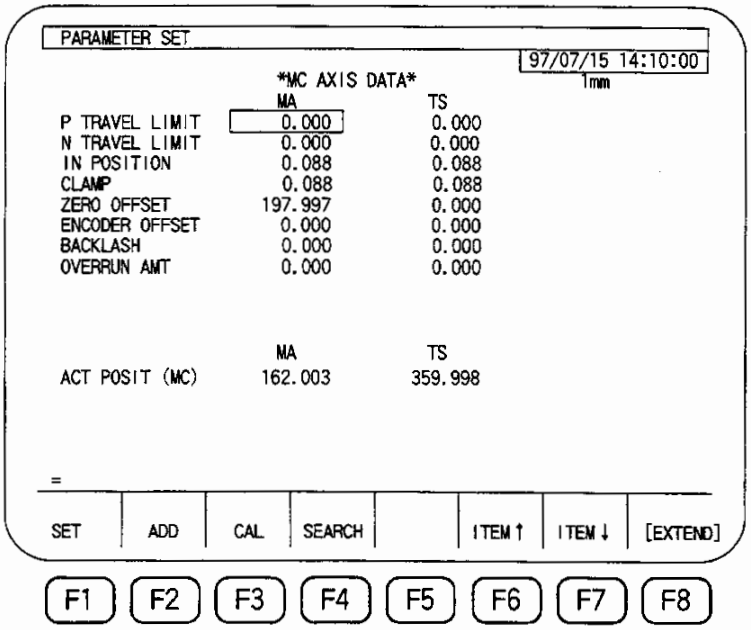
axis	Item	Contents
WA	P TRAVEL LIMIT	Sets the P stroke limit.
	N TRAVEL LIMIT	Sets the N stroke limit.
	IN POSITION	Sets the in position amount.
	CLAMP	Sets the clamp width.
	ZERO-POINT	Designates the crossrail zero-point.
	ENCODER OFFSET	Sets the encoder compensation amount.
	BACKLASH	Sets the backlash amount.
	OVERRUN AMT	Sets Overrun amount at single-direction positioning.
	OFFSET 1	Designates the relative distance from zero-point to the position attained by M199/M85 positioning.
	OFFSET 2	Designates the relative distance from zero-point to the position attained by M198/M84 positioning.
	OFFSET 3	Designates the relative distance from zero-point to the position attained by M197/M83 positioning.
	OFFSET 4	Designates the relative distance from zero-point to the position attained by M196/M82 positioning.
	OFFSET 5	Designates the relative distance from zero-point to the position attained by M195/M81 positioning.
	OFFSET 6	Designates the relative distance from zero-point to the position attained by M194 positioning.
	OFFSET 7	Designates the relative distance from zero-point to the position attained by M193 positioning.
	OFFSET 8	Designates the relative distance from zero-point to the position attained by M192 positioning.
	OFFSET 9	Designates the relative distance from zero-point to the position attained by M191 positioning.
	OFFSET 10	Designates the relative distance from zero-point to the position attained by M190 positioning.
	OFFSET 11	Display zero-offset Designates the relative distance of the actual position display's "machine axis" WP zero-point from the crossrail zero-point.

Axis except above are not used.

Setting procedure is as follows:

(1) Press the PARAMETER key.

(2) Select the MC AXIS PARAMETER setting screen.



(3) To designate data settings for mount axis subsequent to axis No. 5, press function key [F5] (AXIS SWITCH).

(4) Using the cursor keys, position the cursor at the desired position.

(5) Setting:

(a) When data is previously known:

Press function key [F1] (SET).

Enter the data with keyboard.

(b) When data has already been set and it is necessary to set the increment decrement against the data:

Press function key [F2] (ADD).

Enter the increment/decrement with keyboard.

(c) When new setting is made at the position relative to the current value:

Press function key [F3] (CAL).

Enter the relative value.

[Supplement] This procedure cannot be used for the following setting items: in-position, clamp zone, encoder offset, backlash, and single-direction overshoot amount.

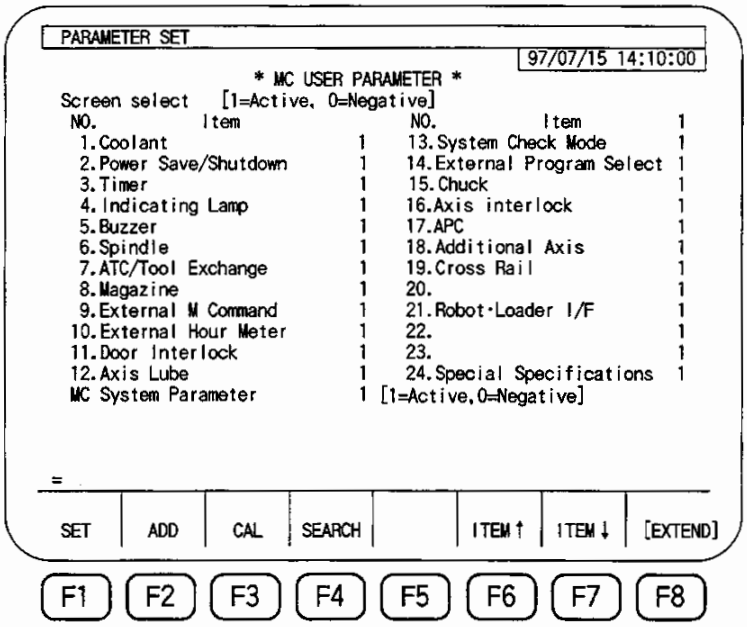
(6) Press the WRITE key.

This rewrites the data indicated by the cursor.

14. Machine User Parameters

To display a parameter, set "1" for the parameter group on the MC USER PARAMETER - Screen select screen.

Set "0" for a parameter group which should not be displayed.



14-1. Coolant Parameters

No.	Parameter	Contents	Set 1	Set 0	Initial Setting Value
1	"COOLANT" SW is active	Selects COOLANT switch "active" or "specification code" according to the setting.	Active	Spec. code	0
2	"A.B. NOZ. (Air Blow Nozzle)" SW is active	Selects A.B. NOZ. (Air Blow Nozzle) switch "active" or "specification code" according to the setting.	Active	Spec. code	0
3	"A.B. ADAPT. (Air Blow Adapter)" SW is active	Selects A.B. ADAPT. (Air Blow Adapter) switch "active" or "specification code" according to the setting.	Active	Spec. code	0
4	"OIL MIST" SW is active	Selects OIL MIST switch "active" or "specification code" according to the setting.	Active	Spec. code	0
5	"OIL HOLE" SW is active	Selects OIL HOLE switch "active" or "specification code" according to the setting.	Active	Spec. code	0
6	"SHOWER" SW is active	Selects SHOWER switch "active" or "specification code" according to the setting.	Active	Spec. code	0

No.	Parameter	Contents	Set 1	Set 0	Initial Setting Value
7	"CHIP CON" SW is active	Selects CHIP CON switch "active" or "specification code" according to the setting.	Active	Spec. code	0
8	"CHIP WASH" SW is active	Selects CHIP WASH switch "active" or "specification code" according to the setting.	Active	Spec. code	0
9	"WATER GUN" SW is active	Selects WATER GUN switch "active" or "specification code" according to the setting.	Active	Spec. code	0
10	"SPINDLE THROUGH AIR BLOW" SW is active	Selects SPINDLE THROUGH AIR BLOW switch "active" or "specification code" according to the setting.	Active	Spec. code	0
11	S-AIR BLOW is active without spindle is zero	Sets if the interlock function, that disables spindle rotation during spindle-through air blow, is made ineffective.	Ineffective	Effective	0
12	CHIP WASH is turn on with NC RUN	Sets whether or not the chip washing function is activated at the start up of the NC.	Activated	Not activated	0
13	M09 doesn't turn off the coolant	Sets whether or not M08 (coolant ON) is turned off by the execution of M09 (coolant group OFF).	Not turned OFF	Turned OFF	0
14	M09 doesn't turn off the oil hole low pressure	Sets whether or not M50 (oil-hole low pressure coolant ON) is turned off by the execution of M09 (coolant group OFF).	Not turned OFF	Turned OFF	0
15	M09 doesn't turn off the oil hole high pressure	Sets whether or not M51 (oil-hole high pressure coolant ON) is turned off by the execution of M09 (coolant group OFF).	Not turned OFF	Turned OFF	0
16	M09 doesn't turn off the air blow (Nozzle)	Sets whether or not M12 (nozzle type air blow ON) is turned off by the execution of M09 (coolant group OFF).	Not turned OFF	Turned OFF	0
17	M09 doesn't turn off the air blow (Adapter)	Sets whether or not M59 (adapter type air blow ON) is turned off by the execution of M09 (coolant group OFF).	Not turned OFF	Turned OFF	0
18	M09 doesn't turn off the oil mist	Sets whether or not M07 (oil mist ON) is turned off by the execution of M09 (coolant group OFF).	Not turned OFF	Turned OFF	0
19	M09 doesn't turn off the work shower	Sets whether or not M120 (work shower ON) is turned off by the execution of M09 (coolant group OFF).	Not turned OFF	Turned OFF	0
20	M00/M01 doesn't turn off spindle/coolant group	Sets whether or not spindle stops and coolant group is turned off by the execution of M00 (program stop) or M01 (optional stop).	Not turned OFF	Turned OFF	0

No.	Display Screen	Contents	Effective Command	Initial Setting Value	Setting Range	Setting Unit
21	Oil mist time	Sets the length of oil mist ON time in an oil mist cycle.	ADD, SET	0 sec	0 to 3600	1 sec

No.	Parameter	Contents	Set 1	Set 0	Initial Setting Value
22	Chip conveyor turn on with coolant	Sets whether or not the chip conveyor starts operating if any one of coolant related outputs (coolant, oil-hole, shower, chip wash, water gun) is turned on.	Starts operating	Does not start operating	0
23	Chip conveyor turns on with NC RUN	Sets whether or not the chip conveyor starts operating at the start-up of the NC.	Starts operating	Does not start operating	0
24	Hollow taper shanks with flat contact surface	(Not used)			0

14-2. Power Save/Shutdown Parameters

No.	Parameter	Contents	Set 1	Set 0	Initial Setting Value
1	"Power Save" is made ineffective	Sets whether or not the power save function is made ineffective.	Ineffective	Effective	0
2	"Power Save" is made ineffective during M00/M01	Sets whether or not the power save function is made ineffective during the execution of M00 (program stop) or M01 (optional stop).	Ineffective	Effective	0
3	"Automatic Power Shutdown" is made effective	Sets whether or not the automatic power shutdown function is made effective.	Effective	Ineffective	0
4	Alarm is added as a requirement for Shutdown	Sets if "occurrence of alarm" is added to requirements for power shutdown.	Added	Not added	0

No.	Display Screen	Contents	Effective Command	Initial Setting Value	Setting Range	Setting Unit
5	Power saving time	Sets the length of time until the power save function is activated after stopping an operation.	ADD, SET	30 minutes	0 to 60	1 min
6	Power shutdown time	Sets the length of time until the power is automatically shut down after stopping an operation.	ADD, SET	0 sec	0 to 3600	1 sec

14-3. Timers

No.	Parameter	Contents	Set 1	Set 0	Initial Setting Value
1	The 2nd timer; Counting spindle rotation period	Sets the function of the 2nd timer as the "spindle ON" timer.	Yes	No	0
2	The 2nd timer; Counting NC operation period	Sets the function of the 2nd timer as the "NC RUN" timer.	Yes	No	0
3	The 2nd timer; Add Auto-mode condition	Sets whether or not the "automatic mode" is added to the conditions for operating the 2nd timer.	Yes	No	0
4	The 2nd timer; Add Auto-mode/Single-block off	Sets whether or not the "automatic mode" and "single block OFF" are added to the conditions for operating the 2nd timer.	Yes	No	0
5	The 3rd timer; Counting spindle rotation period	Sets the function of the 3rd timer as the "spindle ON" timer.	Yes	No	0
6	The 3rd timer; Counting NC operation period	Sets the function of the 3rd timer as the "NC RUN" timer.	Yes	No	0
7	The 3rd timer; Add Auto-mode condition	Sets whether or not the "automatic mode" is added to the conditions for operating the 3rd timer.	Yes	No	0
8	The 3rd timer; Add Auto-mode/Single-block off	Sets whether or not the "automatic mode" and "single block OFF" are added to the conditions for operating the 3rd timer.	Yes	No	0

14-4. Indicating Lamp Parameters

No.	Parameter	Contents	Set 1	Set 0	Initial Setting Value
1	The 3rd lamp (NC running) is made effective	Sets whether or not the 3rd indicating lamp is made effective.	Effective	Ineffective	0
2	It is turned on without S-BLK OFF condition	Sets whether or not the "single block OFF" condition is disregarded for the lighting of the 3rd indicating lamp (NC running).	Disregarded	Regarded	0
3	It is turned on without Auto/S-BLK OFF condition	Sets whether or not the "automatic operation" and "single block OFF" conditions are disregarded for the lighting of the 3rd indicating lamp (NC running).	Disregarded	Regarded	0
4	It is turned off when an alarm occurs	Sets if the 3rd indicating lamp (NC running) is turned off at the occurrence of an alarm.	Turned OFF	Not turned OFF	0
5	Alarm lamp is made effective	Sets whether or not the alarm lamp is made effective.	Effective	Ineffective	0
6	It is turned on without S-BLK OFF condition	Sets whether or not the "single block OFF" condition is disregarded for the lighting of the alarm lamp.	Disregarded	Regarded	0

No.	Parameter	Contents	Set 1	Set 0	Initial Setting Value
7	It is turned on without Auto/S-BLK OFF condition	Sets whether or not the "automatic operation" and "single block OFF" conditions are disregarded for the lighting of the alarm lamp.	Dis-regarded	Regarded	0
8	Operation end lamp is made effective	Sets whether or not the operation end lamp is made effective.	Effective	Ineffective	0
9	It is turned on without S-BLK OFF condition	Sets whether or not the "single block OFF" condition is disregarded for the lighting of the operation end lamp.	Dis-regarded	Regarded	0
10	It is turned on without Auto/S-BLK OFF condition	Sets whether or not the "automatic operation" and "single block OFF" conditions are disregarded for the lighting of the operation end lamp.	Dis-regarded	Regarded	0
11	Alarm/end lamps are not turned off with power save	If the NC enters the power save mode while the alarm or the cycle end indicating lamp is lit, the lamp is not turned off.	Valid	Invalid	0
13	Alarm lamp is turned on with alarm D occurs	Occurrence of alarm D is added to the conditions for the alarm indicating lamp to turn on.	Added	Not added	0
14	Alarm lamp is not turned on with alarm C occurs	Occurrence of alarm C is eliminated from the conditions for the alarm indicating lamp to turn on.	Eliminated	Not eliminated	0
15	Alarm lamp is not turned on with alarm B occurs	Occurrence of alarm B is eliminated from the conditions for the alarm indicating lamp to turn on.	Eliminated	Not eliminated	0
16	Alarm lamp is not turned on with alarm A occurs	Occurrence of alarm A is eliminated from the conditions for the alarm indicating lamp to turn on.	Eliminated	Not eliminated	0

14-5. Buzzer Parameters

No.	Parameter	Contents	Set 1	Set 0	Initial Setting Value
1	Operation end buzzer is made effective	Sets whether or not the operation end buzzer is made effective.	Effective	Ineffective	0
2	Buzzer sounds without S-BLK OFF condition	Sets whether or not the "single block OFF" condition is disregarded for the sounding of the operation end buzzer.	Dis-regarded	Regarded	0
3	Buzzer sounds without Auto/S-BLK OFF condition	Sets whether or not the "automatic operation" and "single block OFF" conditions are disregarded for the sounding of the operation end buzzer.	Dis-regarded	Regarded	0

No.	Parameter	Contents	Set 1	Set 0	Initial Setting Value
4	Buzzer is not turned off by end timer	Sets if the operation end buzzer is not turned off using a timer.	Not turned OFF	Turned OFF	0
5	Buzzer is not turned off when alarm occurs	Sets if the operation end buzzer is not turned on if an alarm has occurred.	Not tuned ON	Turned ON	0
6	Buzzer is not turned off when completing program	Sets if the operation end buzzer is not turned on at the completion of a program.	Not turned ON	Turned ON	0

No.	Display Screen	Contents	Effective Command	Initial Setting Value	Setting Range	Setting Unit
7	Operation end buzzer timer	Sets the length of time the buzzer sounds.	ADD, SET	10 sec	0 to 600	1 sec

14-6. Spindle

No.	Parameter	Contents	Set 1	Set 0	Initial Setting Value
1	Spindle stops when an alarm of level B occurs	Sets whether or not the spindle is stopped at the occurrence of a level B alarm.	Stopped	Not stopped	0
2	The minimum of "S" is the minimum speed of motor	Determines whether or not the minimum value for an "S" command may be set at the minimum speed of a motor.	Can be set	Cannot be set	0
3	"No tool" interlock is made ineffective	Sets if the "no tool in the spindle" interlock is made ineffective.	Ineffective	Effective	0

No.	Display Screen	Contents	Effective Command	Initial Setting Value	Setting Range	Setting Unit
4	Spindle overload allowable time	Sets the length of time in which spindle load is not monitored after the start of the spindle.	ADD, SET	0 sec	0 to 60	1 sec

14-7. ATC/Tool Exchange

No.	Parameter	Contents	Set 1	Set 0	Initial Setting Value
1	Indexing magazine by advances one step	Sets if magazine index is effective by the operation of the 1-step advance button.	Effective	Ineffective	0
2	Exchange angular attachment tool with M06	Sets if a horizontal spindle tool change cycle (M177) is executed by the execution of M06.	Executed	Not executed	0
3	"INTERLOCK RELEASE" button is effective for ATC HP return	Sets if the "ATC at home position" is checked or not for tool change operation if the INTERLOCK RELEASE button is pressed.	Not checked	Checked	0
4	Answer to M06 without door-close condition	Sets if the door close confirmation signal may be disregarded as the condition for outputting the answer signal for M06 (tool change).	Dis-regarded	Not dis-regarded	0

No.	Display Screen	Contents	Effective Command	Initial Set-ting Value	Setting Range	Setting Unit
5	Tool unclamp time	Sets the length of time in which a tool is unclamped after pressing the TOOL UNCLAMP button.	ADD, SET	3 sec	0 to 30	1 sec

14-8. Magazine Parameters

No.	Parameter	Contents	Set 1	Set 0	Initial Setting Value
1	"Tool exist" interlock is made ineffective	Sets if the "tool existing in the magazine" interlock is made ineffective.	Ineffective	Effective	0
2	It does not stop ATC when "MANUAL INT" is on	Sets if the magazine door interlock function, which stops ATC, is ineffective in the manual intervention of magazine operation.	Ineffective	Effective	0
3	Stops ATC and APC with magazine intervention	Sets if the magazine door interlock function stops both the ATC and APC.	Stops ATC and APC	Does not stop ATC and APC	0
4	Magazine intervention mode is made ineffective	Sets if manual intervention of magazine operation is ineffective while the magazine door interlock function is active.	Ineffective	Effective	0

14-9. External M Command Parameters

No.	Parameter	Contents	Set 1	Set 0	Initial Setting Value
1	M181 is executed after completion positioning	Sets whether M181 is executed before or after the completion of positioning.	After	Before	0
2	M182 is executed after completion positioning	Sets whether M182 is executed before or after the completion of positioning.	After	Before	0
3	M183 is executed after completion positioning	Sets whether M183 is executed before or after the completion of positioning.	After	Before	0
4	M184 is executed after completion positioning	Sets whether M184 is executed before or after the completion of positioning.	After	Before	0
5	M185 is executed after completion positioning	Sets whether M185 is executed before or after the completion of positioning.	After	Before	0
6	M186 is executed after completion positioning	Sets whether M186 is executed before or after the completion of positioning.	After	Before	0
7	M187 is executed after completion positioning	Sets whether M187 is executed before or after the completion of positioning.	After	Before	0
8	M188 is executed after completion positioning	Sets whether M188 is executed before or after the completion of positioning.	After	Before	0

14-10. External Hour Meter Parameters

No.	Parameter	Contents	Set 1	Set 0	Initial Setting Value
1	Add "Auto mode" to output conditions	Sets if the "automatic mode" is added to the conditions for activating an external hour meter.	Added	Not added	0
2	Add "RUN lamp on" to output conditions	Sets if the "RUN indicating lamp ON status" is added to the conditions for activating an external hour meter.	Added	Not added	0
3	Add "Spindle in rotating" to output conditions	Sets if the "spindle in rotating" is added to the conditions for activating an external hour meter.	Added	Not added	0
4	Add "Axis moving" to output conditions	Sets if the "axis is moving" is added to the conditions for activating an external hour meter.	Added	Not added	0
5	Add "Spindle override 100%" to output conditions	Sets if the "spindle override setting at 100%" is added to the conditions for activating an external hour meter.	Added	Not added	0

No.	Parameter	Contents	Set 1	Set 0	Initial Setting Value
6	Add "Feedrate override 100%" to output conditions	Sets if the "feedrate override setting at 100%" is added to the conditions for activating an external hour meter.	Added	Not added	0
7	Add "Single block off" to output conditions	Sets if the "single block OFF" is added to the conditions for activating an external hour meter.	Added	Not added	0

14-11. Door Interlock Parameters

No.	Parameter	Contents	Set 1	Set 0	Initial Setting Value
1	Spindle rotation is continued	Sets if the spindle keeps rotating when the door interlock function is activated.	Keeps rotating	Stops	0

No.	Display Screen	Contents	Effective Command	Initial Setting Value	Setting Range	Setting Unit
2	Spindle allowable revolution	Sets the allowable maximum speed for the spindle to rotate while the operator's door is open.	ADD, SET	800 rpm	50 to 800	1 rpm
3	Door lock release Timer	Sets the length of time in which the DOOR LOCK RELEASE button (lock pin release) is effective.	ADD, SET	0 sec	0 to 60	1 sec

14-12. Axis Lubrication Parameters

No.	Display Screen	Contents	Effective Command	Initial Setting Value	Setting Range	Setting Unit
1	Axis Lube cycle time	Sets the length of axis lubrication cycle time.	ADD, SET	10 min	0 to 10	1 min
2	Axis Lube pump time	Sets the length of time in which the axis lubrication pump motor operates.	ADD, SET	15 sec	15 to 120	1 sec
3	Cross rail Lube cycle time	1 cycle time for cross-rail lubrication	ADD, SET	10 min	0 to 120	1 min
4	Cross rail Lube pump time	Cross-rail lubrication pump motor operating time	ADD, SET	15 sec	15 to 60	1 sec

14-13. System Check Mode

No.	Display Screen	Contents	Effective Command	Initial Setting Value	Setting Range	Setting Unit
1	System check mode	Sets the axis number used for testing.	ADD, SET	0	0 to 999	None

No.	Parameter	Contents	Set 1	Set 0	Initial Setting Value
2	Automatic setting cross rail positioning point	Positioning levels of the cross-rail are automatically determined.	Determined	Not determined	0

14-14. External Program Selection Parameters

No.	Parameter	Contents	Set 1	Set 0	Initial Setting Value
1	Check parity (even) is made effective	Sets whether or not the even parity scheme is effective for the designation of the program number of the program to be downloaded from an external device.	Effective	Ineffective	0
2	Check parity (odd) is made effective	Sets whether or not the odd parity scheme is effective for the designation of the program number of the program to be downloaded from an external device.	Effective	Ineffective	0

14-15. Chuck

No.	Parameter	Contents	Set 1	Set 0	Initial Setting Value
1	Chuck grips the inner diameter of the workpiece	Sets the workpiece holding direc-tion by the chuck - I.D. or O.D.	I.D. gripping	O.D. gripping	0
2	Even if chuck opens, cutting feed is effective	Sets if the interlock function which disables cutting feed while the chuck is open is made ineffective.	Ineffective	Effective	0
3	Spindle rotation inhibit when chuck opens	Sets if the interlock function which disables spindle rotation while the chuck is open is made effective.	Effective	Ineffective	0

No.	Parameter	Contents	Set 1	Set 0	Initial Setting Value
4	"Chuck Close" limit switch is made ineffective	Sets if the chuck close limit switch is made ineffective. If set for "ineffective" (limit switch not used), a timer is used; at the count-up of the timer, the chuck is assumed to have closed.	Ineffective	Effective	0
5	"Chuck Open" limit switch is made ineffective	Sets if the chuck open limit switch is made ineffective. If set for "ineffective" (limit switch not used), a timer is used; at the count-up of the timer, the chuck is assumed to have opened.	Ineffective	Effective	0

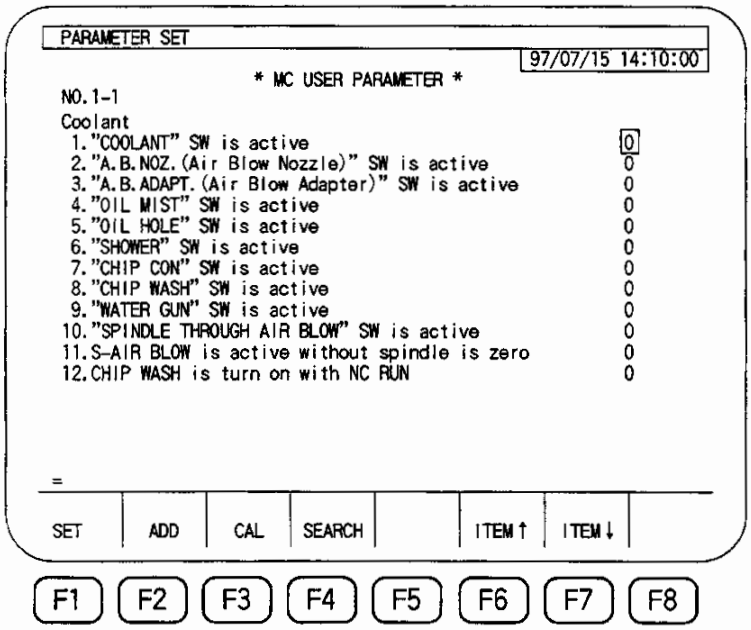
No.	Display Screen	Contents	Effective Command	Initial Setting Value	Setting Range	Setting Unit
6	Work clamp timer	Workpiece clamp confirmation timer	ADD, SET	0	0 to 6000	0.01 sec
7	Work unclamp timer	Workpiece unclamp confirmation timer	ADD, SET	0	0 to 6000	0.01 sec
8	Work seated confirmation timer	Correct clamp of a workpiece is recognized if the workpiece clamp signal stays on for the present length of time.	ADD, SET	1 sec	0 to 6000	0.01 sec

No.	Parameter	Contents	Set 1	Set 0	Initial Setting Value
9	Work seated air is OFF by chuck open	Workpiece clamp solenoid is automatically de-energized when the chuck is opened.	Yes	No	0
10	Work seated air is ON by chuck close	Workpiece clamp solenoid is automatically energized when the chuck is opened.	Yes	No	0

(1) Select the desired parameter setting screen.

(2) Move the cursor to the data to be changed or set using the cursor keys and change or set the desired data.

< Coolant >



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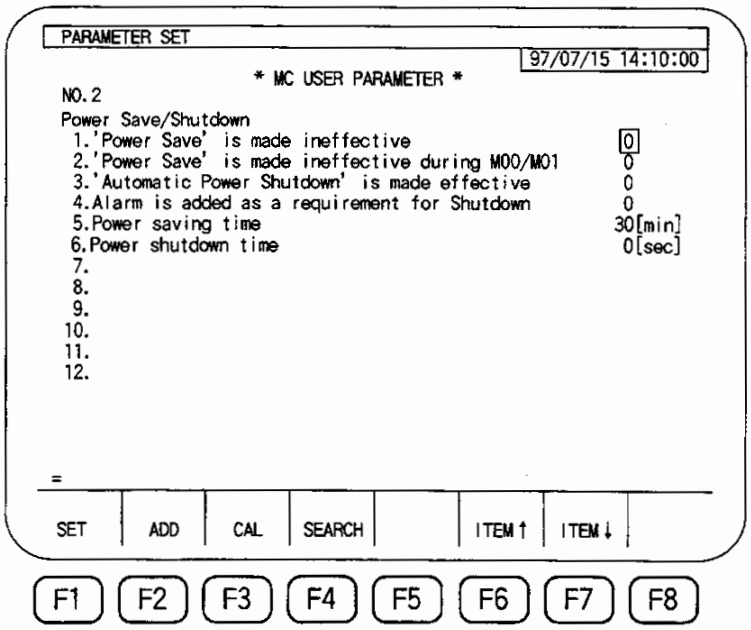
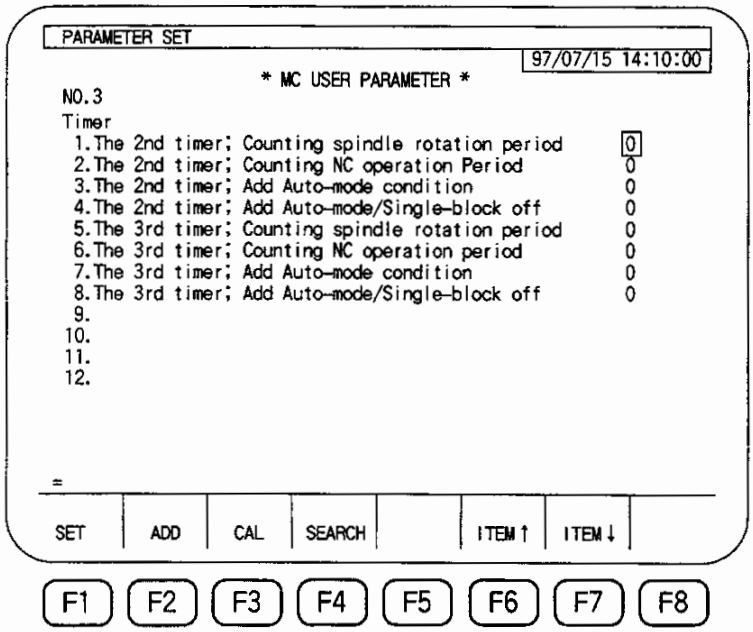


< Timer >



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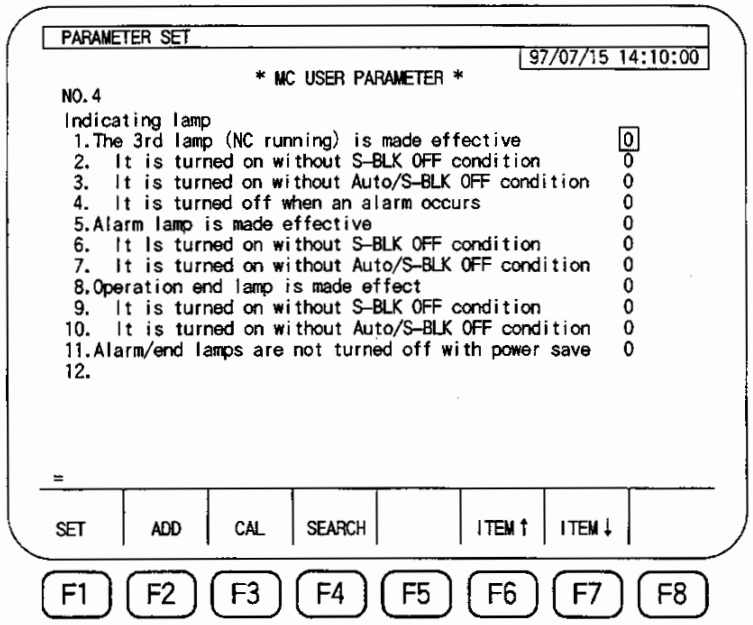
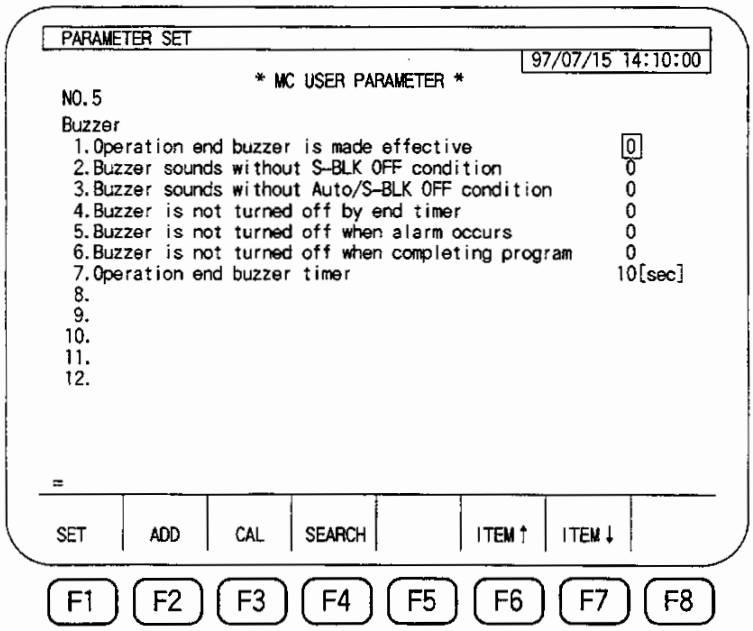
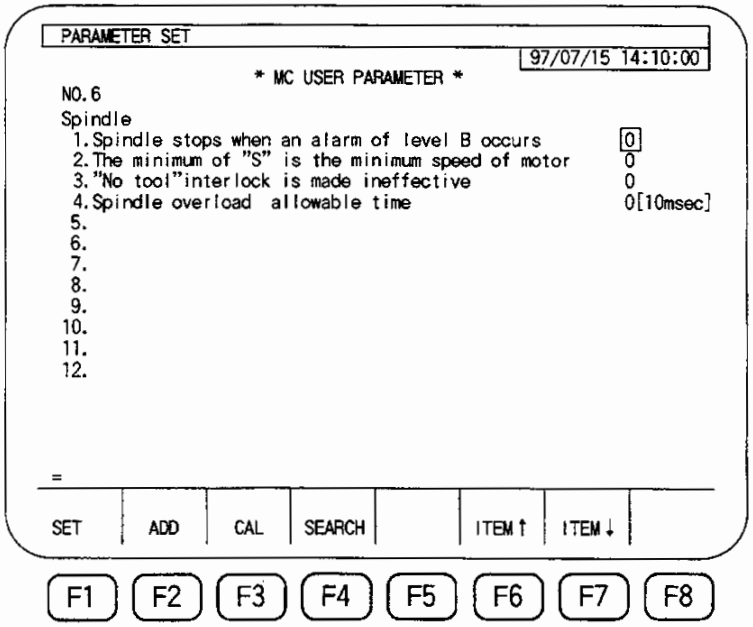


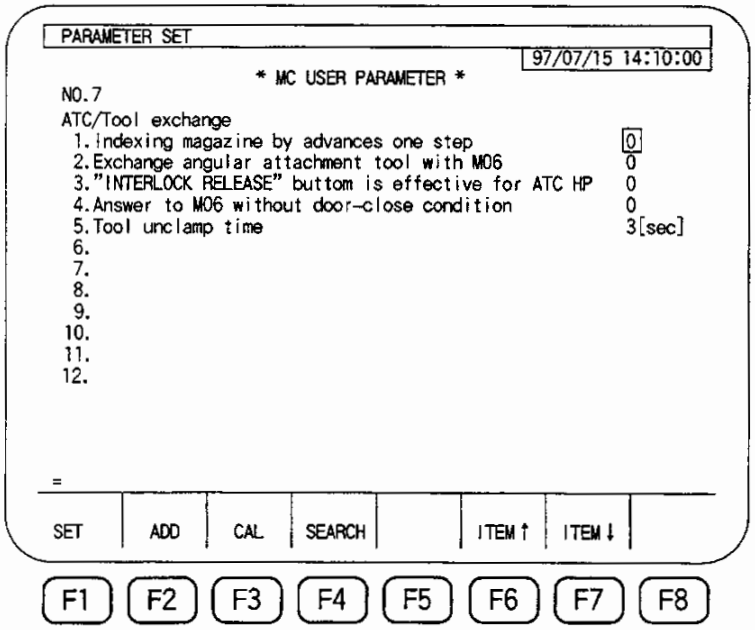
< Buzzer >



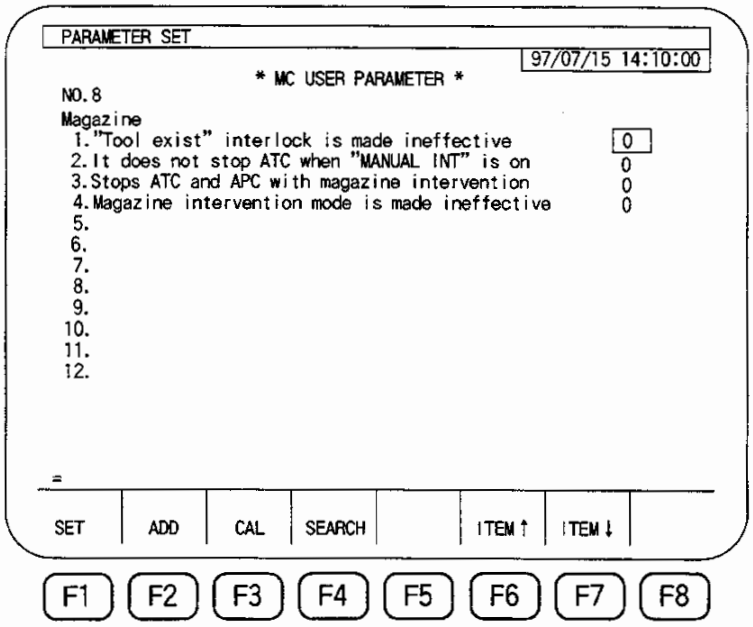
< Spindle >



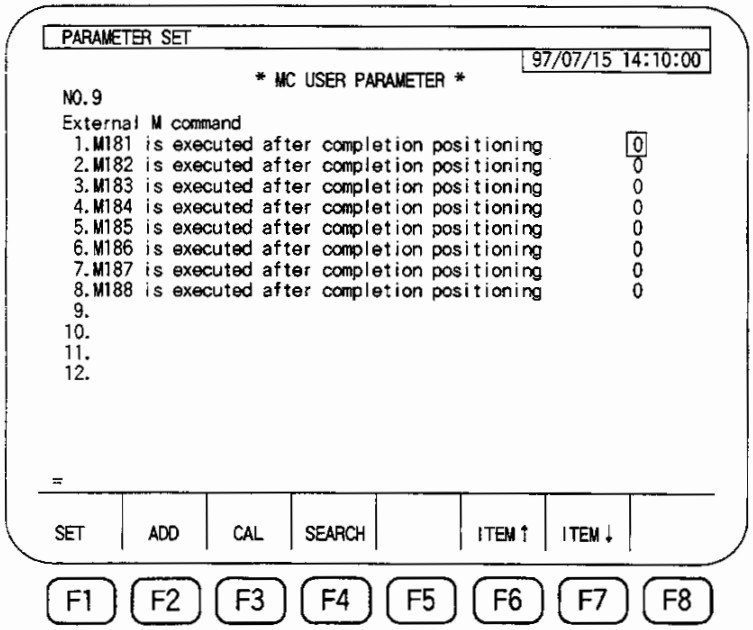
< ATC/Tool exchange >



< Magazine >



< External M Command >



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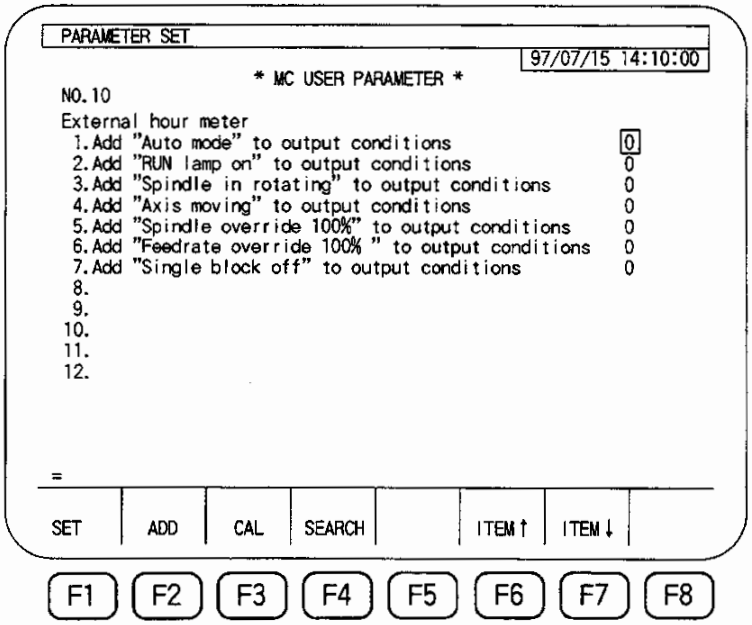
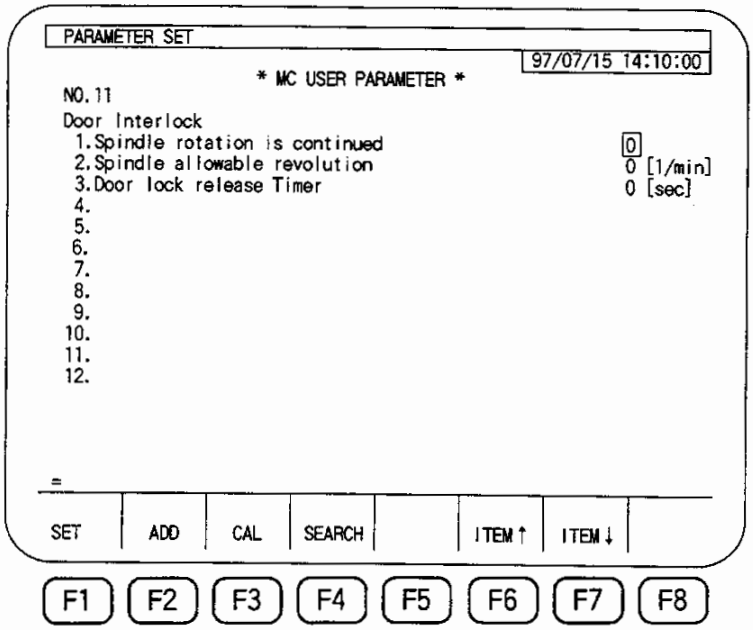
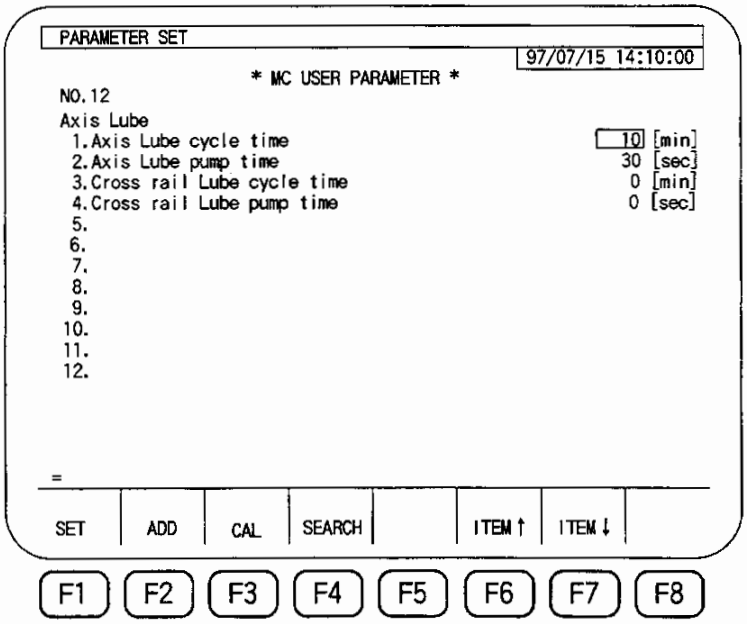


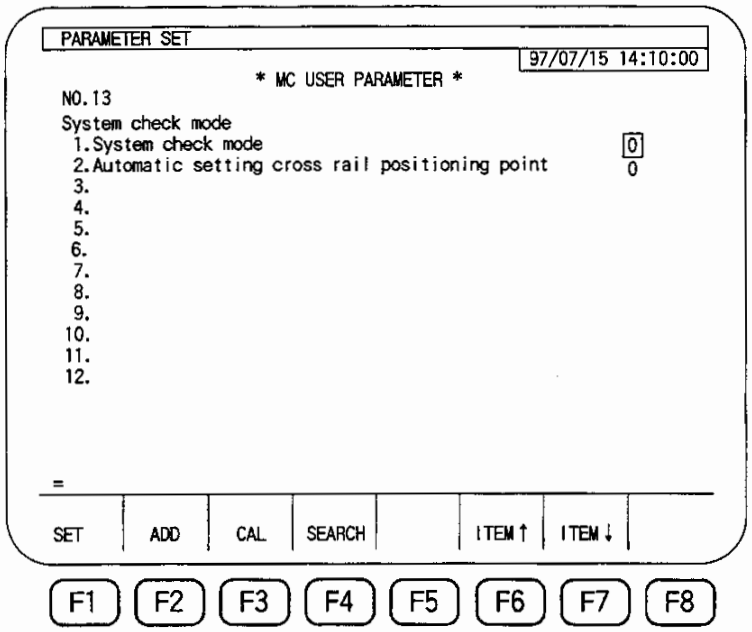
< Door interlock >



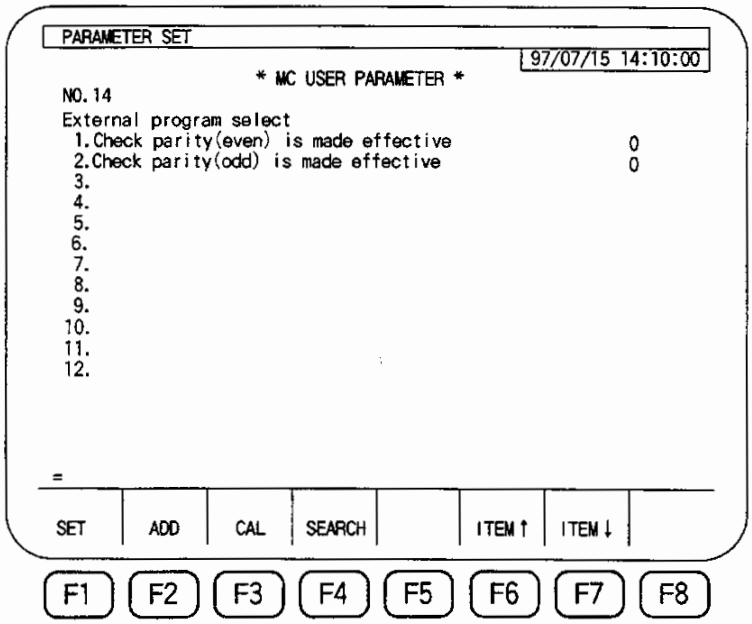
< Axis lubrication >



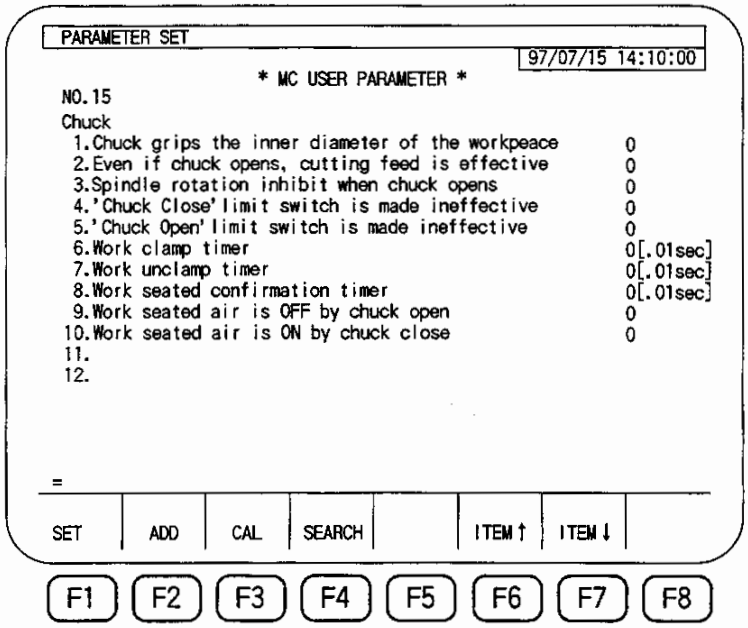
< System check mode >



< External program selection >



< Chuck >

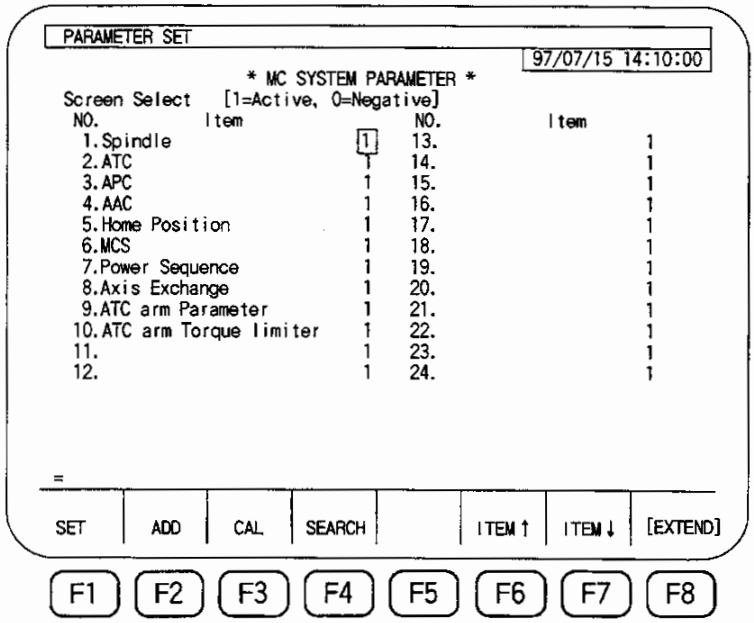


15. Machine System Parameters

To display the MC SYSTEM PARAMETER (Screen Select) screen, set "1" for Machine System Parameter on the MC USER PARAMETER - Screen select screen.

To display a parameter, set "1" for the parameter group on the MC SYSTEM PARAMETER - Screen Select screen.

To disable the display of the MC SYSTEM PARAMETER (Screen Select) screen, set "0" for Machine System Parameter on the MC USER PARAMETER - Screen select screen, or set "0" for a parameter group which should not be displayed.



15-1. Spindle Parameters

No.	Display Screen	Contents	Effective Command	Initial Setting Value	Setting Range	Setting Unit
1	Spindle Oscillate Revolution	Sets the spindle oscillation speed used for changing spindle gear ranges.	ADD, SET	0 rpm	0 to 100	1 rpm
2	Spindle Oscillate Frequency	Sets the length of time to start motor oscillation after the output of the gear range change solenoid signal for spindle oscillation.	ADD, SET	1 sec	0 to 5	1 sec
3	Spindle Oscillate Period	Sets the length of motor rotation time for spindle oscillation.	ADD, SET	5 sec	0 to 5	1 sec
4	Torque Limiter	Sets the torque limit value for spindle rotation. (conversion with 32767 = 100%)	ADD, SET	1% (327)	0 to 32767	1%

15-2. ATC Parameters

No.	Display Screen	Contents	Effective Command	Initial Setting Value	Setting Range	Setting Unit
1	ATC Sequence No.	ATC operation sequence number	SET	1	1 to max. ATC operation step number	None

No.	Parameter	Contents	Set 1	Set 0	Initial Setting Value
2	ATC Arm A/B mode	Selects the tool change arm mode.	A mode	B mode	1
3	ATC Arm torque limiter is made ineffective	Sets if the entries at the ATC arm torque limiter screen are made in-effective.	Ineffective	Effective	0

15-3. APC Parameters

No.	Display Screen	Contents	Effective Command	Initial Setting Value	Setting Range	Setting Unit
1	APC Sequence No.	APC operation sequence number	SET	1	1 to max. APC operation step number	None

No.	Parameter	Contents	Set 1	Set 0	Initial Setting Value
2	Pallet A/B mode	Selects the pallet change mode.	A mode	B mode	1

15-4. AAC Parameters

No.	Display Screen	Contents	Effective Command	Initial Setting Value	Setting Range	Setting Unit
1	AAC Sequence No.	AAC operation sequence number	SET	1	1 to max. AAC operation step number	None

15-5. Home Position Parameters

No.	Parameter	Contents	Set 1	Set 0	Initial Setting Value
1	Automatic override is made effective: HP1	Sets if automatic override is made effective for home position return operation: HP1	Effective	Ineffective	0
2	Automatic override is made effective: HP2	Sets if automatic override is made effective for home position return operation: HP2	Effective	Ineffective	0
3	Automatic override is made effective: HP3	Sets if automatic override is made effective for home position return operation: HP3	Effective	Ineffective	0
4	Automatic override is made effective: HP4	Sets if automatic override is made effective for home position return operation: HP4	Effective	Ineffective	0
5	Automatic override is made effective: HP5	Sets if automatic override is made effective for home position return operation: HP5	Effective	Ineffective	0
6	Automatic override is made effective: HP6	Sets if automatic override is made effective for home position return operation: HP6	Effective	Ineffective	0
7	Automatic override is made effective: HP7	Sets if automatic override is made effective for home position return operation: HP7	Effective	Ineffective	0
8	Automatic override is made effective: HP8	Sets if automatic override is made effective for home position return operation: HP8	Effective	Ineffective	0
9	Automatic override is made effective: HP9	Sets if automatic override is made effective for home position return operation: HP9	Effective	Ineffective	0
10	Automatic override is made effective: HP10	Sets if automatic override is made effective for home position return operation: HP10	Effective	Ineffective	0
11	Automatic override is made effective: HP11	Sets if automatic override is made effective for home position return operation: HP11	Effective	Ineffective	0
12	Automatic override is made effective: HP12	Sets if automatic override is made effective for home position return operation: HP12	Effective	Ineffective	0
13	Automatic override is made effective: HP13	Sets if automatic override is made effective for home position return operation: HP13	Effective	Ineffective	0
14	Automatic override is made effective: HP14	Sets if automatic override is made effective for home position return operation: HP14	Effective	Ineffective	0
15	Automatic override is made effective: HP15	Sets if automatic override is made effective for home position return operation: HP15	Effective	Ineffective	0
16	Automatic override is made effective: HP16	Sets if automatic override is made effective for home position return operation: HP16	Effective	Ineffective	0

No.	Display Screen	Contents	Effective Command	Initial Setting Value	Setting Range	Setting Unit
17	The value of automatic override	Sets the automatic override value applied for home position return operation.	ADD, SET	0%	0 to 100	1%

15-6. MCS Parameters

No.	Display Screen	Contents	Effective Command	Initial Setting Value	Setting Range	Setting Unit
1	MSC Charging Time	Sets the length of time for the system to wait for the operation ready state of the servo controller (MSC).	ADD, SET	0 sec	0 to 30	1 sec

15-7. Power Sequence Parameters

No.	Display Screen	Contents	Effective Command	Initial Setting Value	Setting Range	Setting Unit
1	Compulsory Power Shutdown Delay Timer	Delay timer for shutting off the power forcibly even if all of power shutdown conditions are not satisfied.	ADD, SET	0 sec	0 to 30	1 sec
2	Operating power Shutdown Alarm check Timer	Sets the length of waiting time until the power is shutdown after the start of the operation power shutdown sequence. Alarm message "4709 Alarm D Managing operating power shutdown" is displayed if the power is not shut off after the elapse of the set time.	ADD, SET	0 sec	0 to 30	1 sec

15-8. Axis Exchange Parameters

No.	Display Screen	Contents	Effective Command	Initial Setting Value	Setting Range	Setting Unit
1	Alarm check timer for LS exchange	Sets the length of time the system waits for the input from the axis exchange complete LS.	ADD, SET	0 sec	0 to 30	1 sec

15-9. ATC Arm Parameters

Contents	Effective Command	Initial Setting Value	Setting Range	Setting Unit
Parameters related to the control of operation steps of the ATC arm	ADD, SET	0	–99999999 to 99999999	None

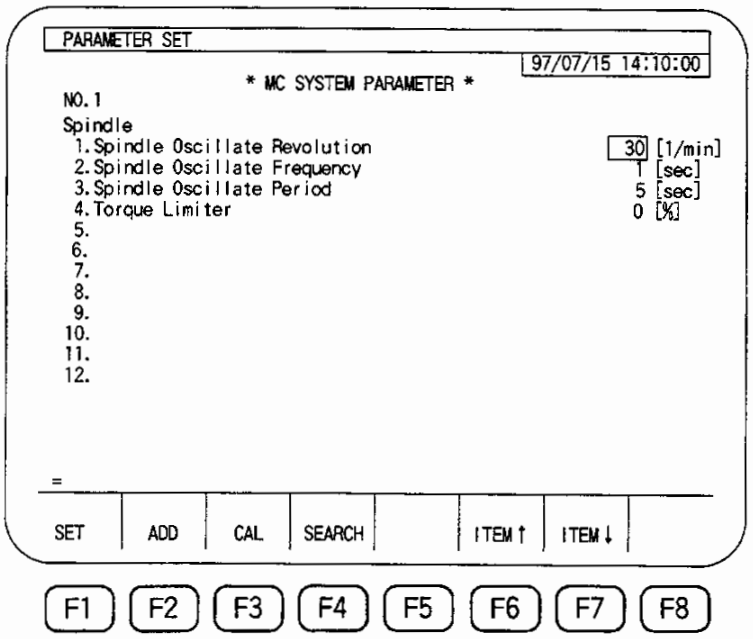
15-10. ATC Arm Torque Limiter Parameters

Parameter	Contents	Effective Command	Initial Setting Value	Setting Range	Setting Unit
degree [deg]	These parameters are provided to set torque limit values of the maximum output torque for the ATC arm motor in relation to the cam angles.	ADD, SET	0	0.000 to 359.000	1 deg
torque limiter [%]	The maximum motor output torque is set assuming 100% for the 300% of the motor rating.	ADD, SET	0	0 to 100	1%

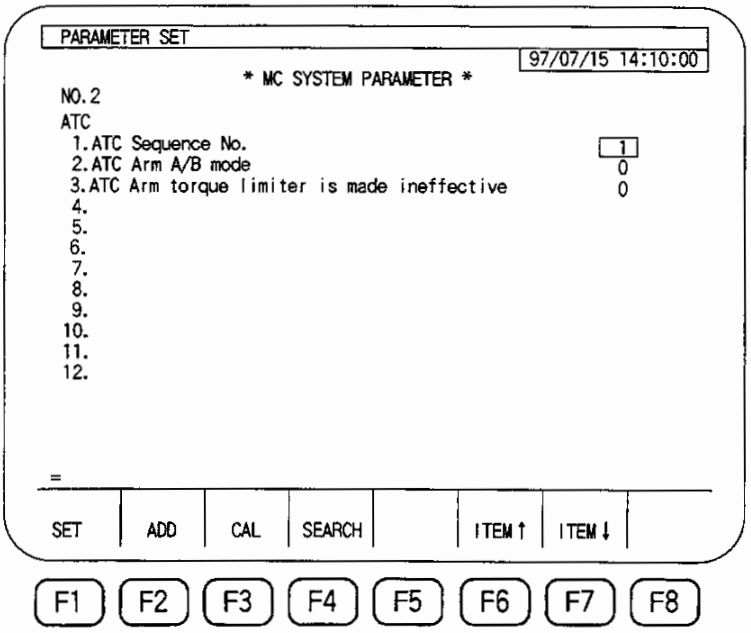
(1) Select the desired parameter setting screen.

(2) Move the cursor to the data to be changed or set using the cursor keys and change or set the desired data.

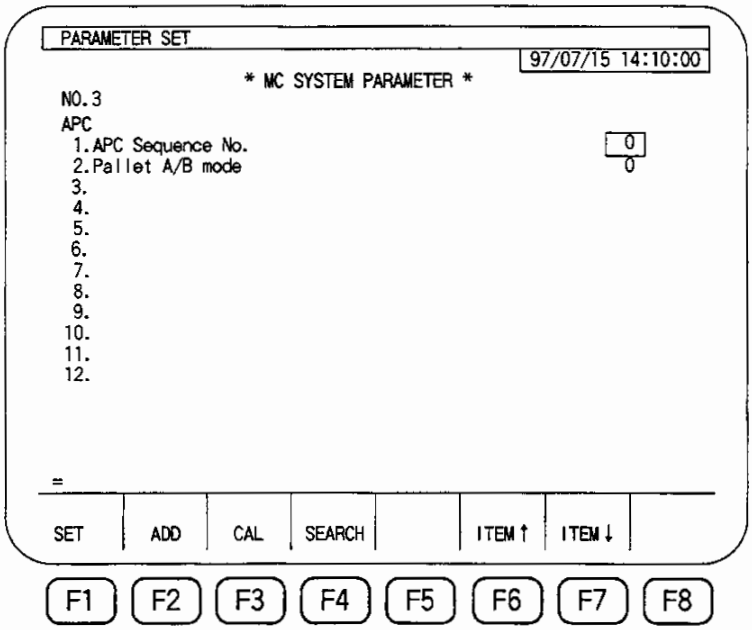
< Spindle >



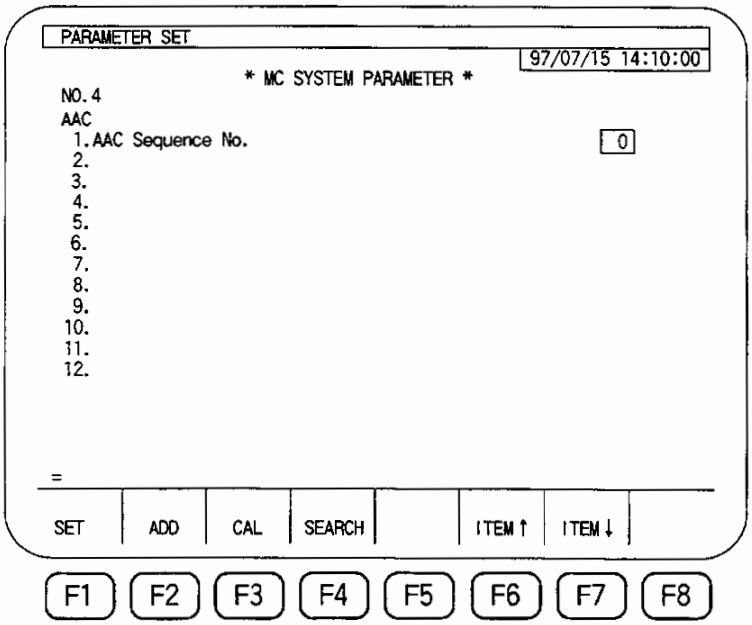
< ATC >



< APC >



< AAC >



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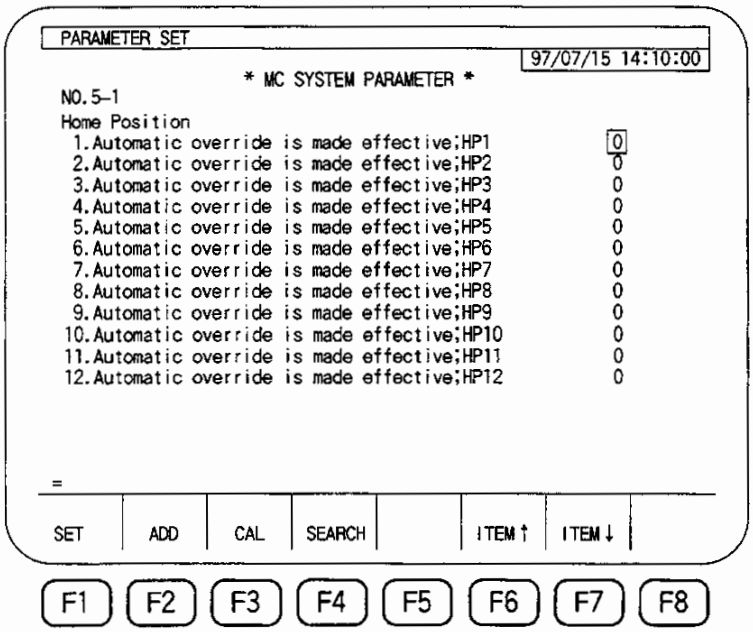

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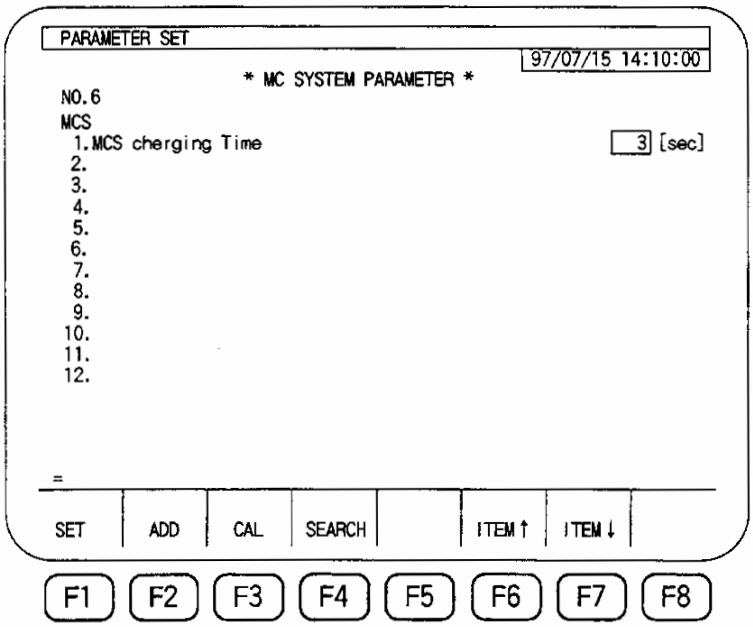

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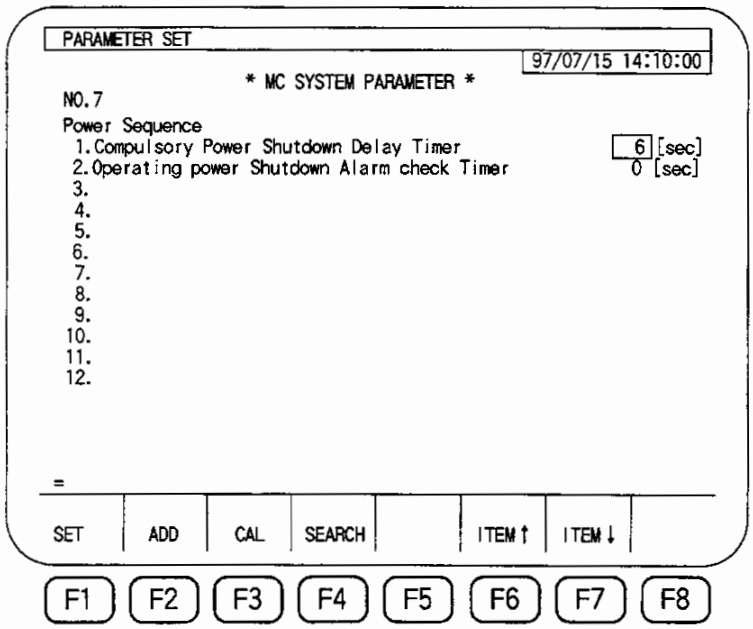
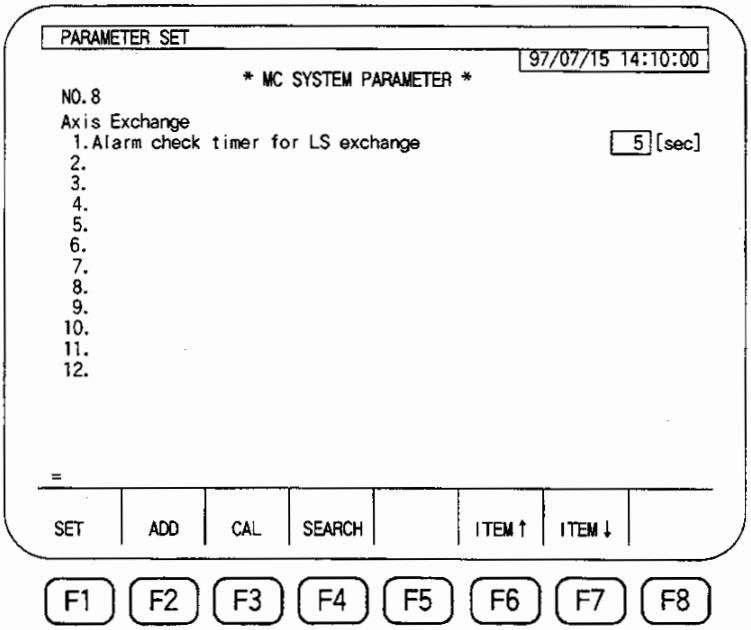


< Axis Exchange >



< ATC arm Parameter >

PARAMETER SET

97/07/15 14:10:00

* MC SYSTEM PARAMETER *

NO.9-1

ATC arm Parameter

NO.		NO.		NO.		NO.	
001	0	011	0	021	0	031	0
002	0	012	0	022	0	032	0
003	0	013	0	023	0	033	0
004	0	014	0	024	0	034	0
005	0	015	0	025	0	035	0
006	0	016	0	026	0	036	0
007	0	017	0	027	0	037	0
008	0	018	0	028	0	038	0
009	0	019	0	029	0	039	0
010	0	020	0	030	0	040	0

=

SET | ADD | CAL | SEARCH | | ITEM ↑ | ITEM ↓ |

F1 F2 F3 F4 F5 F6 F7 F8

< ATC arm Torque limiter >

PARAMETER SET

97/07/15 14:10:00

* MC SYSTEM PARAMETER *

NO.10

ATC arm torque limiter

NO.	degree	torque limiter	NO.	degree	torque limiter
001	0.000	0	011	0.000	0
002	0.000	0	012	0.000	0
003	0.000	0	013	0.000	0
004	0.000	0	014	0.000	0
005	0.000	0	015	0.000	0
006	0.000	0	016	0.000	0
007	0.000	0	017	0.000	0
008	0.000	0	018	0.000	0
009	0.000	0	019	0.000	0
010	0.000	0	020	0.000	0

=

SET | ADD | CAL | SEARCH | | ITEM ↑ | ITEM ↓ |

F1 F2 F3 F4 F5 F6 F7 F8

V. APPENDIX

SECTION 1 APPENDED FIGURES

1. NC Operation Panel

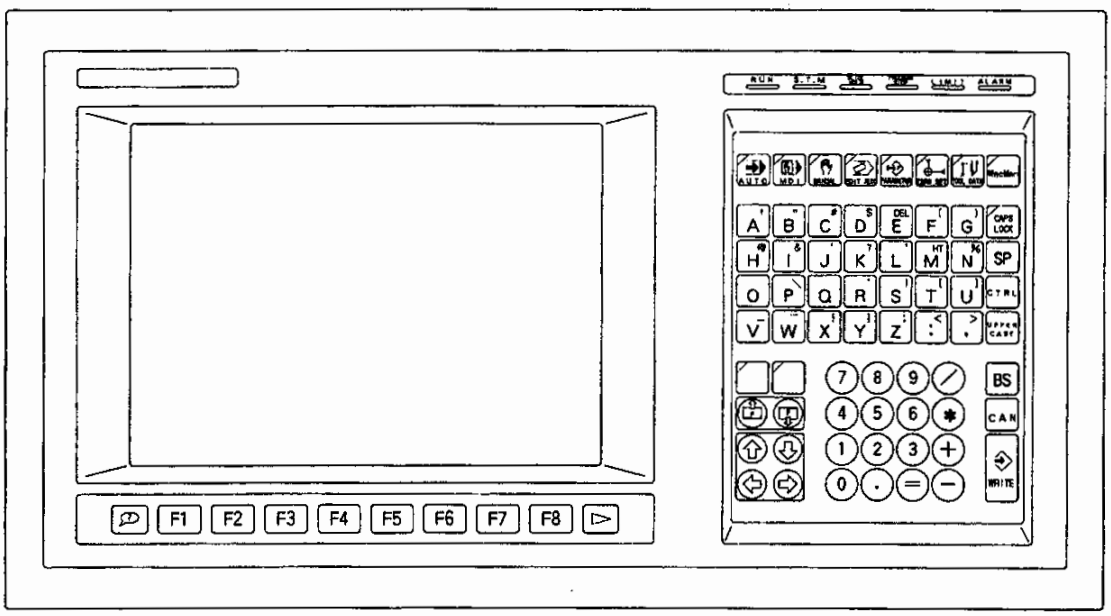


Fig. 1-1 NC Operation Panel (14-inch CRT)

2. Machine Operation Panel

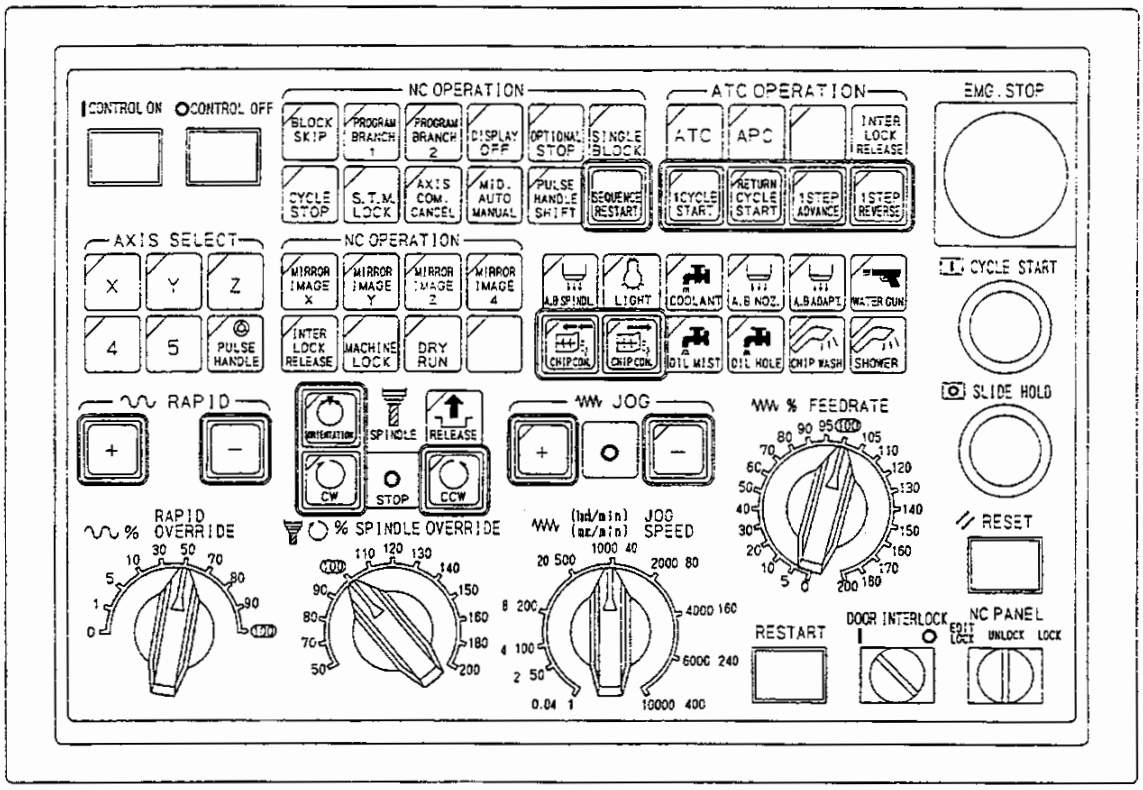


Fig. 1-2 Vertical Type Machine Operation Panel

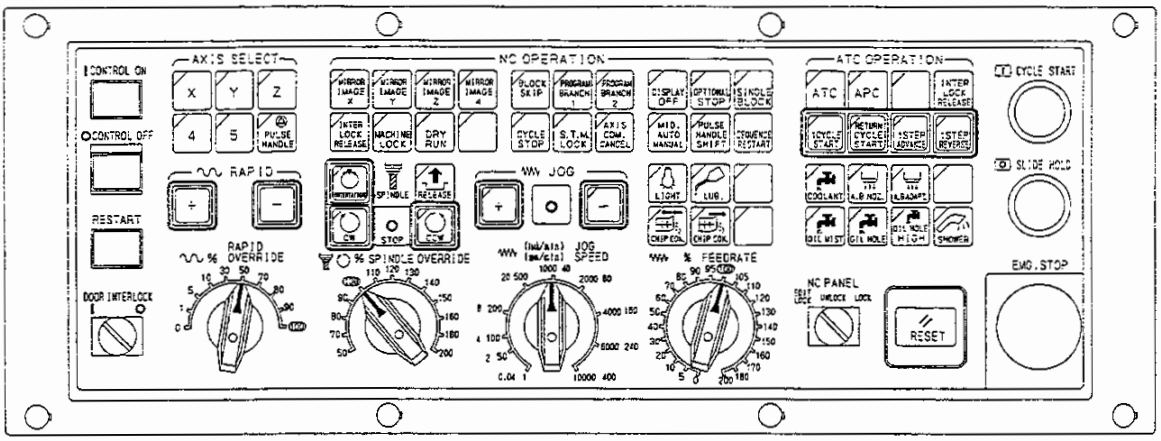


Fig. 1-3 Horizontal Type Machine Operation Panel

3. Option Panel

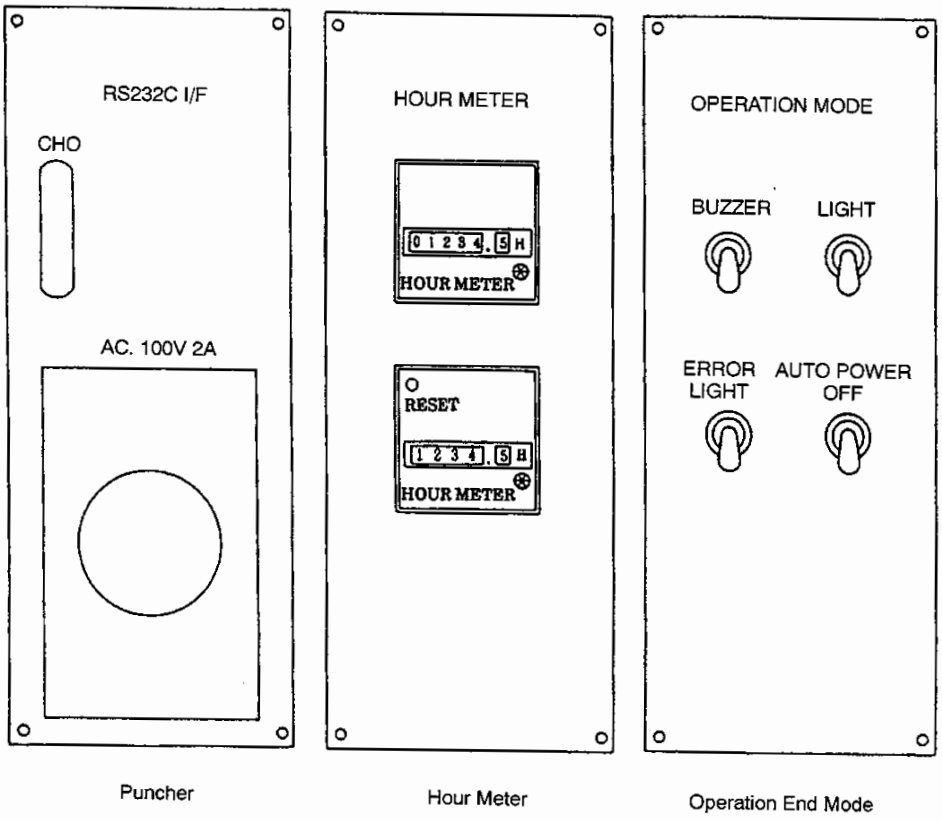


Fig. 1-4 Option Panel

4. Manual Tool Change Operation Panel for OSP

4-1. Manual Tool Change Operation Panel (Vertical Machining Centers)

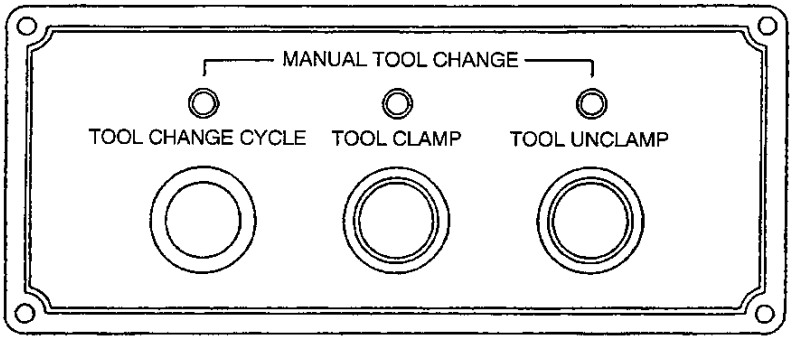


Fig. 1-5 Manual Tool Change Operation Panel (Vertical Machining Centers)

4-2. Manual Tool Change Operation Panel (Horizontal Machining Centers)

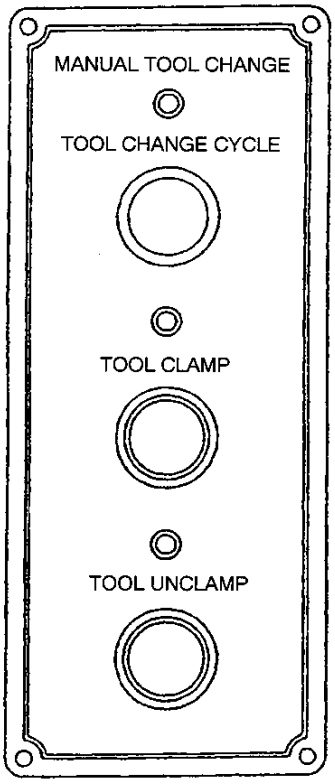


Fig. 1-6 Manual Tool Change Operation Panel (Horizontal Machining Centers)

4-3. Manual Tool Change Operation Panel (MDB-A/B, MCV-A/B)

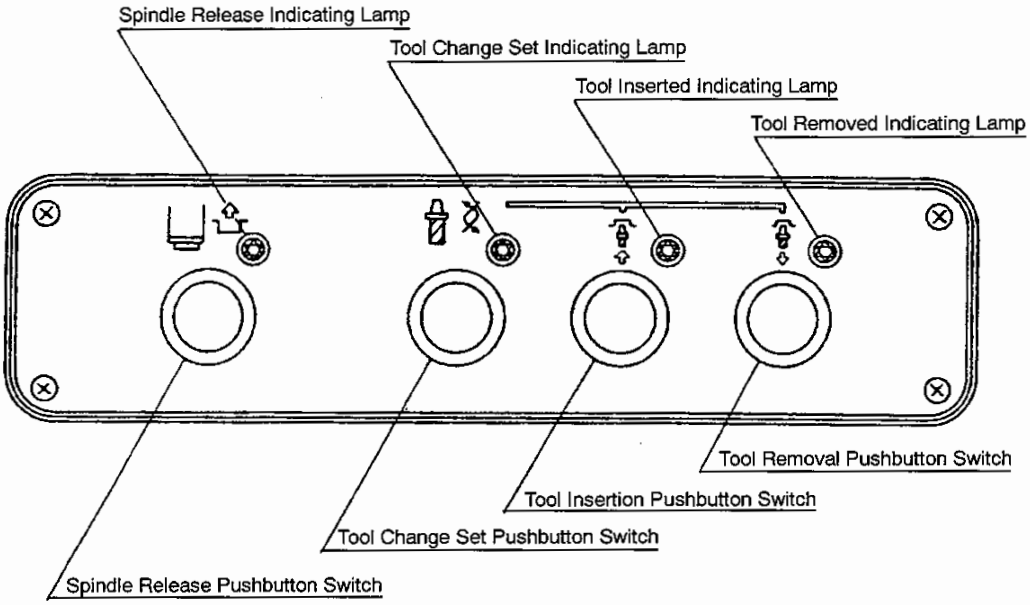


Fig. 1-7 Manual Tool Change Operation Panel (MDB-A/B, MCV-A/B)

4-4. Manual Tool Change Operation Panel (MDB-A/B, MCV-A/B)

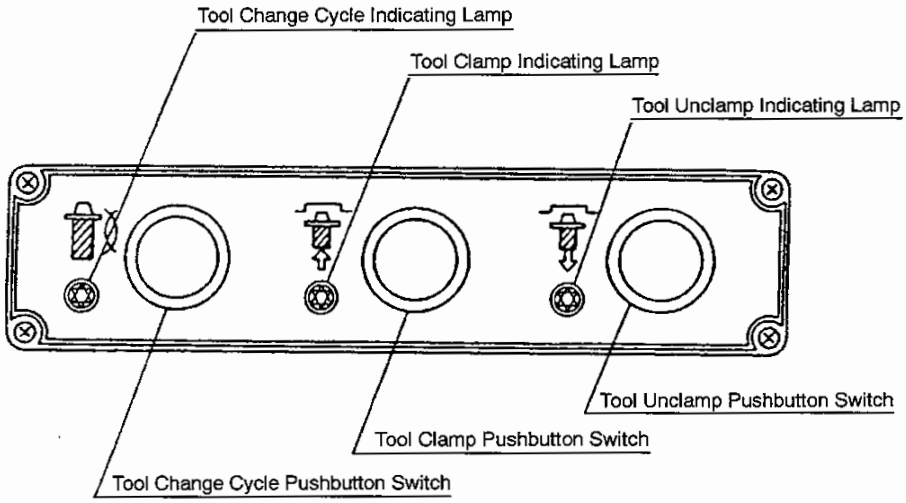


Fig. 1-8 Manual Tool Change Operation Panel (MDB-A/B, MCV-A/B)

5. Magazine Manual Operation Panel

5-1. Magazine Manual Operation Panel (Vertical Machining Centers)

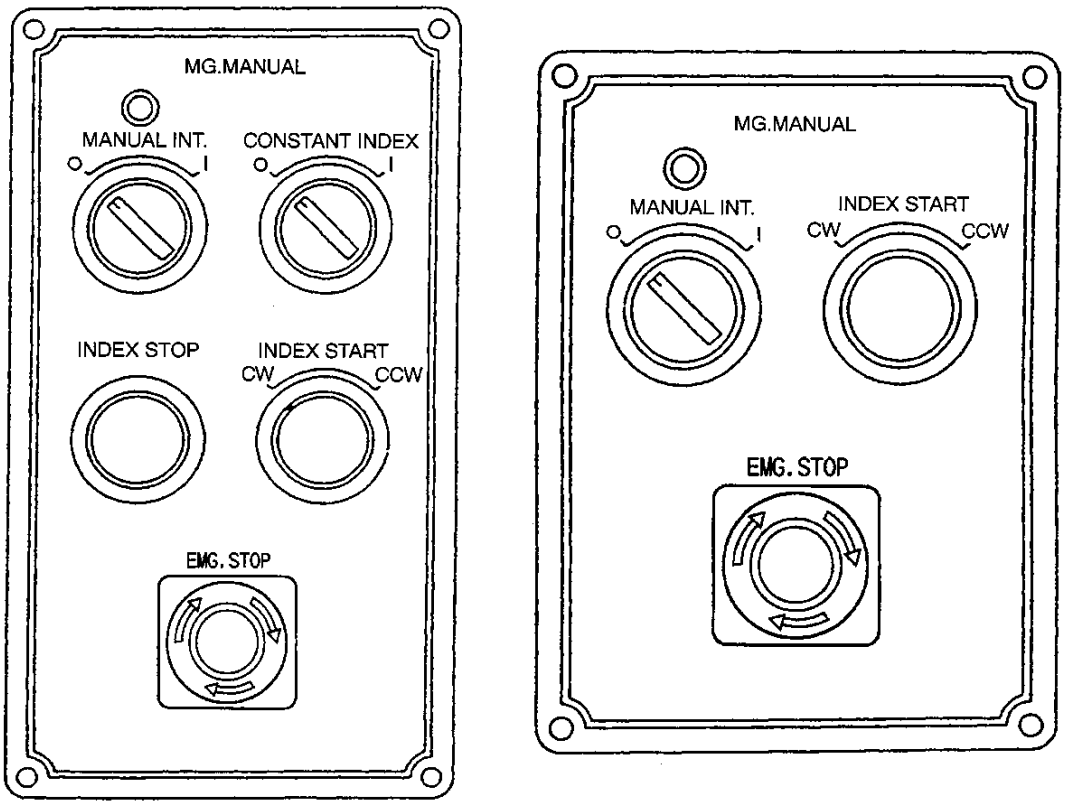


Fig. 1-9 Magazine Manual Operation Panel (Vertical Machining Centers)

5-2. Magazine Manual Operation Panel (Horizontal Machining Centers)

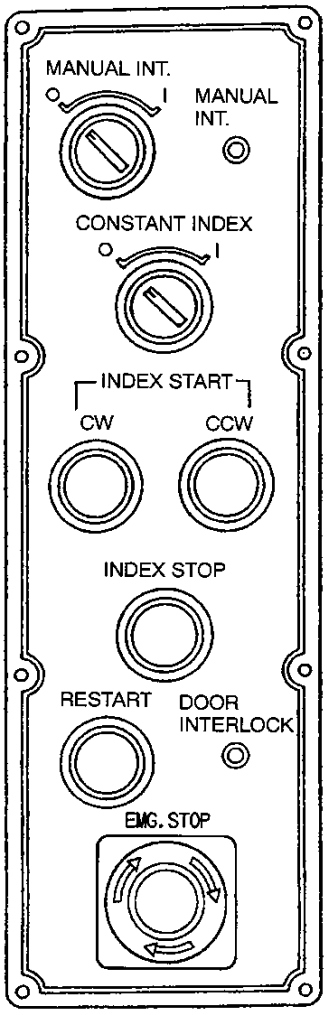


Fig. 1-10 Magazine Manual Operation Panel (Horizontal Machining Centers)

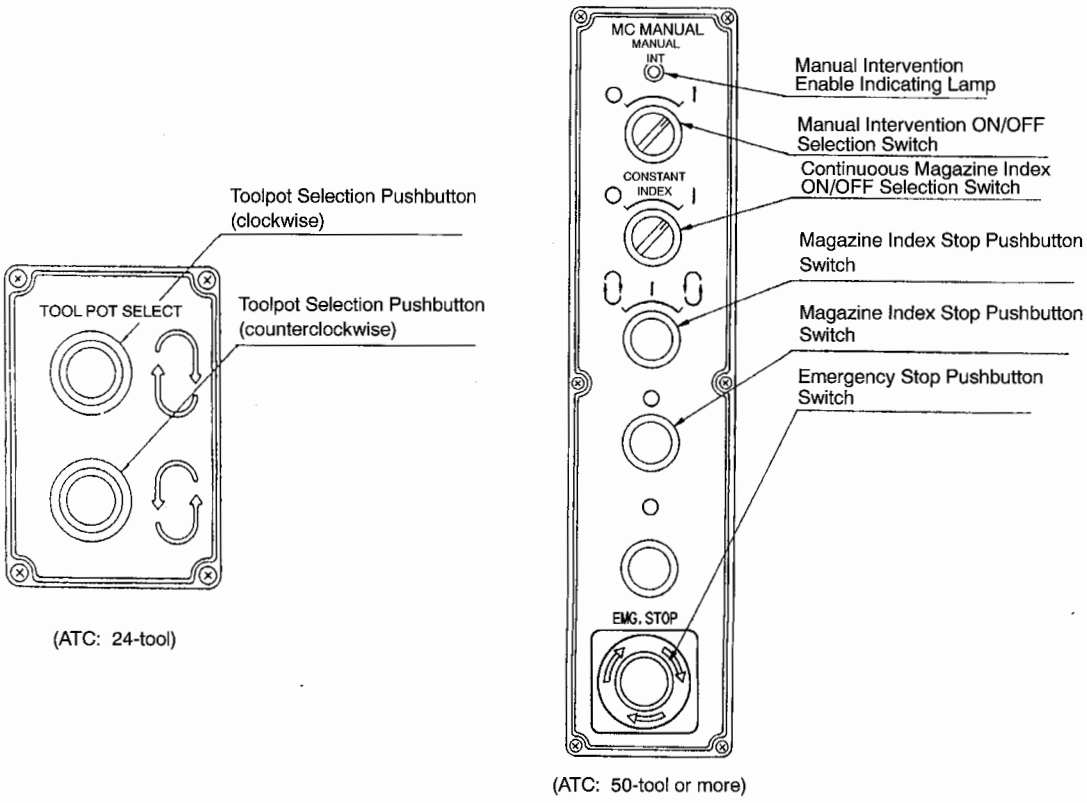


Fig. 4-13 Machine Manual Operation Panel (Double Column)

6. Parallel Type 2-Pallet APC Operation Panel

6-1. Parallel Type 2-Pallet APC Operation Panel (Vertical Machining Centers)

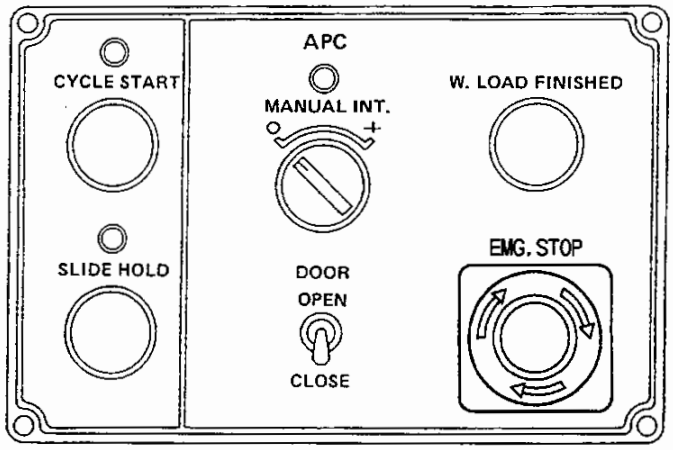


Fig. 1-11 Parallel Type 2-Pallet APC Operation Panel (Vertical Machining Centers)

6-2. Parallel Type 2-Pallet APC Operation Panel (Horizontal Machining Centers)

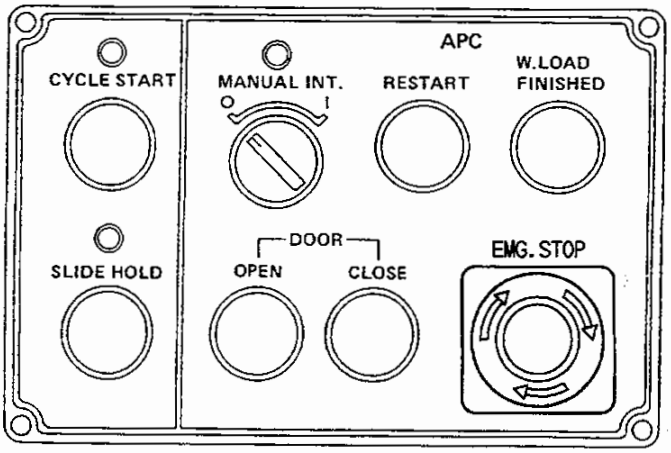


Fig. 1-12 Parallel Type 2-Pallet APC Operation Panel (Horizontal Machining Centers)

7. Rotary Type 2-Pallet APC Operation Panel

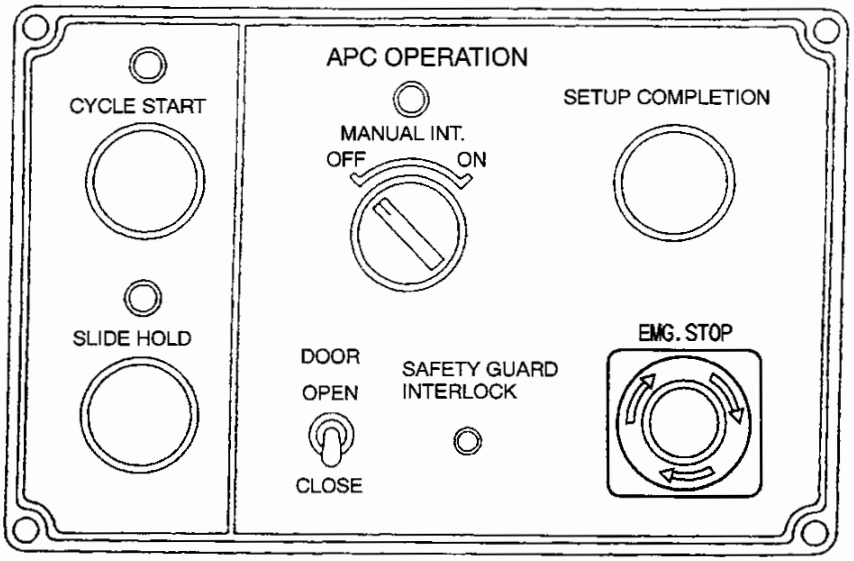


Fig. 1-13 Rotary Type 2-Pallet APC Operation Panel

8. Attachment Operation Panel

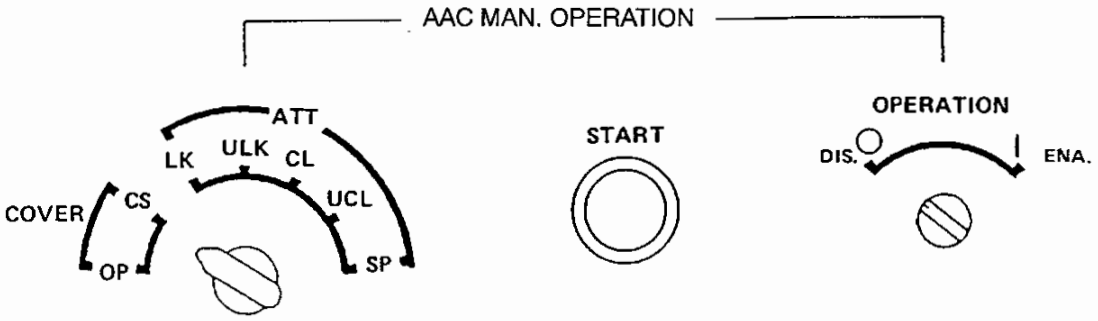


Fig. 1-14 AAC Operation Panel

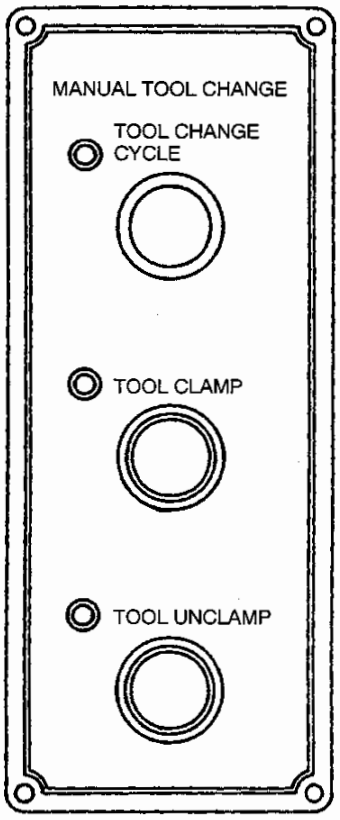


Fig. 1-15 Attachment Manual Tool Change Panel

SECTION 2 TABLES OF COMMAND CODES

1. List of G Codes

Code	Group	Functions	Optional
G00 *3 G01 *3 G02 G03	1	Positioning Linear interpolation Circular interpolation-Helical cutting (CW) Circular interpolation-Helical cutting (CCW)	
G04 *2	2	Dwell	
G05 G06 G07 G08			
G09 *2	18	Exact stop	
G10 *1 G11	3	Cancel of G11 Parallel and rotation shift of coordinate system	○
G12 G13			
G14		Axis name designation/cancel	○
G15 G16 *2	4	Selection of work coordinate system (Modal) Selection of work coordinate system (One-shot)	○
G17 *3 G18 *2 G19 *2	5	Plane selection: XY Plane selection: ZX Plane selection: YZ	
G20 *2 G21 *2	15	Inch input confirmation Metric input confirmation	○
G22 *3 G23 *3	6	Programmable travel limit ON Programmable travel limit cancel	○
G24 G25 G26 G27 G28 G29			

*1 Has already been set when power supply is turned on.
*2 Effective in a specified block.
*3 May be set by an initial condition parameter.

(cont'd)

Code	Group	Functions	Optional
G30 *2	16	Positioning to home position	
G31 *2	17	Skip function	○
G32 G33 G34 G35 G36 G37 G38			
G40 *1 G41 G42	7	Cutter radius compensation cancel Cutter radius compensation, left Cutter Radius compensation, right	
G43 *1 G44	8	Three dimensional compensation cancel Three dimensional compensation ON	○
G45 G46 G47 G48 G49			
G50 *1 G51	9	Enlargement and reduction of geometry cancel Enlargement and reduction of geometry ON	○
G52			
G53 *3 G54 G55 G56 *3 G57 G58 G59	10	Tool length offset cancel Tool length offset, X-axis Tool length offset, Y-axis Tool length offset, Y-axis Tool length offset, 4th-axis Tool length offset, 5th-axis Tool length offset, 6th-axis	
G60	1	One-directional positioning	
G61	14	Exact stop mode	

*1 Has already been set when power supply is turned on.
*2 Effective in a specified block.
*3 May be set by an initial condition parameter.

(cont'd)

Code	Group	Functions	Optional
G62	19	Programmable mirror image function	○
G63			
G64 *1	14	Cutting mode	○
G65 G66			
G67			
G68 G69	24	Cancel of G68 Setting of 3-D coordinate system conversion	○
G70			
G71	11	Fixed cycle, Designation of return level for M53	
G72			
G73 G74	11	Fixed cycle, High speed drilling cycle Fixed cycle, Reverse tapping	
G75			
G76	11	Fixed cycle, Fine boring	
G77 G78 G79			
G80 *1 G81 G82 G83 G84 G85 G86 G87	11	Fixed cycle, Mode cancel Fixed cycle, Drill/spot boring Fixed cycle, Drill/counter boring Fixed cycle, Deep-hole drilling cycle Fixed cycle, Tapping Fixed cycle, Boring Fixed cycle, Boring Fixed cycle, Back boring	
G88			
G89	11	Fixed cycle, Boring	
G90 *3 G91 *3	12	Absolute dimensioning Incremental dimensioning	

*1 Has already been set when power supply is turned on.
*2 Effective in a specified block.
*3 May be set by an initial condition parameter.

(cont'd)

Code	Group	Functions	Optional
G92	20	Setting of work coordinate system	
G93			
G94 *3 G95 *3	13	Feed per min Feed per rev	
G96 G97 G98 G99			
G172	0	3-D arc nearest path	
G173	0	3-D arc farthest path	
G174	77	Cylinder side-face machining OFF	
G175	77	Cylinder side-face machining ON	
G176	71	F-code and S-code ignore CANCEL	
G177	71	F-code and S-code ignore	
G178	0	Threading fixed cycle in the No. 1 axis direction in a plane	
G179	0	Threading fixed cycle in the No. 2 axis direction in a plane	
G180	64	Attachment rotation compensation CANCEL	
G181	64	Attachment rotation compensation facing FRONT	
G182	64	Attachment rotation compensation facing LEFT	
G183	64	Attachment rotation compensation facing REAR	
G184	64	Attachment rotation compensation facing RIGHT	
G185	64	Attachment rotation compensation facing DOWN	
G186	65	Tolerance control mode CANCEL	
G187	65	Tolerance control mode ON	
G188	69	No. 2 tool length offset CANCEL	
G189	69	No. 2 tool length offset ON	
G190	39	Constant G90 mode (absolute) processing	
G191	25	Manual shift amount CANCEL	
G192	67	Top face detection fixed cycle mode CANCEL	
G193	67	Top face detection fixed cycle mode ON	
G194	68	Fixed cycle mode with breakage detection CANCEL	
G195	68	Fixed cycle mode with breakage detection ON	
G196	26	Block call at each sub-program ON	
G197	26	Block call at each sub-program CANCEL	

(cont'd)

Code	Group	Functions	Optional
G198	70	Threading compound fixed cycle in the No. 1 axis direction in a plane	
G199	70	Threading compound fixed cycle in the No. 2 axis direction in a plane	
G256	78	3-D arc projection surface selection	
G274	10	Fixed cycle synchronous tapping reverse tapping cycle	○
G284	10	Fixed cycle synchronous tapping tapping cycle	○

*1 Has already been set when power supply is turned on.

*2 Effective in a specified block.

*3 May be set by an initial condition parameter.

2. List of Mnemonic Codes

Code	Group	Contents	Optional
NOEX	34	Specification of the sequence not executed	
CALL	27	Subprogram, Simple call	
RTS		Subprogram, End code	
MODIN		Subprogram, Call after positioning mode ON	
MODOUT		Subprogram, Call after positioning mode OFF	
GOTO	28	Branch command, Unconditional jump	
IF		Branch command, Conditional jump (6 kinds)	
RTMCR		Macro processing end code (used only in system)	
RTMDI		MDI processing end code (used only in system)	
OMIT	29	Coordinate calculation function, Omit	○
RSTRT		Coordinate calculation function, Restart	
LAA	30	Coordinate calculation function, Line at angle	○
ARC		Coordinate calculation function, Arc	
GRDX		Coordinate calculation function, Grid X	
GRDY		Coordinate calculation function, Grid Y	
DGRDX		Coordinate calculation function, Double grid X	
DGRDY		Coordinate calculation function, Double grid Y	
SQRX		Coordinate calculation function, Square X	
SQRY		Coordinate calculation function, Square Y	
BHC		Coordinate calculation function, Bolt hole circle	
FMILR	31	Area machining, Face milling (Rough)	○
FMILF		Area machining, Face milling (Finish)	
PMIL		Area machining, Pocket milling (Zigzag)	
PMILR		Area machining, Pocket milling (Spiral)	
RMILO		Area machining, Round milling (Out)	
RMILI		Area machining, Round milling (In)	
MSG	35	Message display	○
NMSG		Restoring original display	
NCYL	36	Fixed cycle, No cycle movement	
COPY	39	Copy, initial value of local coordinate system for parallel shift or rotation	○
COPYE		Copy end, Incremental value for parallel shift or rotation of local coordinate system	
CHFC		Arbitrary-angle chamfering	○
CHFR		Arbitrary-angle chamfering (rounding)	

3. List of M Codes

Code	Group	Function Element	Against Axis Movement	Modal/ One-shot	Remarks	Optional
M00	1	Program stop	After	one-shot		
M01		Optional stop	After	one-shot		
M02	18	End of program	After	one-shot		
M30		End of tape	After	one-shot		
M03	2	Spindle CW	At the same time	modal		
M04		Spindle CCW	At the same time	modal		
M05		Spindle stop	After	modal		
M19		Spindle orientation	After	modal		
M06	3	Vertical spindle tool change	After	one-shot		
M77		Horizontal spindle tool change	After	one-shot		
M07	8	Oil mist coolant ON	At the same time	modal		○
M08	10	Coolant pump ON	At the same time	modal		○
M09	24	Coolant system OFF (M07, 08, 12, 50, 51, 59, 120 OFF)	After	modal		○
M10	30	A-axis clamp	After	modal		○
M11		A-axis unclamp	After	modal		
M12	22	Chip air blow ON	At the same time	modal		○
M15	5	Rotary index table CW (4th-axis)	At the same time	modal		
M16		Rotary index table CCW (4th-axis)	At the same time	modal		
M17	7	Swivel head index CCW	At the same time	one-shot	Effective for only the first M73 - M76	
M20	31	B-axis clamp	After	modal		○
M21		B-axis unclamp	After	modal		(Except for MC-H)
M22	32	Y-axis clamp	After	modal		
M23		Y-axis unclamp	After	modal		
M24	33	Z-axis clamp	After	modal		
M25		Z-axis unclamp	After	modal		
M26	35	C-axis clamp	After	modal		○
M27		C-axis unclamp	After	modal		
M32	38	Splash guard door close	At the same time	modal		○
M33		Splash guard door open	At the same time	modal		

(cont'd)

Code	Group	Function Element	Against Axis Movement	Modal/ One-shot	Remarks	Optional
M40	11	High/middle-high/middle-low/low range	At the same time	modal	Spindle gears are automatically determined by RPM command.	
M41		High/middle-high/middle-low range	At the same time	modal		
M42		High/middle-high range	At the same time	modal		
M43		High range	At the same time	modal		
M44		AAC (F) next attachment clear	At the same time	one-shot	F: Floor type T: Table type	○
M45		AAC (F) change preparation	At the same time	one-shot		
M46		AAC (F) no next attachment	At the same time	one-shot		
M47		AAC (T) no next attachment	At the same time	one-shot		
M48		AAC (T) next attachment clear	At the same time	one-shot		
M49		AAC (T) change preparation	At the same time	one-shot		
M50	23	Through-the-tool coolant, low pressure ON	At the same time	modal		○
M51		Through-the-tool coolant, high pressure ON	At the same time	modal		
M52	12	Return level in fixed cycle: upper limit	At the same time	one-shot		
M53	13	Return level in fixed cycle: specified level	At the same time	modal		
M54		Return level in fixed cycle: R level	At the same time	modal		
M57	34	W-axis clamp	After	modal		○
M58		W-axis unclamp	After	modal		
M59	25	Chip air blow ON	At the same time	modal		○
M60	4	Pallet change cycle	After	one-shot		○
M62		Vertical spindle tool change preparation	After	modal		○
M68		Vertical spindle tool clamp	After	modal		
M69		Vertical spindle tool unclamp	After	modal		
M63	21	No next tool in automatic tool change cycle	At the same time	one-shot		
M64		Next tool return cycle	At the same time	one-shot		
M65		ATC ready	At the same time	one-shot		

(cont'd)

Code	Group	Function Element	Against Axis Movement	Modal/ One-shot	Remarks	Optional
M66	14	Continuous tool change between vertical and horizontal spindle (same tool)	At the same time	one-shot		
M67		Continuous tool change between vertical and horizontal spindle (different tool)	At the same time	one-shot		
M70	3	Manual tool change	After	one-shot		○
M71		Attachment manual tool change	After	one-shot		○
M72		Horizontal spindle tool change preparation	After	modal		
M78		Horizontal spindle tool clamp	After	modal		
M79		Horizontal spindle tool unclamp	After	modal		
M73	15	Swivel head, front position	After	one-shot		○
M74		Swivel head, left position	After	one-shot		
M75		Swivel head, back position	After	one-shot		
M76		Swivel head, right position	After	one-shot		
M81	27	Automatic W-axis positioning 1	After	one-shot		○
M82		Automatic W-axis positioning 2	After	one-shot		
M83		Automatic W-axis positioning 3	After	one-shot		
M84		Automatic W-axis positioning 4	After	one-shot		
M85		Automatic W-axis positioning 5	After	one-shot		
M87		Oil mist/Air blow ON	At the same time	one-shot	Effective for M90, 91 and 98	○
M88		Dust collector ON	At the same time	modal		○
M89		Dust collector OFF	At the same time	modal		
M90		Vertical spindle oil mist cycle mode ON	At the same time	modal		
M98		Horizontal spindle oil mist cycle mode ON	At the same time	modal		
M91		Tap-drill hole chip air blow cycle mode ON	At the same time	modal	Turned OFF by M09	○

(cont'd)

Code	Group	Function Element	Against Axis Movement	Modal/ One-shot	Remarks	Optional
M101	4	Pallet selection 1	After	one-shot		○
M102		Pallet selection 2	After	one-shot		
M103		Pallet selection 3	After	one-shot		
M104		Pallet selection 4	After	one-shot		
M105		Pallet selection 5	After	one-shot		
M106		Pallet selection 6	After	one-shot		
M107		Pallet selection 7	After	one-shot		
M108		Pallet selection 8	After	one-shot		
M109		Pallet selection 9	After	one-shot		
M110		Pallet selection 10	After	one-shot		
M111		Pallet selection 11	After	one-shot		
M112		Pallet selection 12	After	one-shot		
M115	6	5th axis-rotary table forward	At the same time	modal		○
M116		5th axis-rotary table reverse	At the same time	modal		
M118		Spindle orientation (reverse)	After	modal		
M119		Spindle orientation (reverse/forward)	After	modal		
M120		Shower coolant ON	At the same time	modal		○
M130	9	Spindle rotation condition for cutting feed OFF	At the same time	modal		
M131		Spindle rotation condition for cutting feed ON	At the same time	modal		
M132	37	Single block ineffective	At the same time	modal		
M133		Single block effective	At the same time	modal		
M134	16	Spindle speed override ineffective	At the same time	modal		
M135		Spindle speed override effective	At the same time	modal		
M136	17	Feedrate override ineffective	At the same time	modal		
M137		Feedrate override effective	At the same time	modal		
M138	36	Dry run ineffective	At the same time	modal		
M139		Dry run effective	At the same time	modal		
M140	39	Slide hold ineffective	At the same time	modal		
M141		Slide hold effective	At the same time	modal		

(cont'd)

Code	Group	Function Element	Against Axis Movement	Modal/ One-shot	Remarks	Optional
M142		Spindle overload detection ineffective	At the same time	modal		○
M143		Spindle overload detection effective	At the same time	modal		
M144	19	Touch sensor advance	After	modal		○
M145		Touch sensor retraction	After	modal		
M150	28	Coolant group specification-vertical spindle	At the same time	modal		○
M151		Coolant group specification-horizontal spindle	At the same time	modal		
M152		Coolant group specification-3rd group	At the same time	modal		
M153		Coolant group specification-4th group	At the same time	modal		
M154	20	Sensor air blow OFF	After	modal		○
M155		Sensor air blow ON	At the same time	modal		
M157		AAC (2 st.) no next tool	After	one-shot		○
M158		AAC (2 st.) next tool clear	After	one-shot		
M159		AAC (2 st.) attachment preparation	After	one-shot		
M160	4	Pallet loading command at PPC ON				○
M161		Pallet unloading command at PPC ON				
M163		Long tool-no next tool	At the same time	one-shot		○
M165		Long tool-tool change preparation	At the same time	one-shot	Safety cover specification for next tool	

(cont'd)

Code	Group	Function Element	Against Axis Movement	Modal/ One-shot	Remarks	Optional
M172	3	Long tool-tool change-command	After	one-shot		○
M166		ATC active tool return mode specification	At the same time	one-shot		○
M170	3	AAC (F) attachment change	After	one-shot	F: Floor type T: Table type	○
M171		AAC (T) attachment change	After	one-shot		
M173		AAC (2 st.) attachment change command	After	one-shot		○
M176		Dust collection mode-sir blow	At the same time	one-shot		○
M178	4	Dust collection mode-ON	At the same time	modal		○
M179		Dust collection mode-OFF	At the same time	modal		
M177	3	Angular attachment tool change	After	one-shot	AT-ATC	○
M181	38	External M signal	At the same time	one-shot		○
M182		External M signal	At the same time	one-shot		
M183		External M signal	At the same time	one-shot		
M184		External M signal	At the same time	one-shot		
M185		External M signal	At the same time	one-shot		
M186		External M signal	At the same time	one-shot		○
M187		External M signal	At the same time	one-shot		
M188		External M signal	At the same time	one-shot		
M190		Automatic W-axis positioning 1	After	one-shot	For automatic W-axis positioning 10 points specification	○
M191		Automatic W-axis positioning 2	After	one-shot		
M192		Automatic W-axis positioning 3	After	one-shot		
M193		Automatic W-axis positioning 4	After	one-shot		
M194		Automatic W-axis positioning 5	After	one-shot		
M195		Automatic W-axis positioning 6	After	one-shot		
M196		Automatic W-axis positioning 7	After	one-shot		
M197		Automatic W-axis positioning 8	After	one-shot		
M198		Automatic W-axis positioning 9	After	one-shot		
M199		Automatic W-axis positioning 10	After	one-shot		

(cont'd)

Code	Group	Function Element	Against Axis Movement	Modal/ One-shot	Remarks	Optional
M234	50	Synchronized tapping gear selection range command (gear determined according to available spindle speeds in each gear range)				
M235	50	Synchronized tapping gear selection range command (spindle speeds in the 1st gear range are covered by 2nd gear range)				
M236	50	Synchronized tapping gear selection range command (spindle speeds in the 1st and 2nd gear ranges are covered by 3rd gear range)				
M237	50	Synchronized tapping gear selection range command (entire speeds are covered by 4th gear range)				
M238	39	Soft override DISABLED				
M239	39	Soft override ENABLED				
M292	44	Threading fixed cycle chamfering ON				○
M293	44	Threading fixed cycle chamfering OFF				○
M294	43	Compound fixed cycle cutting pattern 1				○
M295	43	Compound fixed cycle cutting pattern 2				○
M296	43	Compound fixed cycle cutting pattern 3				○
M323	2	MC500/600H APC/ATC simultaneous operating M-code				
M326	51	Synchronized tapping torque monitoring DISABLED				
M327	51	Synchronized tapping torque monitoring ENABLED				
M331	56	6th axis rotary table FORWARD				
M332	56	6th axis rotary table REVERSE				
M396	49	Synchronized tapping 1-speed gear indexing				

LIST OF PUBLICATIONS

Publication No.	Date	Edition
4203-E	April 1998	1st

This manual may be at variance with the actual product due to specification or design changes.
Please also note that specifications are subject to change without notice.
If you require clarification or further explanation of any point in this manual, please contact your OKUMA representative.