CNC SYSTEMS

OSP500L-G
OSP5000L-G

OPERATION MANUAL (4th Edition)

OKUMA

Your single source for machine & control

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TABLE OF CONTENTS

PAGE

PAGE

Note: To avoid any confusion over the use of the letter "O (oh)" and figure "0 (zero)" in this manual, the numerical value "0 (zero)" is expressed as "Ø" if there is any possibility of misunderstanding.

SECTION 1 OUTLINE

The OSP5ØØ/5ØØØL-G is a high performance numerical control system in which the basic and effective functions available with OSP2ØØØ/3ØØØL series controllers of world renown, have been further up-graded. In addition, it features many new functions for easier operation and maintenance.

(1) Improved Operativeness

The control has a 12-inch CRT (9-inch CRT for OSP5ØØL-G) as a standard feature. Function keys are assigned with respective functions available in the selected operation mode, and the CRT shows the available functions for each function key, thereby eliminating complicated operation procedure. Actual position data, part program data, error messages and other various information are shown on the CRT for correct easy operation.

(2) Improved System Extensibility and Versatility - Never Obsolete

Functions available with OSP2ØØØ/3ØØØL series controllers, such as automatic programming functions (LAP/MAP), tool nose radius compensation function, simultaneous 4-axis control and, user task are all extended. The system configuration also permits easy future functional extension through adding software and hardware such as graphic data processing function, and DNC communication. The control is, therefore, never obsolete.

(3) Adoption of Multitask System

With the multitask system, tape editing can be performed during machine operation; down time is minimized.

(4) Highly Reliable and Easy for Maintenance

Both electrical circuit boards and the control circuitry are housed in a single enclosure provided at the back of the machine.

The computer section uses LSIs to minimize the number of component parts; along with the fully enclosed construction, this feature assures high reliability.

Extended self-diagnostic function, with detailed CRT display of diagnosed results. The operator can readily locate the cause of trouble for easy maintenance work.

SECTION 2 SPECIFICATIONS

2-1. OSP5ØØ/5ØØØL-G SPECIFICATIONS

Basic Functions

o: Standard
△: Optional

Item	Description	
Control	X, Z simultaneous 2-axis control; (Simultaneous 4-axis control for 2S*) Linear and circular interpolation * Not applicable for OSP5ØØL-G.	o
Position detection	OSP absolute position encoder (no reference zero return required)	o
Tape format	Metric system: N4, G2, X±5.3, Z±5.3, I±5.3, K±5.3, F5.3, P4, S4, T4, M2	o
	Inch system: N4, G2, X±4.4, Z±4.4, I±4.4, K±4.4, F4.4, P4, S4, T4, M2	
Tape reader	Photoelectric bi-directional tape reader, 2ØØ characters/sec.	o
Programming	Combined use of absolute/incremental programming; ISO (R84Ø) or EIA (RS-244A) codes	o
Minimum input increment	Metric system: 1 μm for both X- and Z-axis Inch system: Ø.ØØØ1 in. for both X- and Z-axis	o
Maximum input dimension	±99999.999 mm (8-digit decimal number)	o
Input unit setting	"mm", "1Ø μm" and "1 μm" ("in." and "Ø.ØØØ1 in." for inch system) units can be set as desired by parameter. The decimal point indicates the following units:	o
mm unit (in. unit)	mm (in.)	
1Ø μm unit	1Ø μm	
1 μm unit (Ø.ØØØ1 in. unit)	1 μm (Ø.ØØØ1 in.)	
Inch/Metric switchable	Inch or metric system can be set by parameter	△

o: Standard
: Optional

Item	Description	
Decimal point data input	Data with a decimal point can be entered for any input unit system; mm, 1Ø μm, 1 μm.	o
Feed function		
Rapid traverse	X-axis: Max. 56 m/min Z-axis: Max. 56 m/min with automatic acceleration/deceleration	o
	Differs depending on the machine model.	
	See individual machine operation manuals.	
Cutting feedrate	X-axis: Max. 56 m/min Z-axis: Max. 56 m/min F-code mm/rev. direct feedrate command	o
	Differs depending on the machine model.	
	See individual machine operation manuals.	
Override	Feedrate override from Ø to 2ØØ% Used also for jog feedrate change	o
Dwell	Ø.Ø1 to 99999.99 sec.	o
Tool function		o
Tool selection (Depends on machine specifications)	"A" turret: Max. 12 stations, Ø1 to 12 1st and 2nd digits following address T	
	"B" turret: Max. 8 stations, Ø1 to Ø8 1st and 2nd digits following address T	
Tool offset selection	32 pairs for "A" and "B" turrets, each Max. offset value: ±99999.999 mm	
Automatic tool offset calculation	Tool offset automatically calculated through direct entry of measured values or tool wear amount	

o: Standard
△: Optional

Item	Description	
Spindle DC motor drive Spindle VAC motor drive		o
Direct spindle rpm command	4-digit S command	
Constant cutting speed control	Maintaining at specified cutting speeds	
Spindle speed override	In 5Ø to 2ØØ% range	
Max. spindle speed limitation	To set the maximum rpm limit	
Manual functions	Spindle jog/CW/CCW, Tool index, Coolant ON/OFF, Manual X- and Z-axis jog feed, Spindle speed selection, Manual pulse feed handwheel in magnifications (x1, x1Ø, x5Ø)	o
Miscellaneous functions	Single block, Machine lock, Block delete, Optional stop, Dry run, Independent A/B turret operation (for 2S), Overtravel release, etc.	o
Display function		
CRT display	Actual position, Program, Block data, Check, Alarm, Operation guide displayed on screen	o
Status indication	Operation conditions monitored by six lamps	o
Graphic display	Display of tool path and animated tool movements	△
Memory mode operation	Part progam data are stored in the memory and machine operation is controlled by the stored program; 3Ø meter tape length (12ØØØ characters) [Storage capacity extensible up to 1Ø24Ø meter tape length (optional) Up to 384Ø m for OSP5ØØL-G]	o
Multi-task processing	Tape store, edit, and punchout while machining	o
Self-diagnostic function	Program, operation, machine and control system are constantly self checked.	o

Operation Functions

o: Standard
△: Optional

Item	Description	
Program selection	Selects one of the stored programs. Selection by cursor from directory page possible	o
Sequence number search	Cursor advances to a specified sequence in the selected program.	o
Sequence restart	Restarts from the beginning of an interrupted sequence.	o
Mid-auto manual mode & auto restart	Interrupts automatic operation for manual operation. Return to interrupted position automatically.	o
Schedule operation	Scheduled sequential running of stored multiple programs	o
Data setting	Zero offset, Tool offset, Tool interference barrier (for 2S), Travel limit, Chuck barrier, Droop control, and other data	o
Program operation		
Edit function	Screen editor simplifies program editing on the CRT	o
Edit auxiliary function	Tape read/verification, output of part program, sequence No. arrangement, file protection, dating, display of lists, deletion of specified file	o
Tape storage capacity	60 m, 160 m, 320 m, 640 m, 1280 m, 2560 m, 3840 m, 5120 m, 6400 m, 7680 m, 8960 m and 10240 m (up to 3840 m for OSP500L-G)	△
One part program capacity	60 m, 160 m, 320 m and 640 m	△
Interactive color graphic manual data input function (IGF)	Easy to input programs directly from drawings in front of the OSP5000L-G	△

Programming Functions

o: Standard
△: Optional

Item	Description	
Mirror image	Functions to simplify programming for 2-turret models	o
Programmed feedrate command	mm/min. (IPM) or mm/rev. (IPR) selection by G codes	o
Programmed zero offset command	Zero offset by G codes	o
Arc radius direct program function	Circular interpolation by commanding radius (L) and arc end point (X/Z)	o
Taper angle direct program function	Linear interpolation by commanding the angle from the Z-axis and the end point (X or Z)	o
Automatic chamfering	Chamfering (straight or arc) by simple commands	o
Thread cutting function Thread lead	Ø.ØØ1 to 1ØØØ.ØØ mm (Thread lead of less than Ø.ØØ1 mm is programmable.)	o
Command of number of threads	Specify number of threads by J codes. Actual thread lead is F/J. J word other than integer is programmable.	o
Fixed thread cutting cycle	G33: Longitudinal fixed thread cutting	o
	G32: Transverse fixed thread cutting	
	Straight, taper and variable lead thread cutting	
	M23: Chamfering ON M22: Chamfering OFF (Chamfering amount programmable)	
	Shift of threading path straight point	
	Feed hold during thread cutting	
Non-fixed thread cutting cycle	G34, G35	o

o: Standard
: Optional

Item	Description	
Special fixed cycle		o
Thread cutting cycle	Creates several G32 or G33 paths in one block.	
Grooving cycle	Grooving cycle program in one sequence	
Drilling cycle	Drilling cycle program in one sequence	
Tool nose radius compensation 2B	Automatic correction of tool nose radius errors on any straight/curved cuts	△
Lathe auto-programming function (LAP3)	Allows roughing and finishing cycles in bar and copy turning from final work piece dimensions.	△
	Allows both longitudinal and face cutting. Allows cutting condition changes during roughing.	
	Allows various pattern of thread cutting cycles: cutting on one side of the tool, zigzag infeeding, constant stock removal.	
User task 1	For GOTO and IF statements, arithmetic operations, extensive address characters, common variables, local variables and system variables	o
User task 2		△
Subprograms	CALL, RTS, MODIN and MODOUT statements	
Math-function	Trigonometric functions and logical operations	△
I/O variables	Variables related with input/output usable	△
READ/WRITE statement	Communication possible from part program to external device using RS232C interface	△

Automation, Peripheral Functions

o: Standard
: Optional

Item	Description	
Data input/output functions		
Tape punch/print interface (cable length ... 3 m)	FACIT punch (FACIT interface)	△
	FACIT punch (RS232C)	△
	Okuma punch/printer PP-5ØØ1, PP-5ØØ2 (RS232C)	△
	Citizen protyper 7652 (RS232C)	△
	Casio typuter 65ØNC (RS232C)	△
	Tanaka business PT-3ØRS, T-3ØRP (RS232C) FANUC-PPR (RS232C) Kyoritsu KTP8Ø5Ø, KTP825Ø (RS232C) JBM PR-3Ø (RS232C)	△
Tape punch/printer	FACIT punch (FACIT interface)	△
	FACIT punch (RS232C)	△
	Citizen protyper 7652 (RS232C)	△
	Casio typuter 65ØNC (RS232C)	△
Portable floppy disk drive	Floppy disk drive interface	△
	Cable connector (RS232C)	△
	Floppy disk drive (8" disk)	△
Automation, peripheral functions (1)		
Automatic chuck open/close	Automatic chuck open/close control by M codes (with chuck gripping confirmation)	△
Chuck high/low clamp pressure selection	Chucking pressure selection, high/low, by M codes	△
Automatic tailstock quill advance/retract	Automatic tailstock quill advance/retract control by M codes	△

o: Standard
△: Optional

Item	Description	
Automation, peripheral functions (1)		△
Tailstock quill high/low thrust selection	Tailstock quill high/low thrust selection control by M codes	
Automatic front door open/close	Automatic front door open/close control by M codes	△
Air blower function	Air blow control by M codes To chuck (and tailstock quill)	△
Operation end lamp	Turns on when MØ2, MØØ or MØ1 is executed.	△
Alarm lamp	Turns on when alarm takes place.	△
Hour meter	Accumulates time in which the NC has been operated in the MØ3/MØ4 mode (spindle rotation).	△
Work counter	Number of MØ2 code execution is counted. (Cycle stop possible at a predetermined number)	△
Tool life management	Auto tool indexing by counted workpieces or cutting time	△
Overload detection	Overload condition is detected using the X and Z axis drive motor current. At the detection of overload, the control is alarm-stopped.	△
Spindle orientation	Spindle orientation by M code (Pin-type, brake-type, electric-type)	△
NC operation monitor	Accumulation of cutting hour, running hour, spindle running; NC work count	△
Automatic index of index chuck	By M codes	△
Load monitor	Monitors spindle, feed axis and rotary tool axis	△

o: Standard
△: Optional

Item	Description	
Automation, peripheral functions (2) Functions to meet users' needs and machine spec.	Cycle time reduction function Simultaneous initiation of axis motion with spindle start/stop Simultaneous initiation of axis motion with turret index	△
	Programmable tailstock	△
	Lubrication monitor	△
	Bar feeder interface	△
	Loader interface	△
	Robot interface	△
	Work gauging function	△
	Tool gauging function	△
	DNC hook-up (DNC-A, DNC-B, DNC-C)	△

SECTION 3 OPERATION

Prior to the detailed explanation on respective operations, the section contents is outlined as follows:

Machine operation procedures are classified into three categories: "Manual Operation", "MDI Operation", and "Automatic Operation".

As preliminary steps for machine operations, reference zero setting, tool data setting, programming and parameter setting are necessary.

Each operation includes various procedures. A description of these might complicate the explanation. The following order has been adopted to provide you with a clear concept of the operation.

- Basic Construction of Operation Panels
- Outline of Controls on Operation Panels
- Fundamental Machine Operation Procedure

This section is intended to provide familiarization with the fundamental functions and operation procedures of the control. Section 4 is reserved for advanced operations and detailed information.

An outline of key operations to access to the desired operation mode is provided on the following pages.

Key	Command and Function	CRT Display

AUTO / MDI / MANUAL

- **F1** PROGRAM SELECT — Used to select a part program for a desired cutting operation (in auto mode).
  - DATA INPUT — Press [F1] key when entering data (in MDI mode).
- **F2** ACTUAL POSIT — Used to display coordinates of the actual position.
  - Display of the actual position data in enlarged characters
  - Simultaneous display of the actual position data and program
  - Actual position diaplay with display of machine status and load condition
  - Simultaneous display of the remaining axis motion and actual position data
- **F3** PART PROGRAM — Used to display a part program.
  - Display of the program for the currently selected turret, A or B
  - Simultaneous display of part program for both turrets, A and B
  - Display of the data entered through the keyboard in MDI mode
  - Display of schedule program
- **F4** BLOCK DATA — Used to display the data in one block.
  - Display of the data in the block currently in execution
  - Display of the data in the block to be executed next
  - Display of the data in the block succeeding the next block
  - Display of the data in the block last stored in the buffer register
- **F6** TOOL LAYOUT — Used to display the data of tools to be used.
  - F1 LAYOUT EXEC. — Beginning of display of data of tools to be used
  - F7 LAYOUT QUIT — End of display of data of tools to be used
- **F7** CHECK DATA — Used to display various check data.
  - Status display of special data
  - Display of the data related to axes (X, Z)
  - Display of the data related to axes (C)*
  - Status display of EC input signals (No. 1)
  - Status display of EC input signals (No. 2)
  - Status display of extended EC input signals (No. 1)*
  - Status display of extended EC input signals (No. 2)*
  - Status display of EC output signals (No. 1)
  - Status display of EC output signals (No. 2)
  - Status display of extended EC output signals (No. 1)*
  - Status display of extended EC output signals (No. 2)*
  - Status display of machine operation panel input signals (No. 1)
  - Status display of machine operation panel input signals (No. 2)
  - Status display of machine operation panel input signals (No. 3)
  - Status display of machine operation panel output signals (No. 1)
  - Status display of machine operation panel output signals (No. 2)
  - Status display of machine operation panel output signals (No. 3)
  - Display of specification codes (No. 1)
  - Display of specification codes (No. 2)
  - Display of machine model codes
  - Display of machine specification codes
  - Alarm message list
  - Display of ATC input signals*
  - Display of ATC output signals*
  - Display of ATC data*
  - Display of in-process gauging data*
  - Display of post-process gauging data*
- **F8** EXTEND — <Extensive Function>
  - (in MDI and manual mode) — (B)
  - (in auto mode) — (A)

(A) (B)

* Optional

Key	Command and Function		CRT Display
		(A) (B)	
F1	NUMBER SEARCH	Search of the specified block of the part program currently selected by turret selection (also possible by locating the cursor)	
F2	RESTART	Search of the specified block of the part program currently selected; the data up to that block are all read	
F4	SP SELECT	Used to select a scheduled program.	
F5	SP-N SEARCH	Search of the specified block in the schedule program	
F8	EXTEND	<Extensive Function>	

Key	Command	Function	Sub-key	Sub-command	Sub-function
F1	STD GRAPHIC	Used for selecting the standard graphic display.			
F2	EXT GRAPHIC	Used for selecting the enlarged graphic display.			
F3	NORMAL SCALE	Used for setting the scaling on the standard graphic display.	F1	AUTO SCALE	Used for setting the scaling automatically matching the program.
			F2	SCALE SET	Used for setting required scaling.
			F7	SCALE QUIT	Used for ending normal scaling setting.
F4	ENLARGE SCALE	Used for setting the scaling on the enlarged graphic display.	F1	FRAME ENLARGE	Used for enlarging frame.
			F2	FRAME REDUCE	Used for contracting frame.
			F7	SCALE QUIT	Used for ending enlarge scaling setting.
F5	TRACE/ANIMATE	Used for selecting the tool path/animation display.			
F6	MATERIAL	Used for displaying blank material, chuck and tailstock.			
F7	CLEAR	Used for clearing the display.			
F8	EXTEND	<Extensive Function>			

* Optional

Key	Command and Function	CRT Display

ZERO SET

- F1 SET — Used to set new data.
- F2 ADD — Used to add the data to the currently stored data.
- F3 CAL — Used to initiate calculation so that the entered data will be the solution.

TOOL DATA

- F2 ADD — Used to add the data to the currently stored data.
- F3 CONST. ADD — Used to add parameter set data.
- F4 CONST. SUB — Used to subtract parameter set data.
- F5 GUIDE ON/OFF — Used to turn on and off graphic guide message.*
- F6 ITEM↑ / F7 ITEM↓ — Used to change the setting relating to tool data.
  - With tool offset display selected, tool offset/tool nose radius compensation data can be set and changed.
    - Display of tool offset/tool nose radius compensation sation data No. 1 - No. 12
    - Display of tool offset/tool nose radius compensation data No. 13 - No. 24
    - Display of tool offset/tool nose radius compensation data No. 25 - No. 32
  - With tool interference data display selected, tool offset data can be set and changed (not available for the graphic specification).
  - Tool shape selection*
  - Display of tool life management data (tool information table A)*
  - Display of tool life management data (tool information table B)*
  - Display of tool life management data (tool information table C)
  - Display of tool group data*
  - Display of post-process gauging result*
  - Setting and display of ATC tool data
- F8 EXTEND — <Extensive Function>
  - F1 SET — Used for setting new data.
  - F2
  - F3 CAL — Used to initiate calculation so that the entered data will be the solution.
  - F4 GAUGE CAL — Available only for gauging specification*
  - F5 GUIDE ON/OFF — Used to turn on and off graphic guide message.
  - F6 ITEM↑ / F7 ITEM↓ — Used to change the setting relating to tool data.
  - F8 EXTEND — <Extensive Function>

EDIT AUX

- F1 DATE — Used to enter and display the date when preparing a file or other data.
- F2 DIR — Used to display the contents of the file stored in the memory.
- F3 PIP — Used to transfer the file data.
  - F1 READ — Part program on a paper tape is stored in the memory and the file is prepared accordingly.
  - F2 PUNCH — Part programs stored in the memory are punched on paper tape.
  - F3 VERIFY — Contents of the part program on paper tape and those stored in the memory are compared.
  - F4 COPY — The file already stored in the memory is duplicated.
  - F7 PIP QUIT — Used to terminate the file data transfer operation.
- F4 EDIT — Used to edit the data in one file.
  - F1 FIND — Advances or returns the edit pointer by the specified number of lines; searches the specified character-string.
  - F2 LINE ERASE — Blanks the line designated by the edit pointer.
  - F3 LINE DELETE — Deletes the line designated by the edit pointer.
  - F4 CHAR. DELETE — Deletes the character designated by the edit pointer.
  - F5 LINE INSERT — Inserts a blank line just before the line designated by the edit pointer.
  - F6 CHAR. INSERT — Inserts a space just before the character designated by the edit pointer.
  - F7 EDIT QUIT — Terminates the file data edit operation.
  - F8 [EXTEND] — <Extensive Function> → (D)
- F5 FREE — Used to display the remaining capacity of the memory.
- F6 LIST — Used to display the contents of the active file.
- F7 IGF — Available only for IGF specification*
- F8 EXTEND — <Extensive Function> → (C)

(C) (D)

* Optional

Key | Command and Function | CRT Display

(C)

- F1 TIME — Used for entry and display of the time.
- F2 INIT — Used to initialize the memory.
- F3 DELETE — Used to delete the specified file data.
- F4 RENAME — Used to substitute the name of the specified file with another specified file name.
- F5 PROTECT — Used to protect the designated file.
- F8 EXTEND — <Extensive Function>
  - F1 TAPE CONVERT — Available only for conversion specification*
  - F5 DATA PIP — Used for data communications with peripheral equipment.*
    - F1 INPUT — Reads program data from peripherals and creates files.
    - F2 OUTPUT — Outputs program data in memory to peripherals.
    - F3 VERIFY — Compares program data sent from peripherals with data in memory.
    - F7 PIP QUIT — Terminates communucations.
  - F8 EXTEND — <Extensive Function>

(D)

- F1 FIND — The function identical to [F1] (FIND) explained above.
- F2 CHANGE — Replaces the specified character-string with another specified character-string.
- F3 DELETE — Deletes lines; the number can be specified.
- F4 COPY — Copies the data in the specified number of lines to the other area.
- F5 MOVE — Transfers the data in the specified number of lines to the other area and deletes that data.
- F6 EXTRACT — Inserts the data in the other area just before the edit pointer.
- F7 SEQ. NO. ARRANGE — Reassign sequence numbers in the order.
- F8 [EXTEND] — <Extensive Function>

PARAMETER

- F1 SET — Used to set a new data.
- F2 ADD — Used to add the data to the currently stored data.
- F3 CAL — Used to initiate calculation so that the entered data will be the solution.
- F6 ITEM↑ — Used to select parameter contents.
- F7 ITEM↓ — Used to select parameter contents.
  - For setting and/or changing variable stroke limit and droop data
  - For setting and/or changing chuck/tailstock barrier
  - For setting and/or changing common parameter data
  - For setting and/or changing work counter data
  - For setting and/or changing travel end limit, backlash data
  - For setting and/or changing optional parameter (long word) data
  - For setting and/or changing optional parameter (word) data
  - For setting and/or changing optional parameter (bit) data
  - For setting and/or changing spindle orientation position data*
  - For setting and/or changing counter data for gauging function*
  - For setting and/or changing tool interference parameters (available for the graphic specification)*

* Optional

3-1. BASIC CONSTRUCTION OF OPERATION PANELS

The operation panel mainly consists of three panels:

(1) NC Operation Panel (Common Panel)

The NC operation panel is used on all models.

Equipped with a 12-inch CRT (9-inch CRT for OSP5ØØL-G) it is used for all NC operations other than manual.

(2) Machine Operation Panel

The machine operation panel, made for each respective machine model, mainly holds the controls for manual operation.

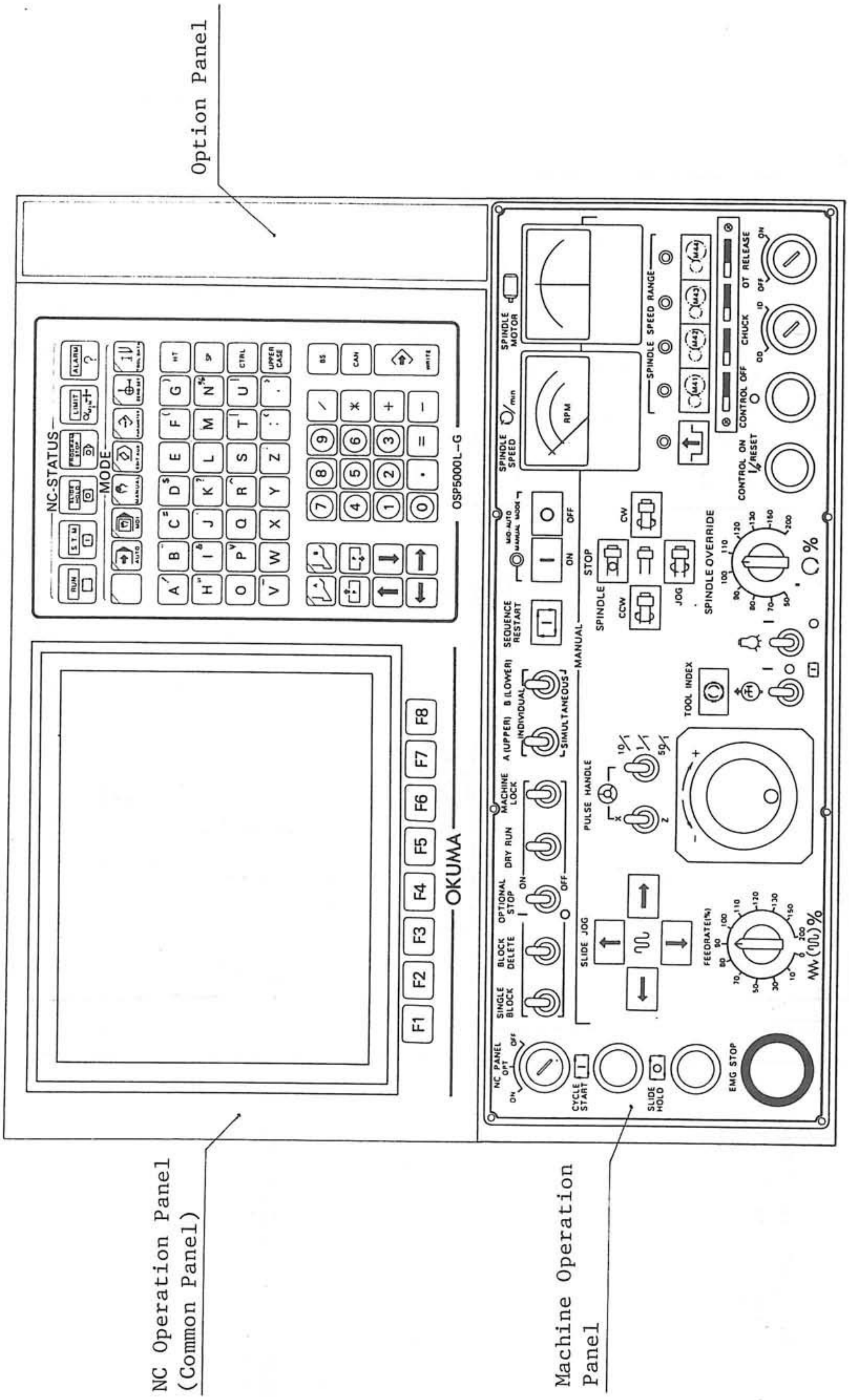
This panel varies from model to model depending on the available functions.

(3) Option Panel

Provided on this option panel are switches and lamps related with the optional functions selected.

External view of these operation panels, arranged on one unit, are shown on the following page.

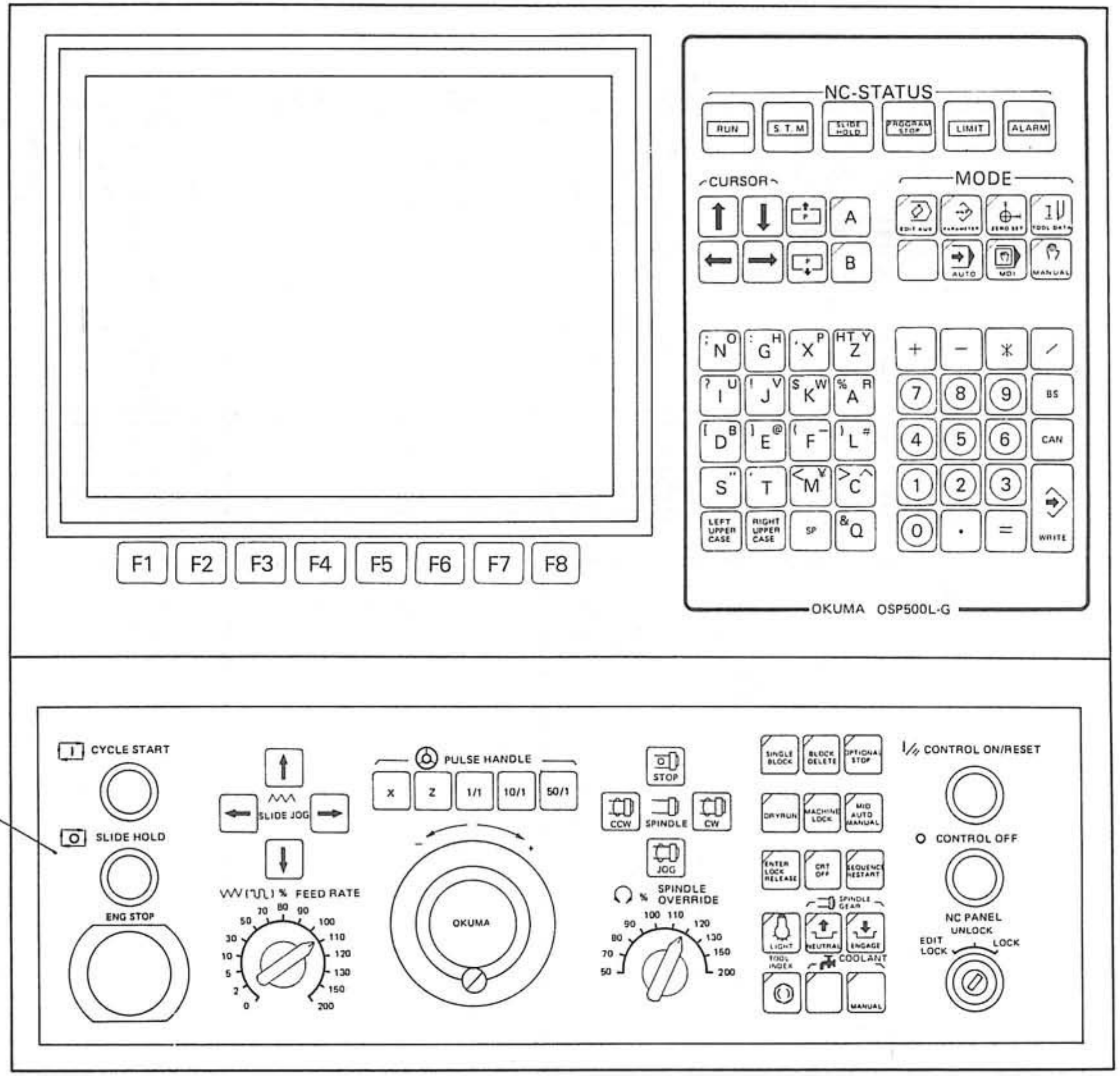
Note: Further explanations are included with the drawing of the OSP5ØØØL-G NC operation panel. The key layout on the OSP5ØØL-G is different, but operators should press the corresponding keys.



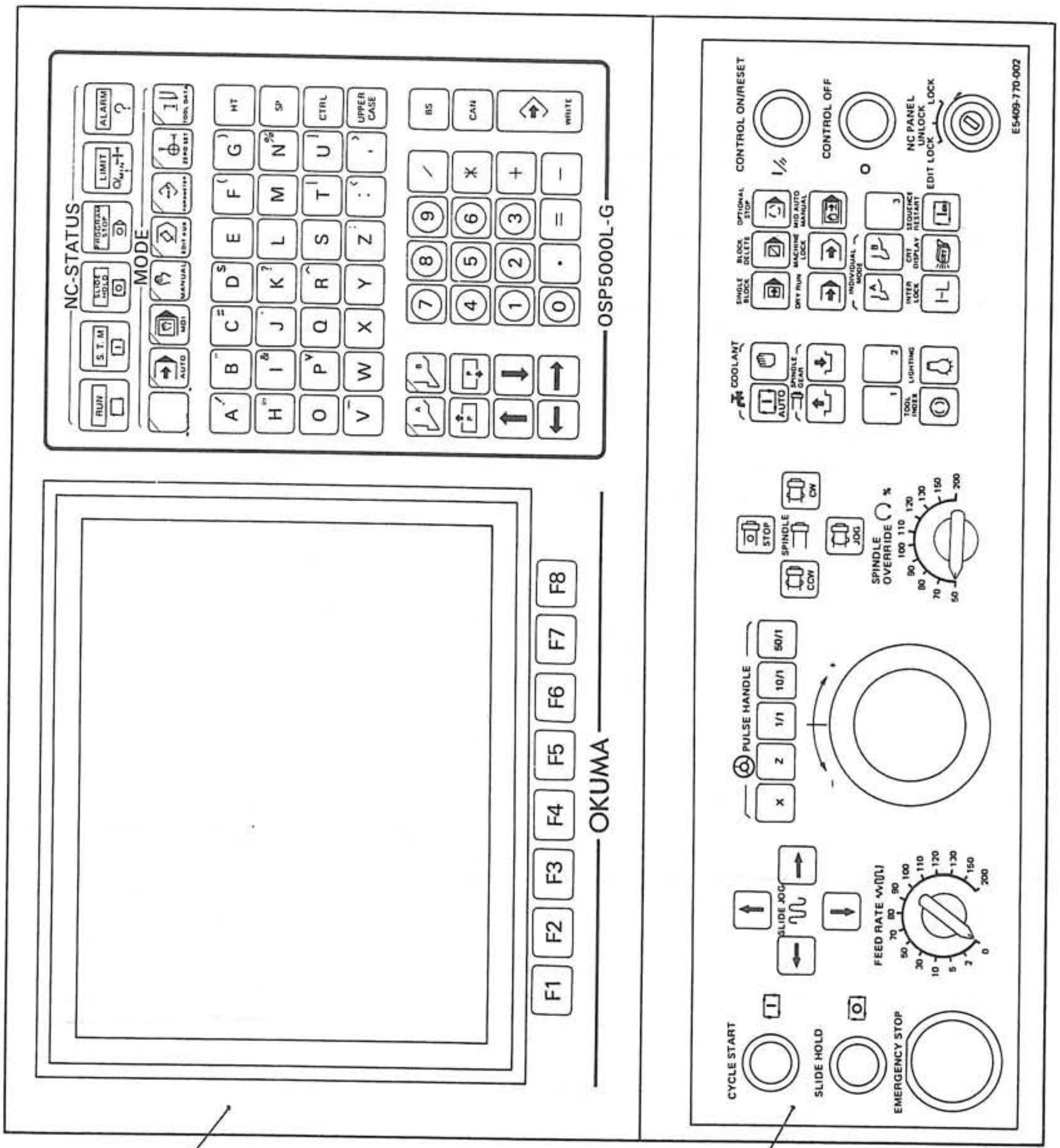
Operation Panel - OSP5ØØØL-G

NC Operation Panel
(Common Panel)

Machine Operation Panel



Operation Panel - OSP5ØØL-G



NC Operation Panel
(Common Panel)

Machine Operation Panel

Operation Panel (Flat Panel) - OSP5ØØØL-G

3-2. OUTLINE OF CONTROLS ON OPERATION PANELS

In this section, an outline of the controls on the NC operation panel and the machine operation panel is provided.

3-2-1. Controls on NC Operation Panel

(1) MANUAL

Press this MANUAL key when operating the machine manually, i.e., when the machine operation through the controls on the machine operation panel is required.

(2) MDI (Manual Data Input)

Press this MDI key when operating the machine with the commands entered through the keyboard (MDI mode operation).

(3) AUTO

Press this AUTO key when operating the machine in the automatic mode by the stored part program in automatic mode.

(4) TOOL DATA

Press this TOOL DATA key when setting, modifying or checking tool offset data and tool nose radius data. (Up to 32 pairs of the data can be stored in the memory.)

(5) ZERO SET

Press this ZERO SET key when setting or modifying the reference point of the machining (reference zero), or checking the stored coordinate values of such position.

(6) PARAMETER

Press this PARAMETER key when setting, modifying or checking parameters:

Stroke end, variable soft-limit, backlash, chuck barrier, droop, spindle jog speed, etc.

(7) EDIT AUX

Press this EDIT AUX key when editing or inputting/outputting the stored part program, or when checking contents of the program.

(8) NC STATUS indicating lamps

a) RUN

The RUN indicating lamp goes on when the machine is normally running in the AUTO or MDI mode.

b) S.T.M

The S.T.M indicating lamp goes on when a command, other than that calling for axis motion, such as spindle speed range change, tool change, spindle rotation/stop, is executed.

When an axis motion command is designated in a block containing S, T and/or M command, the axis motion command is executed after the execution of S, T, and M commands is completed. If the optional cycle time reduction function is active, it is executed simultaneously with them.

When a spindle speed range selection command, spindle speed command or tool number command is changed during automatic mode operation with manual operation intervention function activated, the S.T.M indicating lamp flickers.

c) SLIDE HOLD

The SLIDE HOLD indicating lamp goes on when the SLIDE HOLD button on the machine operation panel is pressed in the AUTO or MDI mode.

This lamp will also come on when the designated commands have been completed on one of the two saddles while the other saddle is placed in the slide hold mode with the single block function activated in the AUTO mode operation.

d) PROGRAM STOP

The PROGRAM STOP indicating lamp goes on during the executing of the program stop (MØØ) or optional stop (MØ1) function in the AUTO or MDI mode. And the indicator lamp flickers during the execution of the dwell (GØ4) function.

e) LIMIT

The LIMIT indicating lamp goes on when either of X- and Z-axis reaches the set variable soft-limit position.

It starts flickering when the spindle speed command calls for the spindle rpm lower or higher than the available spindle speeds of the presently selected range, or when the active spindle speed reaches the higher limit specified by the maximum spindle speed limit function.

f) ALARM

The ALARM indicating lamp goes on when an erroneous machine operation is intended, the wrong part program data is read and decoded, or the computer fails to function normally.

The contents of the alarm are displayed on the CRT. Details concerning the alarm message display are provided in the Alarm & Error List Manual.

(9) FUNCTION KEYS: F1 to F8

There are eight function keys on the NC operation panel.

When the operator selects the desired operation mode, the CRT 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 CRT provides guide of operative steps corresponding to the sequence of operation. The operator can proceed with the intended operation simply by pressing the function keys according to the guide messages given on the CRT.

For those functions, refer to pages 12 through 15.

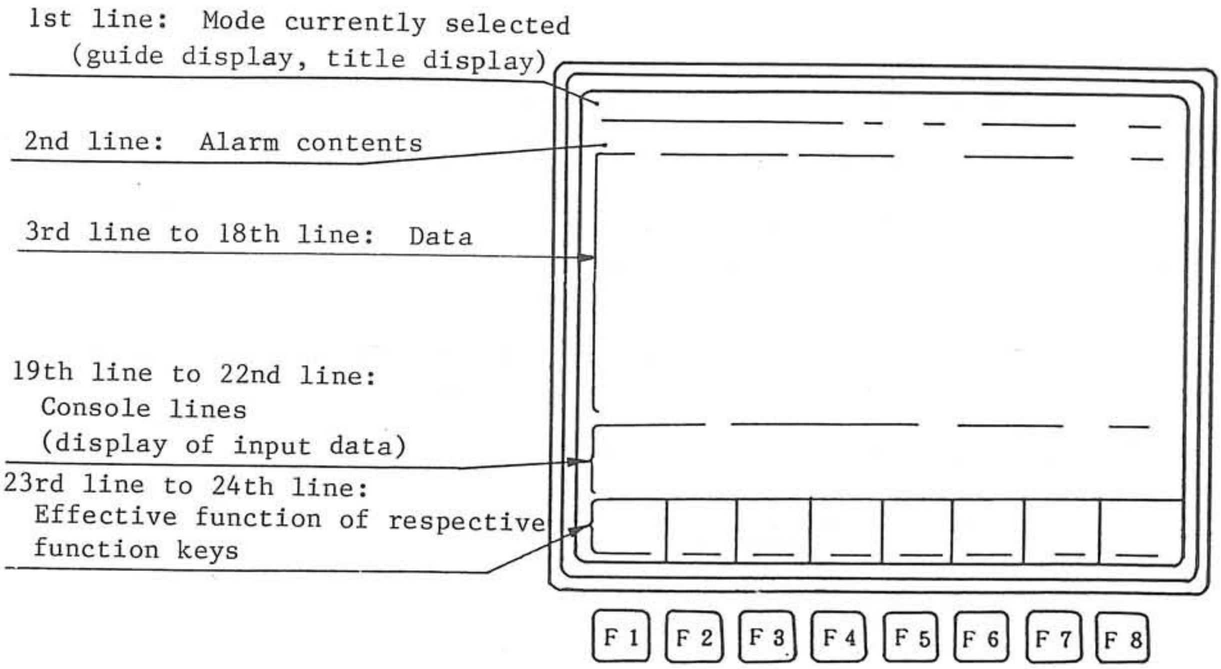
(1∅) CRT

The CRT can display 64 characters x 24 lines.

It shows actual position, part program, part program block, reference zero coordinates, tool offset values, parameter data, alarm, and others.

The contents of display are determined by the selected operation mode, active operation step, and pressed function key (F1 through F8).

The basic format of CRT display is as shown below:



(11) WRITE

Press this key to select the operation mode or setting the data in the MDI mode.

(12) BS

Press the BS key when erroneous data has been entered. Each time this key is pressed, the last character entered is erased. This key is also used to display the next page of the directory.

(13) CANCEL

Press the CANCEL key when erroneous data has been entered. Each time this key is pressed, a line of input data entered is erased.

(14) TURRET

These keys are used to select A- and B-turrets for the 2S and 2-turret models. These keys are also effective in manual mode.

3-2-2. Machine Operation Panel

Flat keys are used on the machine operation panel of the flat panel.

Flat keys:

1) Flat keys with indicating lamps

   For flat keys with indicating LED at the upper left corner, input status is maintained by NC software.

   LED ON .... Input ON
   LED OFF .... Input OFF

   Note: Input status is not maintained for the INTERLOCK RELEASE key.

2) Flat keys without indicating lamps

   With flat keys not provided with the indicating lamp, input status is not maintained.

   Key being held down .... Input ON
   Key not being held down ..... Input OFF

(1) CONTROL ON/RESET

Press the CONTROL ON/RESET button to turn power supply to the control and the servo system after turning the main switch at the side of the control enclosure ON. When the control power is turned on, the pilot lamp in this button illuminates.

This button is also used to reset the control.

(2) CONTROL OFF

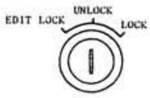
Press the CONTROL OFF button to shut off power supply to the control and the servo system.

To turn off power supply to the machine after the completion of daily operation or for the mid-day recess, be sure to press this button first before turning the main switch OFF.

(3) NC PANEL selector

a) NC PANEL ON

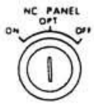
All controls on both the NC and machine operation panel are enabled.



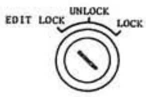
For OSP5ØØL-G and OSP5ØØØL-G flat panel:

UNLOCK

b) NC PANEL OPT



EDIT AUX and PARAMETER keys on the NC operation panel are disabled.

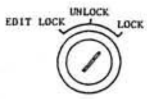


For OSP5ØØL-G and OSP5ØØØL-G flat panel:

EDIT LOCK

c) NC PANEL OFF

All controls on the NC operation panel are disabled.



For OSP5ØØL-G and OSP5ØØØL-G flat panel:

LOCK

(4) CYCLE START

Press the CYCLE START button to initiate machine operations according to the commands.

(5) SLIDE HOLD

Press the SLIDE HOLD button to stop axis movements of X- and/or Z-axis, immediately. To resume axis movements after that, press CYCLE START button.

Note: If the SLIDE HOLD button is pressed while an axis movement is not active, the machine cycle stops when the commands in the present block are completed or when the axis movement command is read and decoded.

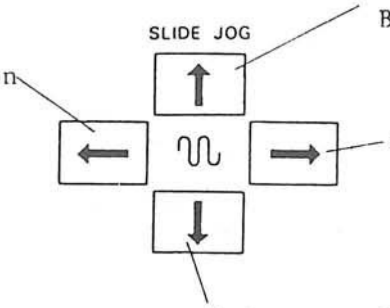
(6) EMG. STOP

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

When it is pressed, power supply to the control is shut off.

(7) SLIDE JOG

The four SLIDE JOG buttons are used to manually jog the axes.

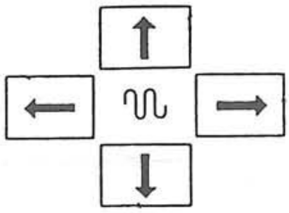


P direction: Positive direction
N direction: Negative direction

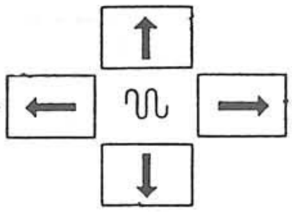
Axis movement directions differ on the models indicated below:

LC1Ø, LPC4, LB6, LH35, LH55, LS3Ø

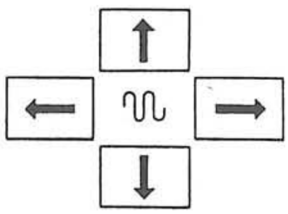
1) LC1Ø



2) LPC4



3) LB6, LH35, LH55, LS3ØN



Note: Special patterns may be applied on some machine models.

The axis moves while a SLIDE JOG button is pressed.

Setting of the FEEDRATE override dial is effective:

X-axis .... 1,2ØØ mm/min. at 1ØØ% setting
Z-axis .... 2,4ØØ mm/min. at 1ØØ% setting

(8) FEEDRATE (%) override dial

The FEEDRATE override dial is used to modify the specified or commanded feedrate for optimizing the cutting.

Override range is:

Ø to 2ØØ% in 13 steps (15 steps for OSP5ØØL-G, OSP5ØØØL-G flat panel)

The FEEDRATE override dial setting is ignored when thread cutting mode is in effect.

The FEEDRATE override dial setting is effective in the GØØ mode. However, the following requirements must be met:

- SINGLE BLOCK mode ON both in the AUTO and MDI mode
- Effective override range is Ø through 1ØØ% in 8 steps. (1Ø steps for OSP5ØØL-G, OSP5ØØØL-G flat panel)

The FEEDRATE override dial setting is effective for manual operations. In this case, effective override range is Ø to 2ØØ% in 13 steps (15 steps for OSP5ØØL-G and OSP5ØØØL-G flat panel specification).

(9) PULSE HANDLE

By rotating the PULSE HANDLE, the axes can be fed as done with conventional lathes.

<u>X/Z toggle switch</u>

Used to select the axis to be fed.

<u>Magnification switch</u>

Used to select axis feed amount per pulse. Three positions are available:

1Ø/1 .... 1Ø μm/pulse (1/1ØØØ inch/pulse)

1/1 .... 1 μm/pulse (1/1ØØØØ inch/pulse)

5Ø/1 .... 5Ø μm/pulse (5/1ØØØ inch/pulse)

(1∅) TOOL INDEX

Press TOOL INDEX button to rotate (index) the turret and select the desired tool position in the manual mode operation.

For the two-saddle or two-turret models, it is necessary to select the turret to be indexed before pressing the TOOL INDEX button.

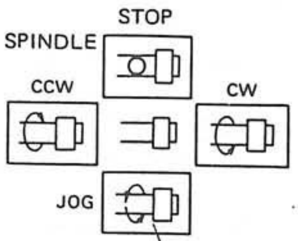
For the turret to index, the following conditions must be satisfied.

LB series LC series LP series LR series LH series LS3∅-N (V turret specification)	X- or Z-axis must be at the variable soft-limit position in the positive direction. This is checked with the LIMIT indicator lamp under NC status on the NC operation panel; when either X- or Z-axis is at the variable soft-limit position in the positive direction, the indicator lamp is illuminated.
LH series LS3∅-N (V turret specification)	X-axis must be at the variable soft-limit position in the positive direction.
LH series LS3∅-N (H6 and H8 specification)	Z-axis must be at the variable soft-limit position in the positive direction.
LH series LS3∅-N (2-turret specification)	The saddle may be at any position.

One push of the TOOL INDEX button rotates the turret by one position. To rotate the turret continuously, hold down on this button.

(11) SPINDLE - STOP/CCW/CW/JOG

The four SPINDLE buttons are used to rotate/stop/jog the spindle manually.



The spindle jogs (FWD) while this button is held down.

To manually rotate the spindle, the following requirements must be met:

- The chuck fulfills the spindle rotation conditions;

  Chuck close during OD gripping
  Chuck open during ID gripping

  For spindle jog operations, this requirement does not apply.

- Spindle speed is entered beforehand through the MDI keyboard.

- Spindle speed gear range selection (M41 - M44) is made beforehand.

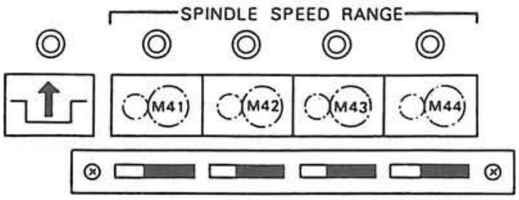
- For center work, the tailstock spindle is at the specified position.

(12) SPINDLE SPEED RANGE

a) OSP5ØØØL-G

The number of spindle speed gear ranges varies from model to model, and of course, the range of spindle speeds available within the selected gear range differs also.

Press any of the SPINDLE SPEED RANGE selecting buttons to select the spindle speed gear range in the MANUAL mode operation.

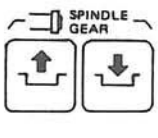


When the operator presses the NEUTRAL (M4Ø) button, the spindle is brought to the neutral state, and the chuck can be rotated by hand.

After the gear selection is completed, the indicator lamp above the respective button goes on. These indicator lamps go on in the AUTO and MDI mode operation also. When the indicator lamp flickers, it indicates that the provided gear range selection command is being executed. The change of spindle speed gear range does not change the active spindle speed.

b) Flat panel specification of OSP5ØØØL-G, OSP5ØØL-G

Spindle speed gear range is selected by pressing the buttons indicated below in the manual operation mode.



When the GEAR NEUTRAL button is pressed, the spindle is placed in the neutral state and the chuck may be rotated by hand lightly. The gear position data is saved and can be called out even after power supply is turned off.

When the GEAR ON button is pressed, the spindle speed gear range selected previously is automatically selected. The selected range is displayed at the CRT screen in corresponding M code. (At MACHINE STATUS display on the ACTUAL POSITION display screen)

The lamp at the upper left corner lights up when the output of gears and confirmation limit switch match. If they do not match, it flickers in intervals of Ø.4 sec.

This is also true when the spindle speed range is selected in the automatic or MDI mode. The spindle speed does not change even when the gear is changed.

(13) SPINDLE OVERRIDE (%)

The SPINDLE OVERRIDE dial is used to modify the commanded spindle speed in the range of 5Ø to 2ØØ% in 1Ø steps.

The spindle speed is not overridden if the operator selects a high percentage position that causes the spindle speed to exceed either the preset permissible spindle speed or that set by G5Ø. In this case, the spindle rotates at the permissible highest spindle speed.

(14) CHUCK - ID/OD (only for OSP5ØØØL-G)

Place the CHUCK selector in the appropriate position to meet the intended chuck gripping method.

In the case of the OSP5ØØL-G and the OSP5ØØØL-G flat panel, this is made as a parameter setting.

(15) OT RELEASE - OFF/ON (only for OSP5ØØØL-G)

This is inside the control box for the OSP5ØØL-G and the OSP5ØØØL-G flat panel.

Outside the variable soft-limit position of X- and Z-axis, there are emergency limit switches (hard-limit) that inhibit any axis travel exceeding them. If any of these emergency limit switches is tripped, power supply to the servo system and electrical control circuit is shut off and the two axes cannot be moved anymore.

In such a case, follow the steps below after turning the OT RELEASE selector to the ON position. Proceed very carefully.

a) Select the MANUAL OPERATION by pressing the MANUAL key.

b) Press the POWER ON button while turning the OT RELEASE selector to the ON position. Keep the OT RELEASE selector in the ON position until the axis releases from the overtravel state.

c) Turn the pulse handle to move the axis in the direction opposite the overtravelled direction.

d) Move the axis until the tripped limit switch is disengaged from the dog. After that, turn the OT RELEASE selector to the OFF position.

Note 1: Be sure to move the correct axis.

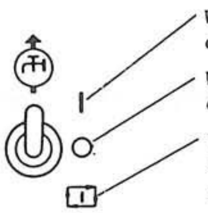
Note 2: Be sure to move the axis in the correct direction.

Note 3: If the axis fails to move smoothly while releasing it from the hard-limit position, or the axis hunts for instance, stop the releasing operation immediately by placing the OT RELEASE selector OFF.

(16) COOLANT

a) OSP5ØØØL-G

The COOLANT toggle switch is used to manually control the coolant supply condition:



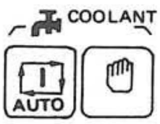
With COOLANT selector set in this position, coolant supply is turned on in any operation mode.

With COOLANT selector set in this position, coolant supply is turned off in any operation mode.

With COOLANT selector set in this position, coolant supply is turned on and off according to the programmed MØ8 and MØ9 codes. This position is effective in AUTO and MDI mode.

MØ8 .... Coolant ON
MØ9 .... Coolant OFF

b) Flat panel specification of OSP5ØØØL-G, OSP5ØØL-G



AUTO and MANUAL OFF .... Coolant is not supplied irrespective of the operation mode selected.

MANUAL ON .... Coolant is supplied in any operation mode

AUTO ON .... Coolant ON/OFF is controlled by M codes in the automatic and MDI mode:

MØ8 ..... Coolant ON
MØ9 ..... Coolant OFF

Note: AUTO and MANUAL switches cannot be on at the same time.

(17) WORK LAMP

The toggle switch is used to turn on and off the work lamp of the machine.

3-2-3. Toggle Switches on Machine Operation Panel

(1) SINGLE BLOCK

Turn the SINGLE BLOCK toggle switch ON when executing part program blocks one by one in the AUTO and MDI mode operation. When it is set to the OFF position, part program blocks are continuously executed.

This SINGLE BLOCK function is effectively used when cutting the first part.

(2) BLOCK DELETE

When the BLOCK DELETE switch is turned to the ON position, commands preceded by a slash (/) code are ignored up to the CR code in that block.

Program the slash code either at the beginning of the block or right after the sequence number (name) of the block.

(3) OPTIONAL STOP

When the OPTIONAL STOP switch is turned to the ON position, the machine cycle, including spindle rotation and coolant supply, stops after the commands in the block containing MØ1 are completed. The operation can be resumed by pressing the CYCLE START button.

(4) DRY RUN

Turn the DRY RUN toggle switch ON when checking a newly prepared part program in the AUTO mode operation. With the DRY RUN function activated, cutting feedrate commands, with the exception of manual feed and GØØ mode feed, are all executed at the milling feedrate (mm/min) set by the parameter.

The milling feedrate is factory-set to 2,4ØØ mm/min.

(5) MACHINE LOCK

When a part program is executed with this MACHINE LOCK toggle switch set ON, all commands in the part program are executed without actual machine operation. This simulated operation can be checked on the CRT. In this mode, cutting feedrate is determined based on the programmed spindle speed.

(6) INDIVIDUAL/SIMULTANEOUS TURRET OPERATION SELECTION

INDIVIDUAL/SIMULTANEOUS toggle switches are available only on two-saddle models.

On two-saddle models, normal operation is made in simultaneous 4-axis control mode. The toggle switches are used to select the required operation mode by setting them to the proper position:

Individual A turret operation

A .... INDIVIDUAL
B .... SIMULTANEOUS

By setting these two switches as indicated above, only turret A is activated in AUTO and MDI mode.

Individual B turret operation

A .... SIMULTANEOUS
B .... INDIVIDUAL

With the setting above, only B turret is activated in AUTO and MDI mode.

Individual A/B turret operation

A .... INDIVIDUAL
B .... INDIVIDUAL

With the setting above, both A and B turrets are activated individually according to the designated synchronizing commands.

Normal operation

A .... SIMULTANEOUS
B .... SIMULTANEOUS

Normal machine cycle is performed according to the programmed commands.

Note: Flat panel specification of OSP5ØØØL-G, OSP5ØØL-G

To activate the following switches, the INTERLOCK button must be pressed at the same time:

- DRY RUN
- MACHINE LOCK
- INDIVIDUAL A TURRET
- INDIVIDUAL B TURRET

(7) SEQUENCE RESTART

Press the SEQUENCE RESTART button to restart the AUTO mode operation which has been interrupted due to tool breakage or because of too long machining cycle time, after resetting the control. For details of sequence restart operation, refer to the instructions in Section 4.

(8) MID-AUTO MANUAL MODE ON/OFF

Use these buttons to interrupt the AUTO mode operation; carry out the required manual mode operation, and then resume the AUTO mode operation.

(9) CRT OFF

The CRT display may be turned off by turning on this switch.

3-3. FUNDAMENTAL MACHINE OPERATION PROCEDURE

3-3-1. Manual Operations

NC lathes operate in three different modes: MANUAL, AUTO (stored part programs), and MDI. This section deals with manual machine operation procedure, which will provide you with the most fundamental knowledge to operate the machine.

It is advisable to actually operate the machine while reading this manual.

(1) Turning ON/OFF Power

When turning power supply to the machine ON for the first time after machine installation, make sure that your power supply is compatible with the machine and the control. Consult our service engineer before doing this. (See Fig. 3-1.)

a) Turning Power ON:

1) Turn the main switch (no-fuse circuit breaker) on the left side of the electrical control enclosure ON.

This turns 200 volt AC power to the electrical control system. The hydraulic power unit pump motor starts at the same time.

2) Press the CONTROL ON/RESET button on the machine operation panel.

This turns on power supply to the CPU and relay circuit.

The CRT will display the contents shown below in five to six seconds after the CONTROL/RESET button is pressed, and the NC software is loaded.

```
SBPII ---
MEMORY TEST OK./0000
LOAD:SYS
OPERATING SYSTEM PROGRAM II V---
OKUMA 1984 --
      ---------  } Names of NC control
      ---------  } programs
      ---------
```

After the NC software has been loaded, the NC starts running with the following messages displayed in succession. These messages allow the operator to know the faulty loading process if start was impossible:

- PBU FILE ON LOADING
- PITCH COMPLEMENT DATA ON LOADING
- EC BUS ON INITIAL PROCESSOR
- GRAPHIC DATA ON INITIAL PROCESSOR
- SERVO PROCESSOR ON INITIAL PROCESSOR
- AXIS PROCESSOR ON INITIAL PROCESSOR
- EC PROCESSOR ON INITIAL PROCESSOR

Note: Messages corresponding only to the specifications selected are displayed.

One to two minutes after that, the control becomes ready to operate and the CRT display changes to NC operation data (actual position, program, etc.). The servo drive circuit and other control circuits are energized at the same time.

The CONTROL ON/RESET button also serves as the RESET button; press it to reset the control during operation or when the ALARM indicator is illuminated.

b) Turning Power OFF:

1) Press the CONTROL OFF button on the machine operation panel.

This turns power supply off to the CPU, servo drive system, relay and magnetic circuits.

2) Turn the main switch (no-fuse circuit breaker) on the left side of the control enclosure OFF.

This shuts off power supply to the machine.

CAUTION

> To turn power supply to the machine on when shop power supply turns off or after turning the main switch off without pressing the CONTROL OFF button: allow at least one minute to elapse and then turn power supply on.

c) Emergency Stop:

To stop the machine operation when some abnormal state takes place, press the EMG. STOP button on the machine operation panel. This cuts off power supply to the hydraulic power unit and servo drive unit with "Alarm A EMERGENCY STOP" displayed. Even after this, CPU is still active. Pressing the CONTROL ON/RESET button restores the control to the normal state.

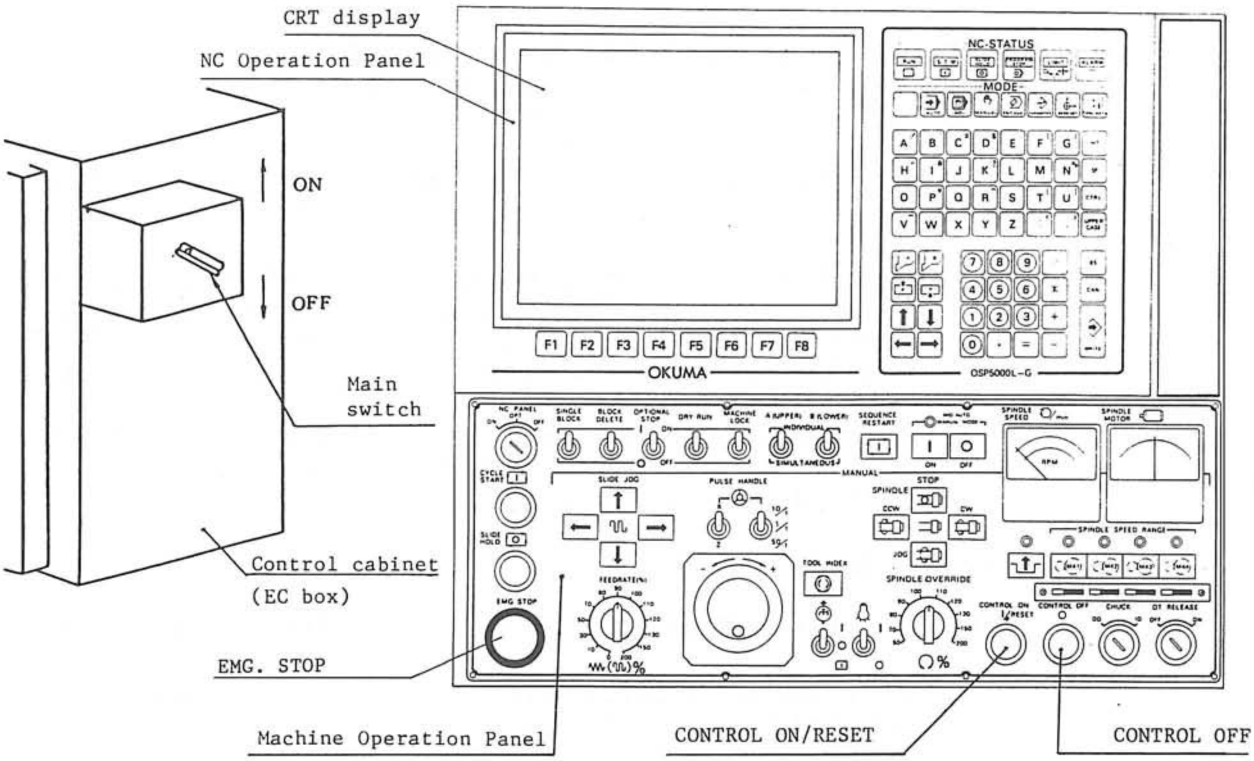


Fig. 3-1

(2) Starting Spindle Rotation

CAUTION

> To prevent hazards to operator and machine, carry out the following steps without workpiece on the machine.

a) Check whether the allowable chuck speed is set with the parameter.

For the chucks, allowable speed is indicated on them. If the spindle speed exceeds this allowable chuck speed, it will be really dangerous to the operators and to the machine as well.

To provide the safety, the allowable chuck speed is set with the parameter and if actual spindle speed exceeds 12Ø percent of the set value, an alarm occurs to stop the machine,

CAUTION

Whenever a chuck is changed, always set the allowable chuck speed with the parameter.

Parameter	:	Optional parameter (word) No. 73
Unit	:	rpm
Setting range	:	Ø - Max. rpm of individual models

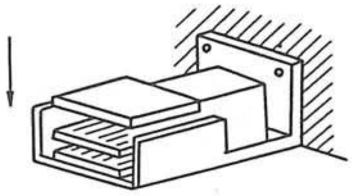
For the procedure to set the parameter, refer to 4-3.

Check the parameter set value whether it matches the allowable speed of the chuck currently in use.

Note: When the DOOR INTERLOCK switch is placed in the ON position, an alarm occurs if the door is open when the spindle is started.

For details, refer to 3-3-2-6.

b) Bring the chuck in the work chucking position.



[Chuck Opening/Closing Foot Pedal]

Close the chuck for OD gripping and open it for ID gripping.

Unless the chuck is set in this state, the spindle cannot rotate.

Press the foot pedal, and the chuck opens and closes alternately each time it is pressed.

Selection of ID and OD gripping is made in the following operation:

1) OSP5ØØØL-G

Use the CHUCK - OD/ID selector at the machine operation panel.

2) Flat panel specification of OSP5ØØØL-G, OSP5ØØL-G

Use parameter setting (for details, refer to Section 4-3).

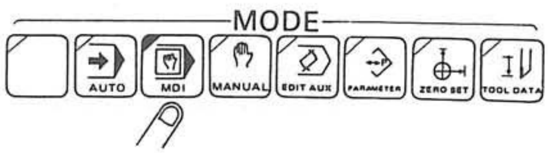
For the machine equipped with the tailstock, advance or retract the tailstock sleeve corresponding to the setting of the CHUCK WORK or CENTER WORK selection.

Selection of the CHUCK WORK and CENTER WORK is made either by the selector switch or parameter setting as with the selection of ID/OD gripping.

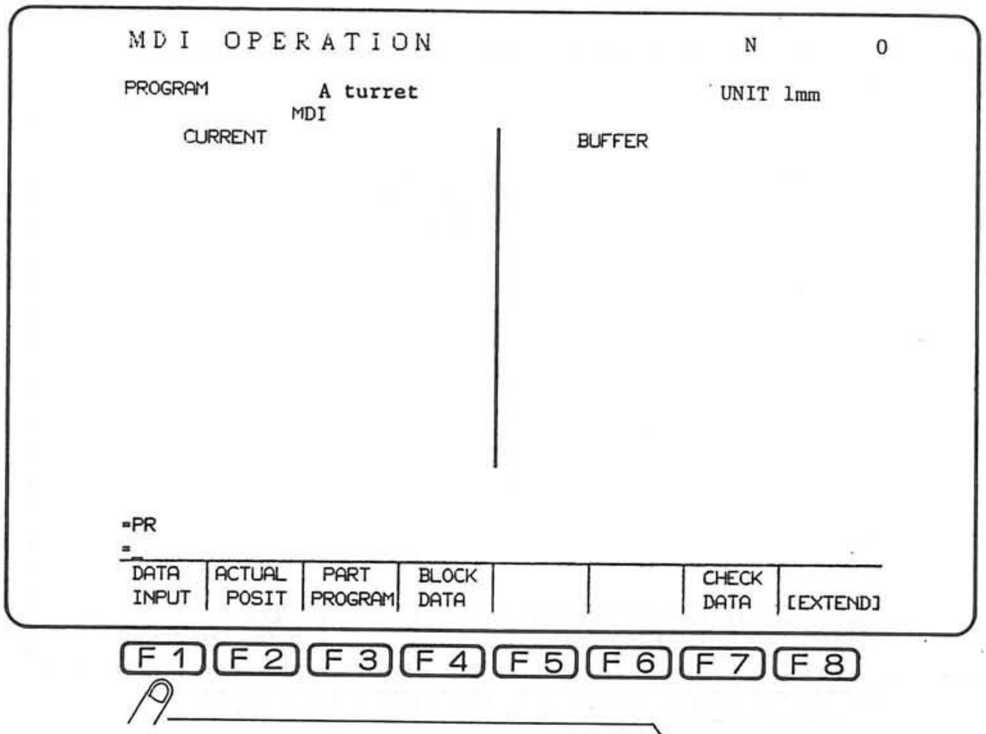
c) Set the desired spindle speed.

Example: To select 1,ØØØ rpm.

1) Select the MDI Operation mode by pressing the MDI key.



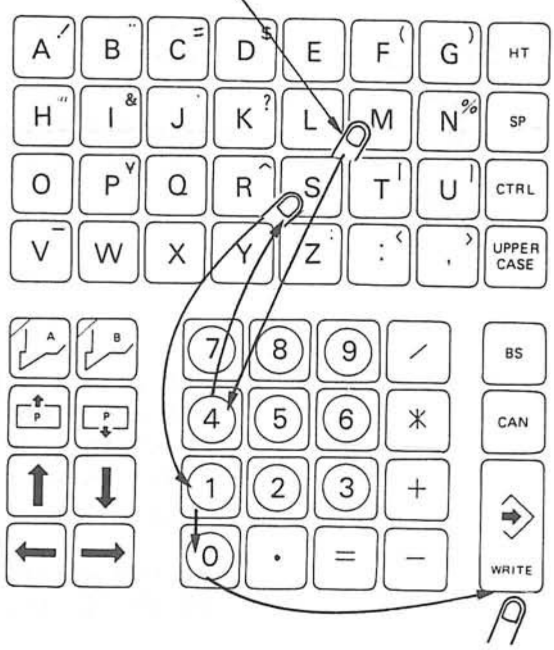
2) Press the function key [F3] (PART PROGRAM) and press the PAGE key until the page shown below is displayed.



3) Press the function key [F1] (DATA INPUT).

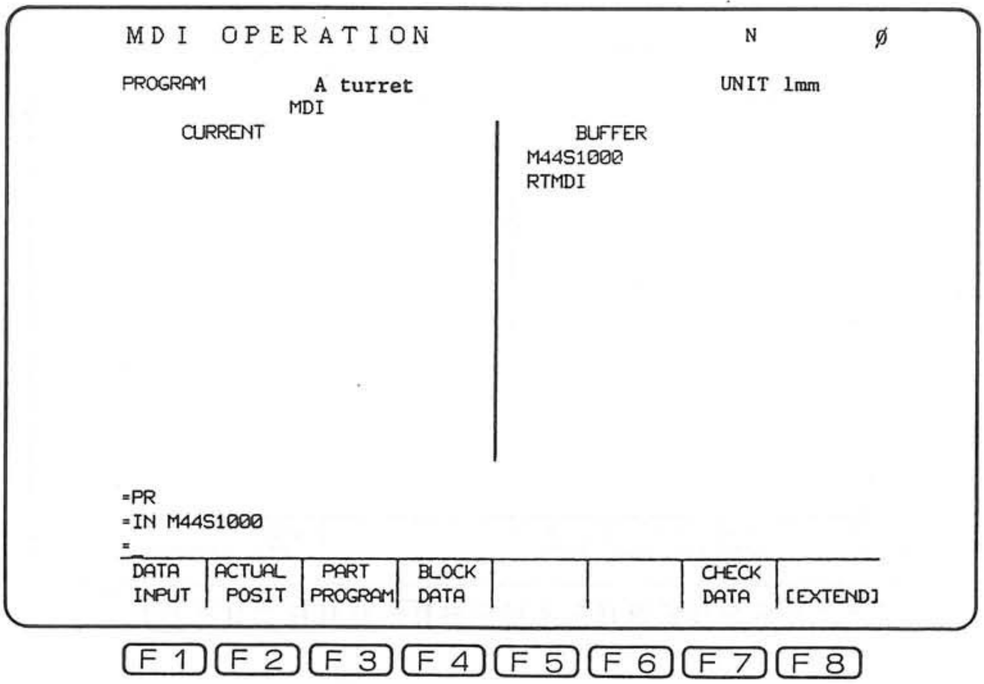
Key in [M][4][4][S][1][Ø][Ø][Ø] and press the WRITE key.

(This enters the spindle speed range and the required spindle speed.)

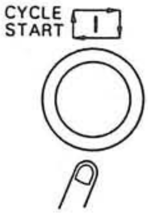


4) The CRT displays the data just keyed-in.

(When the CYCLE START button is pressed, the data in the BUFFER column is transferred to the CURRENT column.)



5) Press the CYCLE START button.



This only enters the keyed in data, S1000, and the spindle does not start.

To start the spindle rotation, follow the steps provided in c).

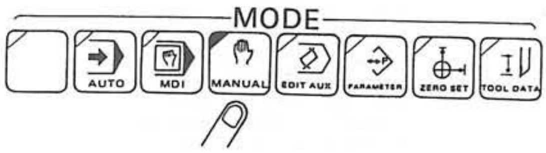
Note 1: For spindle speed range selection, the relationship between M code and available spindle speeds differ from model to model. For spindle speed range selection M codes refer to the Operation Manual for the respective model.

Before entering spindle speed commands, M and S words, check if they match.

Note 2: For details on the MDI mode operation procedure, refer to instructions in 3-3-2-5.

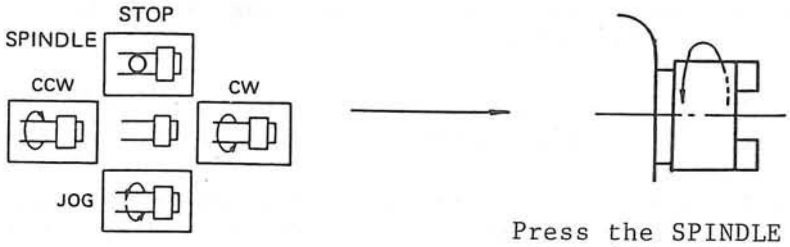
d) Start spindle rotation.

1) Select the MANUAL OPERATION mode by pressing the MANUAL key.



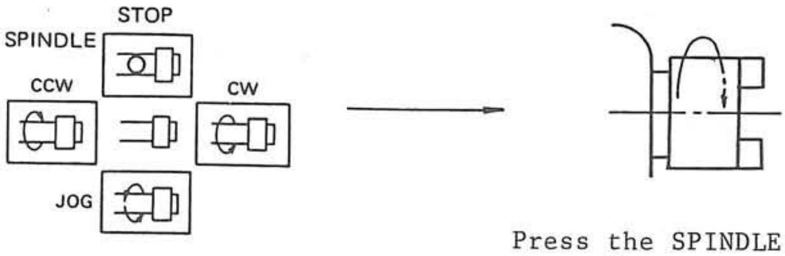
2) Press the SPINDLE CW/CCW/JOG/STOP button on the machine operation panel to rotate the spindle.

SPINDLE - CW button



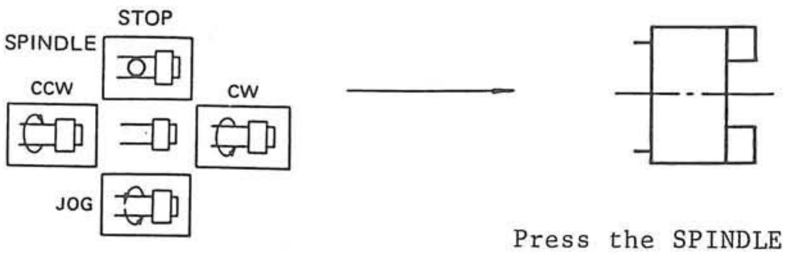
Press the SPINDLE - CW button, and the spindle starts CW rotation at 1,ØØØ rpm. The spindle keeps rotating until the SPINDLE - STOP button is pressed.

SPINDLE - CCW button



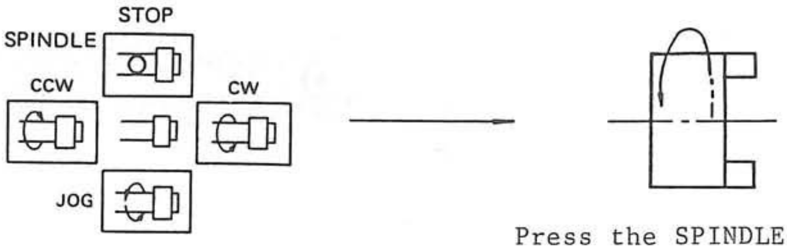
Press the SPINDLE - CCW button, and the spindle starts CCW rotation at 1,ØØØ rpm. The spindle keeps rotating until the SPINDLE - STOP button is pressed.

SPINDLE - STOP button



Press the SPINDLE - STOP button, and the spindle rotation stops.

SPINDLE - JOG button



Press the SPINDLE - JOG button, and the spindle rotates in the forward direction while the button is pressed.

Note 1: For spindle jog speed setting, refer to 4-3, "Operation in Parameter Mode".

Note 2: While the chuck is open, spindle CW/CCW operation is impossible although spindle jog can be performed.

Note 3: The commanded spindle speed can be overridden in the range from 50 to 200% using the SPINDLE OVERRIDE dial.

Note 4: Machines with DC spindle drive motors (LB8, LC10, LC30, LC40, LC50, LH35-N, LH55-N and LS30-N) cannot be directly changed from CW to CCW or from CCW to CW.

(3) Moving Turret

CAUTION

In order to prevent accidental collision of the turret, observe the following points carefully:

Possibility of collision between the turret and the chuck

Possibility of collision between the front and rear turrets (for machine with two saddles)

Tailstock position. Be sure to position the tailstock at its rightmost position (for machine with tailstock).

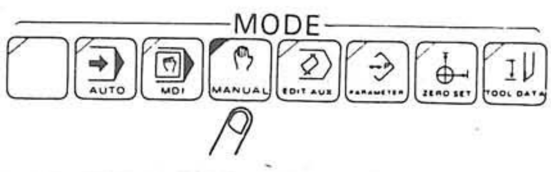
When the turret is moved with the door open, an alarm occurs if the door interlock function is active (DOOR INTERLOCK switch ON). For details, refer to 3-3-2-6.

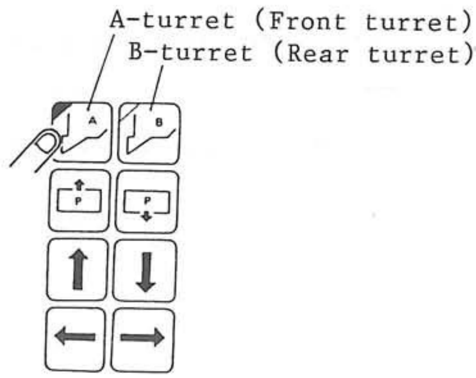
Note: Soft-limit positions of X- and Z-axis are factory-set.

a) Moving Turret at Rapid Feedrate

1) Select the MANUAL OPERATION mode by pressing the MANUAL key.

For the 2-turret/2-saddle models, specify the turret.





2) The turret moves while a SLIDE JOG button is pressed in the direction indicated by an arrow mark on it.

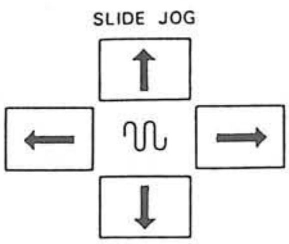
The rapid traverse rate of each axis is (FEEDRATE override dial setting: 100%):

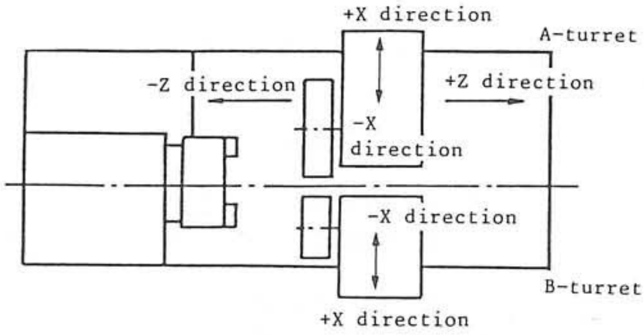
X-axis .... 1,200 mm/min.
Z-axis .... 2,400 mm/min.

Rapid feedrate can be modified using the FEEDRATE override dial.

Axis motion directions are shown below.

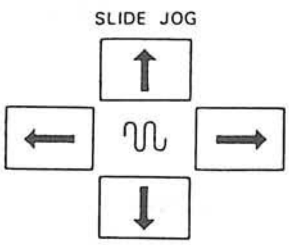
- 2-saddle model (1-saddle model)

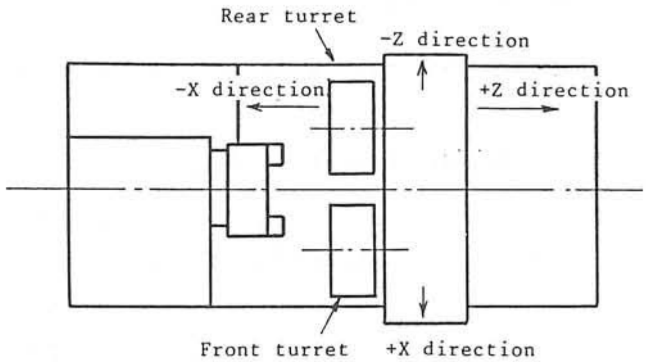




A single-saddle model has only A-turret.

- 2-turret model



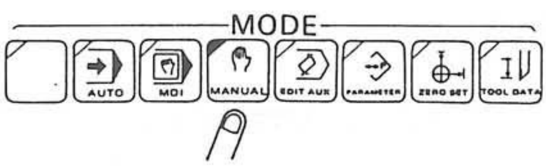


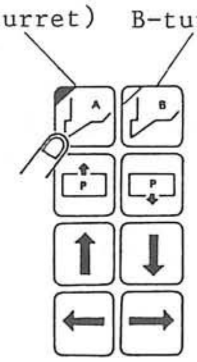
b) Moving Turret by Pulse Handle

1) Select the MANUAL OPERATION mode by pressing the MANUAL key.

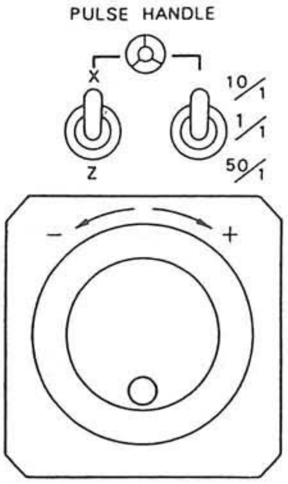
For the 2-turret/2-saddle models, specify the turret.

A-turret (Front turret) B-turret (Rear turret)

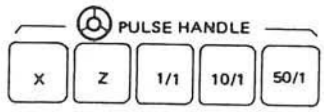




2) Select the axis to move and then place the magnification switch in the desired position.



For OSP5ØØL-G, OSP5ØØØL-G flat panel



3) Turret feed speed varies in accordance with the pulse handle rotation speed.

	Metric System			Inch System		
	1/1	1Ø/1	5Ø/1	1/1	1Ø/1	5Ø/1
Feed per division	1/1ØØØ (1 μm) mm/div.	1/1ØØ (1Ø μm) mm/div.	5/1ØØ (5Ø μm) mm/div.	1/1ØØØØ inch/div.	1/1ØØØ inch/div.	5/1ØØØ inch/div.
Feed per turn	Ø.1 mm/turn	1 mm/turn	5 mm/turn	Ø.Ø1 mm/turn	Ø.1 mm/turn	Ø.5 mm/turn

The turret is fed rightward when the pulse handle is rotated clockwise and leftward when it is rotated counterclockwise.

As stated in (3), the turret can be manually fed in a simple operation; manual feed operation is effectively used to:

- produce one-of-a-kind parts with relatively simple configurations,
- cut off soft blanks for the power chuck jaws,
- minimize work deflections by turning the chucking diameters of parts,
- set up the correct relationship of a cutting tool point with respect to the part to be cut,
- move the turret to change cutting tools, and so on.

(4) Indexing Turret

Before indexing the turret, observe the following point to assure safety in turret index operation.

CAUTION

> Make sure that no turret-mounted tool interferes with the power chuck and tailstock (if installed).

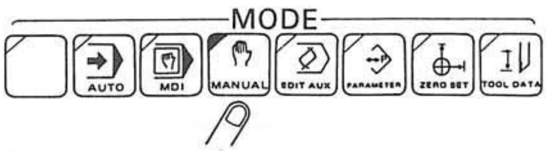
When the turret is moved with the door open, an alarm occurs if the door interlock function is active (DOOR INTERLOCK switch ON). For details, refer to 3-3-2-6.

1) Move the turret to the turret indexing position using the SLIDE JOG buttons on the machine operation panel.

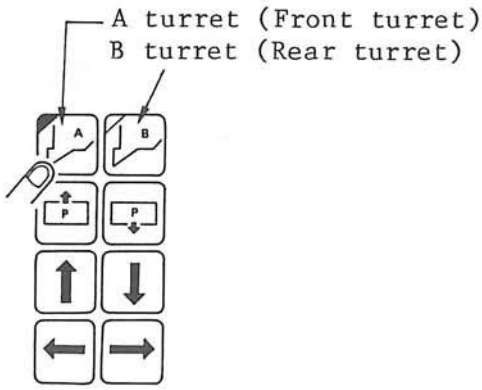
<u>Turret Index Position</u>

Positive soft-limit position of X-axis or Z-axis.

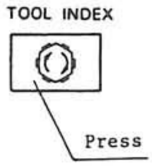
2) Select the MANUAL OPERATION mode by pressing the MANUAL key.



3) Select the turret to index.



4) Press the TOOL INDEX button.



A push on the button indexes the turret by one station. When it is held down, the turret rotates continuously.

Rotation direction can be commanded by M code. However, this is not possible with the following models:

LH series and LS3Ø-N.

M codes are as follows:

M86: Turret right rotation command
M87: Turret left rotation command

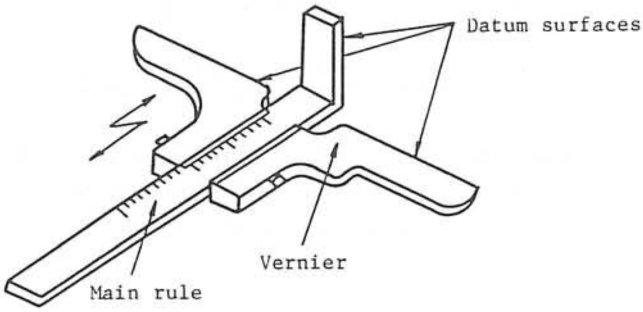
This completes a brief explanation of the operating procedures for the essential movements of the machine. Frequent repetition of these procedures, will insure speedy familiarization with your NC lathe.

3-3-2. Preparation of Machine for Operation

The following is a detailed explanation of the necessary steps and precautions for setting up the machine.

3-3-2-1. Tool Setting

Supplied together with the machine, the special tool setting caliper is used to set the individual cutting tools and holders on the machine.



Setting caliper

Design:

The caliper consisits of a gauge head with a slot to accomodate a narrow main rule. Featuring a total of three finished datum surfaces, the gauge is designed on the same principle as a caliper unit.

The main ruler is graduated up to 15Ø mm and may be used to measure the tool projection amount from Ø to 15Ø mm.

How to Use the Caliper:

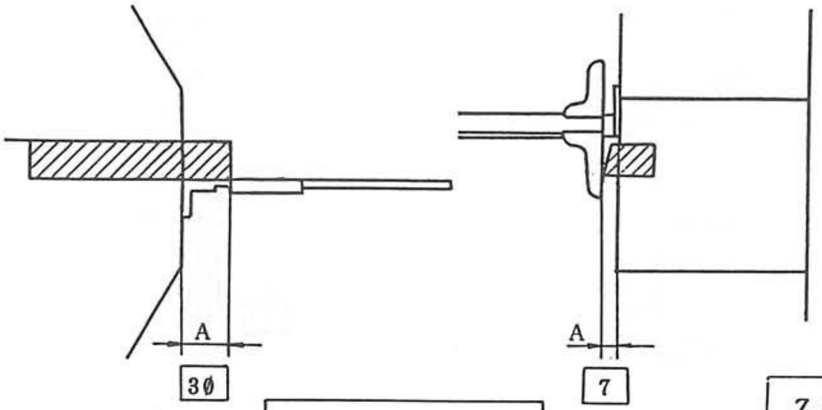
Take the reading with the datum surface held flush against the datum surface of the toolholder and the cutting tool, usually the tool point.

Carry out measurement in both X- and Z-axis directions. The read value indicates the tool projection amount from the datum surface of the toolholder.

(1) OD tool turret

Standard Tool

X, Z: Tool offset values
A: Measured value

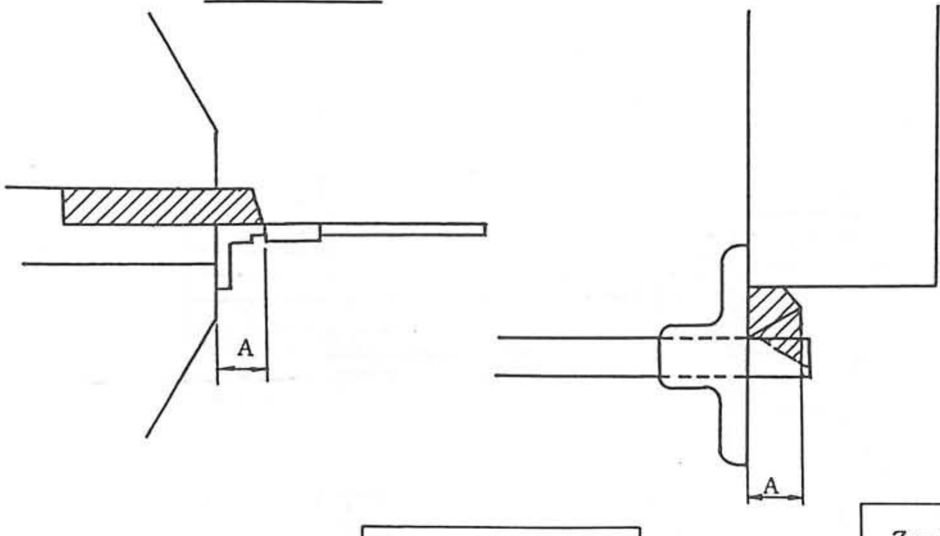


$X = +2(A - 30)$

$Z = A - 7$

Inverted Tool

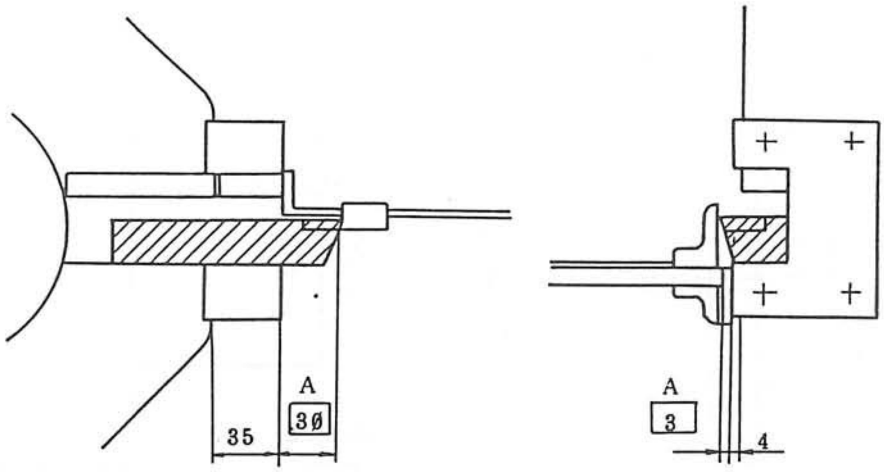
X: same as for standard tool above



$X = +2(A - 30)$

$Z = -(A + 7)$

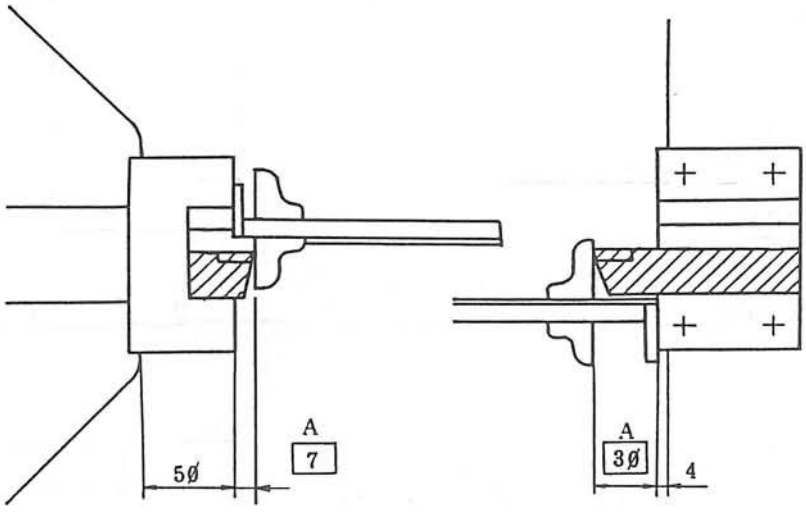
(2) OD toolholder I



X=2 (A+5)

Z = A − 3

(3) OD toolholder II

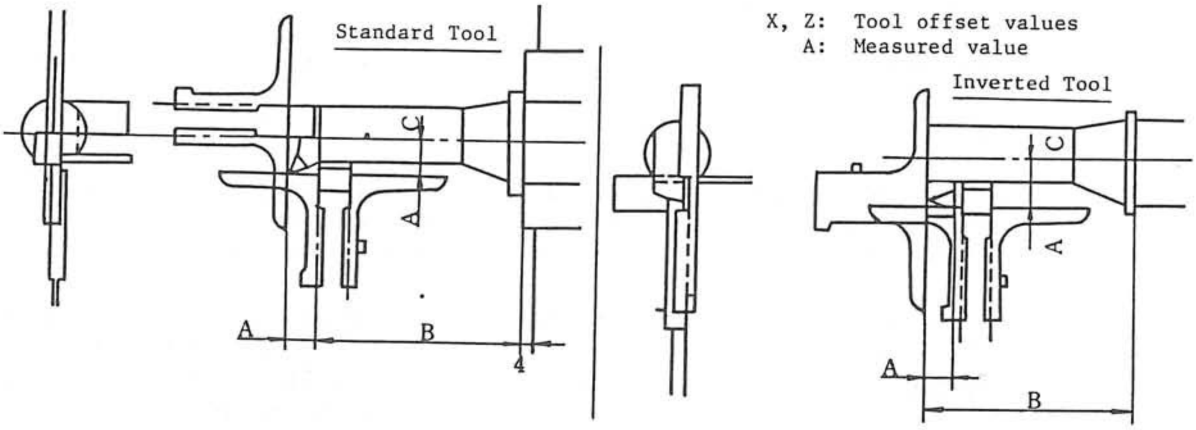


X=2 (A+2 Ø)

Z = A − 3

(4) ID toolholder

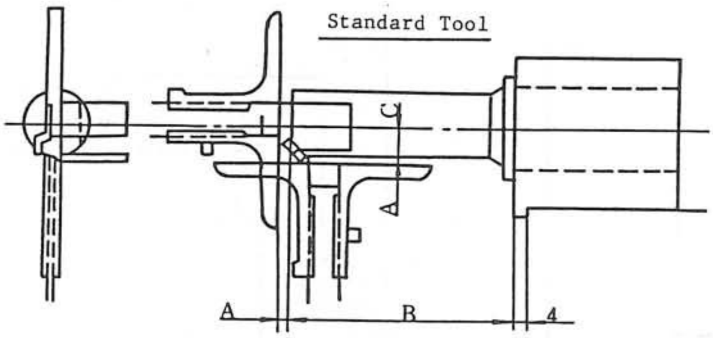
X, Z: Tool offset values
A: Measured value



X=−2 (A+C)
Z=A+B−3

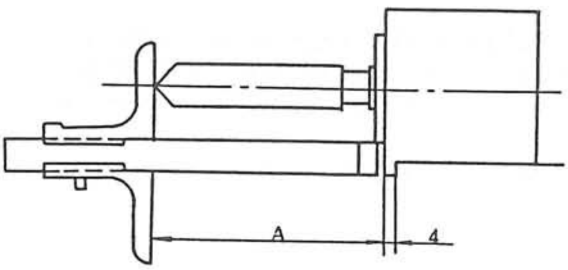
X=−2 (A+C)
Z=B−A−3

(5) Boring bar



X=−2 (A+C)
Z=A+B−3

(6) Drill sleeve



X=Ø
Z=A−3

3-3-2-2. Setting Zero Offsets

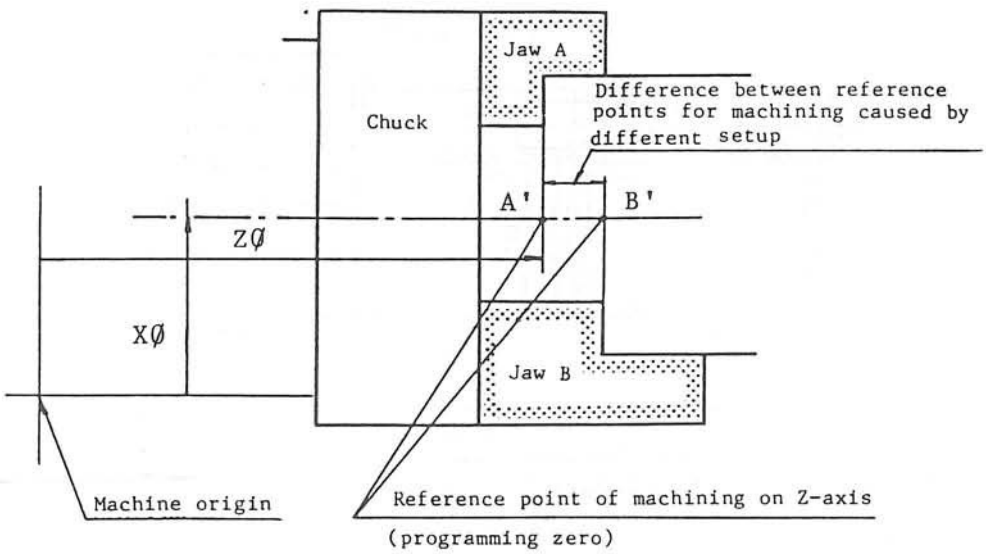
(1) What is Zero Offset?

The common coordinate position from which a complete program is made for a particular component is termed "zero point or programming zero".

The programming zero is located at the fixed position (center of the spindle) on the X-axis. However, the programming zero on the Z-axis will vary depending on the setup (incl. chuck, jaws, etc.).

With the NC lathe, the program origin (program starting point) is fixed anywhere on Z-axis, that is, on the longitudinal axis of the spindle. It may vary with respect to the direction of Z-axis, according to the chucking requirements. As shown below, there is a difference in the coordinate position of zero points between one program using jaws A and another program using jaws B. This is caused by the difference in jaw sizes used in respective programs.

The zero offset feature provides for shifting the zero point of the program with respect to the zero point of the machine to match differences in individual workpieces or setups.

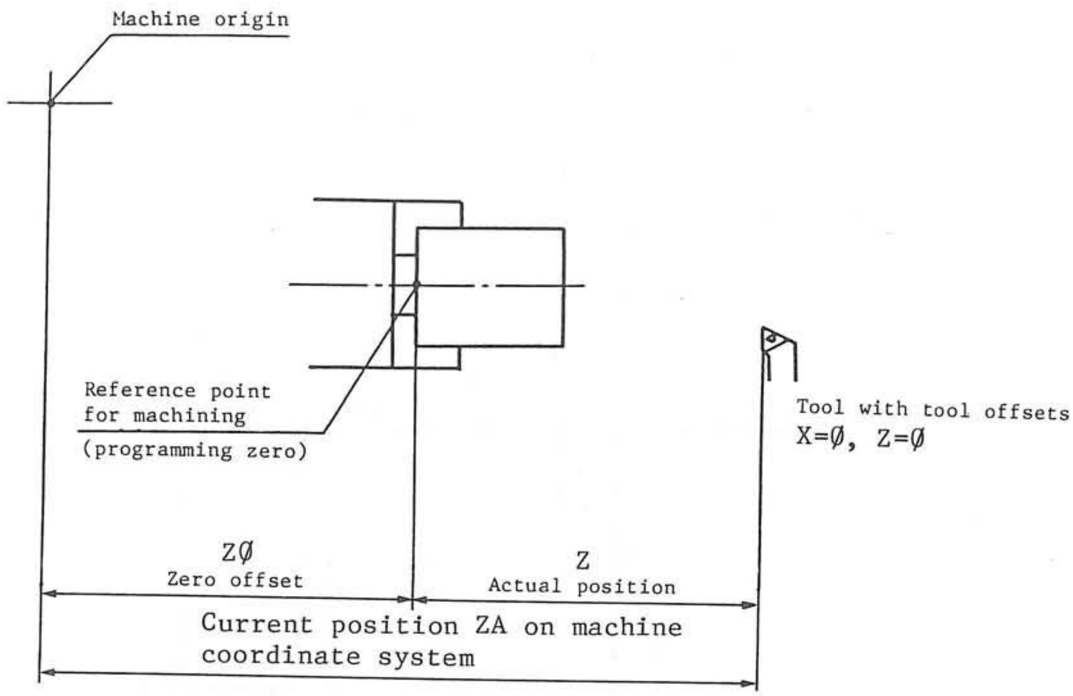


The operator can establish the reference point for machining (zero point of a program) by entering XØ and ZØ through the keyboard dimensioned from the fixed zero point of the machine.

"XØ, ZØ" is called Zero Offset Values.

(2) Relation between of Machine Zero, Program Origin, Zero Offset Value and Actual Position

Shown below is the positional relationship between the factors involved in the Zero Offset function:



Current position ZA on machine coordinate system

The NC machining program needs distance Z as absolute position of the tool at A.

↓

The control always performs calculation "ZA - ZØ" to obtain distance Z, i.e., the absolute position of the tool.

↓

The operator can set the reference point of machining (machining origin) at any desired point by entering zero offset value ZØ.

(3) Setting Zero Offset Values

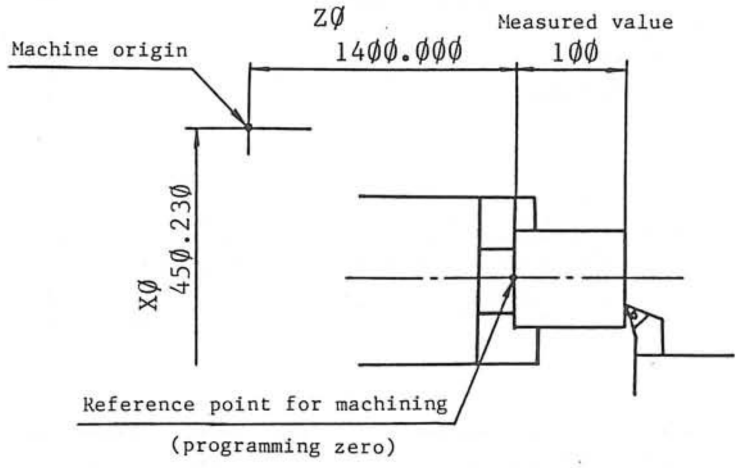
There are three possible cases for entering zero offset values:

a) Where zero offset values are unknown, as in cutting the first workpiece for instance.

b) Where zero offset values are known, as in cutting workpieces of repetitive lots.

c) Where the stored offset values are modified.

Explanation for each case is provided in this paragraph with the following example.

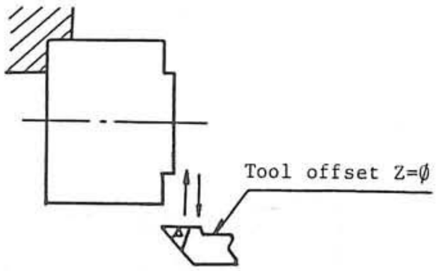


a) Case where zero offset value is unknown:

The explanation below is provided with 1 mm unit system.

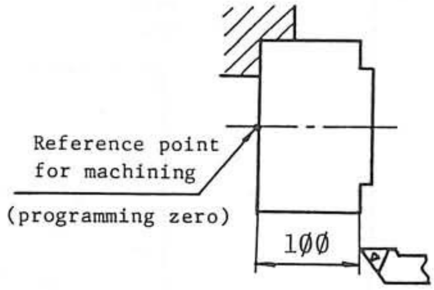
To set the zero offset value of Z-axis, proceed as follows:

1) Turn the end face of the part with a proper depth of cut in the manual mode.

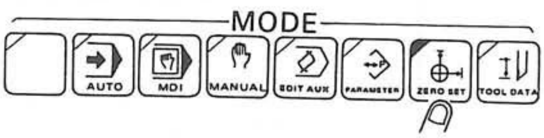


2) Measure the workpiece length to obtain the actual position of the tool dimensioned from the programming zero.

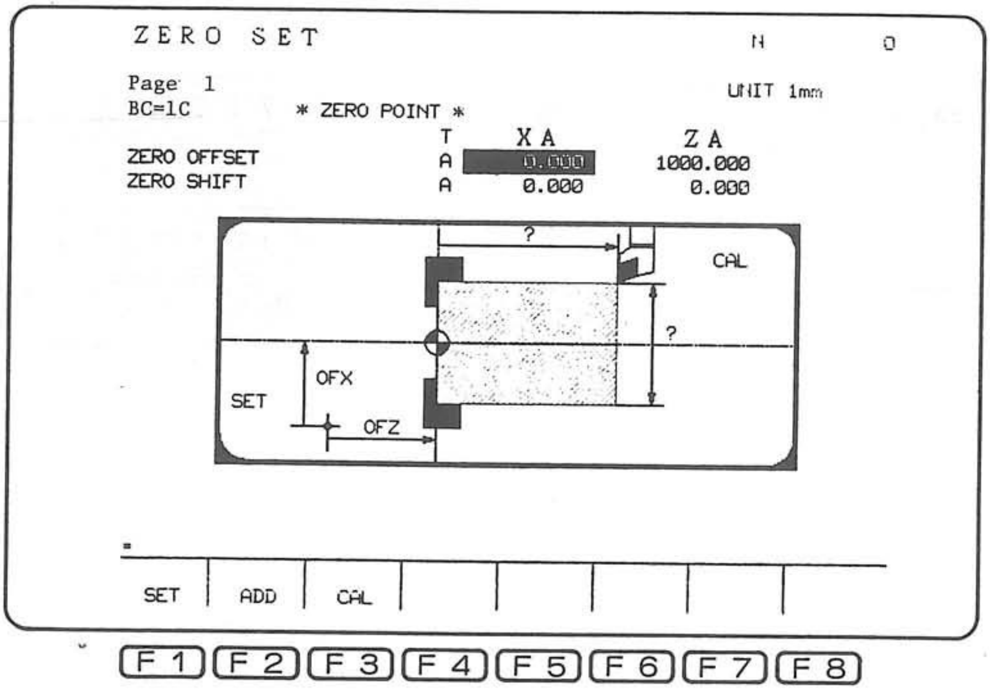
Assume this dimension is measured as 1ØØ mm (1ØØ.ØØØ).



3) Select the ZERO SET mode by pressing the ZERO SET key.



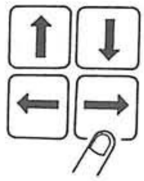
4) The CRT display is as shown below.

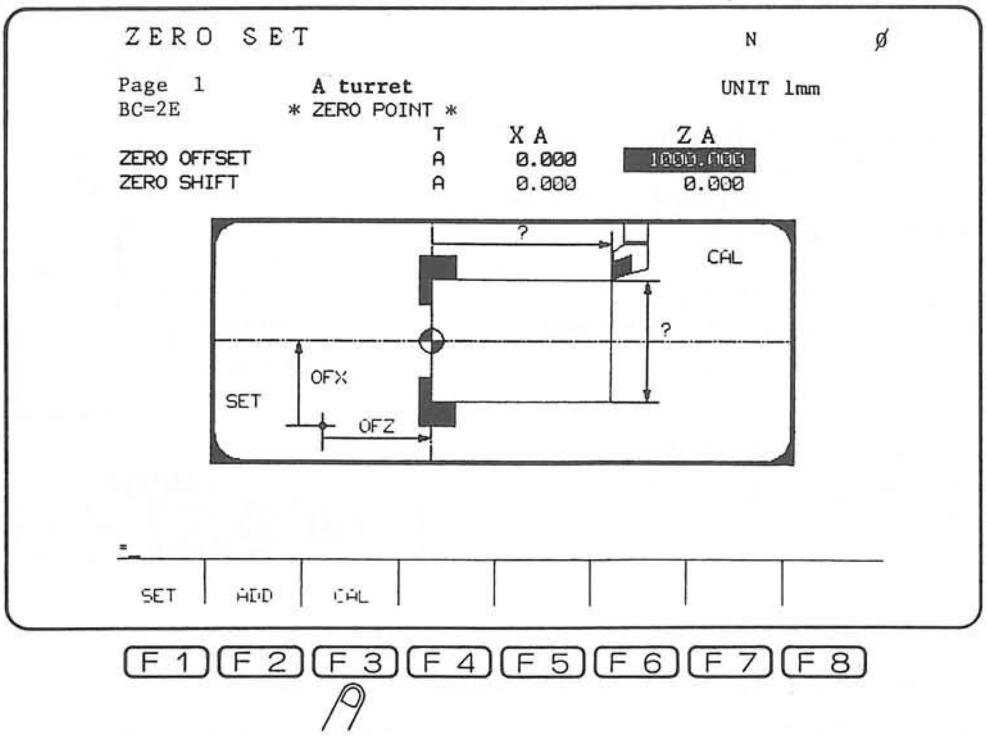


5) Select the turret, either A- or B-turret (for two-saddle and two-turret models).

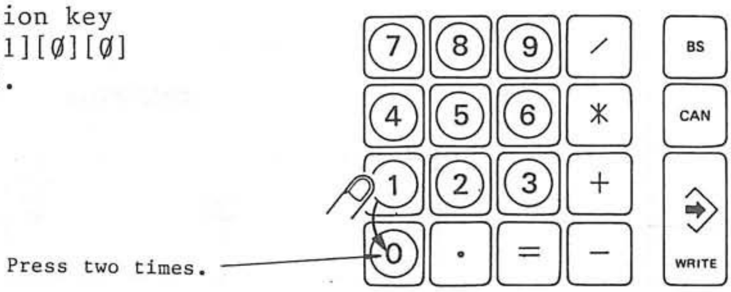
Each time  or  is pressed, turret A and B, is selected alternately.

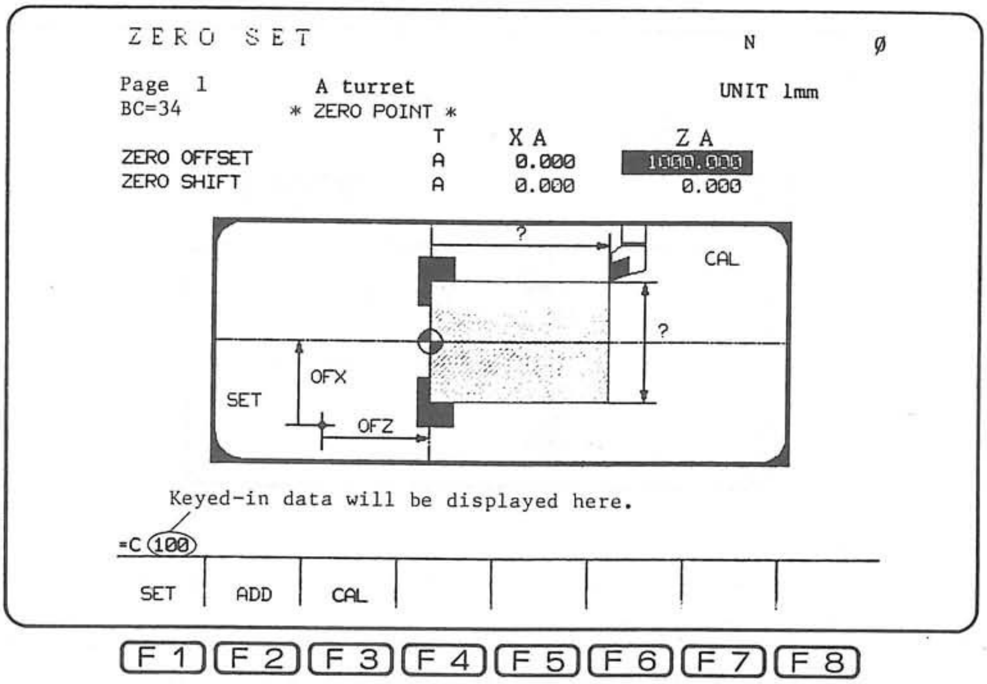
6) With the cursor shift keys, locate the cursor to ZERO OFFSET - ZA data position.



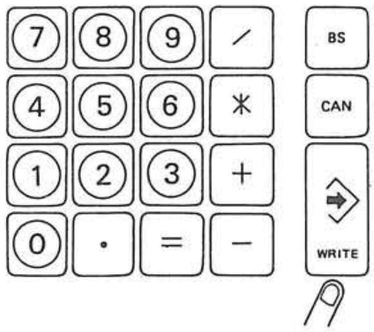


7) After pressing function key [F3] (CAL), key-in [1][Ø][Ø] through the keyboard.



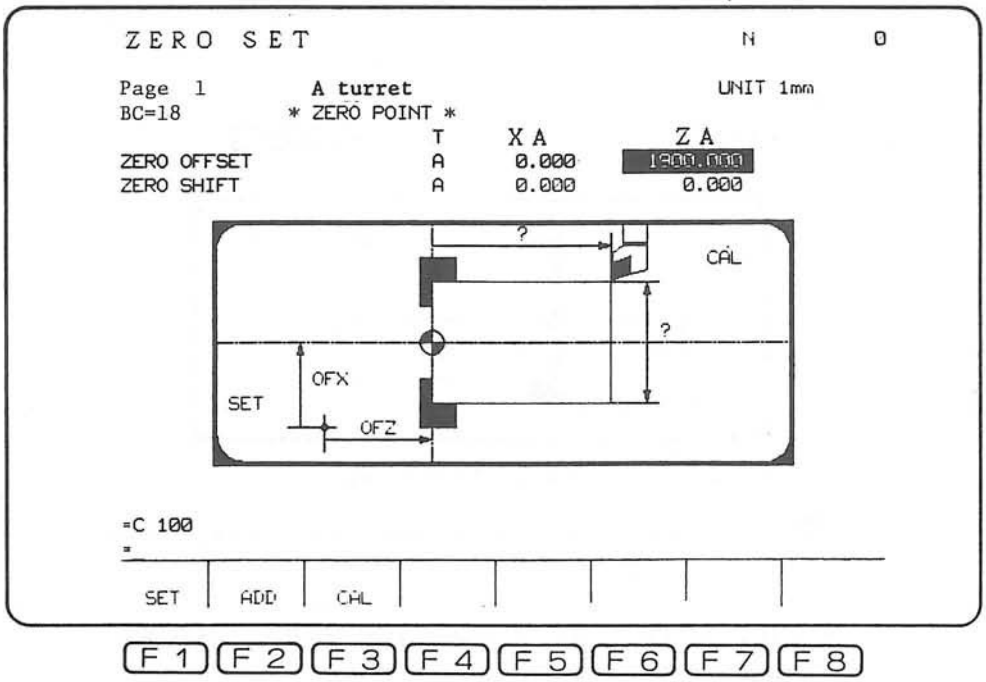


8) Press the WRITE key.



With this, the coordinate system is established so that the present tool position takes coordinate value Z1ØØ mm.

9) The CRT displays the results of calculation or set value.



1Ø) This completes setting the zero offset value.

CAUTION

1) Never move the turret in Z-axis direction, until the zero offset setting is completed.

2) For X-axis, the reference point of X-axis does not change even when the chucking method or setup changes. Accordingly, there is no need for zero offset setting each time the set up changes.

3) Use a tool with offset values of X=Ø, Z=Ø, where practicable, for zero offset setting. If the tool offset values are not zero, zero offset setting procedures will differ from the procedure indicated above.

See below.

When a tool with tool offset values is used to set the zero offset value:

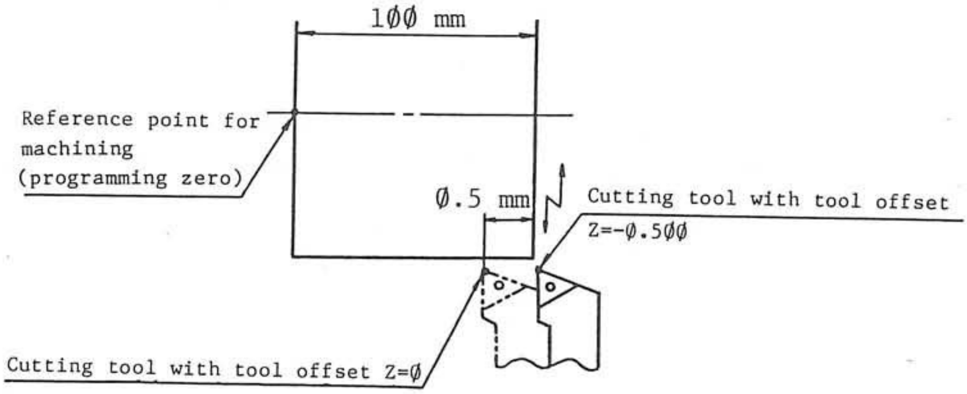
The numeral data to be entered through the keyboard switches is the sum of "measured value" and "tool offset value".

Setting Value = Measured Value + Tool Offset Value

Example: A tool with a tool offset value of Z=-Ø.5ØØ is used.

The zero offset value is calculated as

1ØØ.ØØØ + (-Ø.5ØØ) = 99.5ØØ



If the workpiece length is 1ØØ mm when it has been cut using a tool with a tool offset of Z=-Ø.5ØØ mm, the position of the tool with a tool offset of Z=Ø is 99.5 mm from the reference point (programming zero).

A procedure that does not require a modification of the set zero offset value is described below.

1) Carry out steps 1) and 2) as explained before.

2) Enter tool offset data to tool offset #1 register.

   To enter tool offset, refer to 3-3-2-3.

3) Cut the end face of the part by moving only X-axis in the MDI mode operation with TØ1Ø1 active. (Refer to 3-3-2-5.)

   TØ1 = Tool no.; Ø1 = Tool offset no.

4) Carry out steps 3) through 9) as explained before.

With the procedure above, it is unnecessary to modify the set zero offset value by taking the tool offset value into consideration.

CAUTION

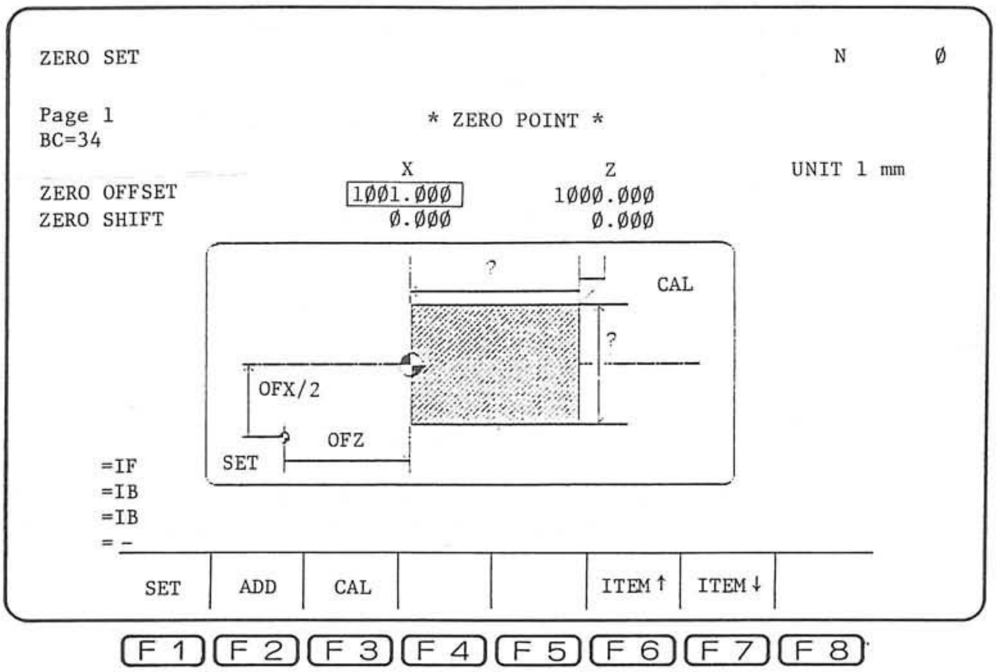
Never reset the control after cutting the part in MDI MODE operation.

The OSP5ØØ/5ØØØL-G has four different types of display. They are;

- Color graphic display
- Monochrome graphic display
- Semi-graphic display
- Monochrome character display

Display screens used in the explanation on the following pages assume the graphic display screens. If the color graphic screen is used, display is provided in color. With the monochrome character display, guide display is not available. The semi-graphic display screen provides virtually the same level of display capability as the graphic display screen except that the chuck jaws are not displayed and cutting tool shape is different from the actual shape.

See the example display below.

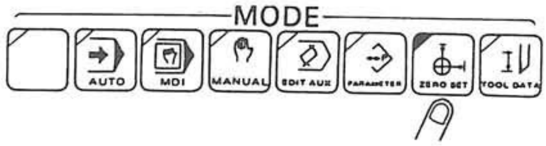


b) Where zero offset value is known:

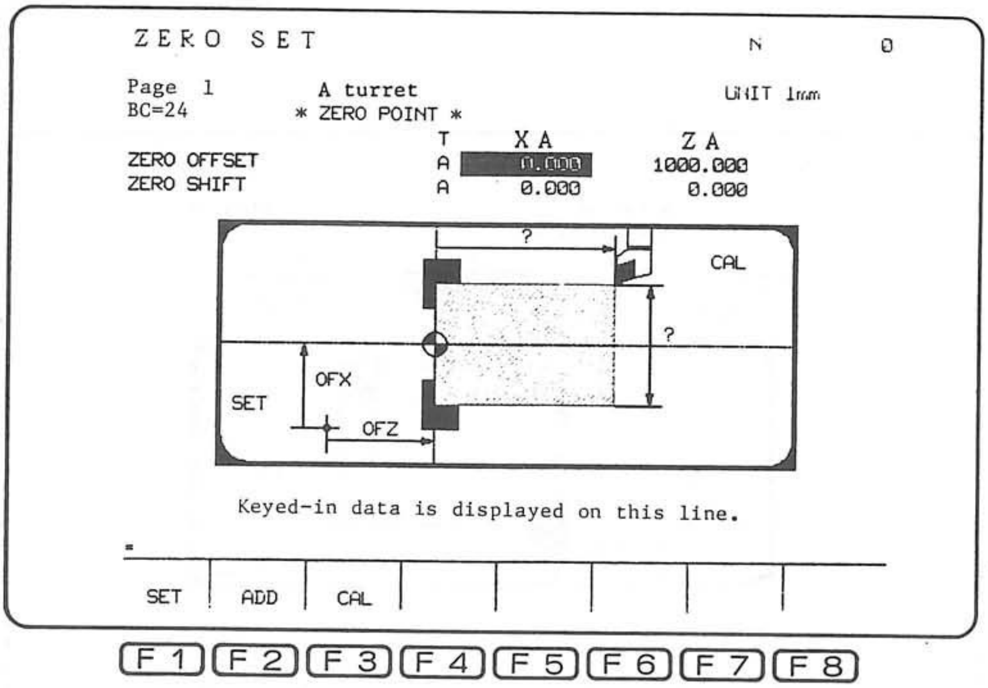
XØ = 45Ø.23Ø
ZØ = 14ØØ.ØØØ

To set zero offset value of X-axis, proceed as follows:

1) Select the ZERO SET mode by pressing the ZERO SET key.



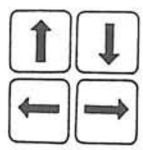
2) The CRT display is as shown below.



3) Select the turret, either A- or B-turret (for two-saddle and two-turret models).

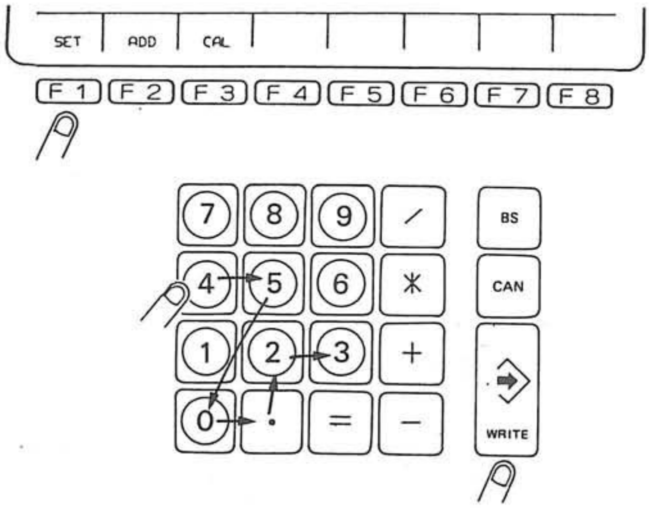
Each time  or  is pressed, turret, A and B, is selected alternately.

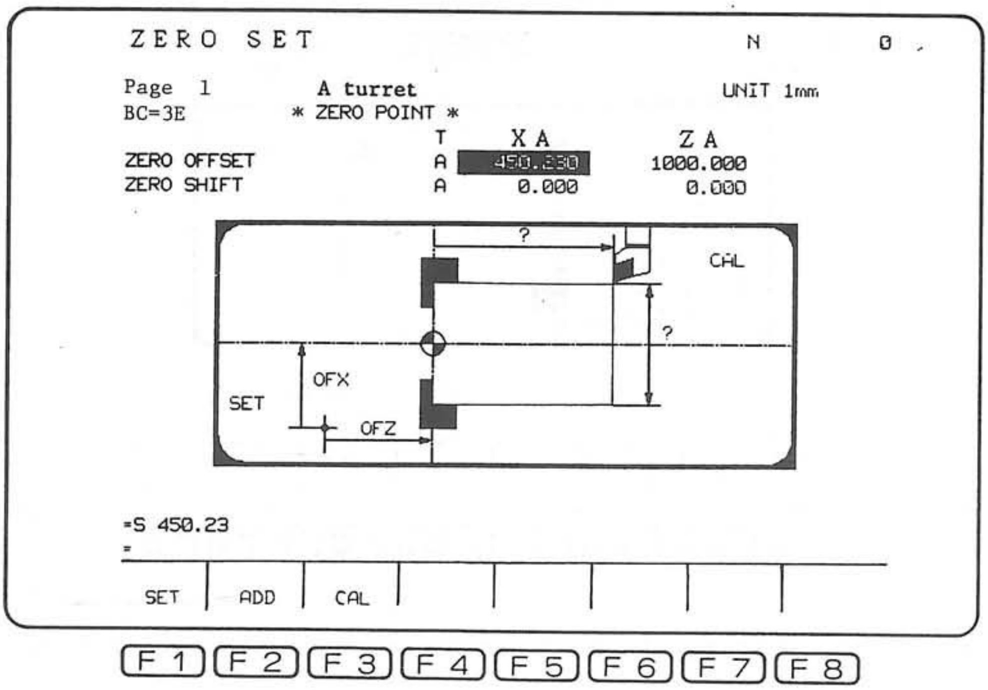
4) With the cursor shift keys, locate the cursor to ZERO OFFSET - XA data position.



5) After pressing function key [F1] (SET), key-in [4][5][Ø][.][2][3] through the keyboard.

6) Press the WRITE key.





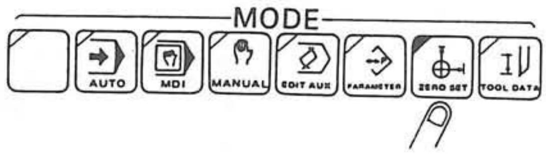
With the steps indicated above, keyed-in zero offset value is stored in the zero offset area of the memory.

For Z-axis zero offset entry, the same procedure applies.

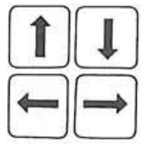
c) Where the stored zero offset value is to be modified:

XØ = 45Ø.23Ø ⟶ to subtract 1Ø.ØØØ
ZØ = 14ØØ.ØØØ ⟶ to add 1Ø.ØØØ

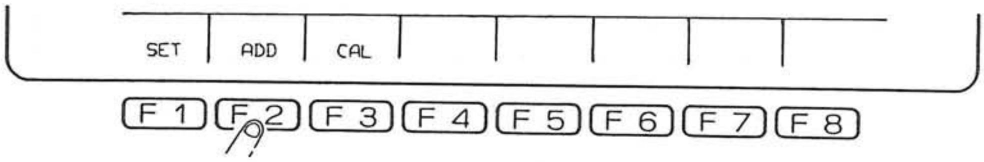
1) Select the ZERO SET mode by pressing the ZERO SET key.



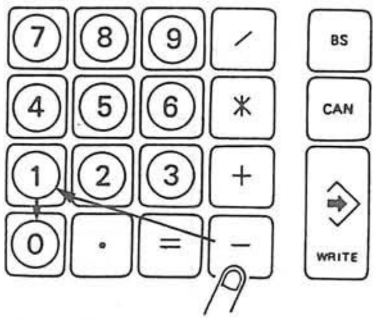
2) With the cursor shift keys, locate the cursor to ZERO OFFSET - XA data position.



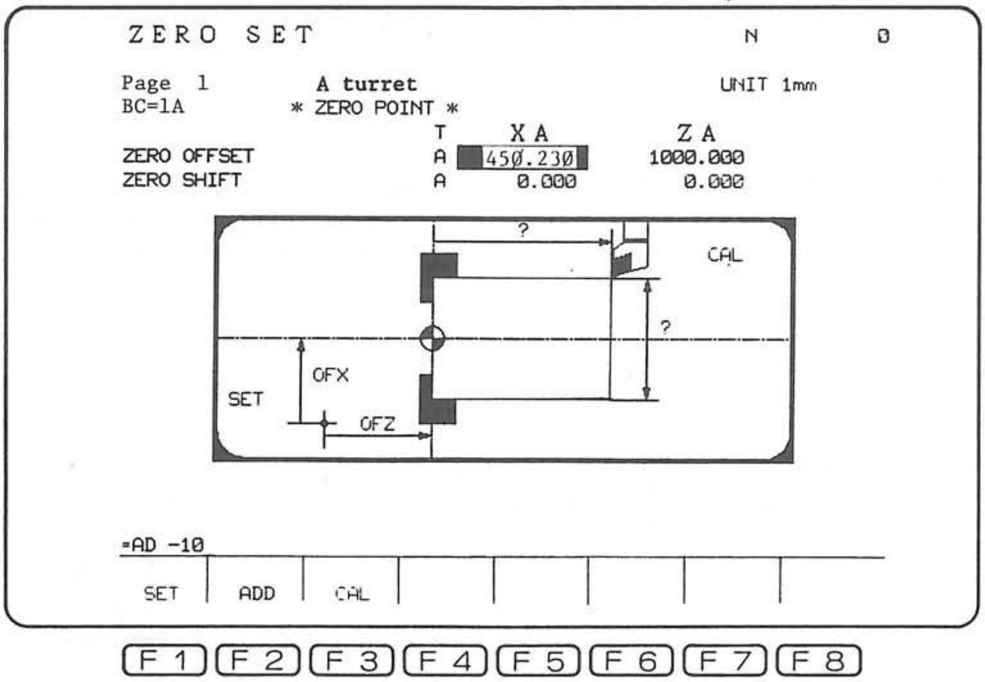
3) Press the function key [F2] (ADD).



4) Key-in [-][1][Ø] through the keyboard.



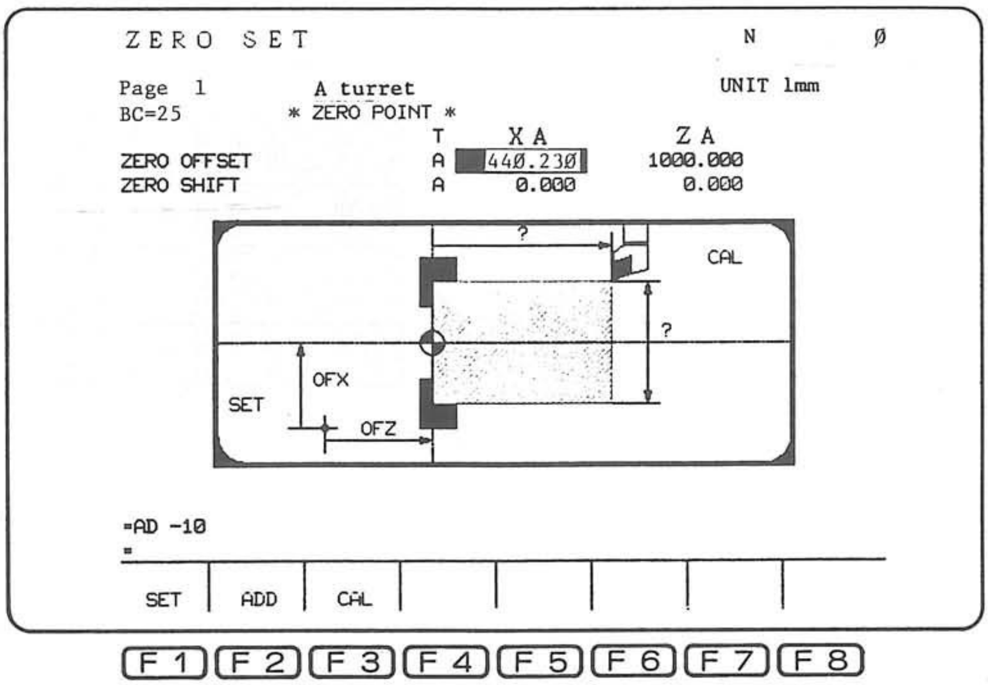
5) The corresponding CRT display is:



6) Press the WRITE key, and the CRT display changes as shown below.

With the WRITE key pressed, the following calculation is performed in the control and the result is stored as X-axis zero offset value.

450.230 + (-10.000) = 440.230



For Z-axis zero offset entry, the same procedure applies.

3-3-2-3. Setting Tool Offsets

(1) What is tool offset?

As illustrated in the foregoing diagrams, the reference dimensions or datum positions for individual cutting tools and holders have been predetermined for each type of turret mounted on the machine.

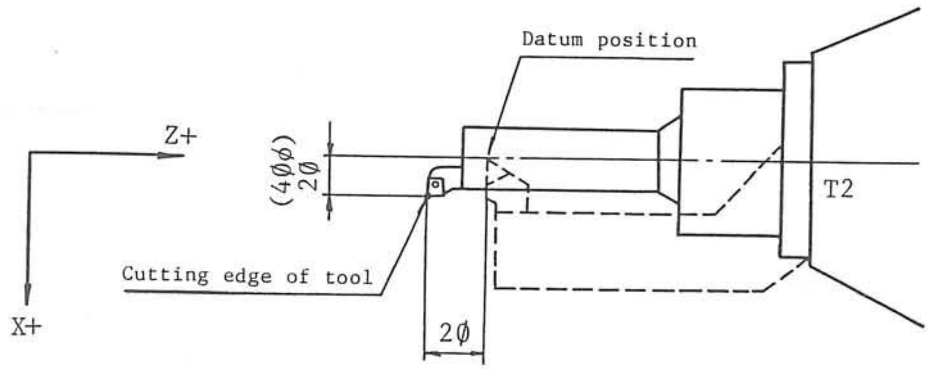
Tools and holders are often mounted in positions different from these datum positions. When installing the tools in the turret, it is time consuming to set the cutting point of each tool to the exact datum position. During operation, the tool point will also wear, resulting in over-sized parts.

On the other hand, the NC program has been prepared on the assumption that all cutting tools to be used are set exactly to the datum positions. This is because the programming procedure becomes extremely difficult if variable factors such as setting errors and tool wear are taken into consideration. It is thus necessary to correct the differences with respect to the required setting.

These differences or the amount of correction to be made are called "tool offset values."

Adjustments of tool positions are necessary before running the first part, after the first cut, and during operation, so that compensation can be made for the amount of wear developed even if the tool has been initially set to the required setting. The control has a "Tool Offset" control which automatically corrects tool setting errors as each tool is indexed into position for cutting. Manual switches can be used to make up for these differences with each tool in the turret.

Example:



The end point of the tool is set in the following coordinate position with respect to the required setting or datum point:

Along X-axis ..... +4Ø mm (in diameter)
Along Z-axis ..... -2Ø mm

These differences are usually measured by the tool setting calipers.

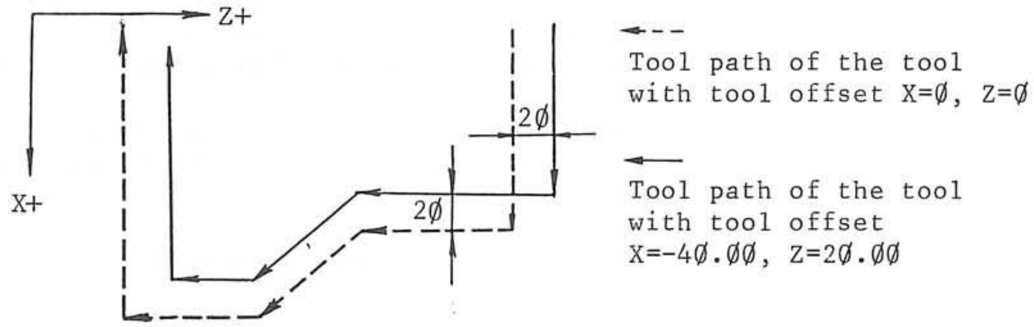
The tool offset values of this tool are:

X = -4Ø.ØØ
Z = +2Ø.ØØ

The tool offset values of the tool set at the datum point are:

X = Ø
Z = Ø

The tool paths of the tool are shown below:



With the tool offset values stored in the control, compensation of the tool path is automatically made generating the path as programmed.

(2) Setting Tool Offset Values

When entering tool offset values, it is advisable to use a tool offset number identical to the number of the tool on which the offset function is activated.

Example: TØ1Ø1   TØ2Ø2

T word consists of "tool number" and "tool offset number":

T [ ][ ] [ ][ ]

Tool offset number, 1 through 32

Tool number, 1 through 12

There are three possible cases for entering tool offset values:

a) Where tool offset values are unknown, as when setting a tool on the turret for the first time.

b) When modifying the stored offset values.

This tool offset value setting procedure is effective when a workpiece is finished in incorrect dimensions due to tool wear.

c) Where tool offset values are known.

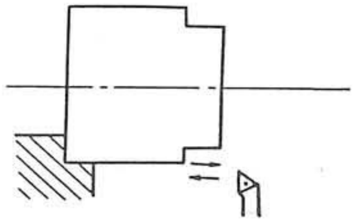
Explanation for each case is provided in this paragraph assuming that:

- numeral values are all expressed in units of 1 μm,
- setting of zero offset values of X- and Z-axis has been completed.

a) Where the tool offset value is unknown:

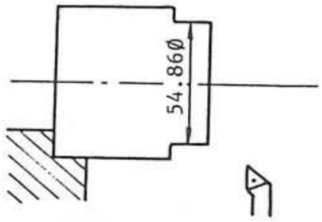
To set the zero offset value of X-axis:
(tool offset no.: 2)

1) Turn the outside diameter of the workpiece with a proper depth of cut in the MANUAL OPERATION mode.

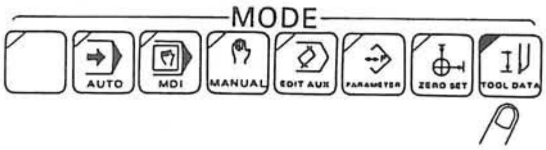


2) Measure the workpiece OD with a micrometer.

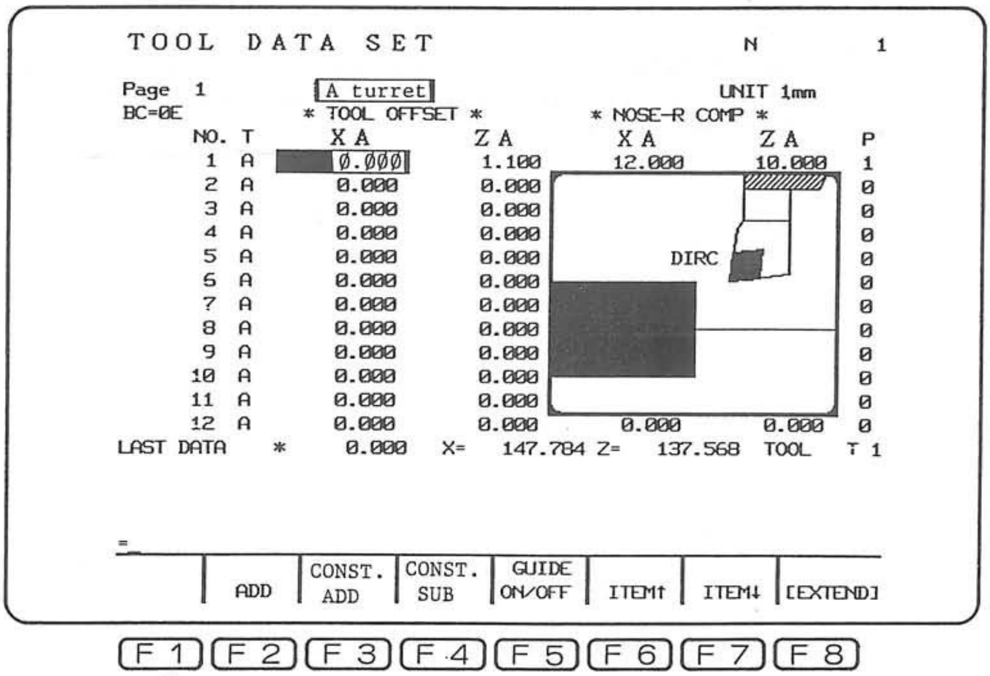
Assume that this dimension is measured as 54.860 mm.



3) Select the TOOL DATA SET mode by pressing the TOOL DATA key.



4) The CRT display is as shown below.



TOOL DATA SET N 1

Page 1 A turret UNIT 1mm
BC=0E * TOOL OFFSET * * NOSE-R COMP *

NO.	T	X A	Z A	X A	Z A	P
1	A	0.000	1.100	12.000	10.000	1
2	A	0.000	0.000			0
3	A	0.000	0.000			0
4	A	0.000	0.000			0
5	A	0.000	0.000			0
6	A	0.000	0.000			0
7	A	0.000	0.000			0
8	A	0.000	0.000			0
9	A	0.000	0.000			0
10	A	0.000	0.000			0
11	A	0.000	0.000			0
12	A	0.000	0.000	0.000	0.000	0

DIRC

LAST DATA * 0.000 X= 147.784 Z= 137.568 TOOL T 1

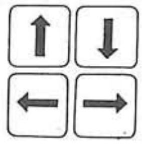
=_

	ADD	CONST. ADD	CONST. SUB	GUIDE ON/OFF	ITEM↑	ITEM↓	[EXTEND]
F 1	F 2	F 3	F 4	F 5	F 6	F 7	F 8

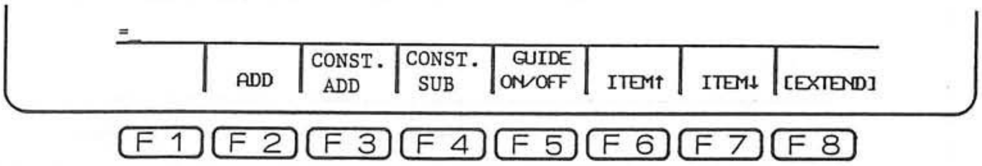
5) Select the turret, either A- or B-turret (for 2-turret/2-saddle models).

Each time  or  is pressed, turret, A and B, is selected alternately.

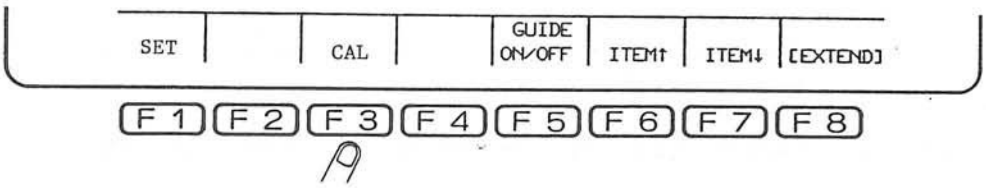
6) With the cursor shift keys, locate the cursor to the No. 2 TOOL OFFSET - XA data position.



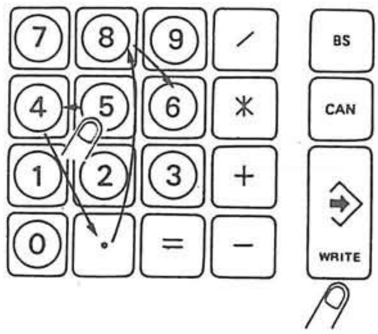
7) Press the function key [F8] (EXTEND) and make sure that the function name CAL appears at function key [F3].



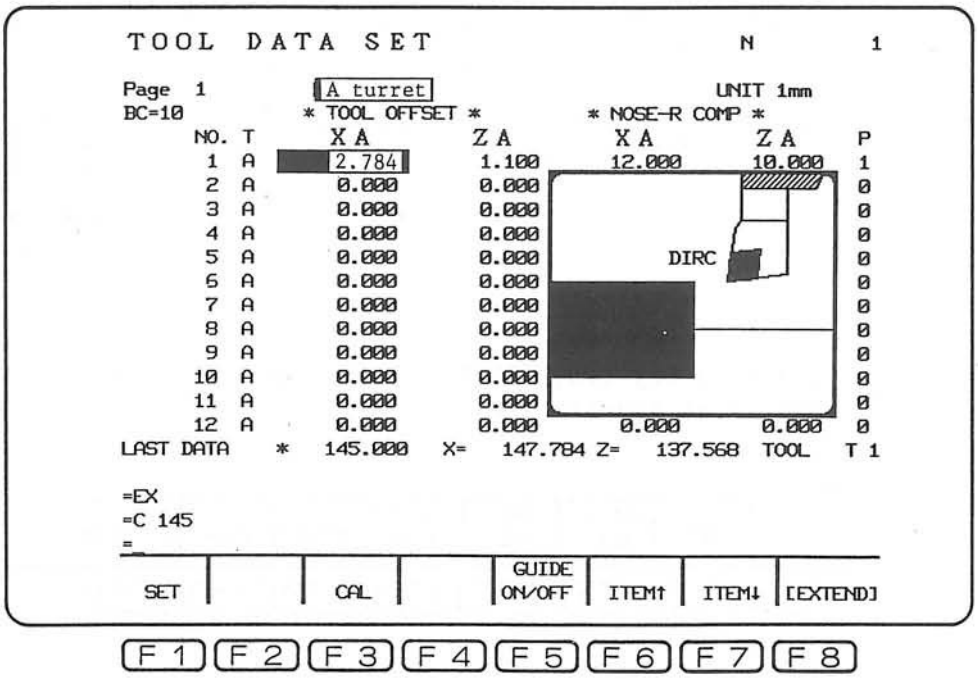
8) After pressing function key [F3] (CAL), key-in [5][4][.][8][6] through the keyboard.



9) Press WRITE key.



The CRT display is as shown below.



With the steps indicated above, the tool offset value is automatically calculated and stored in offset no. 2 area of memory.

Note 1: Never move the turret in X-axis direction until the tool offset setting of the active tool is completed.

Note 2: Perform the same procedure for Z-axis and other tools.

Note 3: Calculation of the tool offset value is carried out in the equation below:

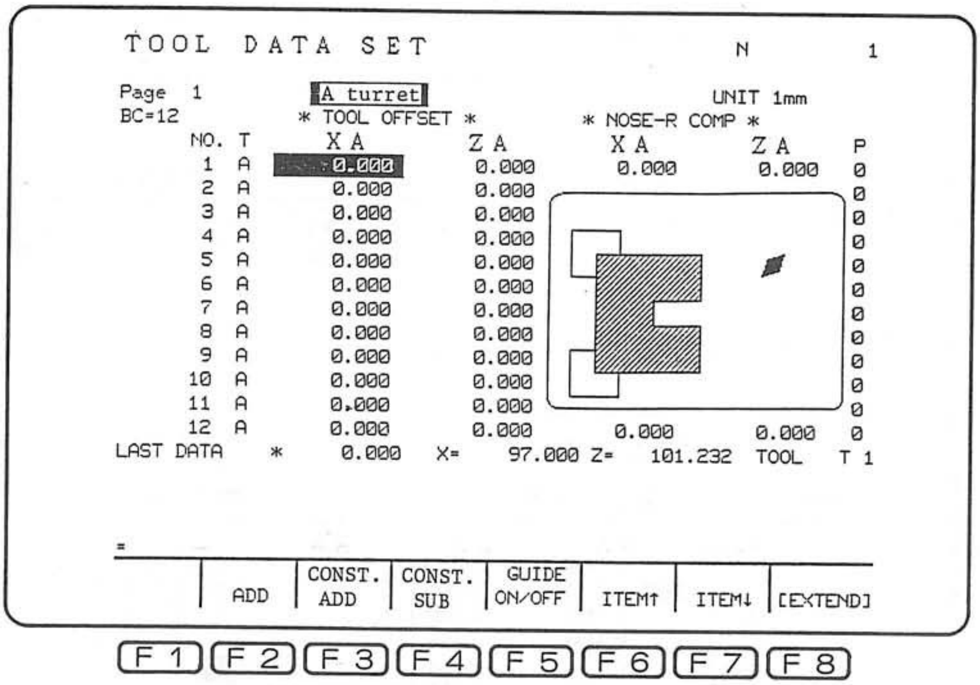
Tool Offset Value
= Calculated Value - Zero Offset Value - Input Value
(Actual tool position) (Measured value with micrometer)

The OSP5ØØ/5ØØØL-G has four different types of display. They are

- Color graphic display
- Monochrome graphic display
- Semi-graphic display
- Monochrome character display

Display screens used in the explanation on the following pages assume the graphic display screens. If the color graphic screen is used, display is provided in color. With the monochrome display is not available. The semi-graphic display screen is as shown below and for tool shape, only tip is displayed.

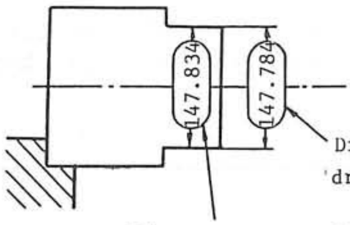
Guide display can be turned off for the graphic and the semi-graphic CRT by pressing the function key [F5] (GUIDE ON/OFF).



b) To modify the stored tool offset value (ADD):

OD cutting with the offset value in no. 2 memory area finished the workpiece Ø.Ø5 mm larger than the programmed dimension. To modify the tool offset value, proceed as follows:

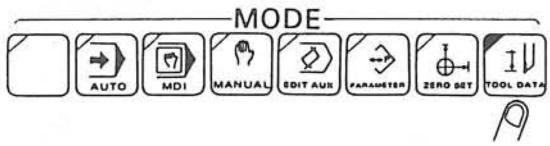
Note: The limit value for the ADD operation can be set within a range of Ø - 1 mm (or Ø - Ø.1 in.) with the parameter (long word) No. 33. This limit, however, can be canceled by setting a proper parameter data (details should be referred to 4-3-6, "Optional Parameter (Bit)").



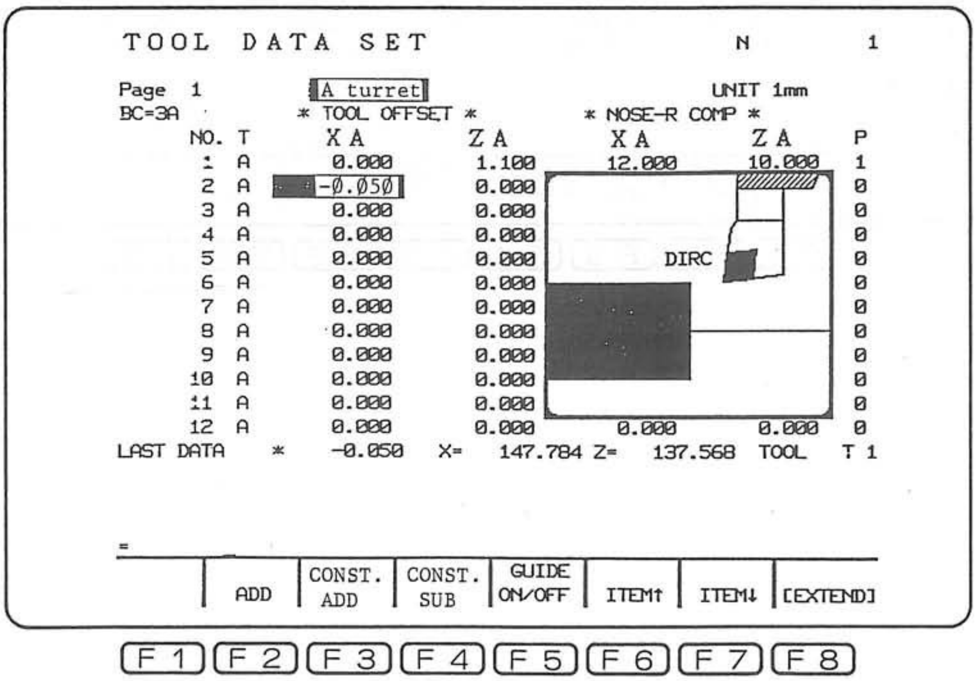
Diameter specified on part drawing (programmed X value)

Diameter measured by a micrometer

1) Select the TOOL DATA SET mode by pressing the TOOL DATA key.



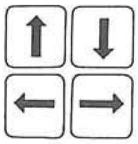
2) The CRT display is as shown below.



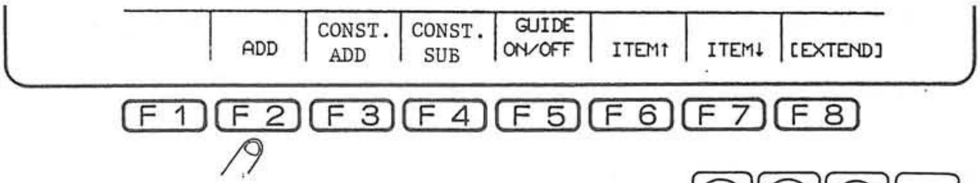
3) Select the turret, either A- or B-turret (for two-saddle and two-turret models).

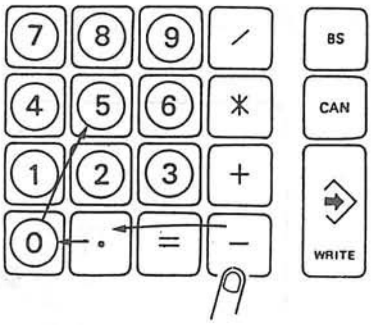
Each time  or  is pressed, turret, A and B, is selected alternately.

4) With the cursor shift keys, locate the cursor to the No. 2 TOOL OFFSET - XA data position.

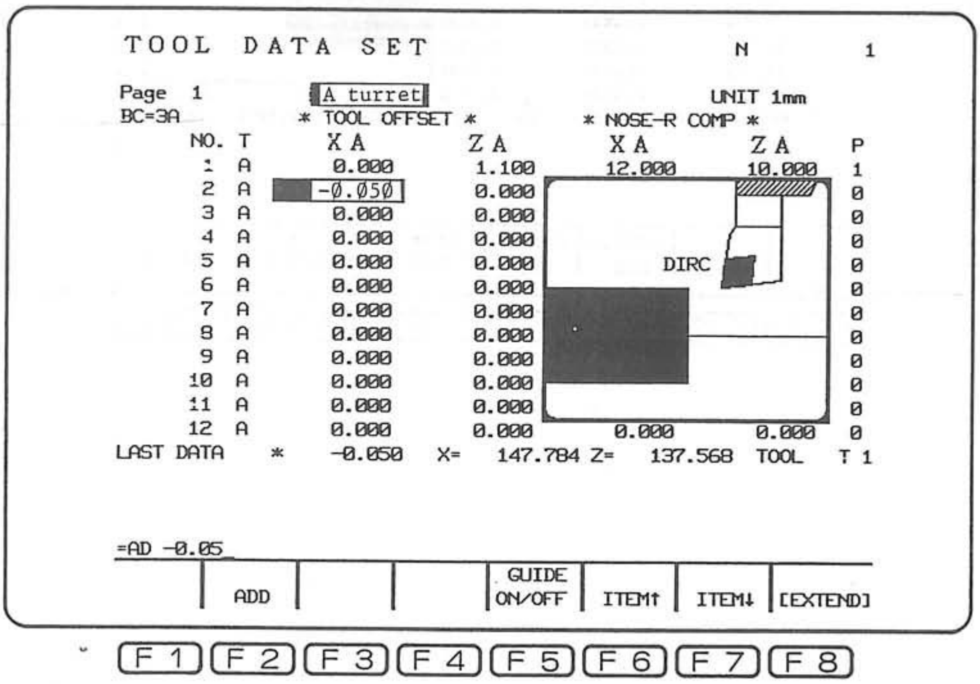


5) After pressing the function key [F2] (ADD), key-in [-][Ø][.][Ø][5] through the keyboard.

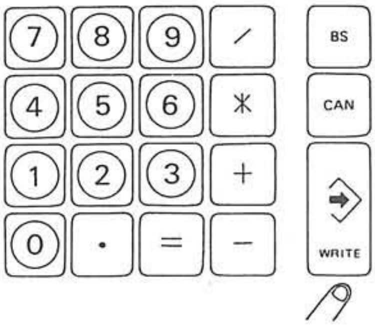




The CRT display is as shown below.



6) Press the WRITE key.

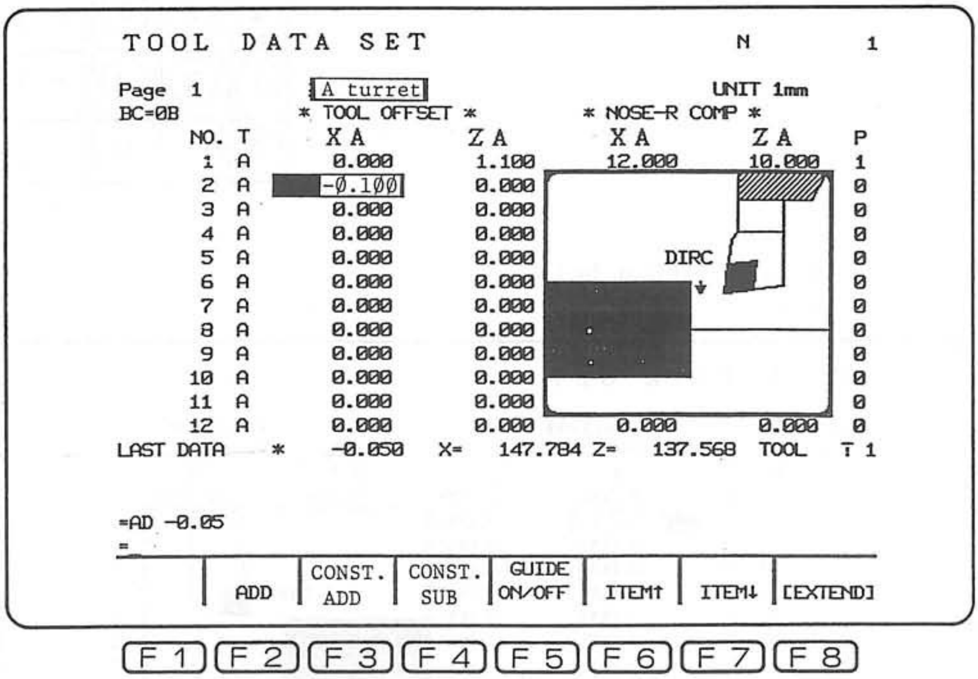


7) With the steps indicated above, calculation for the new tool offset data is made according to the equation below, and the result of the calculation is stored in no. 2 memory area, thus renewing the data.

New Offset Value = Old Offset Value + Keyed-in Data

-Ø.1ØØ = -Ø.Ø5Ø + (-Ø.Ø5Ø)

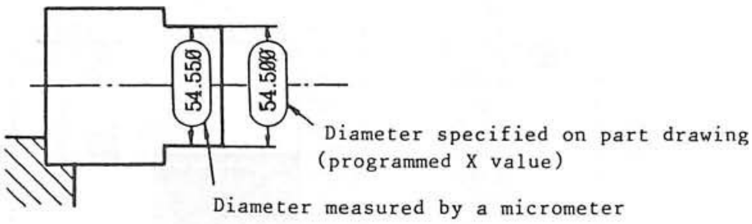
8) The CRT display is as shown below.



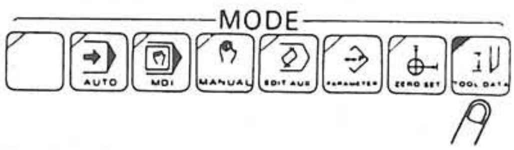
c) To modify the stored tool offset value (CONST. ADD), (CONST. SUB):

To alter the tool offset values using the functions CONST. ADD and CONST. SUB, preset a fixed amount by the parameter and add or subtract the preset value to and from the original tool offset value by simply pressing the function key [F3] (CONST. ADD) and [F4] (CONST. SUB). This fixed amount is set to the optional parameter (long word) No. 32 in units of 1 μm within a range of Ø - 1ØØØ μm.

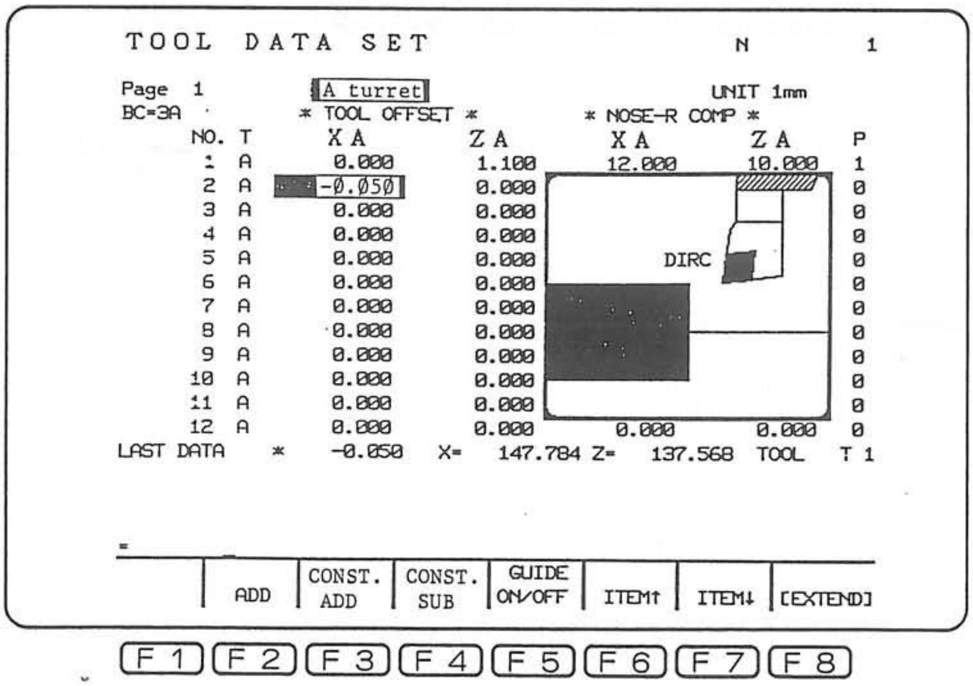
In the turning operation using tool offset number 2, the finished outside diameter is Ø.Ø5 mm larger than the commanded value. Thus, the offset value is required to be compensated.



1) Select the TOOL DATA SET mode by pressing the TOOL DATA key.



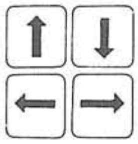
2) The CRT display is as shown below.

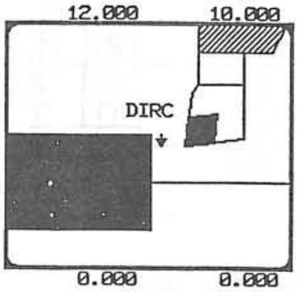


3) Select the turret, either A- or B-turret (for two-saddle and two-turret models).

Each time  or  is pressed, turret, A and B, is selected alternately.

4) With the cursor shift keys, locate the cursor to the No. 2 TOOL OFFSET - XA data position.





TOOL DATA SET　　N　1

Page 1　　A turret　　UNIT 1mm

BC=0B

NO.	T	* TOOL OFFSET * XA	ZA	* NOSE-R COMP * XA	ZA	P
1	A	0.000	1.100	12.000	10.000	1
2	A	-Ø.11Ø	0.000			0
3	A	0.000	0.000			0
4	A	0.000	0.000			0
5	A	0.000	0.000			0
6	A	0.000	0.000			0
7	A	0.000	0.000			0
8	A	0.000	0.000			0
9	A	0.000	0.000			0
10	A	0.000	0.000			0
11	A	0.000	0.000			0
12	A	0.000	0.000	0.000	0.000	0

LAST DATA * -Ø.1ØØ X= 147.784 Z= 137.568 TOOL T 1

=AD -Ø.Ø1Ø

= -

F1	F2	F3	F4	F5	F6	F7	F8
	ADD	CONST. ADD	CONST. SUB	GUIDE ON/OFF	ITEM↑	ITEM↓	[EXTEND]

5) Press the function key [F4] (CONST. SUB).

The following calculation is made in the control and the result of the calculation is stored in X-axis tool offset data No. 2, updating the previous data.

Assume the tool offset data in No. 2 be "-Ø.1ØØ" and the data set at parameter (long word) No. 32 be 1Ø (μm).

New Offset Data
= Old Offset Data + Setting of Optional Parameter (long word) No. 32

-Ø.11Ø = -Ø.1ØØ - Ø.Ø1Ø

Therefore, if the function key [F4] (CONST. SUB) is pressed five times, the tool offset data is updated to "-Ø.15Ø". This means that the tool offset data has been compensated by "-Ø.Ø5Ø mm".

In the turning operation using the tool offset No. 2, the outside diameter was finished Ø.Ø3 mm smaller than the commanded value. Therefore, this error must be compensated for by changing the offset data.

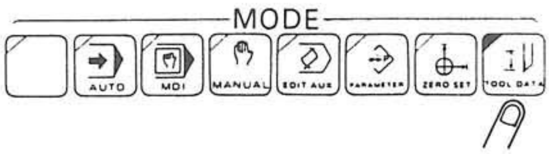
In this case, the function key [F3] (CONST. ADD) should be used instead of [F4] (CONST. SUB). Pressing it three times can compensate for the tool offset data.

Note: When the CONST. ADD and CONST. SUB functions are used, addition and subtraction are possible disregarding of the limit value set with parameter (long word) No. 33.

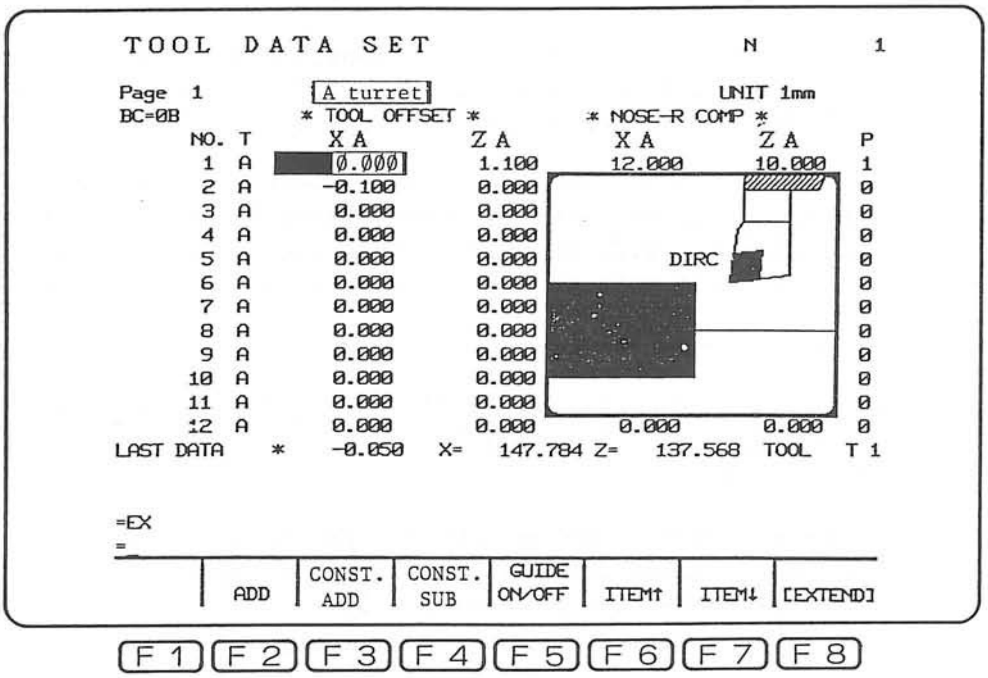
d) Case where tool offset value is known:

To enter the known tool offset value as X = 2.54Ø, proceed as follows:

1) Select the TOOL DATA SET mode by pressing the TOOL DATA key.



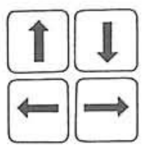
2) The CRT display is as shown below.



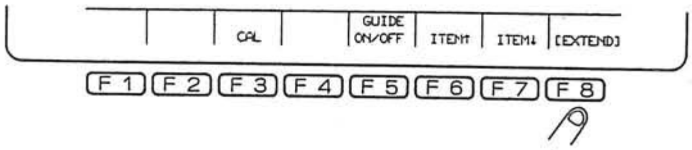
3) Select the turret, either A- or B-turret (only for two-saddle model)

Each time  or  is pressed, turret, A and B, is selected alternately.

4) With the cursor shift keys, locate the cursor to the No. 1 TOOL OFFSET - XA data position.

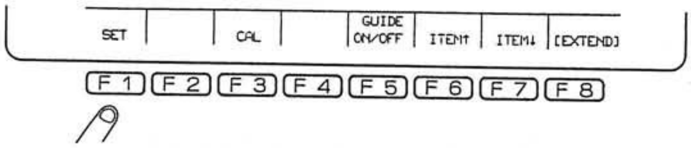


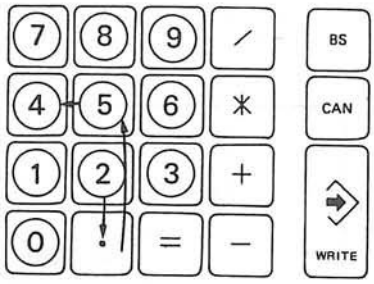
5) Press the function key [F8] (EXTEND).



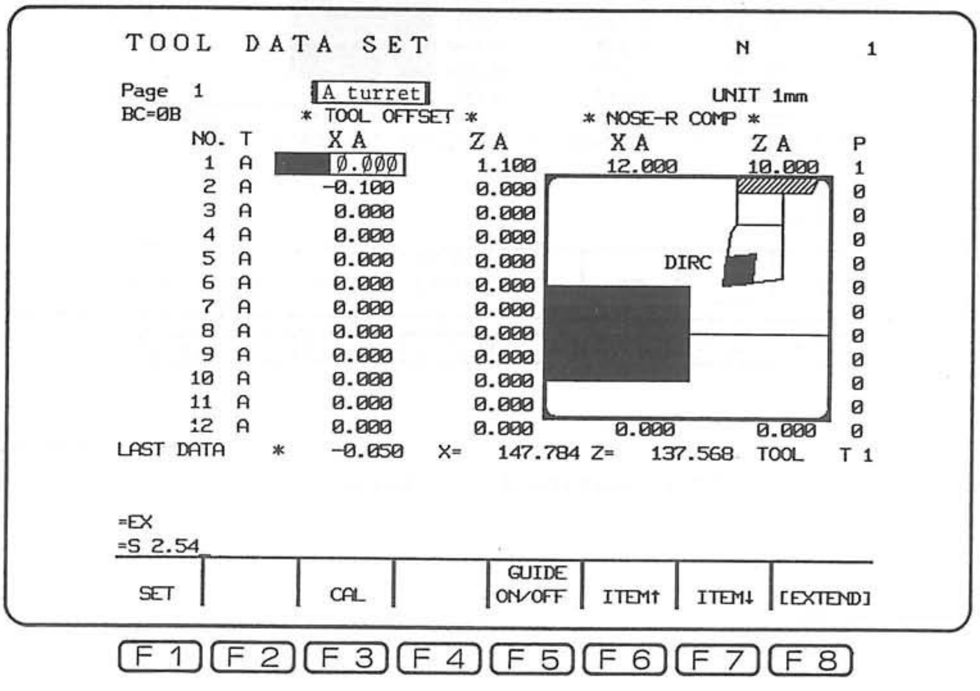
Make sure that the function key name SET is displayed for the function key [F1].

6) After pressing the function key [F1] (SET), key-in [2][.][5][4] through the keyboard.

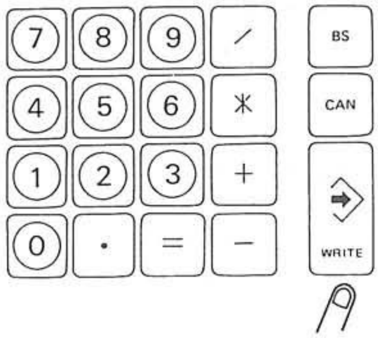




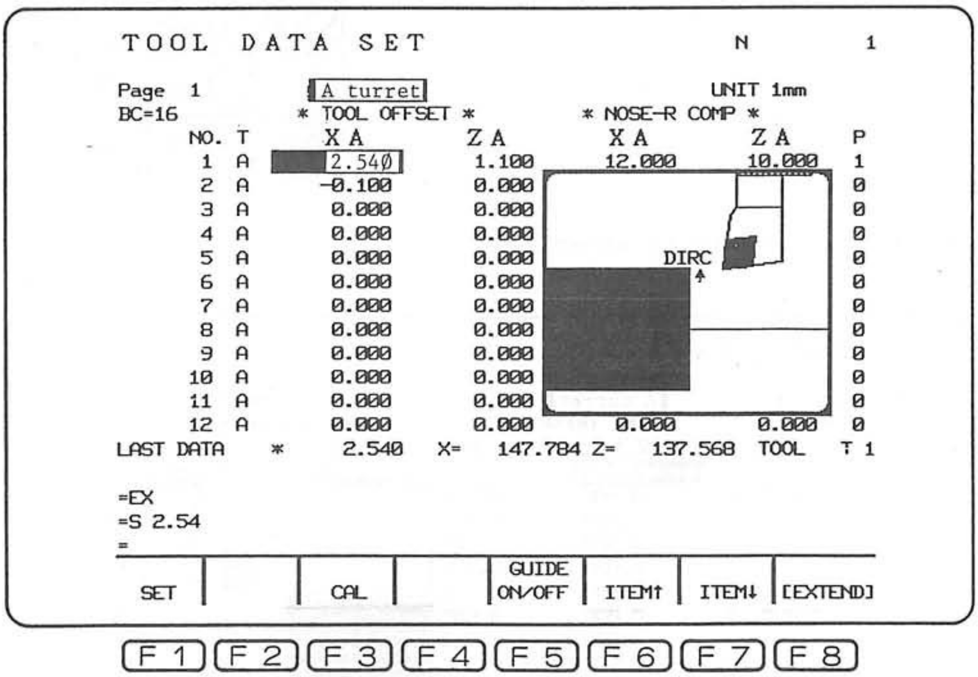
The CRT display is as shown below.



7) Press the WRITE key.

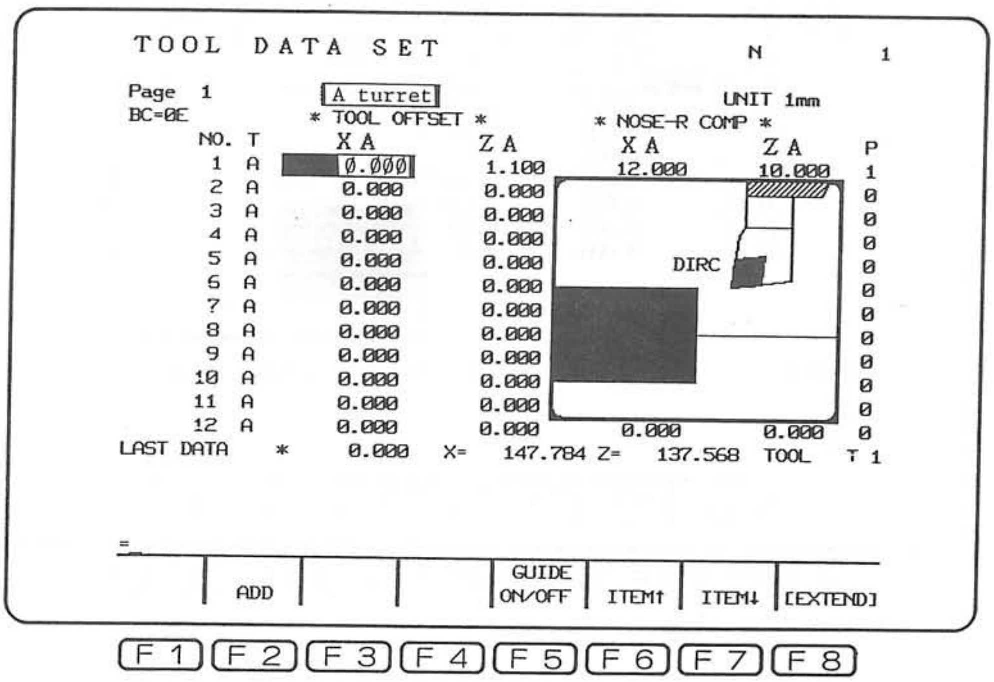


8) With the steps indicated above, keyed-in data is stored as the NO. 1 TOOL OFFSET - XA data position.

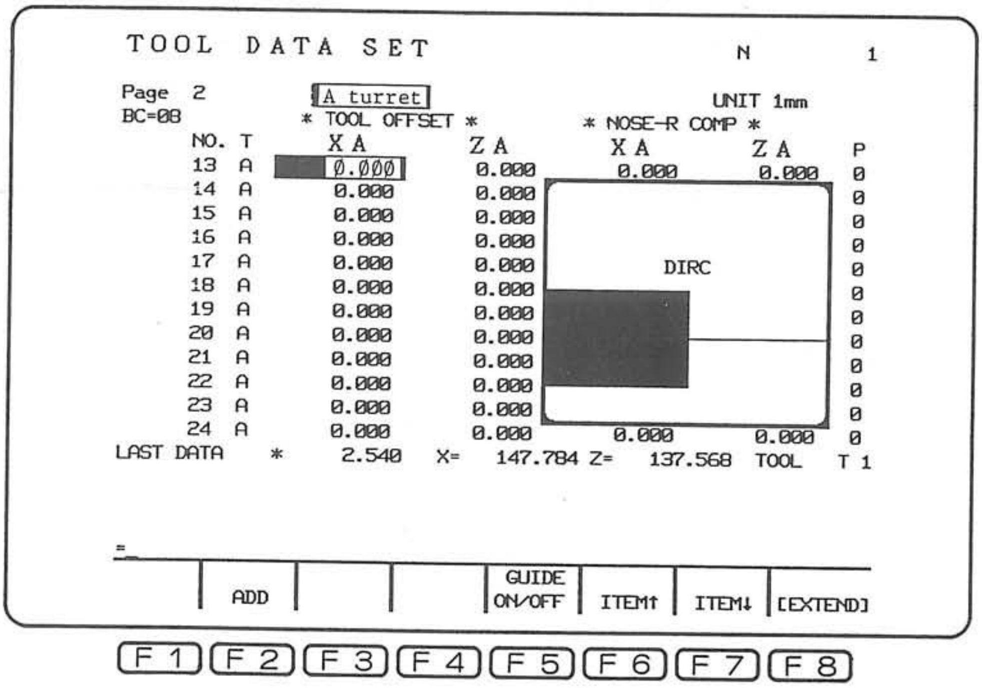


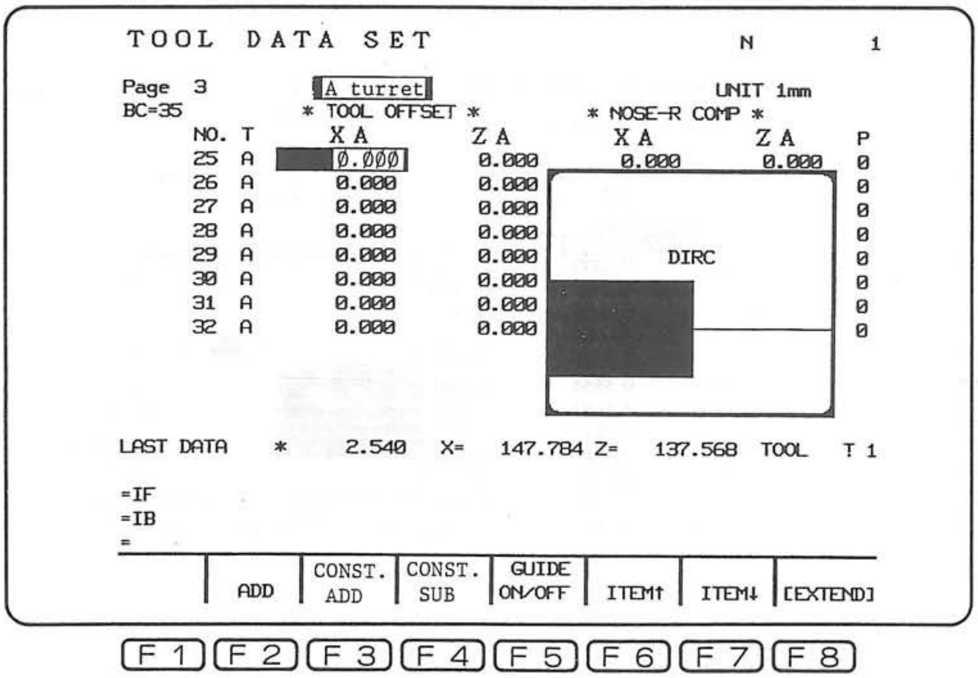
Carry out the same procedure for Z-axis.

Note 1: There are 32 pairs of tool offset data for each of A- and B-turret. One page of the CRT screen can show 12 pairs of offset data.



To obtain the data of other offset numbers, press PAGE key, or and the display changes as below each time that key is pressed.

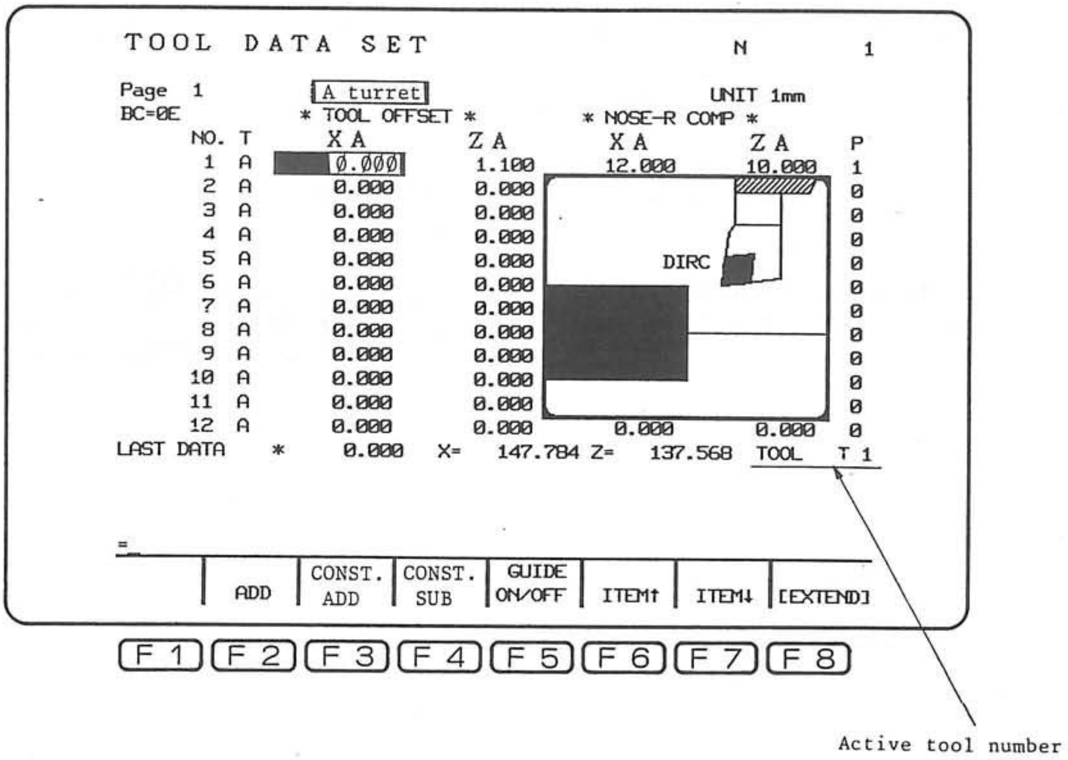




Note 2: Never turn off power supply to the control right after entering or changing the tool offset and/or zero offset data. Be sure to keep the control ON for at least two to three minutes after that. Should power supply be turned off while entering or changing the data or right after that, check the newly data since the data might not be renewed.

(3) Display of TOOL NO. on the CRT screen:

Tool numbers are displayed at the CRT screen (TOOL OFFSET screen and ANIMATED DISPLAY screen) in the manner as indicated below. This allows an operator to check the tool number of the tool being used without switching the display screen.



3-3-2-4. Automatic Operations

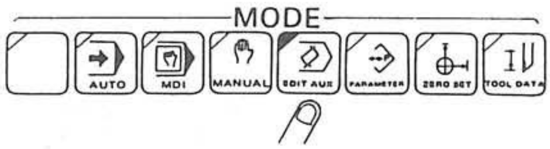
NC lathes are mostly operated in the automatic mode in which machine operations are controlled by taped commands. This section deals with the procedure for automatic mode operations assuming part program tapes have been prepared.

Note that the automatic operation is possible with stored part programs and the automatic operation directly from a command tape is impossible.

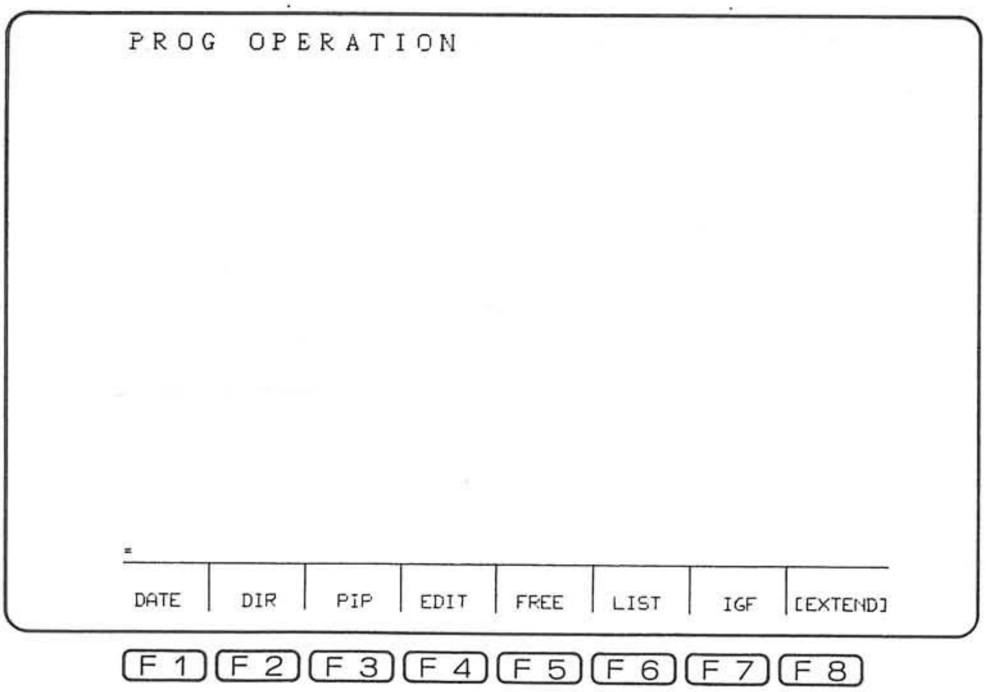
Before starting the operation, refer to 3-3-2-6 to ensure safe operations.

(1) Procedure to store part programs into memory

1) Select the PROG OPERATION by pressing the EDIT AUX key.

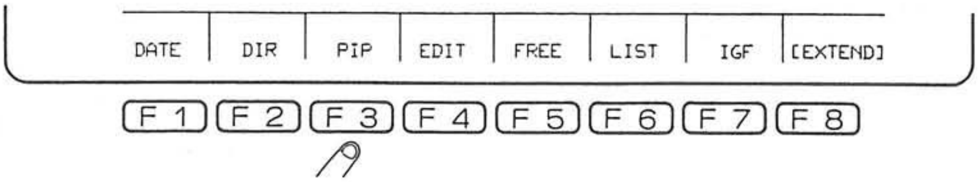


2) The CRT display is as shown below.



3) Set the part program tape in the tape reader following the steps indicated in page 87.

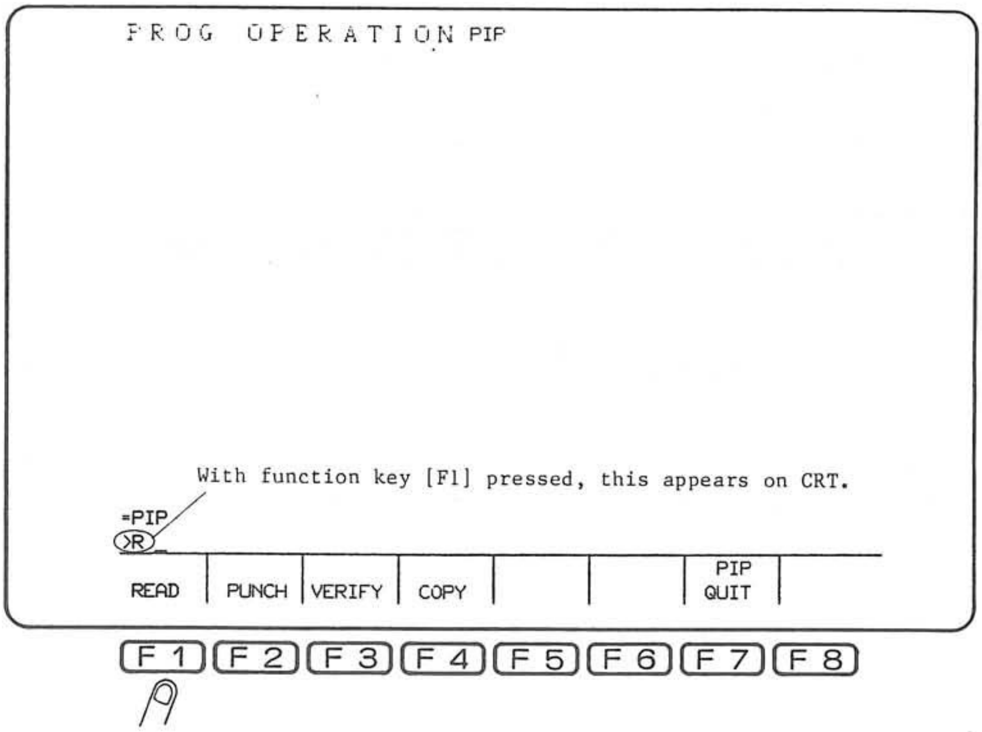
4) Press the function key [F3] (PIP).



The CRT shows PIP message.

5) Press the function key [F1] (READ).

With this the control is ready to read a part program tape.

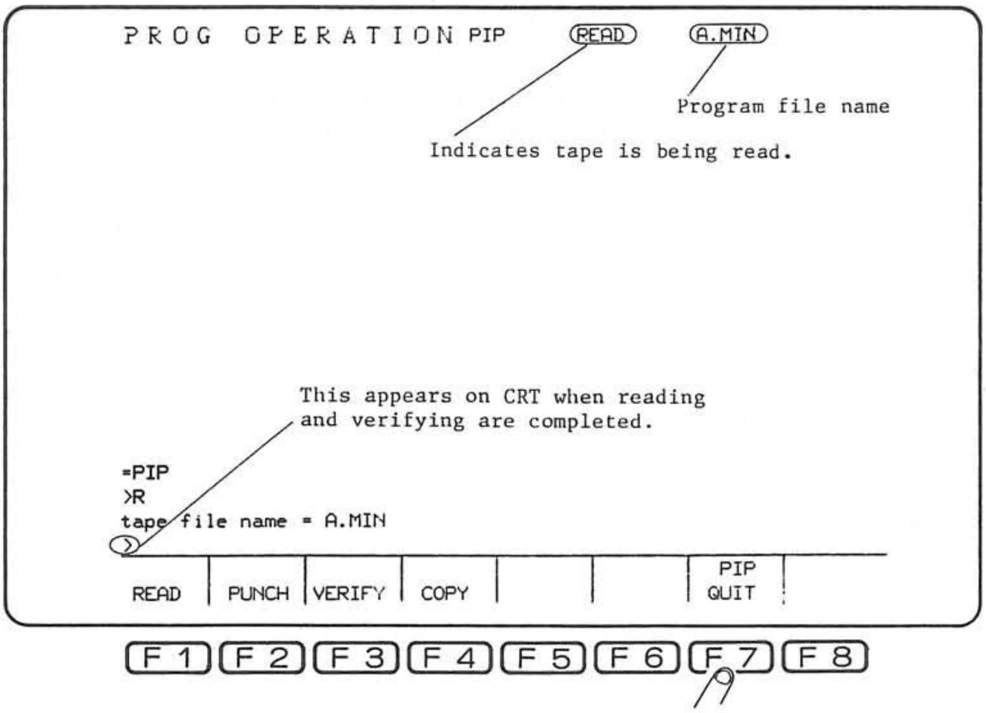


6) Press the WRITE key.

This initiates tape reading-in and storing operations. While the part program tape is being read, the CRT shows READ message and A.MIN (file name).

After the completion of tape reading-in and storage, the tape is fed backward to compare the stored part program data and the data on the tape. This comparison feature is called "tape verifying function".

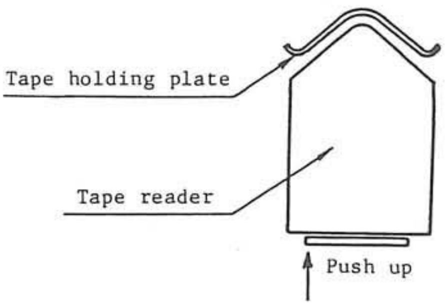
When the tape reading-in and verifying is completed, ">_" symbol appears right above function key name READ display.



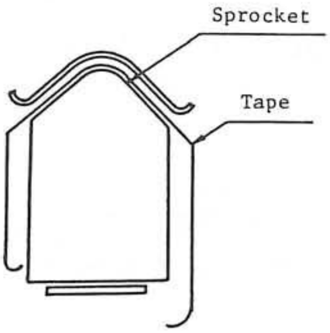
7) After making sure that tape storage is complete, press the function key [F7] (PIP QUIT).

The tape storage operation is complete; the CRT display restores the state right after the EDIT AUX key is pressed.

SETTING TAPE IN TAPE READER



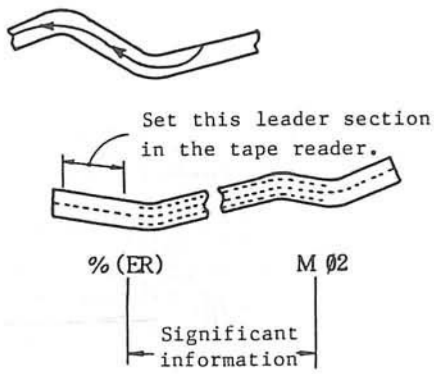
1) Push up the plate which is under the tape reader to move up the plate holding the tape.



2) Place the tape as shown at the left.

Engage feed holes on the tape to match the sprockets.

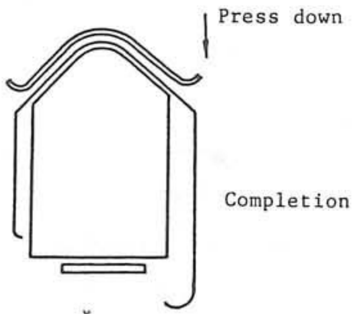
IMPORTANT



Use only "black" tapes. Never use tapes of other colors. That could cause malfunctions of the machine due to misreading.

Set the tape with the white arrow pointing to the left.

Set the leader section containing only feed holes preceding the first % or ER code on the tape, in the tape reader.



3) Press down the tape holding plate.

Completion of tape setting

(2) Preparations for automatic operation

Before starting automatic operations, confirm the following points without fail.

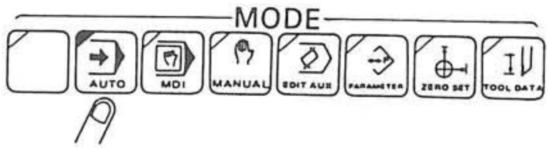
1) After changing the chuck, always set the allowable chuck speed with the parameter.

2) In a machining program, designate the maximum spindle speed following G5Ø. This speed must be lower than the allowable chuck speed.

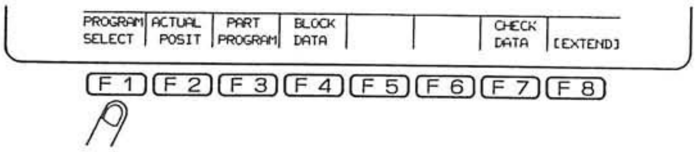
(3) Block-to-Block Operation (Single Block Operation)

In the single block mode operation, part program blocks are executed block by block. This operation is useful for checking newly prepared part programs.

1) Select the AUTO OPERATION mode by pressing the AUTO key.

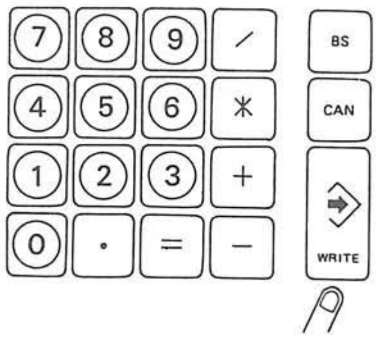


2) Press the function key [F1] (PROGRAM SELECT).

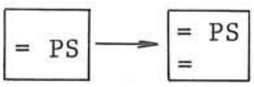


If the function PROGRAM SELECT is not assigned to [F1], press [F8] (EXTEND).

3) Press the WRITE key.

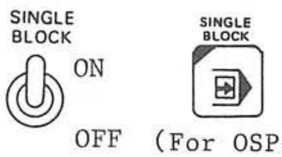


This selects the program to be executed. After the program selection has been completed, the display above [F1] in the CRT changes as shown below:



In case more than one program are stored in memory, refer to the procedure to select the desired program explained in Section 4.

4) Turn the SINGLE BLOCK toggle switch ON.

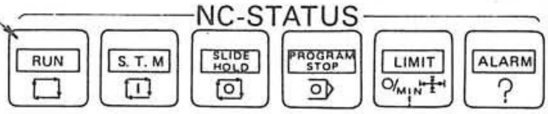


(For OSP5ØØL-G, OSP5ØØØL-G flat panel)

5) Press the CYCLE START button.

With this, part program blocks are executed one by one.

While the commands in the block are executed, the RUN indicating lamp illuminates. It goes off when the execution has been completed.



Press the CYCLE START button each time the execution of one block commands has been completed.

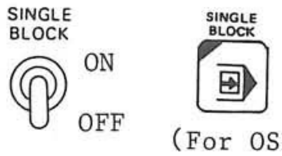
(4) Automatic Continuous Operation

After making sure that the operation with the new tape is correct, you can run the machine in the automatic continuous mode.

Follow the steps indicated below:

1) Perform steps 1) in (2) "Single Block Operation".

2) Turn the SINGLE BLOCK toggle switch OFF.



(For OSP5ØØL-G, OSP5ØØØL-G flat panel)

3) Press the CYCLE START button.

The part program is read out from memory and executed continuously.

CAUTION

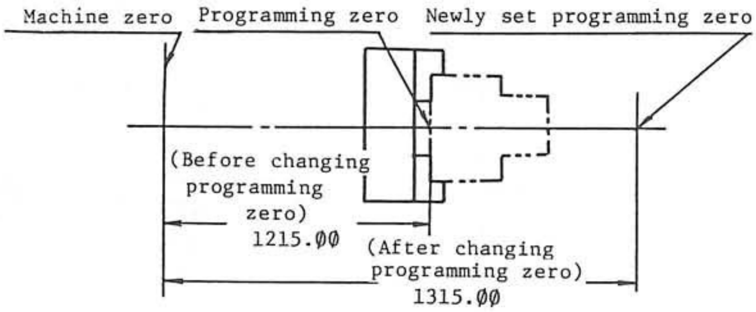
1) Before starting the automatic continuous operation, be sure to check the chuck:

   The chuck must be closed for OD GRIPPING, and open for ID GRIPPING. Otherwise, the spindle will not start even when the CYCLE START button is pressed.

2) Before operating the machine with a new program, be sure to check the safety of axis movements by executing the program in the single block mode.

3) It is also advisable to run the new program without setting a workpiece on the machine or shifting the zero point of Z-axis toward the tailstock side.

   Example:



   By changing the zero offset value to "Z=1315.ØØ" dimension words are executed offset by 1ØØ mm in the positive direction of Z-axis from the programmed points.

   When the tailstock is used, watch out for interference between the turret and the tailstock; retract the tailstock to avoid accidental collision between the turret and the tailstock.

(5) Display of Active Commands in Single Block Mode Operation

While checking programmed commands by executing them in the single block mode operation, the contents of active commands can be checked on the CRT by following the steps below:

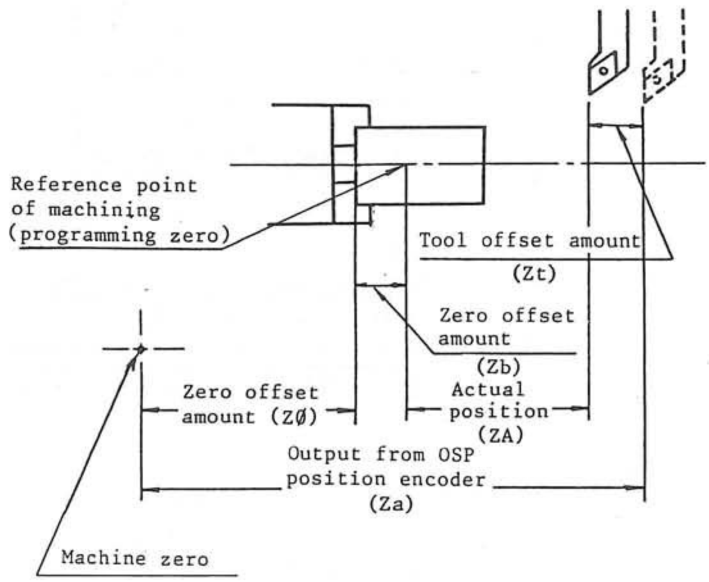
1) Press the function key [F2] (ACTUAL POSIT).

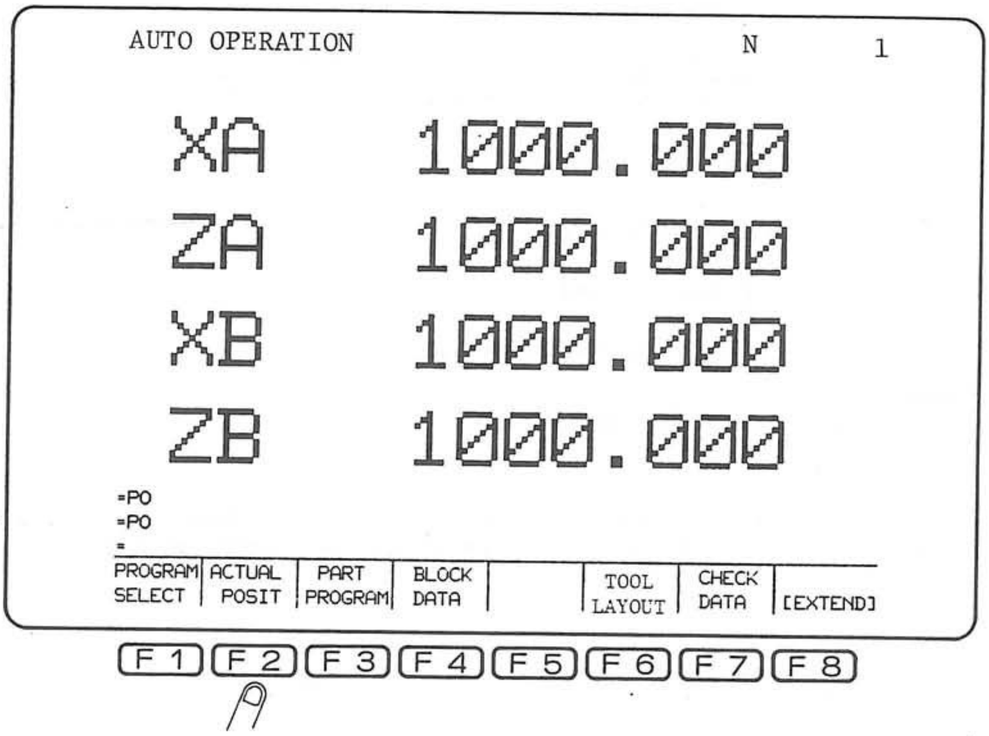
The actual position of X- and Z-axis can be displayed on the CRT in enlarged characters.

The actual position data means the value expressed as "ZA" in the figure at the right. It indicates the distance between the programming zero and the tool tip point.

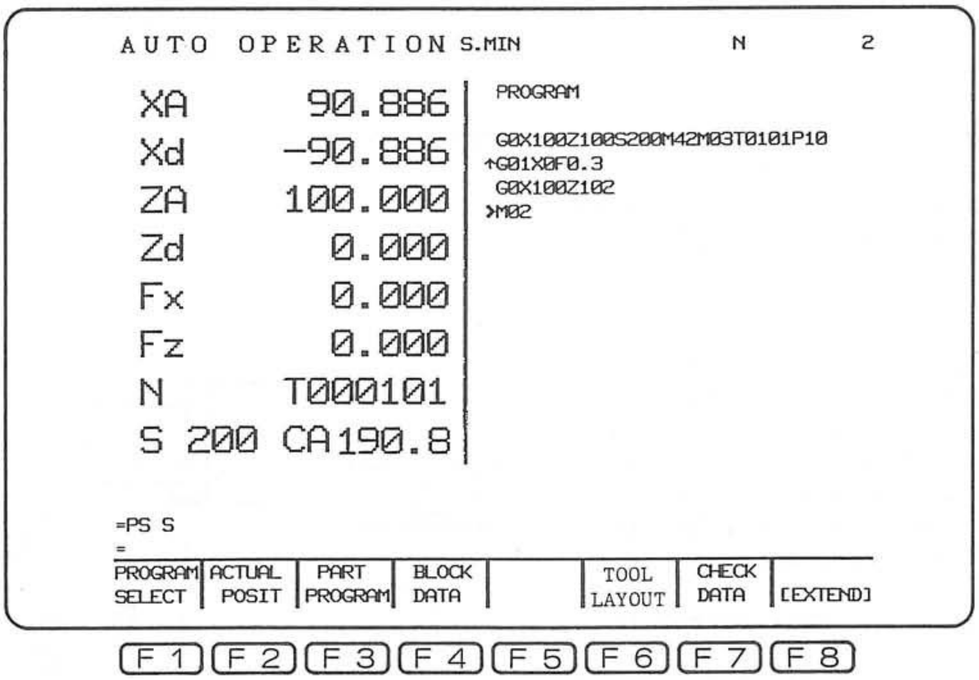
When the rear turret is selected on the two-turret model, the display is given by XB and ZB.

For the two-saddle model, XA, XB, ZA and ZB are displayed at the same time (see below).





2) Press the key. This changes the display as shown below.



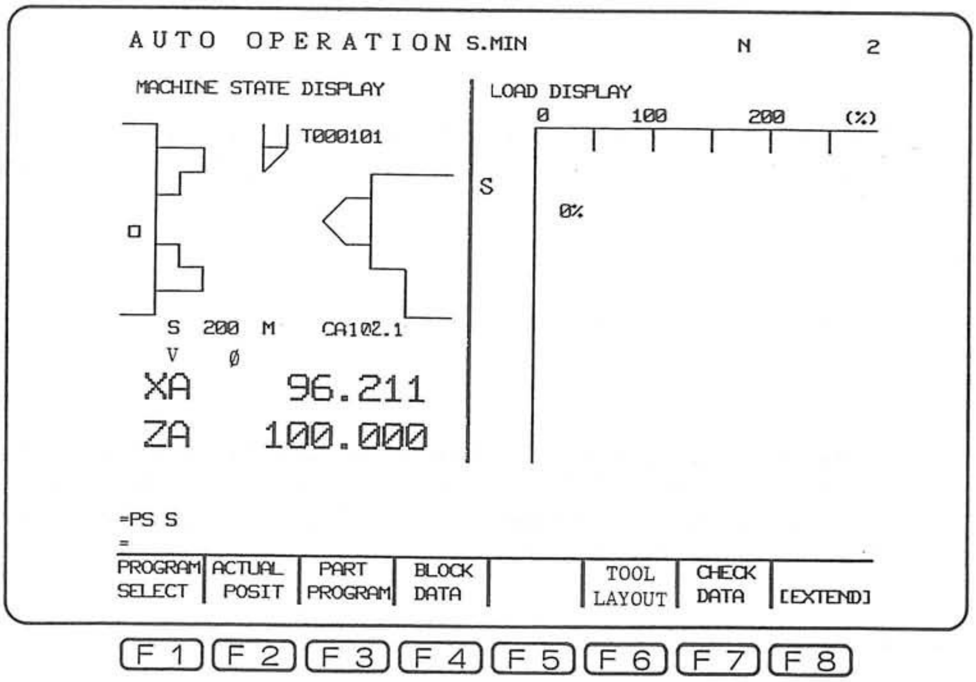
The CRT display is divided into two sections. Actual position and other related data is displayed on the left hand section, and the program presently selected is displayed on the right hand section.

X, Z	:	Distance between the tool tip point and the programming zero
Xd, Zd	:	Remaining axis movement distance (= command value - actual position)
N	:	Sequence number
T	:	T command value
S	:	Spindle speed
CA	:	Actual position of spindle
FX, FZ	:	Axis feedrates

Display of actual spindle position can be omitted by setting "1" at bit 6 of parameter (bit) No. 19. (Initial setting: Ø (OFF))

3) Press the key. This changes the display as shown below.
(For OSP5ØØL-G, OSP5ØØØL-G flat panel only)

The CRT display is divided into two sections. Machine status, actual position of X and Z axes and other related data are displayed on the left hand section, and the loaded condition of the spindle is displayed at the right section.



X, Z : Distance between the tool tip point and the programming zero

T : T command value (Displayed only during cutting)

S : Spindle speed (rpm)

V : Cutting speed (m/min)

CA : Actual position of spindle

The angular position of the spindle calculated from the output of the pulse generator; with the single-phase pulse generator, display is "***.*".

Display of actual spindle position can be omitted by setting "1" at bit 6 of parameter (bit) No. 19. (Initial setting: Ø (OFF))

Semi-graphic guide display (machine status):

(a) Spindle

While the spindle is rotating, symbol is displayed.

(b) Chuck

Display shape varies depending on the setting of ID/OD gripping selector switch.

(c) Work

Displayed only when the chuck is in the clamped state. The shape displayed varies depending on the setting of ID/OD gripping selector switch.

(d) Tool

Displayed only while cutting is in progress.

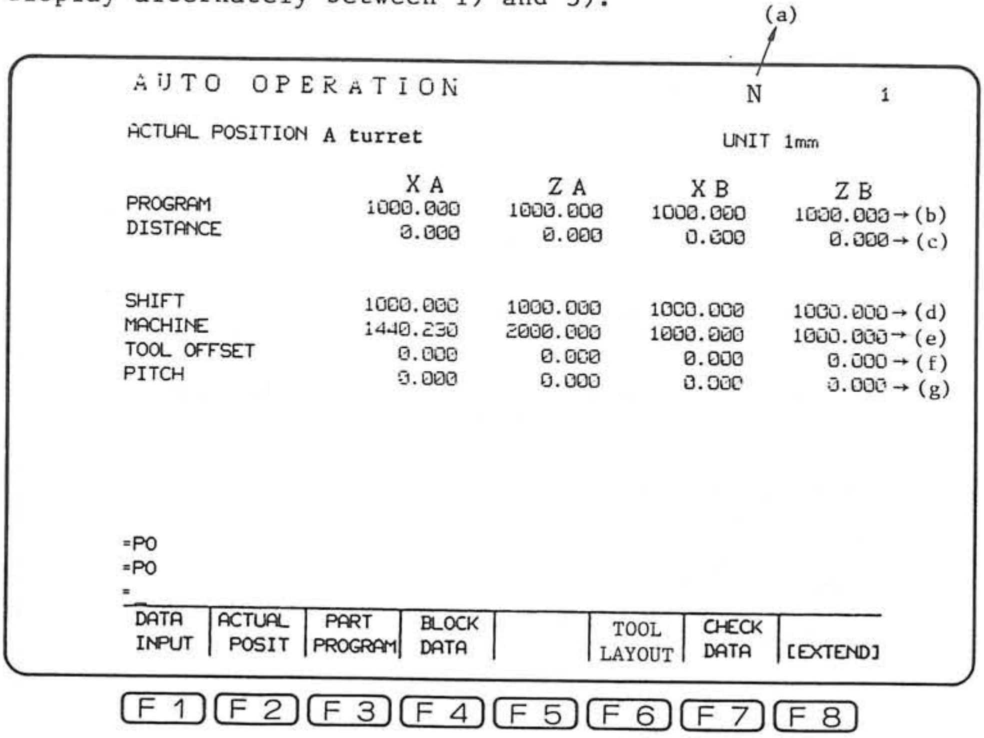
(e) Tailstock sleeve

Displayed only for the center work (CHUCK/CENTER WORK selector switch at CENTER WORK) on the center work specification model. The tailstock sleeve shape varies depending on the position of it --advance end or retract end.

Load condition display:

Loaded condition of the spindle is displayed by bars. The bar is displayed in units of 10 percent and the numerical value is displayed below the bar. The value displayed is the average value of "n" samples collected in intervals of 12.8 msec. Value "n" can be set by parameter.

4) Pressing the key again restores the CRT display as obtained in step 1). After that each pressing of the key changes the CRT display alternately between 1) and 3).



(a) Active sequence number

(b) PROGRAM

Dimension between the programming zero and the tool tip point. (ZA in the figure on page 93)

(c) DISTANCE

Commanded value - Actual position value

This indicates the remaining axis motion distance.

(d) SHIFT

Actual position data + Zero offset value + Tool offset value (ZA + Zb + Zt in the figure on page 93)

(e) MACHINE

Output from OSP position encoder (ZA in the figure on page 93)

(f) TOOL OFFSET

This indicates the tool offset value of the tool presently used.

(g) PITCH

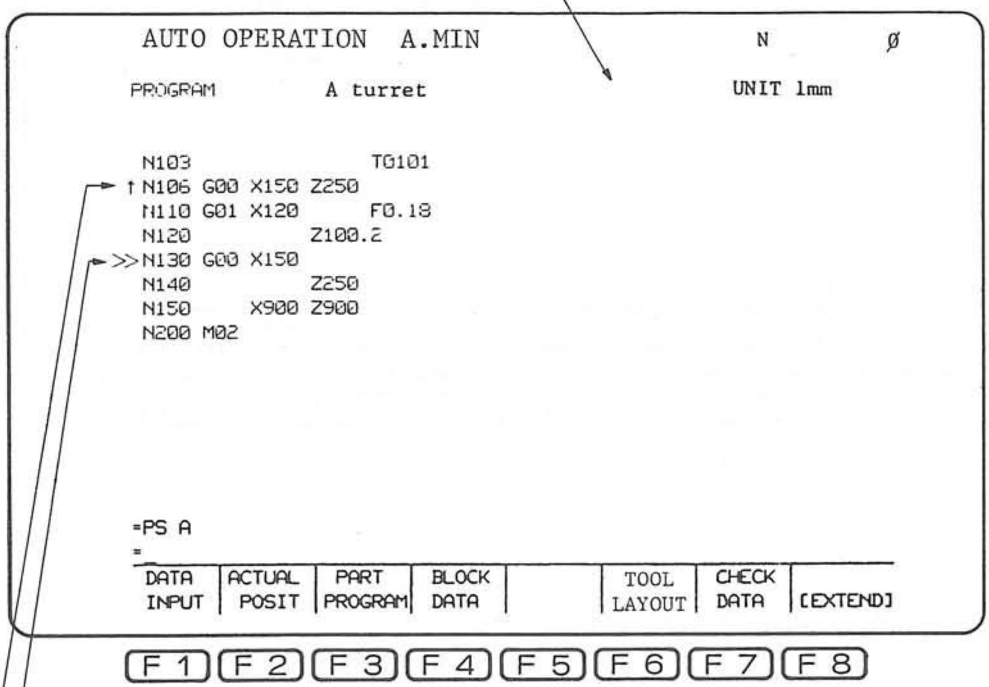
This indicates the active pitch error compensation value.

(6) Display of Stored Program Data

Stored program data can be displayed on the CRT through the following procedure:

1) Press the function key [F3] (PART PROGRAM). The programmed commands are displayed on the CRT.

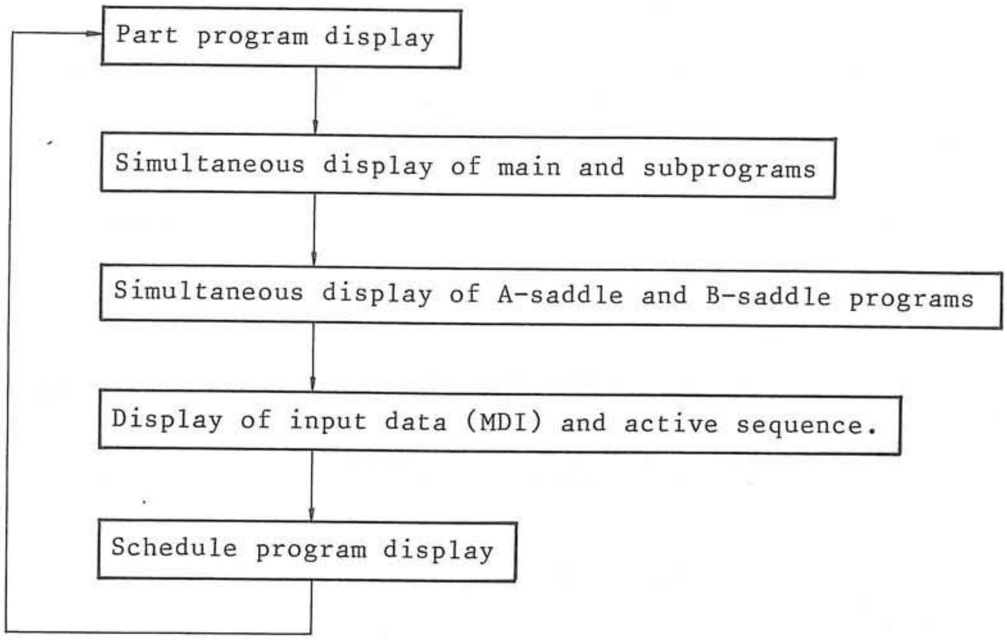
For the two-turret model, the message MIRROR IMAGE is displayed on the CRT while the program is for the rear turret (G14).



The symbol (>>) indicates the block read in the buffer register.

The symbol (↑) indicates the active block.

2) Pressing the PAGE key after that changes the CRT display in the order indicated below.



Note: Details of part program display are provided in Section 4, "Applications".

3-3-2-5. Manual Data Input (MDI) Operation

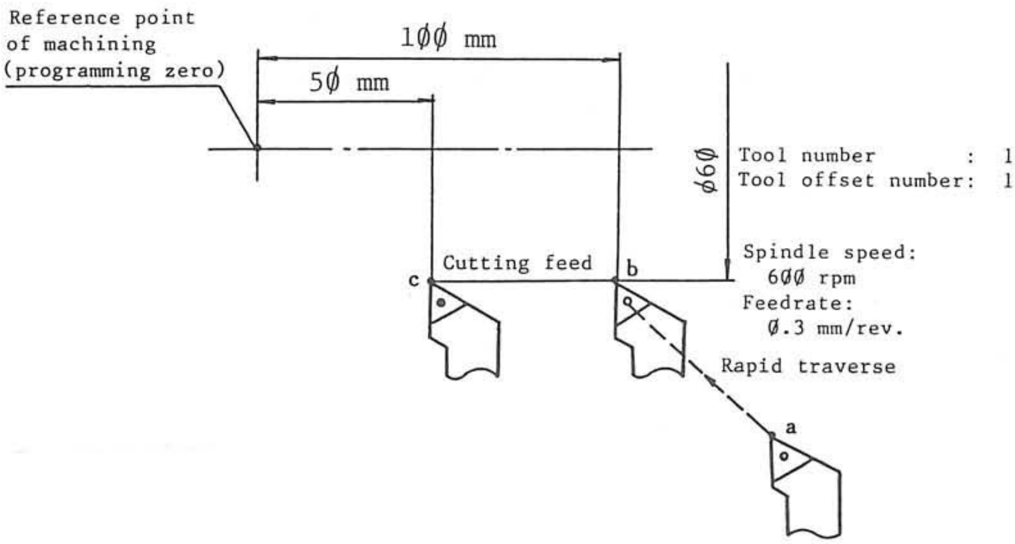
The operator can operate the machine with the commands entered through the MDI keyboard switches instead of tape commands. This mode of operation is called Manual Data Input (MDI) mode.

This MDI mode operation is effectively used for simple cutting operations such as shaping soft jaws, cutting workpieces with simple contour and turning workpiece part to be chucked.

CAUTION

> Before pressing the CYCLE START button, check if all the commands entered are correct.
>
> Set the FEEDRATE OVERRIDE dial to the lowest percentage setting (1Ø%). It may be set at the 1ØØ% position only after the operator has assured the axis movements.

The operation procedure is explained with the following case as an example:

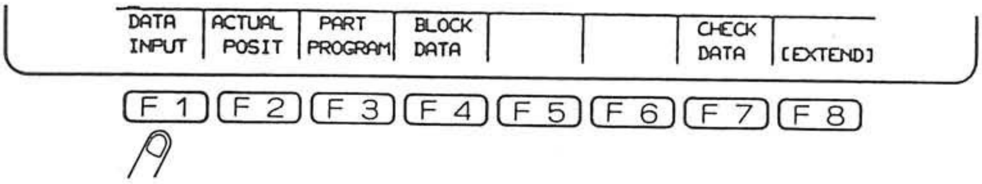


Commands to feed the cutting tool from "a" to "b" and then to "c":

a → b	GØØ	X6Ø	Z1ØØ	S6ØØ	M41	MØ3	TØ1Ø1
b → c	GØ1		Z5Ø	FØ.3			

(1) Axis movement from "a" to "b"

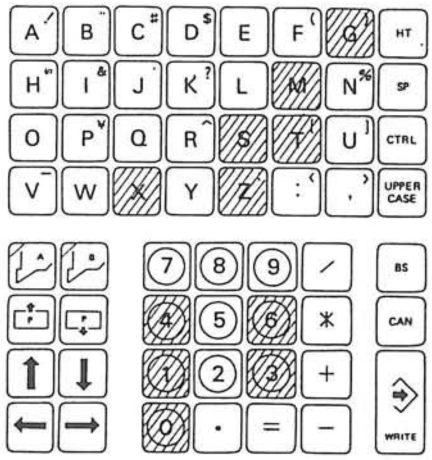
1) Press the function key [F1] (DATA INPUT).



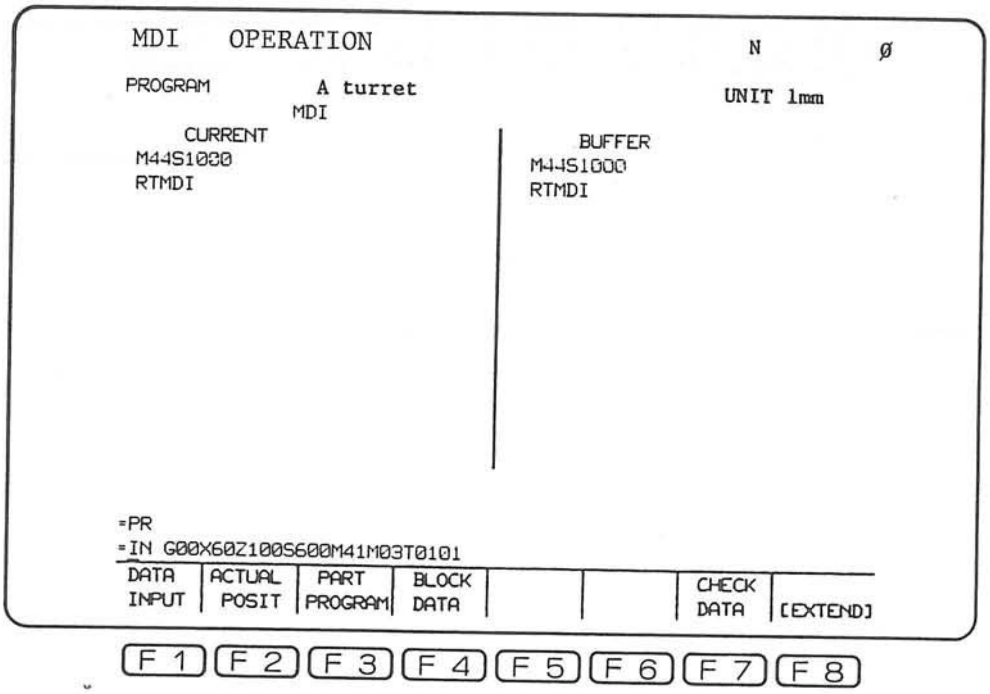
The "IN" message appears above "F1" display, telling the operator that the control is ready for data entry.

2) Enter a block of data through the keyboard

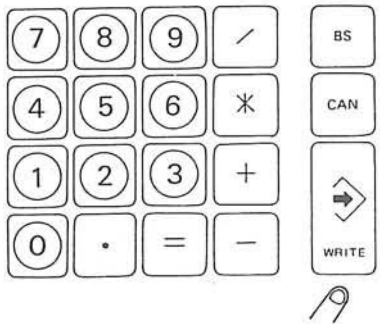
GØØ X6Ø Z1ØØ
S6ØØ M41 MØ3 TØ1Ø1



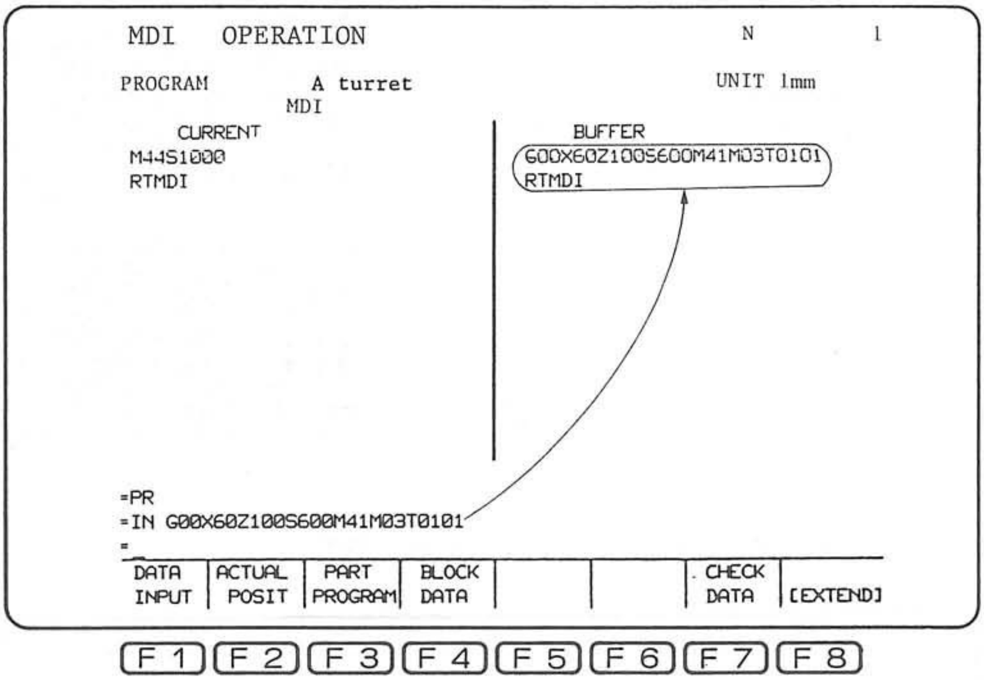
3) The keyed-in data is displayed on the CRT.



4) Press the WRITE key.

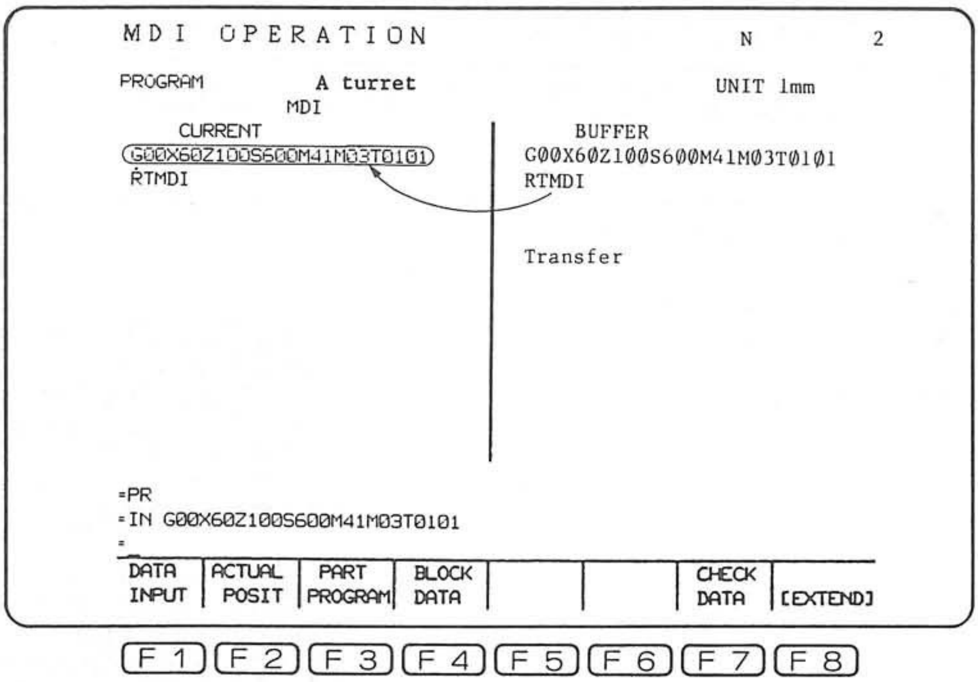


This transfers the keyed-in data to the BUFFER area.



5) Press the CYCLE START button.

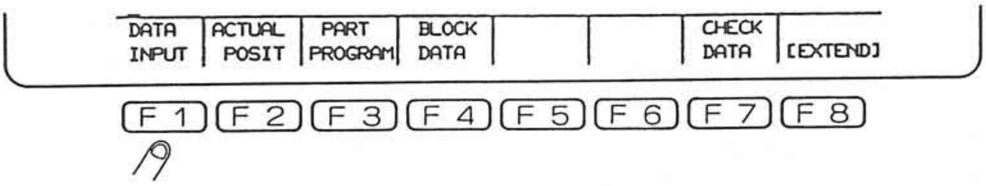
This transfers the data in the BUFFER area to the CURRENT area.



At the same time, the tool selection command (TØ1Ø1) and spindle function commands (S6ØØ M41 MØ3) are executed. After the completion of these commands, axis movement from "a" to "b" is initiated in the GØØ rapid feed mode.

(2) Axis movement from "b" to "c"

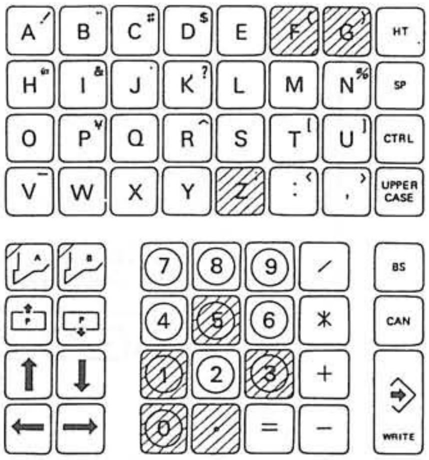
1) Press the function key [F1] (DATA INPUT).



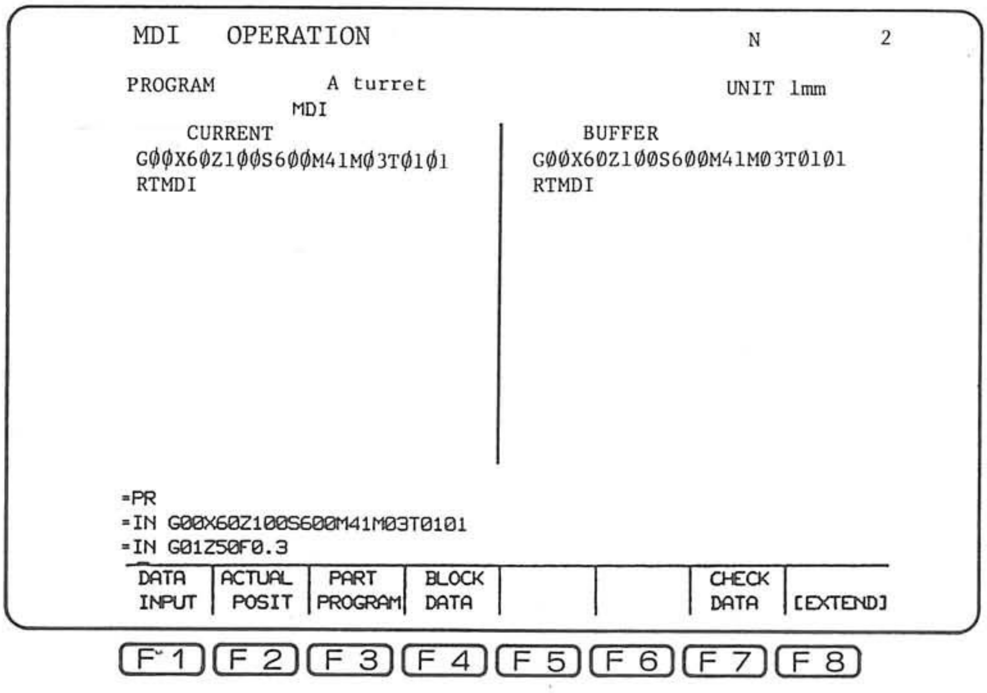
The "IN" message appears above "F1" display, telling the operator that the control is ready for data entry.

2) Enter a block of data through the keyboard:

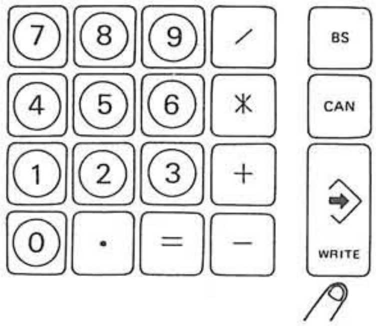
GØ1 Z5Ø FØ.3



3) The keyed-in data is displayed on the CRT.

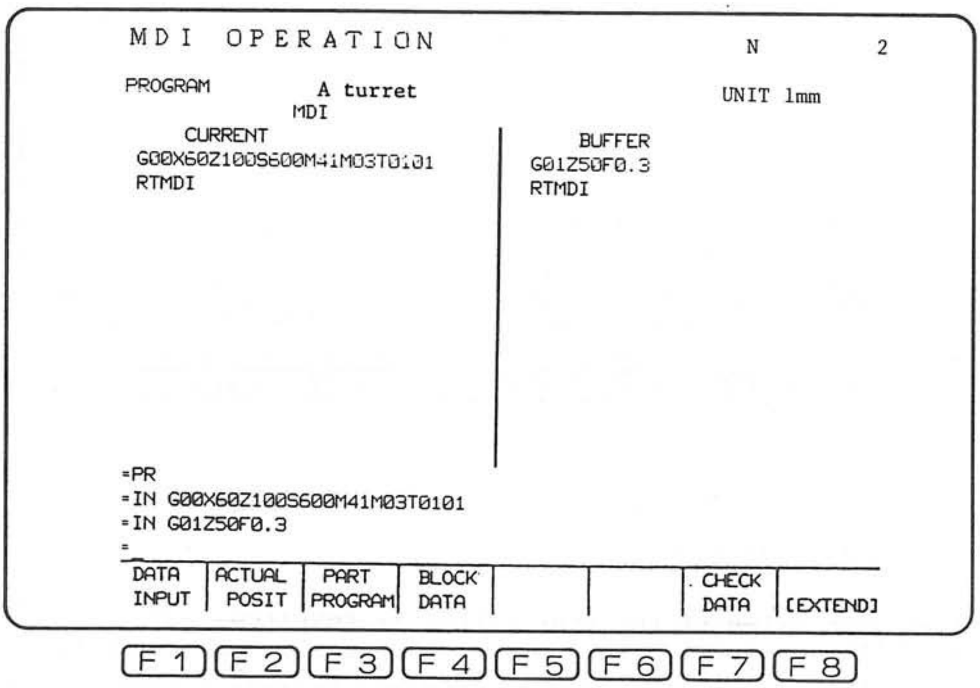


4) Press the WRITE key.



This transfers the keyed-in data to the BUFFER area.

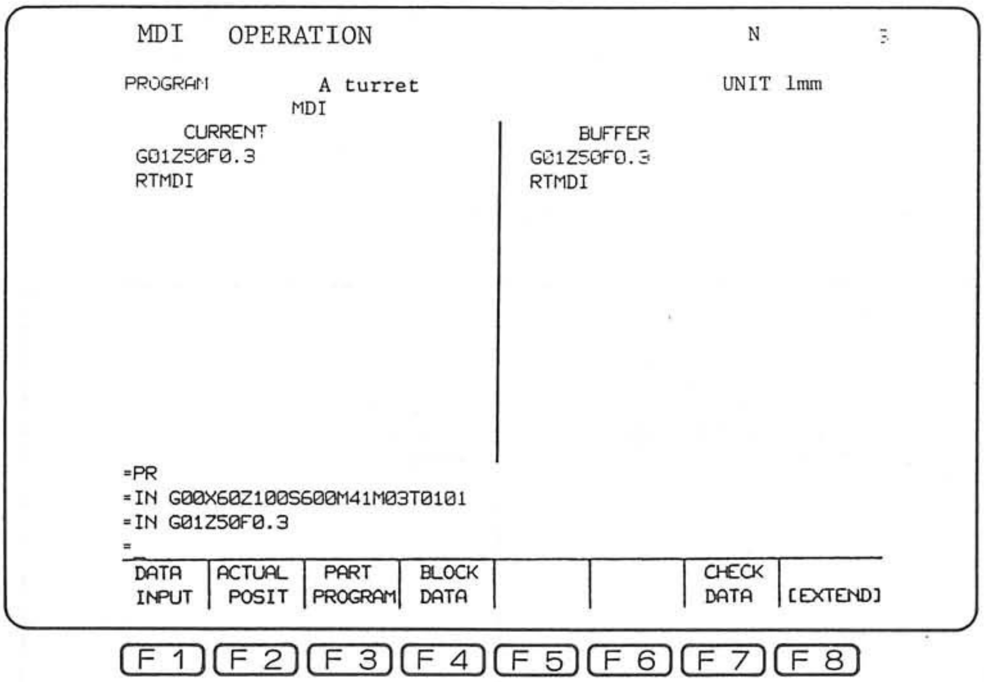
The data of the preceding block is cleared.



5) Press the CYCLE START button.

This transfers the data in the BUFFER area to the CURRENT area.

The data of the preceding block is cleared.



At the same time, axis movement from "b" to "c" is initiated at the commanded feedrate (GØ1 FØ.3).

If the operation of the rear turret is required, key-in "G14" and press the WRITE key first. Then press the CYCLE START button to select the rear turret. After this, the operation procedure explained above may be followed.

3-3-2-6. Interlock Functions

As the standard OSP5ØØL-G/OSP5ØØØL-G interlock function, the maximum spindle speed interlock function and the door interlock function are provided. These two interlock functions are provided to ensure safety in machine operations and thus, they must be correctly used following the instructions given below.

(1) Spindle Speed Interlock Function

a) Overview

In addition to the conventional maximum spindle speed designation function using the G5Ø command, the allowable chuck speed can be designated. The spindle speed is limited using these two speeds.

The interlock is taken so that the spindle cannot be started unless the maximum spindle speed is designated in a program.

b) Function

1) Level A alarm occurs if the MØ3/MØ4 command is executed unless the maximum spindle speed is designated with the G5Ø command in a block preceding the MØ3/MØ4 command.

This check is not conducted when a program is executed after the cursor movement or sequence number search.

2) Set the allowable chuck speed with the optional parameter (word). Each time the chuck is replaced, set the allowable speed which is indicated on the chuck.

Parameter : Optional parameter (word) No. 73
Initial value: Ø
Unit : Revolution per minute (rpm)
Setting range: Ø - allowable speed for each machine

If the setting of this parameter is "Ø", level D alarm occurs, which cannot be reset until a value is set for this parameter.

3) The following interlock becomes effective according to the setting value of the allowable chuck speed.

i) If the designated S value preceded by G5Ø exceeds the allowable chuck speed, which is set by the optional parameter (word), level B alarm occurs.

ii) The spindle speed is limited by whichever value is lower; the G5Ø designated maximum spindle speed or the allowable chuck speed.

iii) If actual spindle speed exceeds 12Ø% of the maximum spindle speed designated following G5Ø or the allowable chuck speed, level A alarm occurs.

iv) Spindle speed is always checked in any operation mode (automatic, MDI, and manual).

Note: For the controls providing the optional IGF specification, pay attention on the following point.

In the program output using the IGF, the value set by the IGF integer parameter No. 11 MAXIMUM SPINDLE RPM is output for an S command following G5Ø. Because an alarm occurs if this S command value is greater than the allowable chuck speed, changing this value becomes necessary.

(Refer to the Operation Manual for Interactive Graphic MDI Function (IGF-L3) for OSP5ØØL-G/OSP5ØØØL-G (Publication No. 2476-E).)

(2) Door Interlock C Function

a) Overview

There are cases which cause hazard to the operator if the spindle is rotated or the turret is moved while the front door is open. The door interlock C function inhibits spindle rotation and turret movement while the door is not closed.

b) Interlock function

The following interlock becomes effective in any operation mode (automatic, MDI, and manual) while the door is open when the DOOR INTERLOCK switch at the side panel of the machine operation panel is ON.

1) Level A alarm occurs when an attempt is made to start the spindle.

For spindle jogging, oscillation and orientation operations, spindle rotation below the parameter set speed does not cause an alarm even if the door is open.

Parameter	:	Optional parameter (word) No. 74
Unit	:	rpm
Setting range	:	1 - 5ØØ
Initial setting	:	5Ø (for all models)

To prevent an occurrence of an alarm even when the spindle jog or oscillation speed exceeds 5Ø rpm, set proper value for the parameter.

2) Level A alarm occurs if an attempt is made to start the M-spindle.

This interlock is effective only for the multi-machining model.

3) Level A alarm occurs if an attempt is made to feed the turret.

4) Level A alarm occurs if an attempt is made to rotate the turret.

5) Level A alarm occurs if the signal which indicates that the coupled external device (bar feeder, for example) is in operation is ON.

If the door is opened in any of the following conditions, level A alarm occurs.

- Spindle is revolving.
- Turret is moving.
- Turret is rotating.
- M-spindle revolving.
- External signal from coupled device is ON.

Note 1: The door interlock is effective even during manual intervention operation while the DOOR INTERLOCK switch is ON.

Therefore, to open the door during the manual intervention mode, stop the spindle first. If turret rotation/motion is required, it is necessary to turn off the DOOR INTERLOCK switch.

Note 2: The door interlock function is ineffective when the machine lock mode is on.

c) Cancelling interlock

The interlock is cancelled in the following two methods:

* To turn OFF the DOOR INTERLOCK switch on the side panel of the operation panel.

* To input proper M code command.

1) Cancellation using DOOR INTERLOCK switch

Use this method for setup change, etc.

2) Cancellation using an M code

Use this method for automatic loading/unloading using a robot, etc. so that the alarm does not occur when the door is opened for robot service.

Once the door interlock cancel M code is designated in a program, the alarm check based on door opening is not conducted until the M code to cancel the door interlock cancel mode is executed or the control is reset (MØ2 included).

Door interlock cancel M2Ø9
Cancel of door interlock cancel M2Ø8

SECTION 4 APPLICATIONS

With the instructions provided in the previous section, the operator can handle the machine to cut workpieces with relatively simple contour.

This section deals with various types of operation procedures for more efficient working, such as automatic mode operation, program handling, and parameter setting. The explanation provided hereafter will contain some technical terms related to computerized NC; those terms are detailed below as an introduction to advanced operation technique.

(1) Bubble Memory

All the information necessary as NC data, such as part program, tool offset values, zero offset values, and soft-limit data are all stored in the bubble memory. Since the bubble memory employs bubble element, which is a type of magnetic element, stored data can be retained even after the power is cut off.

On the OSP5ØØ/5ØØØL-G, tapeless operation which makes the most of the bubble memory characteristics, assures a reliability of the highest terms.

To this effect, it is necessary to store machining programs in the bubble memory prior to starting machine operation, according to the instructions on tape storage procedures. Then that selection of the desired machining program is made from a number of machining programs stored in the bubble memory. Machine operation is controlled by that selected machining program.

Once a machining program is stored in the bubble memory, that program is retained even after power supply to the control is cut off. However, to resume automatic mode operation with the selected program, it is necessary to call out the desired program again after turning power supply on.

Selection of the desired program is necessary since several machining programs are stored in the bubble memory. The advantage lies in that the bubble memory can retain the stored data when power supply is cut off, thus eliminating repeated tape reading-in operations otherwise necessary to cut workpieces with the same part program.

(2) File Management

The term file management refers to the unit that stores machining program data in the bubble memory; OSP5ØØ/5ØØØL-G employs a Filing System similar to the filing methods commonly used for documents in an office.

Fig. 4-1 exposes the System Structure of the File management. It is useful as a guide to the concept of file management and its relevant methods.

The System structure is widely classified in to three elements.

a) The bubble memory (data bank)

It functions as racks or cabinets used for keeping documents.

b) Files

The function is equivalent to that of files consisting of documents or ledgers.

c) Program name or number (process sheet)

The function is similar to that of documents on file.

Description of the structure elements:

a) Bubble memory (data bank)

The bubble memory serves as a data bank. Program data is stored in file units. Those act as racks or cabinets where documents are kept.

Data exceeding the capacity of the bubble memory cannot be stored. To store such data, either unnecessary data is cleared, or the capacity is increased (optional).

b) Files

There are four types of files as described later. They correspond to filed documents, or ledgers; to manage NC data, each file is stored with the name of a part such as gear, shaft or flange assigned to it. File names consist of "main file names" and "extentions".

The main file name ...... Consists of a character string of 16 characters beginning with an alphabetic character.

Extention .... Consists of a character string of 3 characters beginning with an alphabetic character.

Note that in assigning usable characters a file name are: alphabetic characters, numeral characters and "-" (hyphen).

A file name is assigned in the order of "main file name" first, then "extention".

A period must be entered as a delimiter between the main file name and extention.

Type of files:

1) Main program file

Character string (16 characters) beginning with an alphabetic character	.MIN

2) Subprogram file

Character string (16 characters) beginning with an alphabetic character	.SUB

3) System subprogram file

Character string (16 characters) beginning with an alphabetic character	.SSB

4) Schedule program file

Character string (16 characters) beginning with an alphabetic character	.SDF
↑ Main file name	↑ Extention

Description of respective files:

1) Main program file

A file comprising one or more main programs, with the main file name followed by the extention "MIN".

To make a main program file, there are two systems:

i) Classified; depending on types of workpieces such as gear, shaft, and flange.

ii) Program(s) for each workpiece to be assigned with one file name.

2) Subprogram file

Patterns often repeated in cutting parts such as Vee-groove, and parting off cycle are filed in the subprogram file when preparing part programs. The subprogram file comprises one or more subprograms; the main file name is followed by the extention "SUB".

When the called main program contains the command that calls the subprograms, it is necessary to call the subprogram file of these subprograms also when selecting the program(s).

3) System subprogram file

Basically, the system subprogram file is the same as the subprogram file explained above; in the system subprogram file, repetitive patterns often used by respective users are filed.

The system subprogram file comprises one or more system subprograms, and the name consists of the main file name and extention "SSB".

Programs, once stored in the bubble memory, can be accessed from the main program as needed. In other words, it is not necessary to call out the system subprogram file.

4) Schedule program file

This file is used when controlling several part programs prepared to meet the production schedule. A schedule program file consists of one schedule program, and its file name is suffixed by "SDF".

c) Program name or number

A program name or number corresponds to the program name or number assigned to the tape or process sheet of each part program. For instance a part name or drawing number can be used.

A program name or number is made up from:

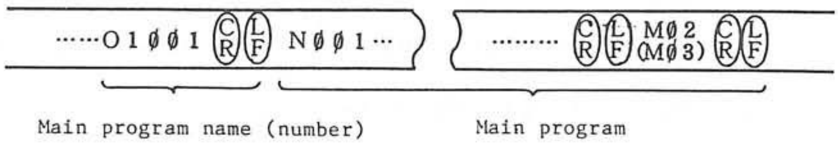
Program name .... Address character "O" and four alphanumerics beginning with an alphabetic character.

Program number ...... Address character "O" and four numeral characters.

There are four types of program names and program numbers that correspond to the type of files explained in b).

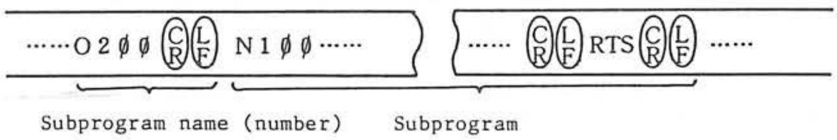
1) Main program

A main program begins with "program name (number) CR LF" and ends with "MØ2 CR LF" or "M3Ø CR LF".



2) Subprogram

A subprogram begins with "program name (number) CR LF" and ends with "RTS CR LF".



3) System subprogram

A system subprogram begins with "program name (number) CR LF" and ends with "RTS CR LF" as a subprogram indicated above.

4) Schedule program

All the data in the schedule program file becomes schedule programs.

The program format is as follows:

Program selection block
IF block
GOTO block
Variable setting block
Schedule end block

For details, refer to Section 4-1-6, "Scheduled Operation".

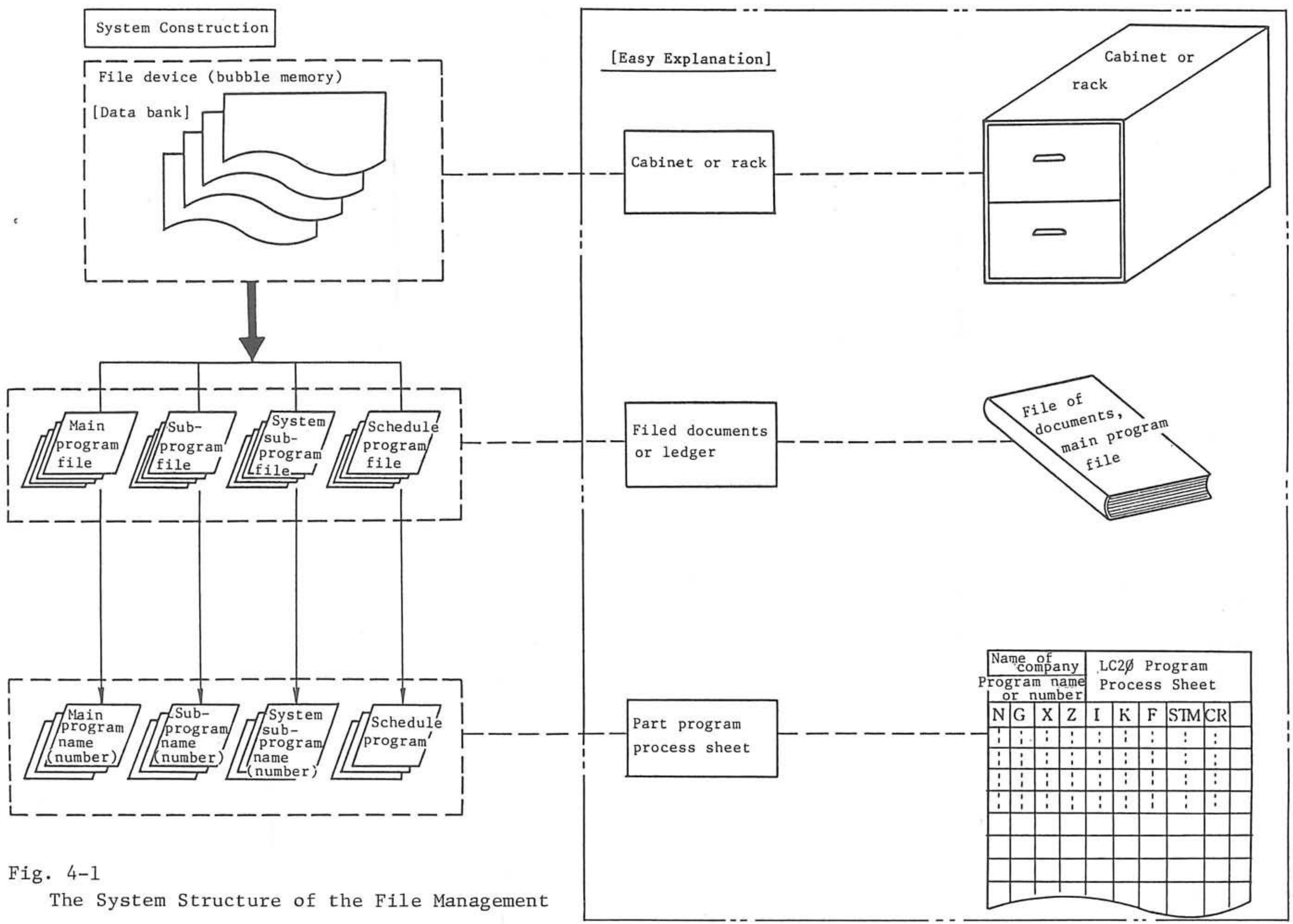


Fig. 4-1
The System Structure of the File Management

(3) Construction of Machining Program (Format)

The general explanation concerning programs and how they are handled was provided in (1), Bubble Memory and (2), Managing User File.

This paragraph deals with the formats used to make a machining program.

1) Main program
[Main program tape]

```
............$  SHAFT-135Ø.MIN............% CR LF O1ØØØ CR LF N....   ........... CR LF MØ2 (M3Ø) CR LF   ......
```

(Tape feed holes) (Main program file name) (Tape feed holes) (Main program name (number)) (Machining program data) (Tape feed holes)

Code indicating that a file name is used

2) Subprogram and system subprogram
[Subprogram tape]

```
............$  GEAR-4ØØØ.SUB (SSB)  ............% CR LF O4ØØ1 CR LF  N....   ..... CR LF RTS CR LF   ......
```

(Tape feed holes) (Sub or system subprogram file name (number)) (Tape feed holes) (Sub or system subprogram name (number)) (Subprogram data) (Tape feed holes)

Code indicating that a file name is used

3) Schedule program
[Schedule program tape]

```
..........  $ GEAR-SHAFT-1ØØØ.SDF..% CR LF NS1 PSELECT [    ] . [    ] . [    ] . [Q4ØØ] CR LF →
```

(Tape feed holes) (Schedule program file name) (Tape feed holes) Program selection block (Main program name (number)) (Subprogram file name) (Number of main program repetitions)

Code indicating that a file name is used

Sequence name (number) of block

```
→ MS2 IF [  ] MS5 CR LF NS3 GOTO NS2 CR LF NS4 VSET [    ] CR LF NS5 END CR LF   .....
```

(Tape feed holes)

[Precautions on Programming]

Note 1: When the first character in a program is "$", it indicates that a file name follows it.

Note 2: If no file name is provided at the beginning of a machining program, there are two ways for assigning a file name to that program:

1) Press the WRITE key right after pressing the function key [F1] (READ). A file name A.MIN is automatically provided after the read-in data, and the data is stored in the bubble memory with that file name.

2) After pressing the function key [F1] (READ), key-in ",[File Name]" and then press the WRITE key. The read-in data is stored in the bubble memory with the keyed-in file name.

Note 3: To store several machining programs in the bubble memory (data bank), it is necessary to name each program with a different file name. Or each program should be given a specific file name in accordance with step 2) in Note 2 when stored in the bubble memory.

Note 4: There are two possible ways to designate the coding system of a program, either EIA or ISO:

- Setting of parameter (bit) data,
- Designation of option when carrying out Read, Punch or Verify operation.

1) Parameter (bit) data setting

When "tape code parity check" bit is "1":

- ISO and EIA coding systems are automatically recognized when reading or verifying is carried out.
- When the program is punched out, data is punched out in the ISO code when "tape code ISO code" bit is "1", and in EIA code when it is "Ø".

When "tape code parity check" bit is "Ø":

- When "tape code ISO code" bit is "1", data is handled as coded according to the ISO coding system for tape reading or verifying operation. When it is "Ø", the EIA coding system is assumed. Therefore, if the bit data setting and actual coding system do not match, an alarm occurs.
- When the program is punched out, data is punched out in the ISO code when "tape code ISO code" bit is "1", and in the EIA code when it is "Ø".

2) Option designation

For individual operations, tape read-in, verifying, and punching-out, data is handled as coded in the coding system designated as "option" disregarding the setting of parameter bit data.

For details, refer to instructions in 4-2-1, "Transfer of Main Program Data".

Note 5: In a machining program, data following the first LF (or CR) code is effective.

Note 6: End of data in a machining program is judged by the tape feed holes. However, it can also be judged using the "% (ER)" code by setting a proper bit data.

Note 7: The symbols $, *, = and [,] are not included in EIA code, but it is possible to register EIA code patterns to correspond to these symbols at optional parameter (bit) which enables the use of the symbols $, *, = and [,] in EIA code as well.

(4) Math Operation Function for Parameter Data Input

To set data for tool offset, for example, in the parameter set, zero set, and tool data set modes, arithmetic and function operation expressions can be used in addition to the conventional direct numerical data input method.

a) Arithmetic and function operation symbols

Arithmetic and function operation expressions are designated using the symbols below.

Operation Symbol List

Symbol	Contents	Example	Remark
+	Plus sign	+ 12.34	Usable only at the beginning of an expression or right after the "[" symbol.
-	Minus sign	[- SIN 9Ø]	
+	Addition	12.3 + 456.7	
-	Subtraction	[12.3 - 4] - [5 - 6]	
*	Multiplication	12.34 * 56.7	* indicates the multiplication symbol (x).
/	Division	[12.3 / 4] / 5.6	/ indicates the division symbol (÷).
R S Q R T	Square root	R SP 3Ø S Q R T [3Ø-2Ø]	If symbols [ ] are not used to indicate figures (operand) following the function symbol, place at least one space between the function symbol and the operand.

Symbol	Contents	Example	Remark
$\boxed{S}$ $\boxed{S}\boxed{I}\boxed{N}$	Sine	$\boxed{S}$[45*2] $\boxed{S}\boxed{I}\boxed{N}$ SP 6Ø	The figure written following the function symbol is an angle and expressed in units of degrees. If symbols [ ] are not used to indicate figures (operand) following the function symbol, place at least one space between the function symbol and the operand.
$\boxed{C}$ $\boxed{C}\boxed{O}\boxed{S}$	Cosine	$\boxed{C}$ SP 3Ø $\boxed{C}\boxed{O}\boxed{S}$[15+45]	
$\boxed{T}$ $\boxed{T}\boxed{A}\boxed{N}$	Tangent	$\boxed{T}$[45-15] $\boxed{T}\boxed{A}\boxed{N}$ SP [15*3/2]	
$\boxed{A}\boxed{S}$ $\boxed{A}\boxed{S}\boxed{I}\boxed{N}$	Arc sine	$\boxed{A}\boxed{S}$ SP Ø.5 $\boxed{A}\boxed{S}\boxed{I}\boxed{N}$[15.5/22.2]	The result of operation is an angle in units of degrees.
$\boxed{A}\boxed{C}$ $\boxed{A}\boxed{C}\boxed{O}\boxed{S}$	Arc cosine	$\boxed{A}\boxed{C}$[Ø.8*Ø.6] $\boxed{A}\boxed{C}\boxed{O}\boxed{S}$ SP Ø.45	If symbols [ ] are not used to indicate figures (operand) following the function symbol, place at least one space between the function symbol and the operand.
$\boxed{A}\boxed{T}$ $\boxed{A}\boxed{T}\boxed{A}\boxed{N}$	Arc tangent (-9Ø° to 9Ø°)	$\boxed{A}\boxed{T}$ SP 45 $\boxed{A}\boxed{T}\boxed{A}\boxed{N}$[45*2]	The result of operation is an angle in units of degrees. If symbols [ ] are not used to indicate figures (operand) following the function symbol, place at least one space between the function symbol and the operand.
$\boxed{A}\boxed{T}\boxed{2}$ $\boxed{A}\boxed{T}\boxed{A}\boxed{N}\boxed{2}$	Arc tangent (-18Ø° to 18Ø°)	$\boxed{A}\boxed{T}\boxed{2}$[Ø.5, 1.5] $\boxed{A}\boxed{T}\boxed{A}\boxed{N}\boxed{2}$[Ø.45, 1]	Designation should always be AT2 [numerator, denominator]. Symbols [ ] cannot be omitted.

Remarks:

1. If the expression does not follow the format indicated above, or an overflow occurs in the course of operation, a calculation error occurs.

   Example: S3Ø ⟶ Calculation error (No space between "S" and "3Ø")

2. As indicated in the list above, symbols [ ] can be used for operation. Although the nesting level for the usage of them is not specially limited, fourth nesting level is the maximum depth to guarantee the results of operations.

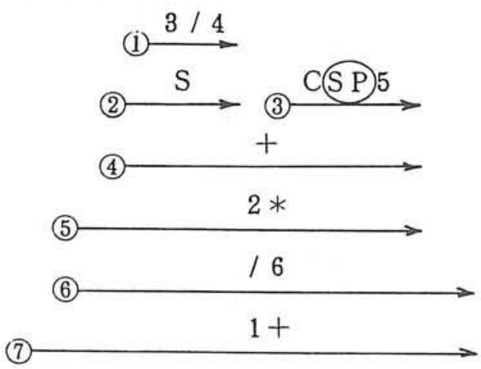
   Example: R (SP) [18Ø+[S*[3Ø-5]-2Ø*[6-2]]]

3. Calculation order follows usual arithmetic operation rules:

   In parentheses ⟶ Functions ⟶ Multiplication/division ⟶ Addition/subtraction

   If operations of the same calculation priority are used, calculation is made from the leftmost operations in order.

   Example: 1+2*[S [3/4] + C SP 5]/6



b) Input Example using Expressions

With the machine having the rapid traverse speed of 1Ø m/min., manual feedrate is usually 2.4 m/min. However, this feedrate can be changed by changing the manual feed unit amount set with the system parameter. However, since the setting is made in units of μm/12.8 msec., complicated calculation is required to obtain the setting value.

To change the manual feedrate to X = 2 m/min and Z = 1.5 m/min, calculation required would be:

X-axis manual feed unit amount

$$= \frac{2 \times 10000000}{60 \times 1000} \times 12.8$$

Z-axis manual feed unit amount

$$= \frac{1.5 \times 10000000}{60 \times 1000} \times 12.8$$

To input the data, calculation function can be used in the following manner.

Procedure:

(1) Locate the cursor at the manual feed unit amount column of X-axis.

(2) After pressing the function key [F1] (SET), input as indicated below.

= S␣[2][*][1][Ø][Ø][Ø][Ø][Ø][Ø][Ø][/][[][6][Ø]

[*][1][Ø][Ø][Ø][]][*][1][2][.][8] [WRITE]

Then, the following is displayed on the console line of the CRT screen;

= S␣2*1ØØØØØØØ/[6Ø*1ØØØ]*12.8

and the result of the calculation is displayed at the cursor position. In this example, the calculation result is "426".

(3) Move the cursor to the manual feed unit amount column of Z-axis.

(4) After pressing the function key [F1] (SET), input as indicated below.

= S␣[1][.][5][*][1][Ø][Ø][Ø][Ø][Ø][Ø][Ø][/][[][6][Ø]

[*][1][Ø][Ø][Ø][]][*][1][2][.][8] [WRITE]

Then, the following is displayed on the console line of the CRT screen;

= S␣1.5*1ØØØØØØØ/[6Ø*1ØØØ]*12.8

and the result of the calculation is displayed at the cursor position.

Note: Input of symbol [..... OSP5ØØØL-G:

Press $T^{[}$ while holding down the [UPPER CASE] key.

OSP500L-G:

Press $[_{D}{}^{B}$ while holding down the [LEFT UPPER CASE] key.

Input of symbol] OSP5ØØØL-G:

Press $U^{]}$ while holding down the [UPPER CASE] key.

OSP5ØØL-G:

Press $]_{E}{}^{@}$ while holding down the [LEFT UPPER CASE] key.

4-1. APPLICATION OF OPERATIONS - AUTOMATIC MODE OPERATION

4-1-1. Program Selection and Operation

To execute a machining program in Automatic Mode operation, the desired program must be selected. This is because the bubble memory stores several machining programs, and it is necessary to call the specific program for execution.

There two methods which can be used for selecting programs:

(1) Selection from the directory display page
(2) Direct designation

(1) Selection from the Directory Display Page

Program selection including a schedule program is possible from the program directory page by locating the cursor (reverse display) on the desired program name.

Follow the step below:

1) Select the AUTO OPERATION mode by pressing the AUTO key.

2) Press the function key [F1] (PROGRAM SELECT).

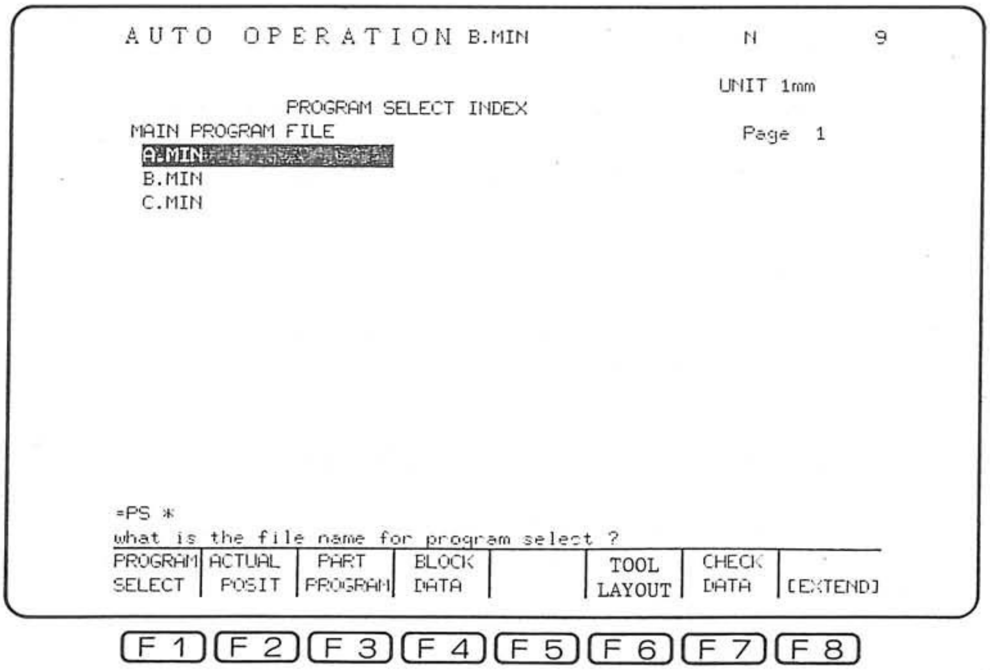
3) Key-in an asterisk (*) through the keyboard.

The CRT will display:

=PS *

4) Press the WRITE key.

The program directory page will be displayed by the operations above. One page of this display shows a total of 12 file names and if more than 12 file names are registered, press the  key to display the second page.



5) Locate the cursor to the file name desired.

6) Press the WRITE key.

This selects the program and the CRT display is restored to the program display page with the program designated on it.

7) Press the CYCLE START button.

This starts the execution of a program elected.

For the selection of a schedule program, press the function key [F8] (EXTEND) after the completion of step 1) above and press the function key [F4] (SP SELECT) instead of the operation of step 2). Then, follow the steps above.

Note 1: During the operations in steps 4) through 6), keys other than , , and are not opera

Note 2: The only files which can be selected by this operation are programs with the extension "*.MIN" and schedule programs with the extension "*.SDF".

Note 3: Since designation of a program name is not possible, the first main program in the designated main program file is automatically selected, if the designated main program file has more than one main program.

Note 4: Since subprogram names cannot be designated, subprograms usable in a main program are limited to those indicated below:

a) Those in the subprogram file of "*.SSB"

b) Those in the subprogram file of "*.MSB"

c) Those in the main program to be selected

Subprogram file "*.SSB":

Subprogram file which a user can create as needed. It is edited and created under the file name "*.SSB" (* represents a character-string of up to 16 alphanumerics.)

Subprogram file "*.MSB":

Subprogram file created by Okuma and called out by a user as needed. Mainly called out for execution the gauging cycle.

Note 5: If there is no main programs or schedule programs, the message "not found main program file" or "not found schedule program file" will be displayed on the CRT.

(2) Direct Designation of Programs

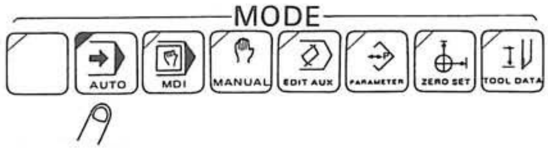
Assume the bubble memory stores several machining programs including the one to be executed now.

Example of registered programs:

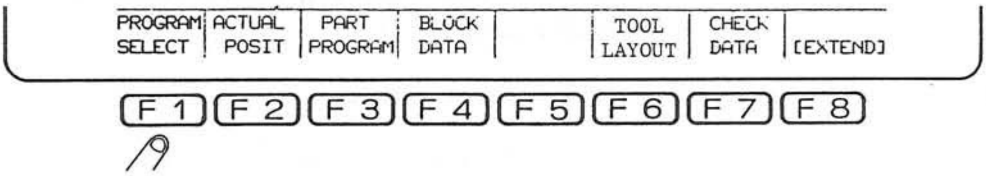
File Name	Program Name	Contents
A.MIN	OMIN1	Machining program 1
	OMIN2	Machining program 2
SHAFT.MIN	OSHT1	Shaft machining program 1
	OSHT2	Shaft machining program 2

Explanation and notes below are provided according to the example above.

1) Select the AUTO OPERATION mode by pressing the AUTO key.



2) Press the function key [F1] (PROGRAM SELECT).

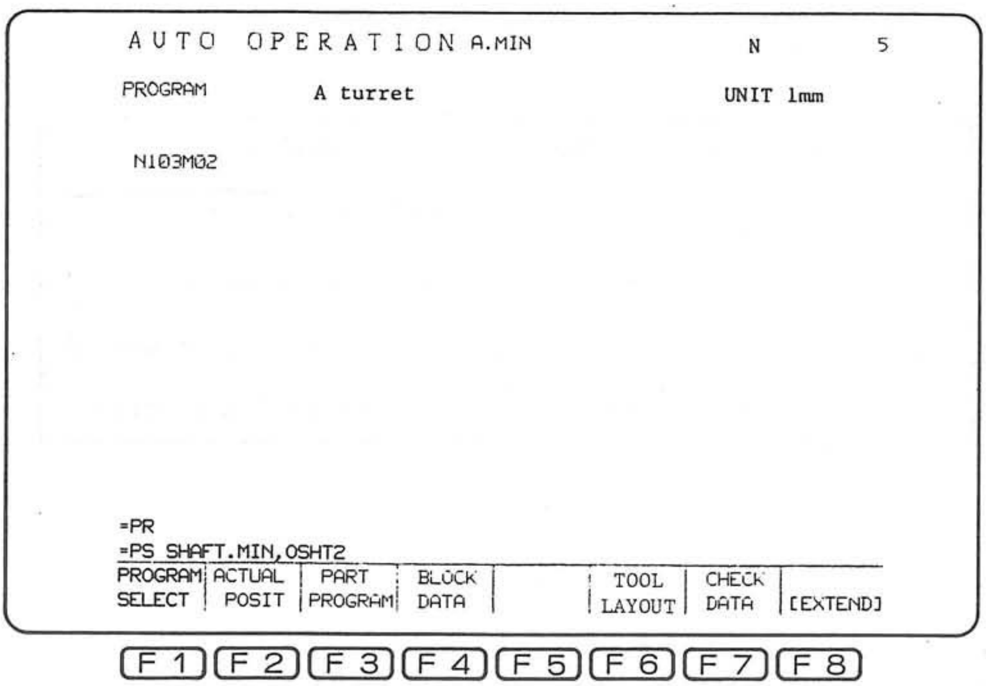


The CRT displays prompt "PS" on its console line and the control is ready for data keying-in.

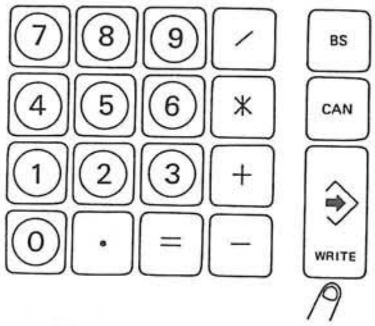
3) Key-in the file name and program name through the keyboard. Use a comma "," as a delimiter.

=PS SHAFT.MIN,OSHT2

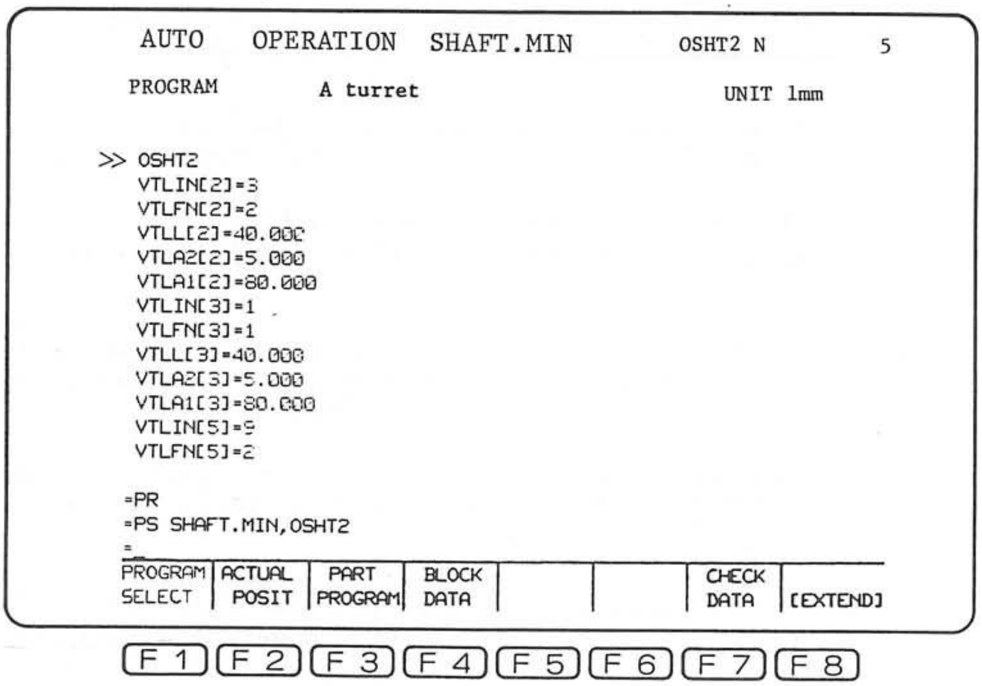
Keyed-in data



4) Press the WRITE key.



This selects the program to be executed, and the contents of the selected program are displayed on the CRT. Also the designated file name and the program are displayed at the top of the CRT.



5) Press the CYCLE START button.

With steps 1) through 5), the machining program OSHT2 in the file named SHAFT is executed.

Note 1: Omission of the file name and/or program name during designation:

- When the extension of a file is "MIN", it can be omitted.

PS SHAFT.MIN,OSHT2	→	PS SHAFT,OSTH2

- When both or either the file name or program name is omitted.

	File Name/Program Name	Effective Command
a	=PS Omitted Omitted	=PS A.MIN , OMIN1
b	=PS SHAFT.MIN Omitted	=PS SHAFT.MIN , OSHT1
c	=PS SHAFT.MIN , OSHT2	=PS SHAFT.MIN , OSHT2
d	=PS Omitted , OMIN2	=PS A.MIN , OMIN2

When a file name is omitted, "A.MIN" is automatically selected as the file name .... a) and d)

When a program name is omitted, the first program in the specified file is selected ..... a) and b)

Note 2: If the bubble memory does not have the designated file or program name, an alarm results. In this case, the program previously selected becomes ineffective.

The effective file and program name appear on the first line of the CRT; be sure to check those when selecting the program.

Note 3: The program once selected remains effective until another program is selected. Turning power supply on/off has no influence on the selected program. If this operation is attempted, symbol "□" will appear after the program name and file name. However, selection of a schedule program makes the selected program ineffective.

Note 4: A maximum length of a program (including subprograms) usable for the program selection operation is 3Ø meter in tape length. This value may be expanded to up to 64Ø meter optionally.

4-1-2. Sequence Restart

When the execution of a program is interrupted with the control reset or the emergency stop button pressed due to tool breakage or entangled cutting chips, the use of "sequence restart" feature permits the resumption of the program from the block right before the one where the operation was interrupted; it is not necessary to start the machine operation from the beginning.

There are two ways for sequence restarting:

1) Sequence restart with the designation of a sequence number.

2) Sequence restart with the designation of a block counter.

Example: SHAFT-1.MIN

```
OSHT1
N1ØØ  GØØ  X3ØØ  Z3ØØ
N11Ø  G5Ø                   S35ØØ
N12Ø                        S 424  M41  MØ3  MØ8
N13Ø  GØØ  X1Ø5  Z92.Ø48    TØ2Ø2
N14Ø             Z9Ø
N15Ø                        S 424  MØ9
N16Ø       X3ØØ  Z3ØØ       TØ2ØØ
N17Ø                        S 792  MØ8
N18Ø  GØØ  X1Ø6  Z9Ø        TØ3Ø3
N19Ø       X1Ø2
N2ØØ       X 66
N21Ø  GØ1        Z85        FØ.1
N22Ø       X 7Ø  Z83
N23Ø             Z6Ø
N24Ø       X 8Ø  Z45
N25Ø             Z29
N26Ø  GØ2  X 88  Z25        I 4
N27Ø  GØ1  X 9Ø             FØ.45
N28Ø             Z2Ø        FØ.3
N29Ø       X 98             FØ.45
N3ØØ       X1ØØ  Z19        FØ.3
N             :
              :
              :
```

To restart the sequence from N18Ø, follow the procedures below.

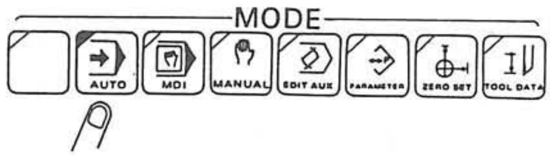
(1) To restart the sequence by designating the sequence number (name):

1) After selecting the MANUAL OPERATION mode, retract the turret to the desired position.

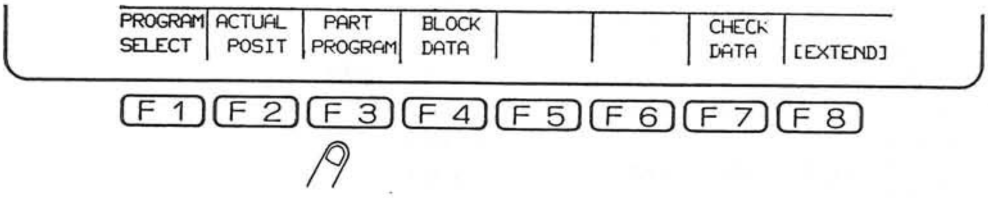
   If sequence restart is to be made from the block calling for ID turning, retract the turret carefully so that the cutting tool and the workpiece do not interfere with each other.

2) Change the broken tool or remove entangled chips.

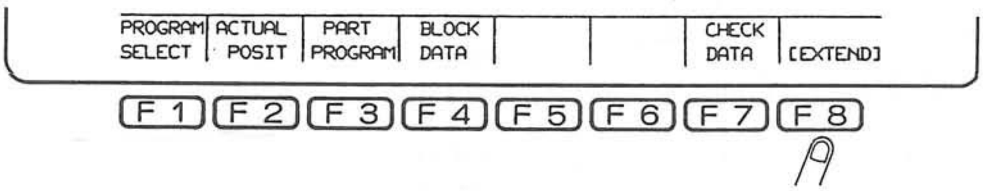
3) Select the AUTO OPERATION mode by pressing the AUTO key.



4) Press the function key [F3] (PART PROGRAM) to display the machining program on the CRT.



5) Press the function key [F8] (EXTEND) to select the page that allows the designation of a sequence number.



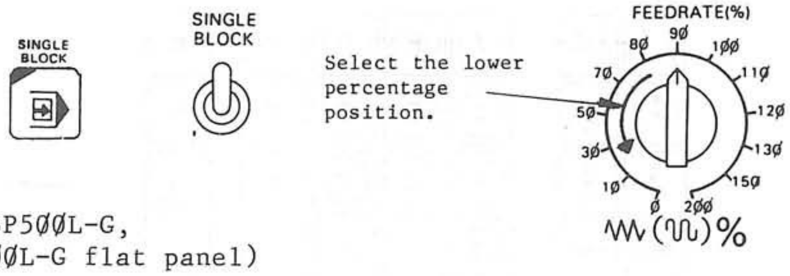
```
AUTO OPERATION          SHAFT-1.MIN   OSHT1 N        Ø
PROGRAM                                      UNIT 1mm

OSHT1
N100 G00 X   300    Z   300
N110 G50                      S3500
N120                          S 424 M41 M03 M08
N130 G00 X   105    Z   52.048 T0202
N140                Z   90
N150                          S 424 M09
N160     X   300    Z   300   T0200
N170                          S 792 M08
N180 G00 X   106    Z   90    T0303
N190     X   102
N200     X    66
N210 G01            Z   85    F0.1

=PS SHAFT-1.MIN
=EX
=_
NUMBER |        |  | SP     | SP-N   |  |  |
SEARCH |RESTART |  | SELECT | SEARCH |  |  | [EXTEND]
```

[F 1] [F 2] [F 3] [F 4] [F 5] [F 6] [F 7] [F 8]

Make sure the guide display of functions has changed.

6) Turn the SINGLE BLOCK toggle switch up to the ON position and select the low percentage position on the FEEDRATE override dial.

   This is to prevent unexpected hazards (mainly collision between the cutting tool and the workpiece) when sequence restart is performed erroneously. Therefore, MAKE SURE this step is performed.



(For OSP5ØØL-G,
OSP5ØØØL-G flat panel)

7) Read out the sequence number N18Ø where the sequence is to be restarted.

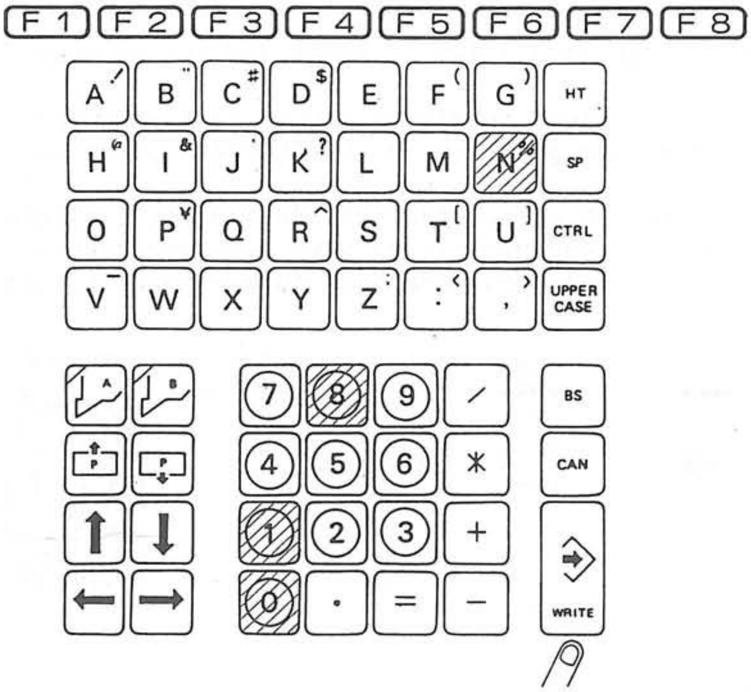
   Press the function key [F2] (RESTART).

```
NUMBER |        |  | SP     | SP-N   |  |  |
SEARCH |RESTART |  | SELECT | SEARCH |  |  | [EXTEND]
```

[F 1] [F 2] [F 3] [F 4] [F 5] [F 6] [F 7] [F 8]

After keying-in N18Ø through the keyboard, press the WRITE key.

```
AUTO OPERATION          SHAFT-1.MIN    OSHT1 N          Ø
PROGRAM                                       UNIT 1mm

OSHT1
N100 G00 X   300   Z   300
N110 G50                     S3500
N120                         S 424 M41 M03 M08
N130 G00 X   105   Z   92.048 T0202
N140               Z   90
N150                         S 424 M09
N160     X   300   Z   300   T0200
N170                         S 792 M06
N180 G00 X   106   Z   90    T0303
N190     X   102
N200     X    66
N210 G01           Z   85    F0.1

=PS SHAFT-1.MIN
=EX
=RE N180
NUMBER |        |  | SP     | SP-N   |  |  |
SEARCH | RESTART|  | SELECT | SEARCH |  |  | [EXTEND]
```



Note: Leading zeros of sequence numbers must not be omitted.

Example: NØ1ØØ

This "Ø" cannot be omitted

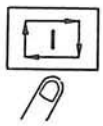
For the two-saddle model, the sequence number should be read by designating the restart numbers for both the A- and B-turret.

This locates the address pointer ">>" at the sequence number N18Ø.

```
     AUTO OPERATION        SHAFT-1.MIN   OSHT1 N              Ø
    PROGRAM                                         UNIT 1mm

     OSHT1
     N100 G00 X    300      Z   300
     N110 G50                          S35ØØ
     N120                              S 424 M41 MØ3 MØ8
     N130 G00 X    105      Z    92.048 TØ2Ø2
     N140                   Z    90
     N150                              S 424 M09
     N160      X   300      Z   300    TØ2ØØ
     N170                              S 792 MØ8
   >>N180 G00 X    106      Z    90    TØ3Ø3
     N190      X   102
     N200      X    66
     N210 G01               Z    85    FØ.1
    =PS SHAFT-1.MIN
    =EX
    =RE N180
    =_
    NUMBER |        |    |  SF    | SP-N   |    |    |
    SEARCH |RESTART |    | SELECT | SEARCH |    |    | [EXTEND]

    (F 1)  (F 2)  (F 3)  (F 4)  (F 5)  (F 6)  (F 7)  (F 8)
```

8) Press the SEQUENCE RESTART button.

SEQUENCE RESTART



With the steps indicated above, the turret is fed to X3ØØ.ØØ, Z3ØØ.ØØ programmed in N16Ø at a rapid feedrate after miscellaneous functions (S, T and M commands) have been completed.

That is, the coordinate point where the axes (turret) are positioned is the point commanded in the block preceding the read out block.

The axes move to the sequence restart point at a rapid feedrate (GØØ) irrelevant to the programmed feed mode.

[Supplement]

When one program contains two or more blocks assigned with the same sequence number, to restart the program from that sequence number, it is necessary to indicate where the required sequence appears, at the 1st, 2nd, etc.

Example:

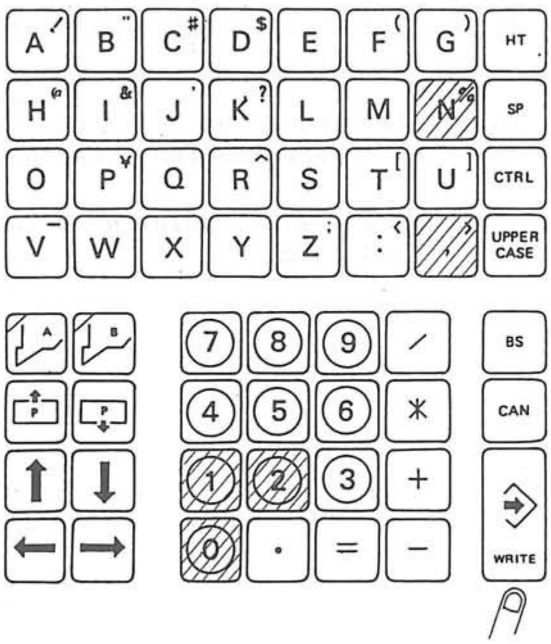
To restart the sequence from this N12Ø (2nd N12Ø)

```
N1ØØ GØØ X   3ØØ   Z   3ØØ
N11Ø G5Ø                       S35ØØ
N12Ø                           S 424 M41 MØ3 MØ8
N13Ø GØØ X   1Ø5   Z    92.Ø48 TØ2Ø2
N14Ø               Z    9Ø
N15Ø                           S 424 MØ9
N16Ø     X   3ØØ   Z   3ØØ     TØ2ØØ
N17Ø                           S 792 MØ8
N12Ø GØØ X   1Ø6   Z    9Ø     TØ3Ø3
N13Ø     X   1Ø2
N16Ø     X    66
N21Ø GØ1           Z    85     FØ.1
N22Ø     X    7Ø   Z    83
N23Ø               Z    6Ø
N24Ø     X    8Ø   Z    45
```

1) Key-in as indicated below for step 7) explained before.

[F2] (RESTART) <u>N12Ø,2</u> [WRITE]

This indicates the 2nd N12Ø in the selected machining program. The numeral data following delimiter "," is used to indicate where the desired sequence is, 1st, 2nd, etc.

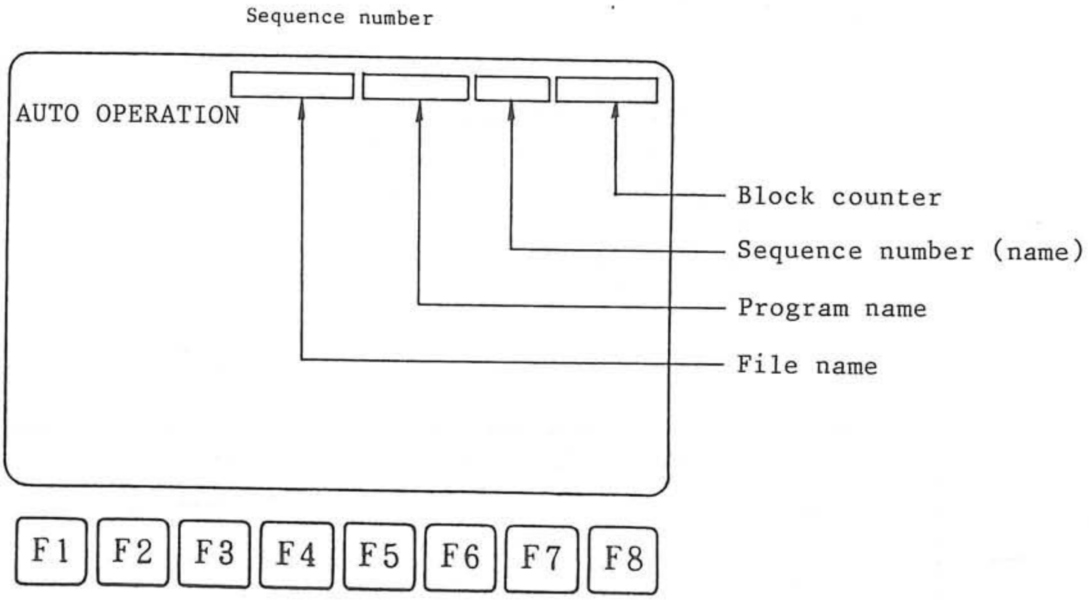


(2) To restart the sequence by designating the block counter

Block counter:

In automatic mode operation, the control counts the number of executed blocks taking the block executed first as "1". This number is, therefore, not the sequence number but the number of actually executed blocks: therefore, in LAP or subprogram which repeatedly executes the same block many times, the block counter counts the number of executed blocks. This greatly helps the sequence restart operation when it is attempted from a block in LAP or thread cutting subprogram.

Block counter data is displayed at the upper right part of the CRT.



Note 1: The block counter is not cleared when the control is reset or the operation mode switched.

Note 2: The block counter is cleared when power supply to the control is shut off. Therefore, if power supply to the control is shut off by emergency stop or similar operation during machine operation, sequence restart using the block counter cannot be made.

When it is necessary to use the block counter feature after turning off power supply once to restart the sequence in LAP, thread cutting subprogram, or parameter program: find the block counter data at which emergency stop was activated by actually running the program in MACHINE LOCK or DRY RUN mode.

Procedure to restart sequence by designating the block counter number:

Basically, the same procedure to restart the sequence by designating the sequence number applies. In this case, however, the block counter number is designated instead of the sequence number in step 7) in (1), "To restart the sequence by designating the sequence number (name)".

Follow the steps below:

Assume the block counter is;

8 for sequence number N18Ø

1) Do as follows instead of steps 7) and following steps.

Read out the block counter number "8" where the sequence is to be restarted.

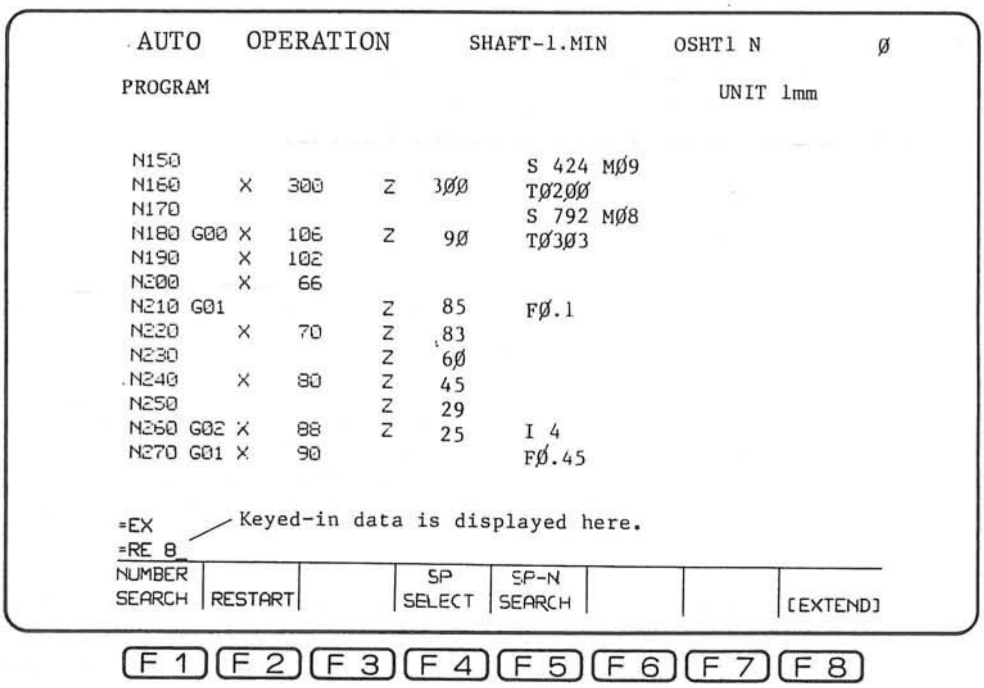
Press the function key [F2] (RESTART).

↓

Key-in "8" through the keyboard.

↓

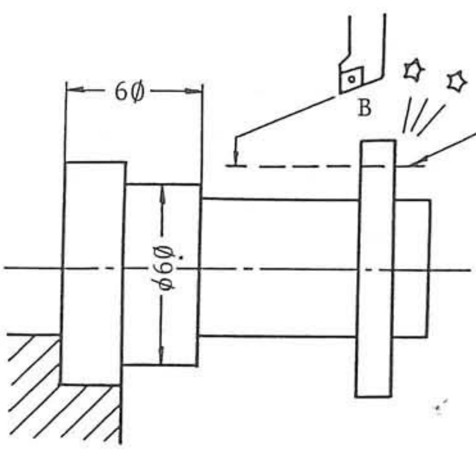
Press the WRITE key.



This reads out the block counter number.

[Remarks on Carrying Out Sequence Restart Operation]

(1) Interference between Cutting Tool and Workpiece



If sequence restart is performed with the cutting tool positioned at point A, the cutting tool will collide against the workpiece. Be sure to move the cutting tool to point B with manual controls on the NC operation panel before carrying out sequence restart operation.

Index the turret manually to select the necessary tool for sequence restart before pressing SEQUENCE RESTART button.

(2) Sequence Restart from The First Block in LAP

To restart the designated commands from the very beginning of LAP, sequence restart must be made from the block containing the G code used to call the LAP cycle to be executed.

G codes used to call LAP cycle: G85, G86, G87 and G88

Example:

```
NAP1  G81
NØØ1  GØØ  X 5Ø  Z1ØØ
NØØ2  GØ1  X 54  Z 98   FØ.25  S1ØØØ
 :          :
 :          :
NØ2Ø  G8Ø

N1Ø1  GØØ  X8ØØ  Z3ØØ
N1Ø2       X1ØØ  Z2ØØ   S75Ø  TØ1Ø1  MØ3  M42
N1Ø3  G85  NAP1
 :          :
 :          :
```

Sequence restart must be done from N1Ø3 block containing G85 NAP1.

The CRT displays the commands in the first sequence NØØ1 of the contour defining commands of LAP.

(3) Sequence Restart from a Block within LAP

To restart the program from a block within LAP blocks, be sure to use the block counter number. If sequence restart is intended by designating the sequence number, it is difficult to find the desired infeeding point since the number of infeedings and the reading-in times of contour definition blocks do not match.

(4) If the operator intends sequence restarting while a program is being executed, or after MDI operation, it results in "MAIN PROGRAM EXECUTING ERROR". To activate the sequence restart function in such cases, reset the control first.

4-1-3. Sequence Number Search Operation

Sequence number search is a function that serves to search for the block assigned with the commanded sequence number. The data in the previous blocks are all ignored, and those in that block become effective.

This feature provides effective means to restart the program from the desired block. If the same effect as sequence restart operation is desired in sequence number search operation, be sure to search for the block which contains all the conditions necessary to restart the operation intended, i.e., the block containing G, X, Z, S, T and M commands.

In order to remind the operator of the fact that the cycle is going to start in the midst of a program, both hands are required to start operation. (Press CYCLE START while pressing MID-AUTO MANUAL MODE OFF*.)

* MID-AUTO MANUAL MODE OFF for OSP5ØØØL-G; INTERLOCK for OSP5ØØL-G, SP5ØØØL-G flat panel

Sequence number search procedure is detailed below taking the same example as used in 4-1-2, "Sequence Restart".

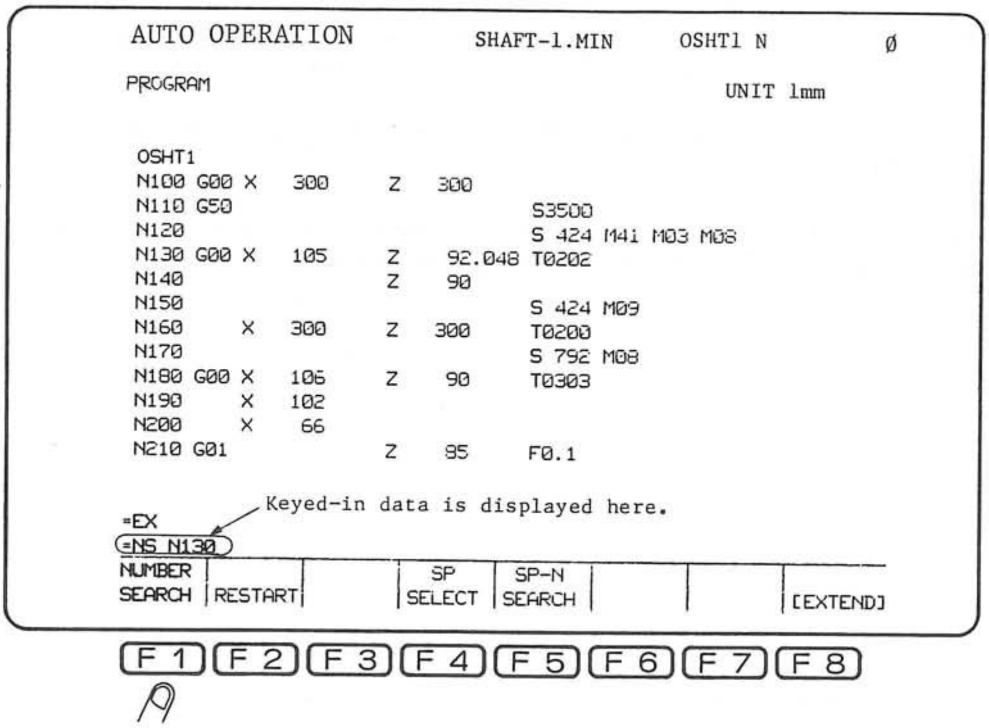
The sequence number to be searched for is: N13Ø

Follow the steps below:

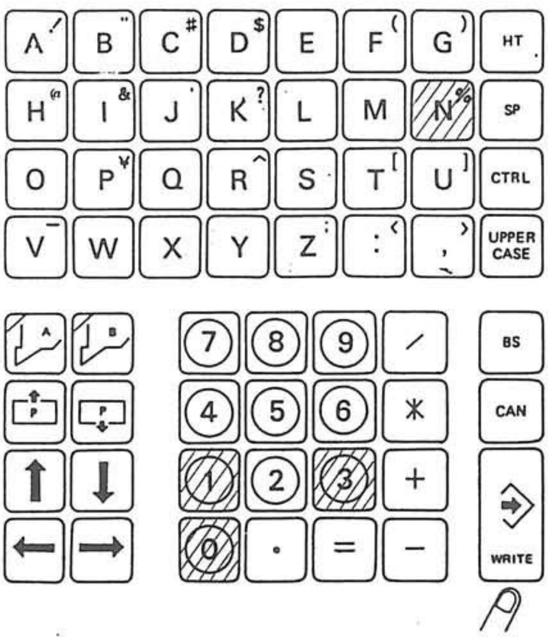
1) Follow the same steps 1) through 6) as in 4-1-2.

2) Press the function key [F1] (NUMBER SEARCH) to read out the sequence number N13Ø.

3) Key-in N13Ø through the keyboard.



4) Press the WRITE key.



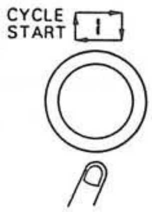
With this, the desired sequence number N13Ø is searched for.

```
          AUTO OPERATION          SHAFT-1.MIN      OSHT1  N          Ø
        PROGRAM                                         UNIT 1mm

         OSHT1
         N100 G00 X   300     Z   300
         N110 G50                        S35ØØ
         N120                            S 424 M41 MØ3 MØ8
      >> N130 G00 X   8ØØ     Z   2ØØ    TØ2Ø2
         N140                 Z    90
         N150                            S 424 MØ9
         N160     X   300     Z   300    TØ2ØØ
         N170                            S 792 MØ8
         N180 G00 X   106     Z    30    TØ3Ø3
         N190     X   102
         N200     X    66
         N210 G01             Z    85    FØ.1

        =EX
        =NS N130
        =_
        NUMBER |        |      | SP     | SP-N   |      |      |
        SEARCH |RESTART |      | SELECT | SEARCH |      |      | [EXTEND]
```

F 1 F 2 F 3 F 4 F 5 F 6 F 7 F 8

The address pointer (>>) is moved to the designated sequence number (N13Ø).

5) While pressing the MID-AUTO MANUAL MODE OFF button*, press the CYCLE START button to initiate the execution of the commands in read out blocks.



* MID-AUTO MANUAL MODE OFF for OSP5ØØØL-G; INTERLOCK for flat panel specification of OSP5ØØØL-G, OSP5ØØL-G

With the CYCLE START button pressed, S, T and M commands are executed first. After the completion of those commands, the turret is positioned to the designated coordinate point, in the mode specified by the commanded G codes. In this example, the turret moves to the point (X8ØØ, Z2ØØ) designated in N13Ø in rapid feedrate (GØØ).

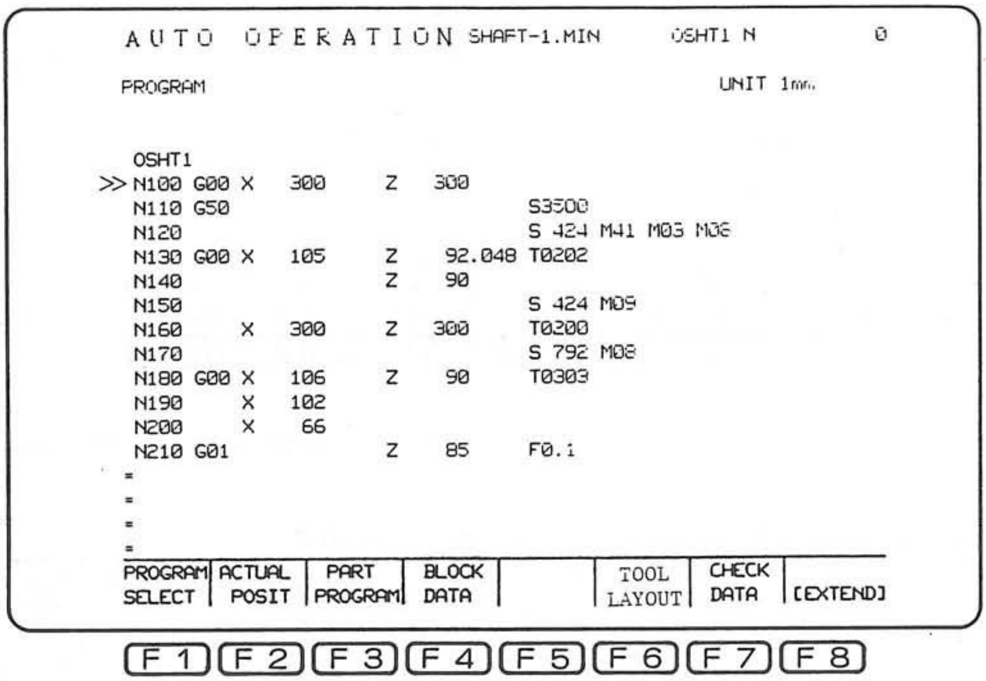
PLEASE NOTICE THE DIFFERENCE BETWEEN SEQUENCE RESTART AND SEQUENCE NUMBER SEARCH.

[Supplement]

The cursor control keys [↑] and [↓] may also be used for sequence number search operation:

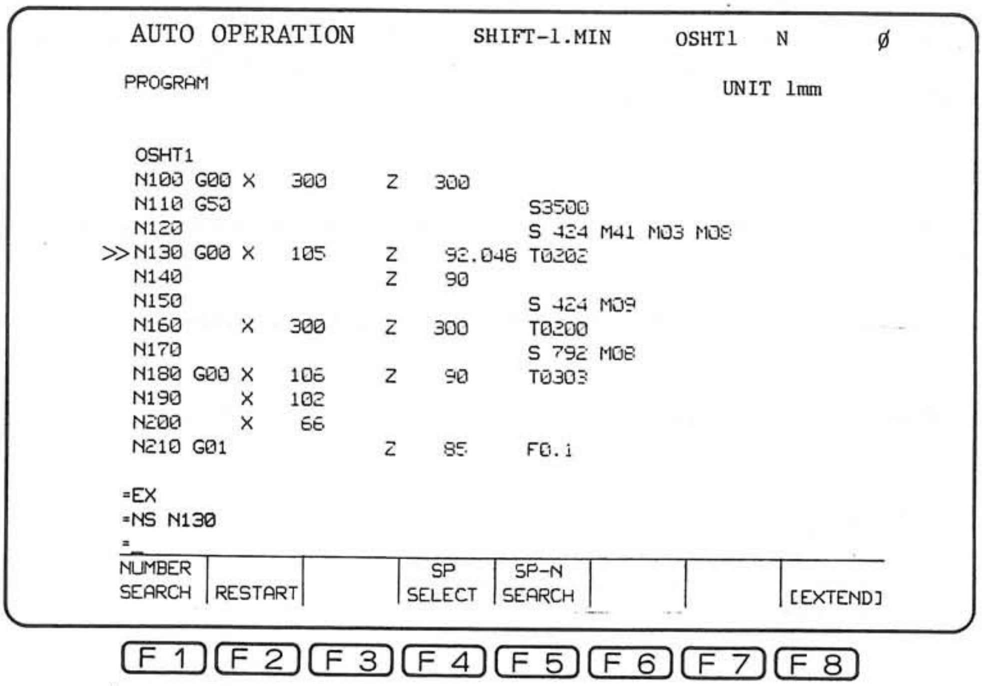
1) Follow steps 1) through 6) as in 4-1-2.

2) Press [↓] key until the address pointer ">>" is located at N13Ø.



Note: When the cursor control key is kept pressed, the address pointer ">>" can advance successively. If it passes the required block, press [↑] key to return it.

3) When the address pointer ">>" reaches N13Ø block, sequence number search operation is complete.



4) While pressing the MID-AUTO MANUAL MODE OFF button*, press CYCLE START button to initiate execution of the commands.

* MID-AUTO MANUAL MODE OFF for OSP5ØØØL-G; INTERLOCK for flat panel specification of OSP5ØØØL-G, OSP5ØØL-G

This feature allows the operator to check the contents of the selected program.

4-1-4. Operation Resumption after Manual Operation Intervention

This feature allows manual operation intervention in automatic mode operation, by interrupting the automatic mode operation through activation of the slide hold or the single block (including MØØ and MØ1 command) feature; after completion of the manual operation, automatic mode operation can be resumed.

This feature is conveniently used when an abnormal condition which does not require emergency stop or control resetting occurs, such as: chip entanglement, replacement of cutting tip and checking of finished dimensions.

This function can be activated for each spindle independently.

(1) Operation Procedure

Example:

```
Program

N1Ø1  GØØ  X8ØØ  Z2ØØ  S6ØØ  TØ1Ø1  M42
N1Ø2       X132  Z 6Ø  MØ8   MØ3
N1Ø3  GØ1  X 78   FØ.3
N1Ø4  GØØ  X129  Z 63
N1Ø5  GØ1        Z 29
  :             :
  :             :
```

Manual operation intervention is performed while the program above is being executed by pressing the SLIDE HOLD button.

The sequence number when the slide hold function is activated is:

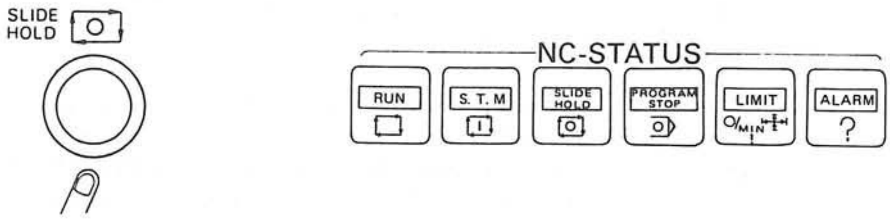
N1Ø5

Coordinate point of the turret when the slide hold function is activated is:

X = 129.ØØØ
Z = 43.256

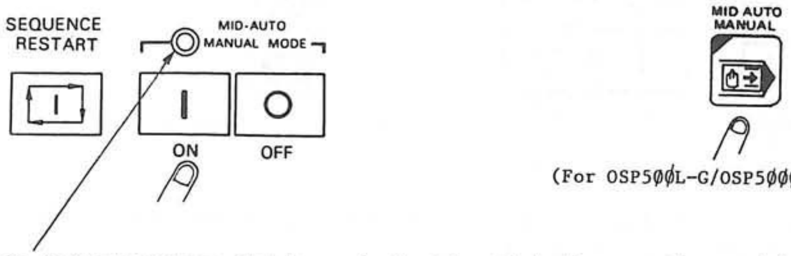
Follow the steps below:

1) Press the SLIDE HOLD button.



This stops axis motion of both X- and Z-axis and turns on the SLIDE HOLD indicating lamp under NC STATUS, telling the operator that the system is in the slide hold state.

2) Press the MID-AUTO MANUAL MODE ON button on the machine operation panel.



(For OSP5ØØL-G/OSP5ØØØL-G flat panel)

This indicator lamp lights up indicating that the manual operation intervention is enabled.

3) Manual operation intervention:

Operative manual operation is as follows:

a) Manual axis feed
b) Axis feed by manual pulse handle
c) Spindle control (CW/CCW/STOP/JOG)
d) Change of spindle drive gear range
e) Turret indexing

When operation c), d) and/or e) is executed, the S.T.M indicating lamp starts flickering, telling the operator that S.T.M condition is different from the programmed condition.

Other operation:

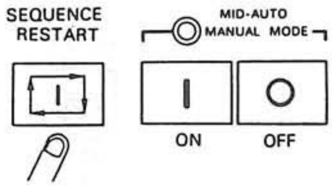
a) Change/setting of tool offset values:

When the tool offset data of the active tool offset number is changed, the new tool offset value is effective from the block after the read-in block displayed on the CRT when program display mode is selected.

Read-in block: If the address pointer ">>" is on the CRT, the block identified is the read-in block. When such symbol is not on the CRT, the block identified by " " is the read-in block.

4) Returning to the point where manual operation intervention has been activated.

To return the axes to the points where manual operation intervention has been activated, simply press the SEQUENCE RESTART button.



(For OSP5ØØL-G, OSP5ØØØL-G flat panel)

- Pressing the SEQUENCE RESTART button returns the turret to the operation resumption point at a jog rate:

  X = 129.ØØØ
  Z = 43.256

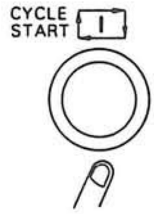
- If the active spindle speed, tool number and/or spindle drive gear range is different from the programmed one, the S.T.M indicating lamp keeps flickering, inhibiting the axes to return to the operation resumption points.

- When the axes return to the operation resumption points is complete, the MID-AUTO MANUAL MODE indicating lamp turn off, indicating that return to the operation resumption point is complete.

- The FEEDRATE override switch setting is effective while the axes are returning to the operation resumption point.

- SLIDE HOLD button is inoperative while the axes are returning to the operation resumption point. To stop the axes feed, in this case, turn the FEEDRATE override dial to "Ø%" position.

5) Press the CYCLE START button.

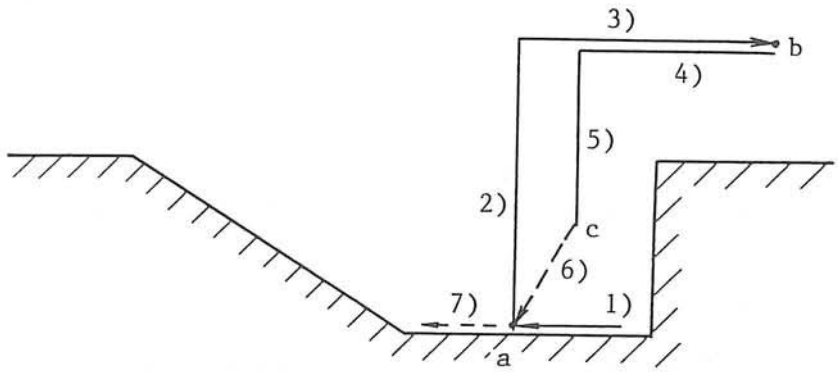


With this, the interrupted program is continuously executed.

CAUTION

When SEQUENCE RESTART button is pressed, X- and Z-axis return to the operation resumption point simultaneously. It is advisable to bring the axes (turret) near the operation resumption point manually before pressing SEQUENCE RESTART button to avoid unexpected collision of the turret mounted tools and the workpiece.

(2) Example



1) Press the SLIDE HOLD button at point "a" while cutting in the AUTO mode. (The SLIDE HOLD indicating lamp goes on.)

2),3) Press the MID-AUTO MANUAL MODE ON button* (indicating lamp illuminates) to retract the cutting tool to point "b".

* MID-AUTO MANUAL MODE ON for OSP5ØØØL-G; MID-AUTO MANUAL for OSP5ØØL-G, OSP5ØØØL-G flat panel

At point "b", necessary manual operations such as spindle stop, turret indexing, and change of tool offset value. (If S, T and/or M mode becomes different from what was active at point "a", the S.T.M. indicating lamp starts flickering.)

4),5) Restore the S, T, and/or M mode as active at point "a", move the cutting tool to point "c" near point "a" (operation resumption point) in the MANUAL mode.

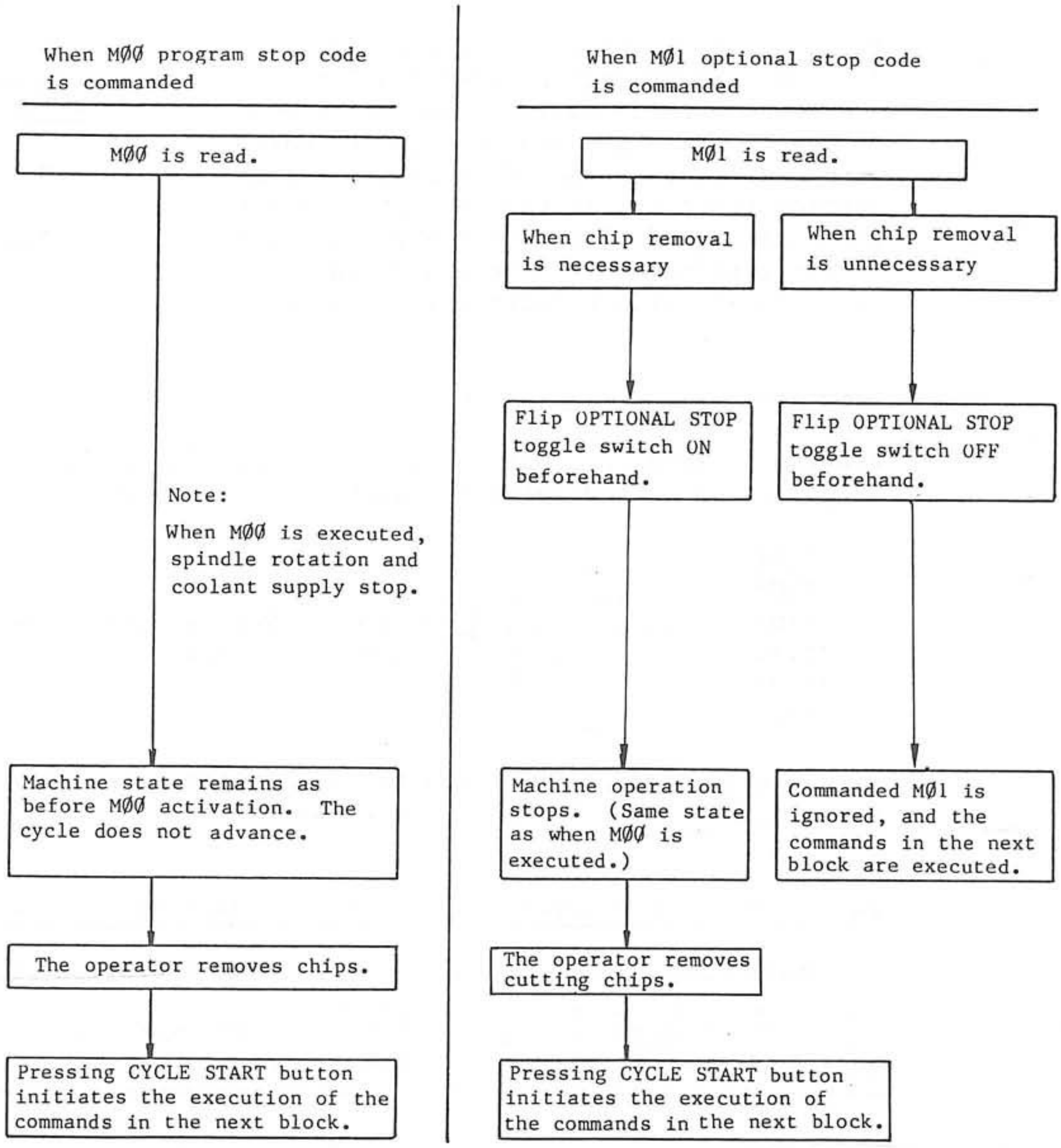
6) Press the SEQUENCE RESTART button, and the cutting tool is positioned to point "a" at a slide jog feedrate. As soon as positioning is completed, the MID-AUTO MANUAL MODE ON indicating lamp turns off.

7) Press the CYCLE START button. The SLIDE HOLD indicating lamp turns off and the interrupted operation is resumed.

4-1-5. Other Operations while in Automatic Mode Operation

(1) To carry out a manual operation to remove chips or to measure dimensions (Program Stop/Optional Stop):

Program stop (MØØ) or optional stop (MØ1) code.

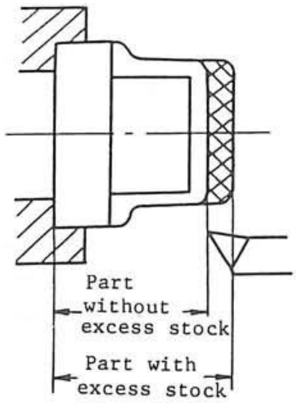


Spindle and coolant supply state is restored as before MØØ activation.

As explained above, programmed MØØ always interrupts machine operation while MØ1 leaves option to the operator whether cycle is to be stopped or continued according to the switch setting.

(2) Block Delete

This feature provides a means for skipping certain blocks in the program by programming a slash (/) code ahead of the block. This feature is useful when the operator desires to leave off certain cuts on a particular part configuration.



In case variations in stock removal are desired, the program is prepared for the workpiece with a maximum amount of stock removal. This can also be used for parts with a smaller amount of stock removal by setting BLOCK DELETE toggle switch ON for these parts and eliminate the possibility of air-cutting. The direct advantage of this feature is a reduction in cycle time.

Example:

Program a slash (/) code in the block containing the commands to cut excess stock as indicated by hatching lines in the figure above.

```
 N1Ø1 ____________
/N1Ø2 ____________ ┐
/N1Ø3 ____________ │  Program for cutting excess stock off
/N1Ø4 ____________ │  the above part.
/N1Ø5 ____________ ┘
 N1Ø6 ____________
```

During operation, BLOCK DELETE toggle switch gives the operator the option to activate the programmed slash codes.

Parts with excess stock	Parts without excess stock
Machine Operation Panel	Machine Operation Panel
Place BLOCK DELETE toggle switch OFF.	Place BLOCK DELETE toggle switch ON.
↓	↓
Programmed commands are executed in the order as programmed: N1Ø1 through N1Ø6. The excess stock is removed.	Blocks of commands N1Ø2 through N1Ø5, all preceded by a slash command (/), are ignored. And execution of the program jumps from N1Ø1 to N1Ø6.

(3) Checking New Program (Machine Lock, Dry Run)

It is very dangerous to cut parts with a new program without checking its contents. The Machine Lock and Dry Run features stated herein are effective to check the newly prepared program before using it to actually cut parts.

a) Machine Lock

With the Machine Lock feature, the operator can check the contents of the program without actually operating the machine.

Procedure:

1) Place MACHINE LOCK toggle switch ON.

This locks output to the axis drive circuitry, the EC relay circuitry, and the spindle drive circuitry.

2) Press the CYCLE START button.

Execution of the program is initiated. The operator can check the contents of the programmed commands on the CRT.

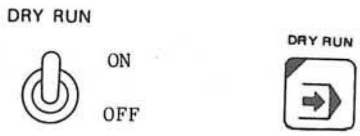
Note: When feedrate commands (GØ1, GØ2, GØ3, G33, G34, etc.) are designated in mm/rev. (ipr) mode, the control executes them assuming spindle speed of designated in the program.

This spindle speed override, however, can be set as desired using a parameter. For details on parameter setting, refer to 4-3, "Operation in Parameter Mode".

b) Dry Run

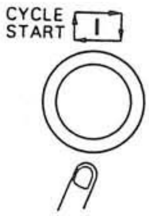
This feature permits the operator to check the actual tool path and other function executing points by actually operating the machine in a short time.

1) Place the DRY RUN toggle switch ON.



(For OSP5ØØL-G, OSP5ØØØL-G flat panel)

2) Press the CYCLE START button.



This starts the execution of the program. Take the following instructions into account.

CAUTION

a) Feed commands in the following feed modes, such as GØ1, GØ2, GØ3, G33 and G34, are executed at the milling speed set by the parameter, usually set to 24ØØ mm/min.

b) Therefore, feed commands F and vari-pitch commands E are all ignored.

c) When both the Machine Lock and the Dry Run features are active, the Machine Lock feature precedes.

4-1-6. Scheduled Operation

To cut several different workpieces continuously, this scheduled operation feature is very effective. The scheduled operation feature permits programs to be automatically executed in the order specified in the schedule program, which should be prepared according to the instructions provided below.

Assume 1ØØ workpieces are to be machined, and the machine is equipped with a robot or auto-loader for automatic loading/unloading of workpieces.

The schedule program can be designated so that the machining program is repeated 1ØØ times in combination with the programs controlling loading/unloading cycles.

Or assume 2Ø pieces of workpiece A, 1Ø pieces of workpiece B and 5Ø pieces of workpiece C are to be machined on the machine equipped with an automatic loading/unloading unit.

With the machining programs for respective workpieces, and control programs for loading and unloading cycles prepared, the schedule program can specify the order of execution of those programs.

The schedule program features the following functions to perform the above indicated control:

i) Function to select (or specify) a main program.

ii) Function to designate the execution order of the blocks of the schedule program.

iii) Function to count the number of machined workpieces, to receive signals from external switches and external control circuits, and to output signals to external control circuits. Also referred to as "variable setting function".

The preparation of a schedule program permits the effective use of the various functions. Continuous cutting of different workpieces can be performed in automatic mode operation through the selection of that schedule program.

For detailed procedure of schedule program preparation, refer to the related section in the Programming Manual.

The instructions on scheduled operation provided hereafter should be read only after the programming procedures for schedule program as explained in the programming manual have been duty grasped.

Scheduled operation is explained taking the following case as an example:

Continuous cutting of three different workpieces, A, B and C.

Workpiece A ..... 2Ø pieces
Workpiece B ..... 1Ø pieces
Workpiece C ..... 5Ø pieces

```
    LIST    BB1:SGEAR.SDF

N1ØØ  VSET    V1=1
N1Ø1  PSELECT LOADER.MIN
N1Ø2  PSELECT GEAR.MIN,OØØ1
N1Ø3  PSELECT UNLOADER.MIN
N1Ø4  VSET    V1=V1+1
N1Ø5  IF [V1 LE 2Ø] N1Ø1
N2ØØ  VSET    V2=1
N2Ø1  PSELECT LOADER.MIN
N2Ø2  PSELECT GEAR.MIN,OØØ2
N2Ø3  PSELECT UNLOADER.MIN
N2Ø4  VSET    V2=V2+1
N2Ø5  IF [V2 LE 1Ø] N2Ø1
N3ØØ  VSET    V3=1
N3Ø1  PSELECT LOADER.MIN
N3Ø2  PSELECT GEAR.MIN,OØØ3
N3Ø3  PSELECT UNLOADER.MIN
N3Ø4  VSET    V3=V3+1
N3Ø5  IF [V3 LE 5Ø] N3Ø1
N999  END
```

Note 1: Main program file named GEAR.MIN contains the following machining programs:

Machining program for
workpiece A .... Program no. "OØØ1"

Machining program for
workpiece B .... Program no. "OØØ2"

Machining program for
workpiece C .... Program no. "OØØ3)

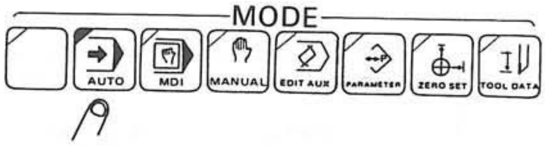
Note 2: Programs controlling loading and unloading cycles are filed in the main program file, LOADER.MIN and UNLOADER.MIN.

(1) Selection and Execution of Schedule Program

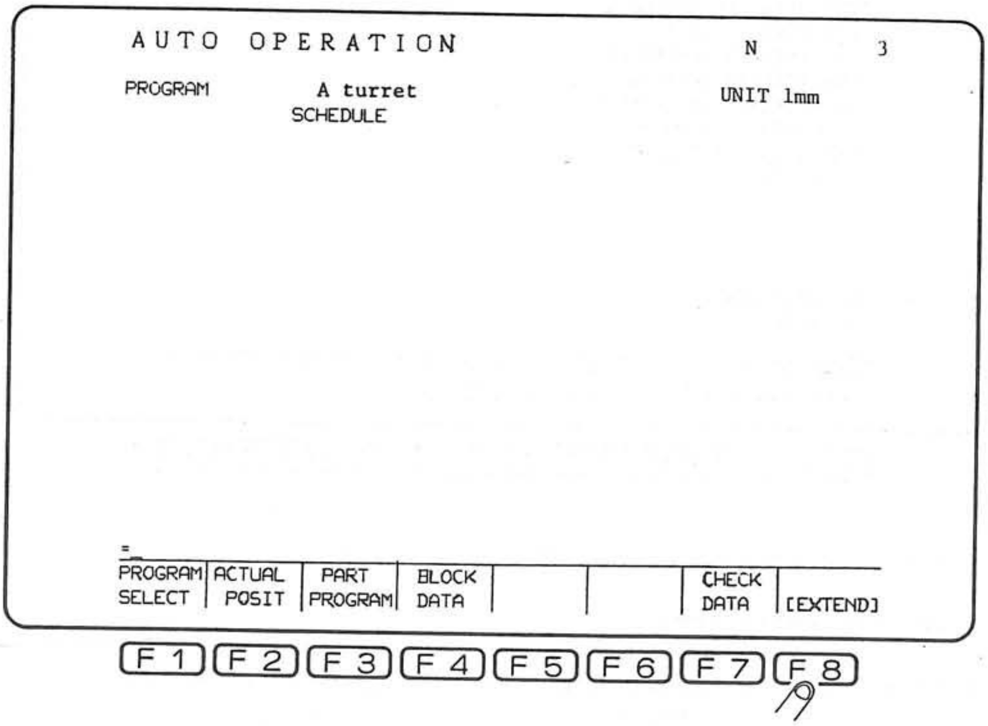
To perform the scheduled operation, first prepare a schedule program and then store it in the memory following the steps used in storing machining programs. For details, refer to the instructions on Tape Reading-in Operation.

After that carry out the automatic operation steps as indicated below.

1) Select the AUTO OPERATION mode by pressing the AUTO key.

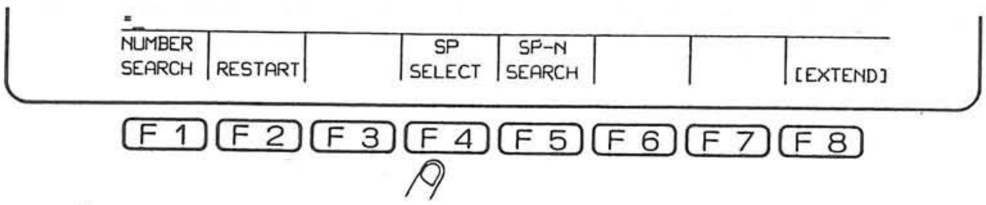


2) Display the SCHEDULE page pressing PAGE key.



3) Press the function key [F8] (EXTEND) to display the function by which schedule program selection is possible.

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



5) Key in an asterisk (*) through the keyboard.

=SS *

6) Press the WRITE key.

The program directory page will be displayed by the operations above. One page of this display shows a total of 12 file names and if more than 12 file names are registered, press the PAGE key to display the second page.

```
AUTO OPERATION                                   N        3

PROGRAM          A turret                        UNIT 1mm
                SCHEDULE

  N203 PSELECT UNLOADER.MIN
  N204 VSET    V2=V2+1
  N205 IF[V2 LE 10] N201
>>N300 VSET    V3=1
  N301 PSELECT LOADER.MIN
  N302 PSELECT GEAR.MIN,0003
  N303 PSELECT UNLOADER.MIN
  N304 VSET    V3=V3+1
  N305 IF[V3 LE 50] N301
  N999 END


=EX
=SS SGEAR.SDF
=SN N300
=_
NUMBER  |        |      |SP     |SP-N   |     |     |
SEARCH  |RESTART |      |SELECT |SEARCH |     |     |[EXTEND]

 F 1      F 2      F 3    F 4     F 5     F 6   F 7   F 8
```

7) Locate the cursor to the file name desired.

8) Press the WRITE key.

This selects the program and the CRT display is restored to the program display page with the program designated on it.

9) Press the CYCLE START button.

This starts the execution of a program selected.

With the steps above, continuous operations begin according to the schedule program. The example program is used to machine 2Ø pieces of workpiece A, 1Ø pieces of workpiece B, and 5Ø pieces of workpiece C.

Note 1: The schedule program selection operation (steps 5) - 8)) is also possible by directly inputting a file name. See "Direct Designation of Programs" in 4-1-1.

Note 2: Select the schedule program after resetting the control.

If it is selected while in operation, an error results.

Note 3: When normal operation (automatic operation by selecting a program) is desired after selecting a schedule program, select the desired program again.

Note 4: When Scheduled Operation is initiated with the single block function activated, a main program is selected by the schedule program first and the control waits for cycle start operation.

Pressing the CYCLE START button after that initiates execution of the commands in the first block of the main program, and normal single block mode operation is per formed after that.

Note 5: When the optional CYCLE STOP switch is set ON in scheduled operation mode, machine cycle stops each time one main program is completed. Pressing the CYCLE START button resumes the operation, i.e., executes another cycle.

Note 6: To execute the schedule program on a machine equipped with the robot, bar feeder or other autoamtic loading/unloading system, it is possible to place the control in the cycle start ready state after the completion of a program (MØ2, M3Ø executed) by using an external cycle stop signal.

For instance, the schedule program below executes the main program A.MIN infinitely. When an external cycle stop signal is input after the completion of a lot or when the bar material is used up from an external device to the NC, it is placed in the cycle start signal waiting state after the completion of the main program.

```
A.SDF
PSELECT A.MIN,,,Q9999
                    Repetition of the program infinitely
END
```

Note 7: When RESET button is pressed while in scheduled operation mode, and when the interrupted program is then resumed, the program selected at that time is executed from the beginning.

When the program selection block in the schedule program contains the specified number of main program repetitions, the cycle interrupted is not counted. For instance, if the number of repetitions is specified as "1Ø", and when RESET button is pressed while the 8th cycle is being executed, the control does not count the interrupted cycle. Pressing CYCLE START button resumes the cycle from the 8th cycle.

That is, counting-up of the number of cycle repetitions is activated when MØ2 (or M3Ø) in the program is executed.

(2) Schedule Program Number Search

When machining only 50 pieces of workpiece C using the example schedule program, without machining workpieces A and B, the schedule program number search function is convenient.

After the selection of the schedule program following the steps 1) - 6) in (1), conduct the schedule program number search operation for block N300.

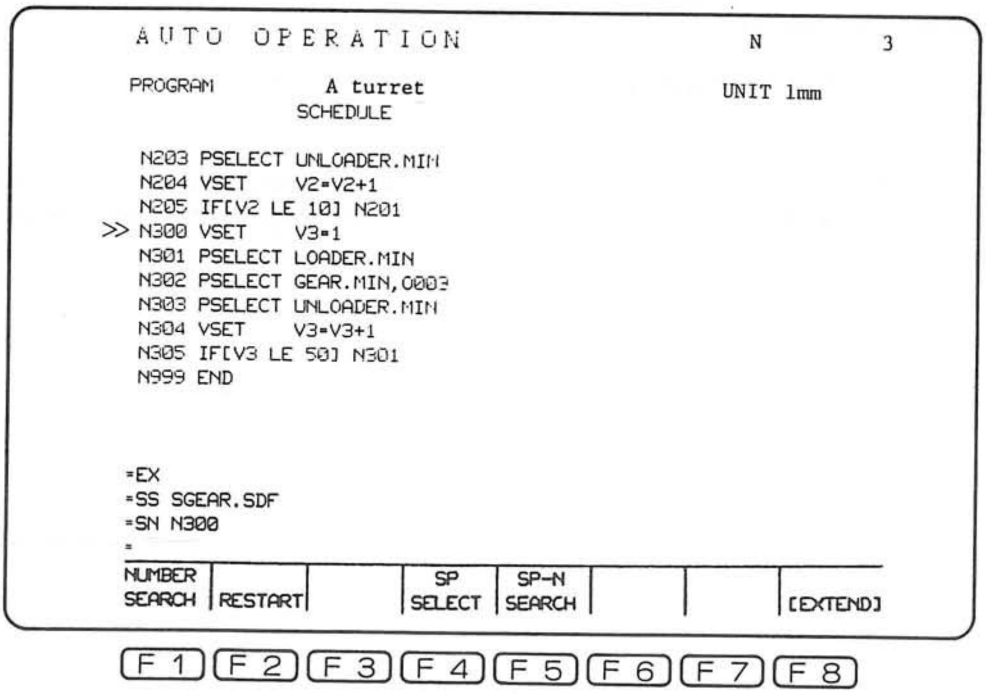
Follow the steps below:

1) Press the function key [F5] (SP-N SEARCH).

2) Key in "N300".

3) Press the WRITE key.

The sequence number search operation is executed for block N300 and the symbol ">>" is located at the left of N300 displayed on the screen.



4) Press the CYCLE START button.

With the steps above, 50 pieces of workpiece C are machined.

[SUPPLEMENTS]

The cursor control keys [↑] and [↓] can be used for schedule program search operation.

The keys are operative only when the control is reset, automatic operation mode is selected, and the CRT displays the schedule program. Follow the steps below, instead of carrying steps 1) through 3).

1) Press cursor control key [↓].

   This advances ">>" by one block.

   Keep pressing [↓] key until the address pointer ">>" reaches N3ØØ block.

   Note: While the cursor control key is kept pressed, the address pointer ">>" advances successively. If it passes the required block, press [↑] key to return it.

   When the address pointer ">>" reaches N3ØØ block, the schedule program search is complete.

2) Press the CYCLE START button.

Note: When conducting a schedule program search, always perform a schedule program selection operation and cancel the previous schedule.

4-1-7. CRT Display while in Operation

CRT displays often used while in machine operation are explained in 3-3-2-4 and 3-3-2-5. This paragraph deals with all CRT displays available during machine operation.

As seen in the following pages, there is no difference in CRT displays between the selected operation modes, AUTO, MDI and MANUAL with the exception of the tool layout screen in the AUTO mode.

The tool layout screen available only in the AUTO mode and the functions accessible from this screen are explained in details in 4-1-8, "Tool Layout Function". Thus, this section provides explanations of other screens which are common to all operation modes.

CRT displays are largely divided into four modes, depending on the pressed functions keys, [F2] (ACTUAL POSIT), [F3] (PART PROGRAM), [F4] (BLOCK DATA) and [F7] (CHECK DATA).

(1) Actual position data .... [F2]
(2) Main program .... [F3]
(3) Programmed data in one block .... [F4]
(4) Check data .... [F7]

Since it is not necessary to read check data during normal operation, the function key [F7] is separated from other function keys.

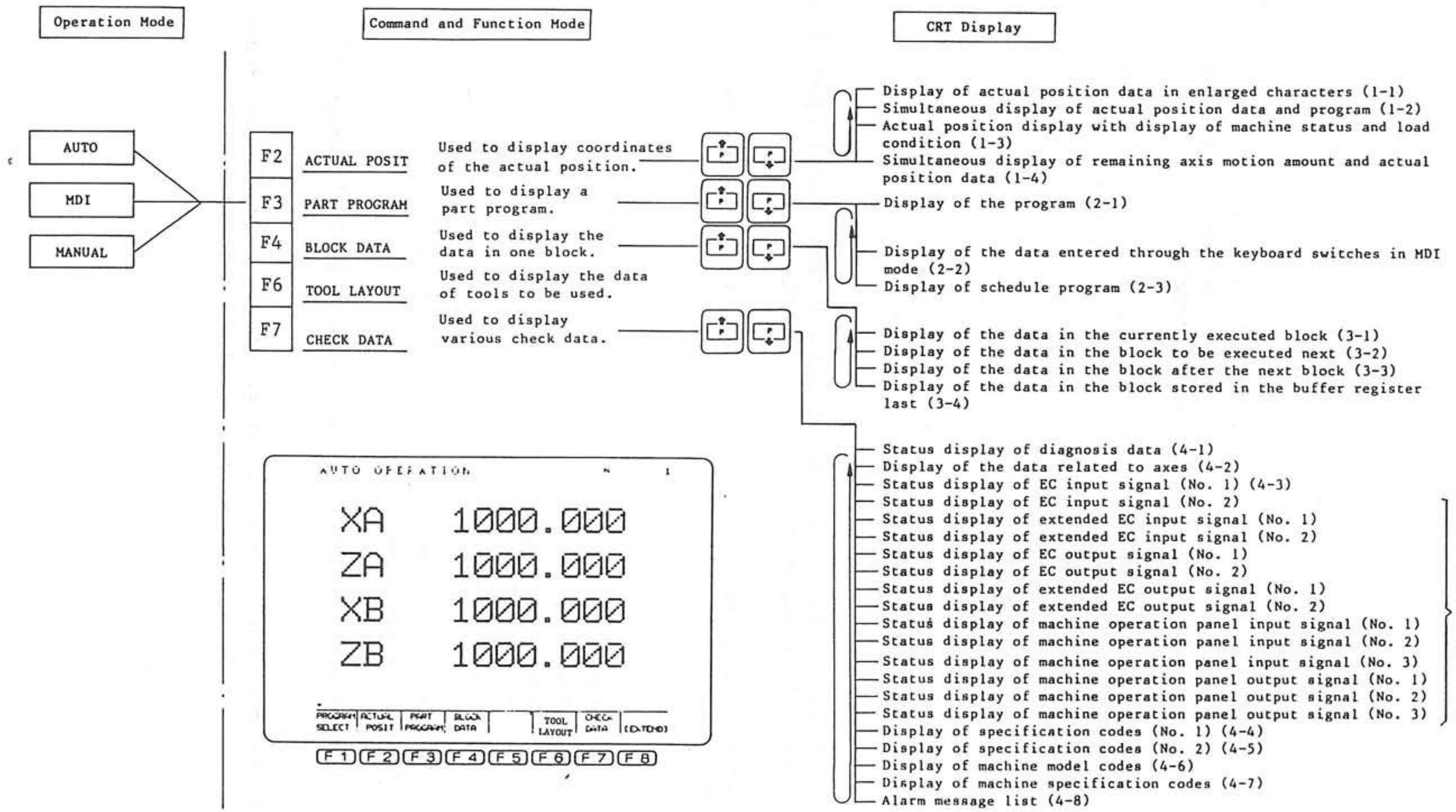
By setting proper parameter bit data, display of corresponding pages can be disabled. See below.

Parameter bit No.

bit Ø: Axis data
bit 1: EC input 1, 2
bit 2: EC input (extended) 1, 2
bit 3: EC output 1, 2
bit 4: EC output (extended) 1, 2
bit 5: Machine operation panel input 1, 2, 3
bit 6: Machine operation panel output 1, 2, 3
bit 7: Specification code

Provided in the following pages are the explanations for respective CRT displays.

Note that differing specifications may result in some display areas described above not being displayed on certain systems.

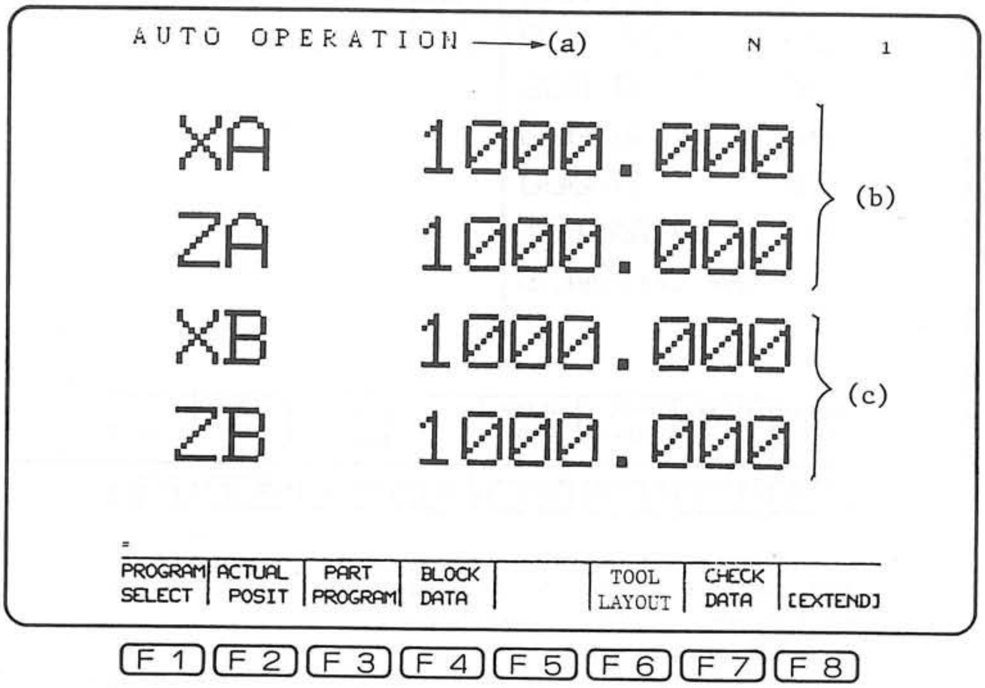


Details of respective CRT displays are provided in the following pages.

The CRT display changes in the order indicated by an arrow mark when [key] key is pressed.

(1) Display of Actual Position Data

(1-1) Display of Actual Position Data in Enlarged Characters

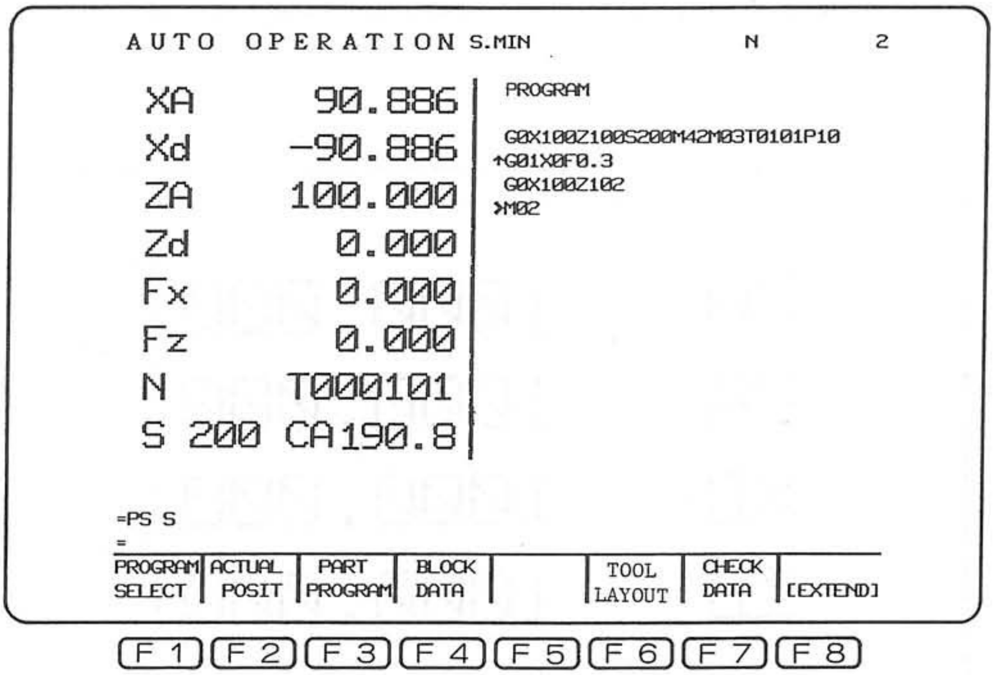


(a) Indicates the operation mode currently selected.

(b) Actual position data of A-turret

(c) Actual position data of B-turret
(two-saddle, two-turret models)

(1-2) Simultaneous Display of Actual Position Data and Program



Program number (name) of the main program selected by the program selection operation is displayed.

File name of the main program selected by the program selection operation is displayed.

Left section:

X : Actual position of X-axis (program)
Xd : Remaining X-axis movement distance to target point
Z : Actual position of Z-axis (program)
Zd : Remaining Z-axis movement distance to target point
N : Sequence number
S : Spindle speed (rpm)
FX : X-axis feedrate (mm/min)
FZ : Z-axis feedrate (mm/min)
T : T command
CA : Actual position of spindle (deg.)

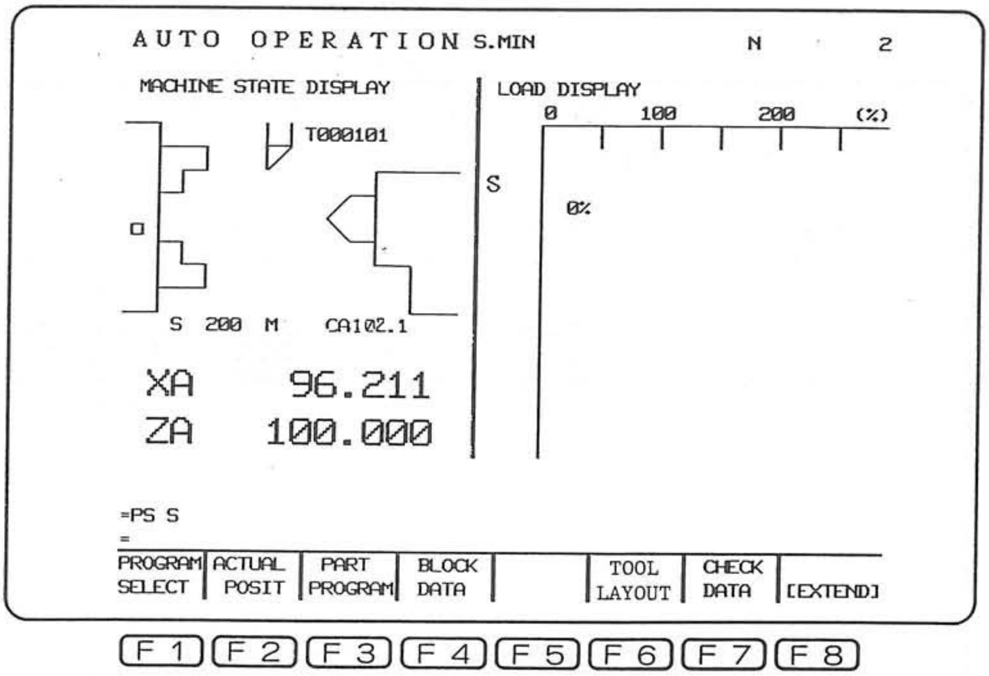
Display of actual spindle position can be omitted by setting "1" at bit 6 of parameter (bit) No. 19. (Initial setting: Ø (OFF))

Right section:

Program presently selected.

The line identified by the up-arrow (↑) mark is the block being executed. Blocks up to the one identified by the symbol (>>) preceding the sequence number N are read and stored in buffer.

(1-3) Actual Position Display with Display of Machine Status and Load Condition (For OSP5ØØL-G, OSP5ØØØL-G flat panel only)



Left section:

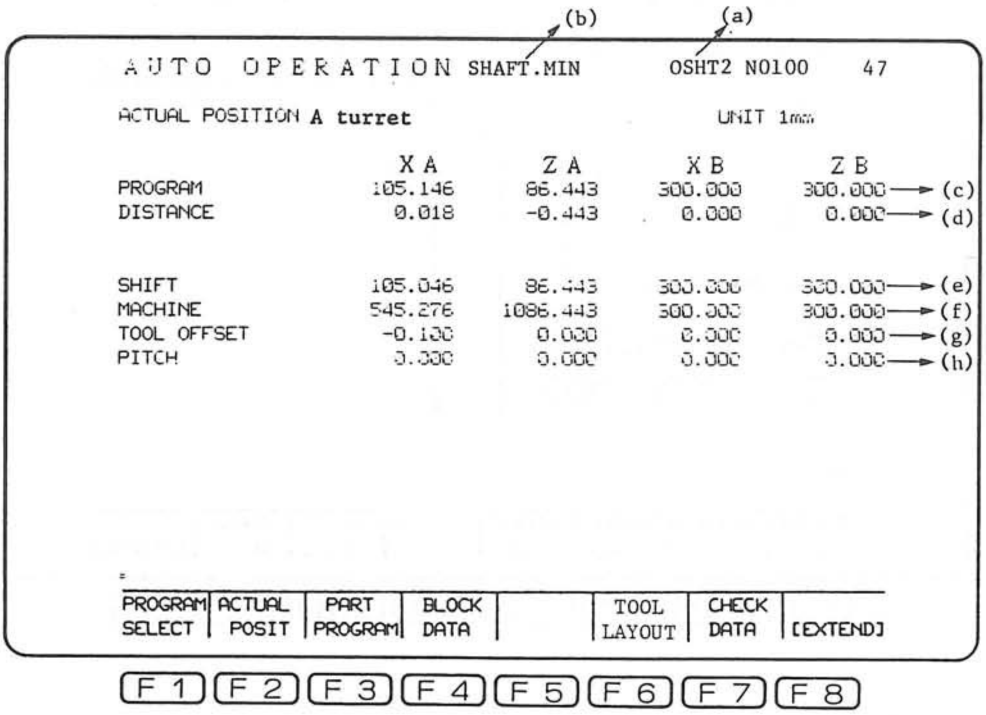
Actual position display

X : Actual position of X-axis (program)
Z : Actual position of Z-axis (program)
T : T command
S : Spindle speed
V : Cutting speed
CA : Actual position of spindle
Machine status

Right section:

Load status of spindle

(1-4) Simultaneous Display of Remaining Axis Motion Amount and Actual Position Data



(a) Indicates the program number (name) of the main program selected by program selection operation.

(b) Indicates the file name of the main program selected by program selection operation.

(c) Programmed position data of A- and B-turret

(d) Remaining axis motion amount of A- and B-turret

(e) Actual position of A- and B-turret on the offset coordinate system

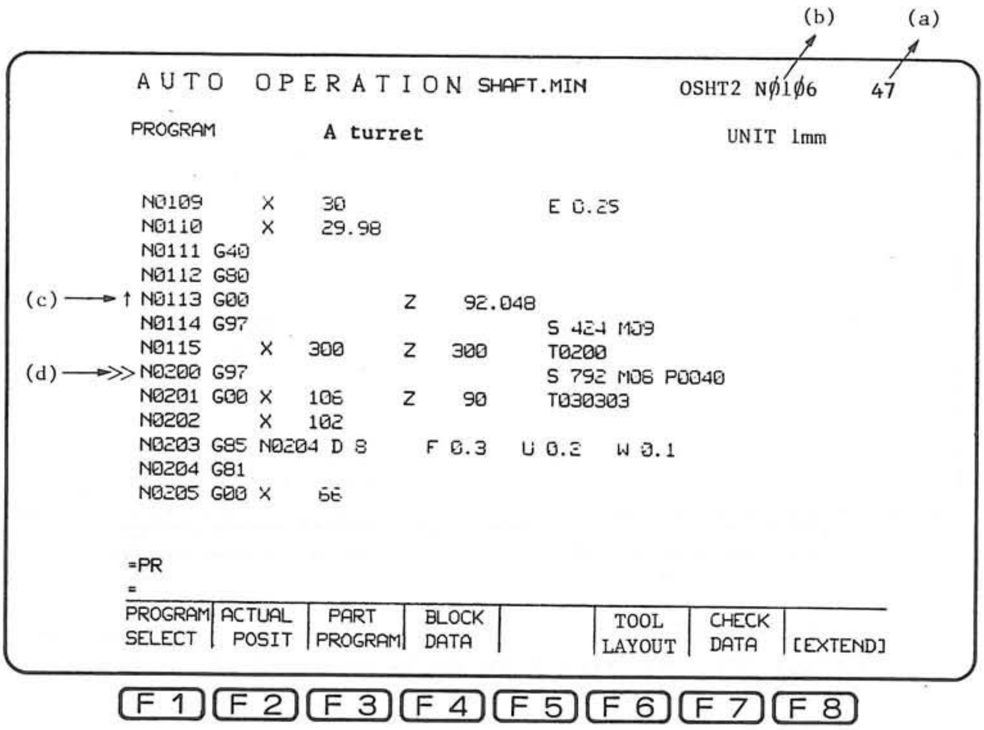
(f) Position of A- and B-turret referenced to machine origin

(g) Active tool offset amounts of A- and B-turret

(h) Ball screw pitch error compensation

(2) Display of Part Program

(2-1-1) Display of Program



(a) Indicates the block counter number.

(b) Indicates the number (name) of the sequence currently executed.

(c) Cutting is carried out according to the commands in the block identified by " ↑ " preceding sequence number.

(d) The commands in the blocks up to the one identified by ">>" are read into the buffer registers.

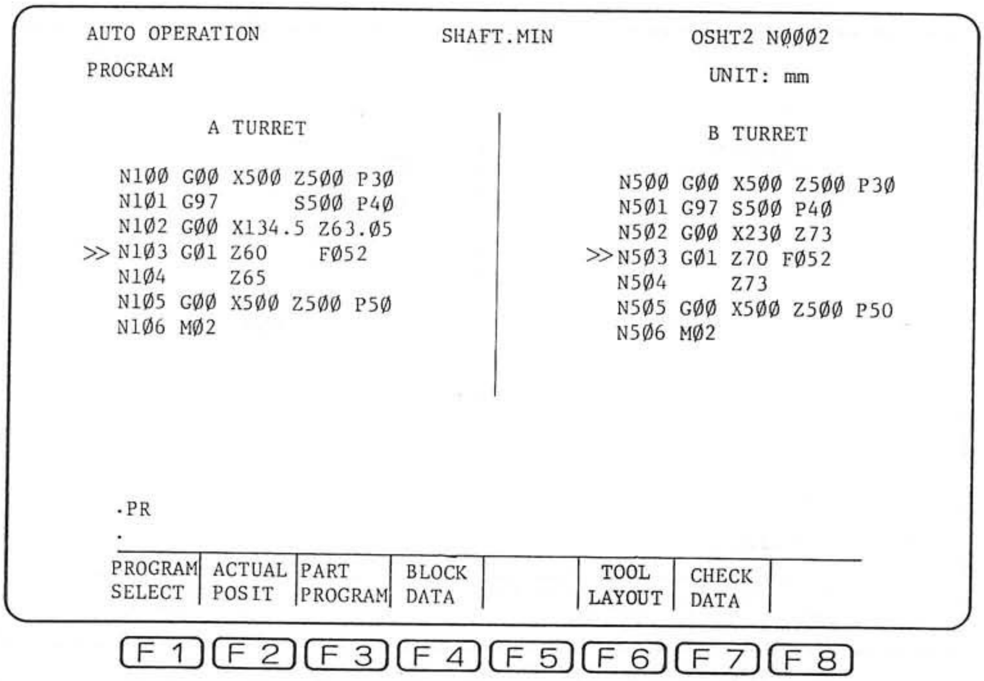
(2-1-2) Simultaneous Display of Main Program and Subprogram

```
AUTO OPERATION              SHAFT.MIN            OSHT2 NØØØ2        1
PROGRAM                                                  UNIT: mm

        MAIN PROGRAM                          SUB PROGRAM

   NØØ1  GØØ X1ØØØ Z1ØØØ           X=XP3   T=TOF1
   NØØ2  CALL ORGIA APP=2          NOEX    V929=VRNGZ
   & IMP21 TLN=8 TOF1=8 TOF2       CALL    OSKPZ
   &=18  ZP1=1ØØ ZP2=1Ø XP3        PRINT   14
   &=1Ø  ZP3=2Ø                    NOEX    VMDT[1]=VIMDZ[3]
   MØ2                             M1ØØ
                                   GØØ X=XP1
                                   Z=ZP1
                                 >>X=XSTP Z=ZSTP M5Ø
                                   GOTO NA2
                                   NA1 NOEX VMDT[1]=Ø

   ·PR
   .
   PROGRAM| ACTUAL |PART    | BLOCK |      | TOOL  | CHECK |
   SELECT | POSIT  |PROGRAM | DATA  |      | LAYOUT| DATA  |
   (F 1)   (F 2)    (F 3)    (F 4)   (F 5)  (F 6)   (F 7)   (F 8)
```

On the PROGRAM page*, when a subprogram is called the subprogram called and the main program from which the subprogram is called are displayed on one screen.

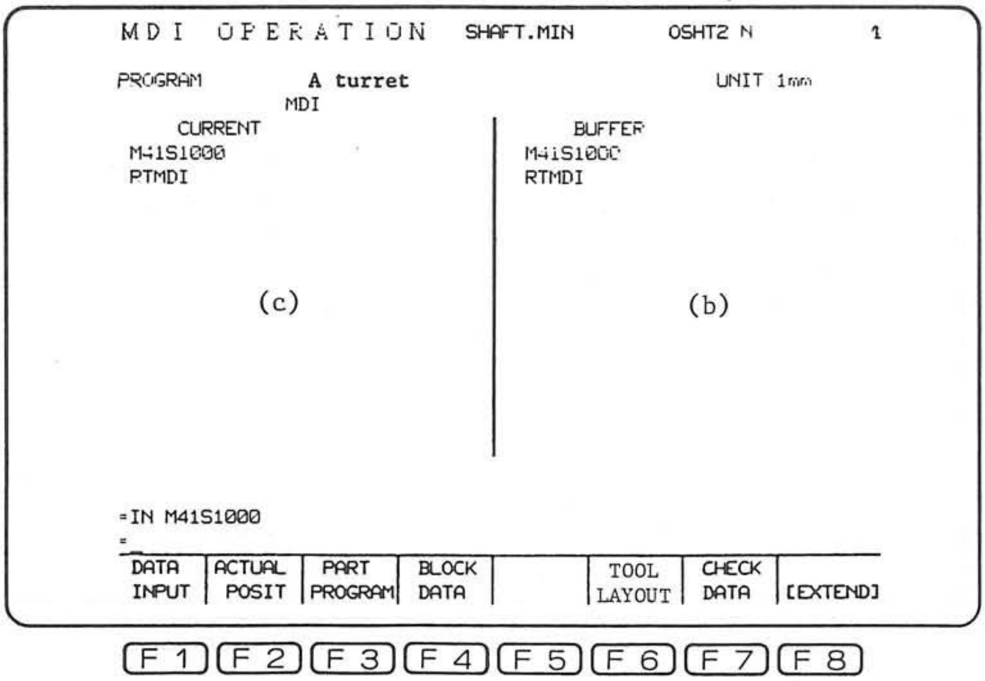
* Except display on which programs of both saddles A and B are displayed.

(2-1-3) Simultaneous Display of Program for Saddles A and B (only for two-saddle model)



For the two-saddle specification, programs for saddles A and B are displayed simultaneously.

(2-2) Display of Data Entered through Keyboard in MDI Mode



(a) Turret selection is possible by pressing A B keys.

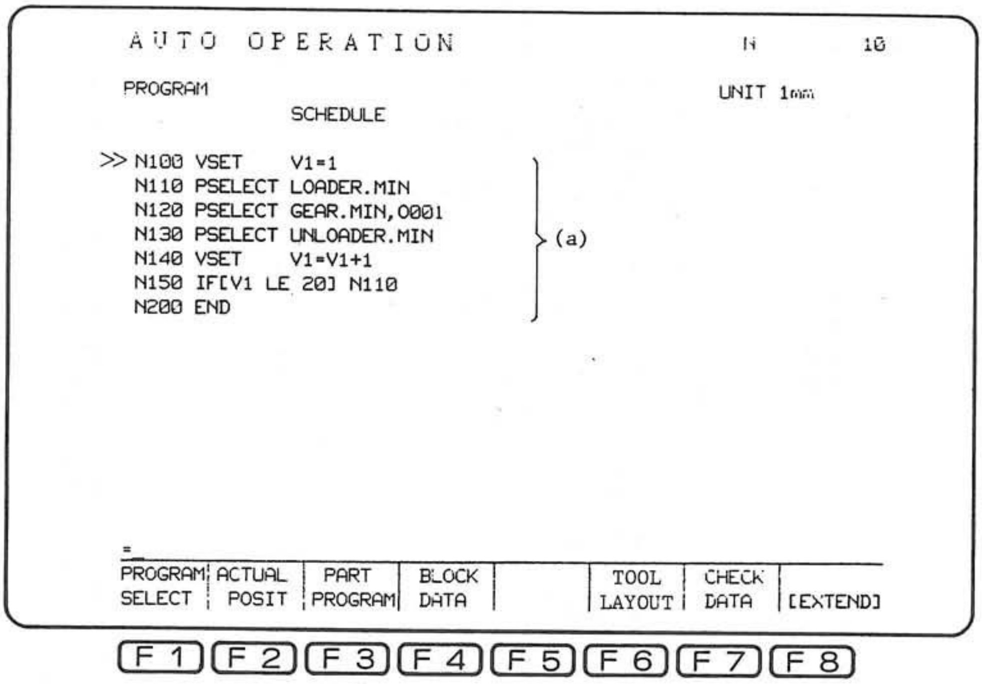
(b) Indicates the data stored in the buffer area.

The data are keyed-in into this area by pressing the function key [F1] (DATA INPUT).

(c) Indicates the data stored in the active area.

Pressing the CYCLE START button transfers the data in the buffer area to the active area; the transferred data are then executed.

(2-3) Display of Schedule Program

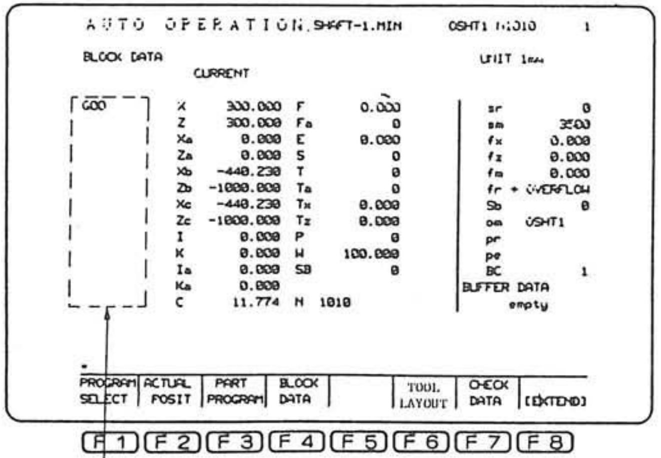


(a) Displays schedule program.

(3) Display of Data in One Block

(3-1) Display of Data in Currently Executed Block

Displays one block of the data.



Effective G and M codes

Description of respective data

X	Target value: X-axis
Z	Target value: Z-axis
Xa	Target value: X-axis, in G5Ø thread cutting mode
Za	Target value: Z-axis, in G5Ø thread cutting mode
Xb	Starting point: X-axis, thread cutting
Zb	Starting point: Z-axis, thread cutting
Xc	Target point: X-axis, thread cutting
Zc	Target point: Z-axis, thread cutting
I	Programmed I value
K	Programmed K value
Ia	End point: I
Ka	End point: K
C	Target value: C-axis
F	Programmed F value
Fa	Programmed dwell length
E	Programmed E value
S	Programmed S value
T	Tool number
Ta	Tool offset number
Tx	Tool offset value: X-axis
Tz	Tool offset value: Z-axis
P	Programmed P value
W	Target value: W-axis
SB	Rotary tool command
N	Sequence name

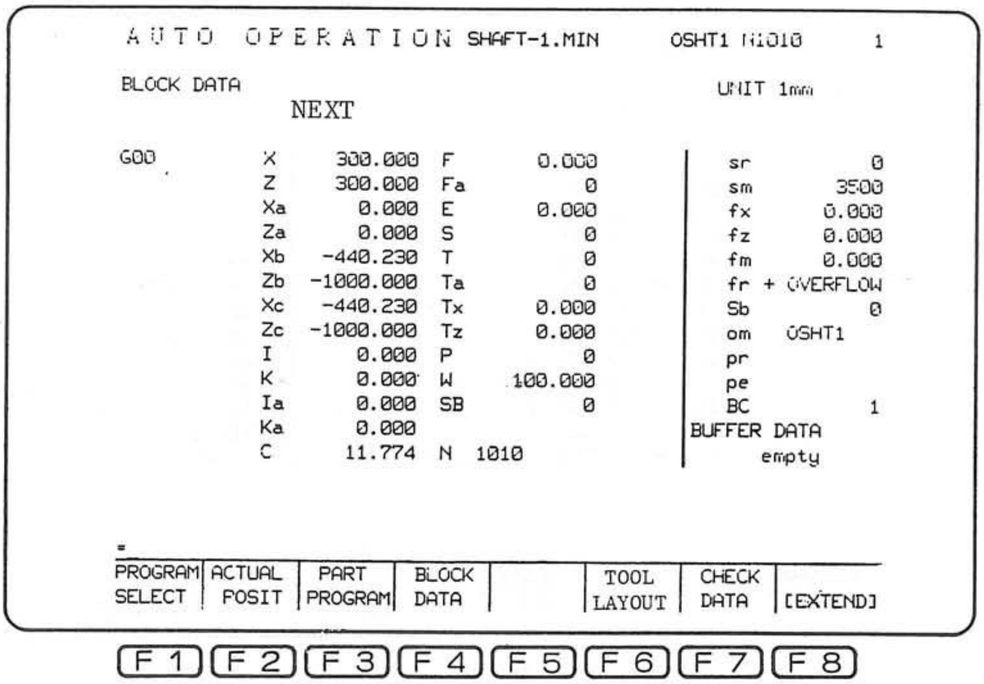
The data below are always the active data, whichever page the operator selects.

Sr	Spindle speed (rpm)
Sm	Maximum spindle speed (rpm)
fx	Feedrate of X-axis (mm/min.)
fz	Feedrate of Z-axis (mm/min.)
fm	Axis traverse speed (mm/min.)
fr	Axis traverse speed (mm/rev.)
Sb	Rotary tool spindle speed (rpm)
Om	Main program name
Pr	Programmed number of main program repetitions
Pe	Actual program executed number
BC	Block counter
full	Data in buffer register
empty	Data not in buffer register

(These data are available only while in scheduled operation mode.)

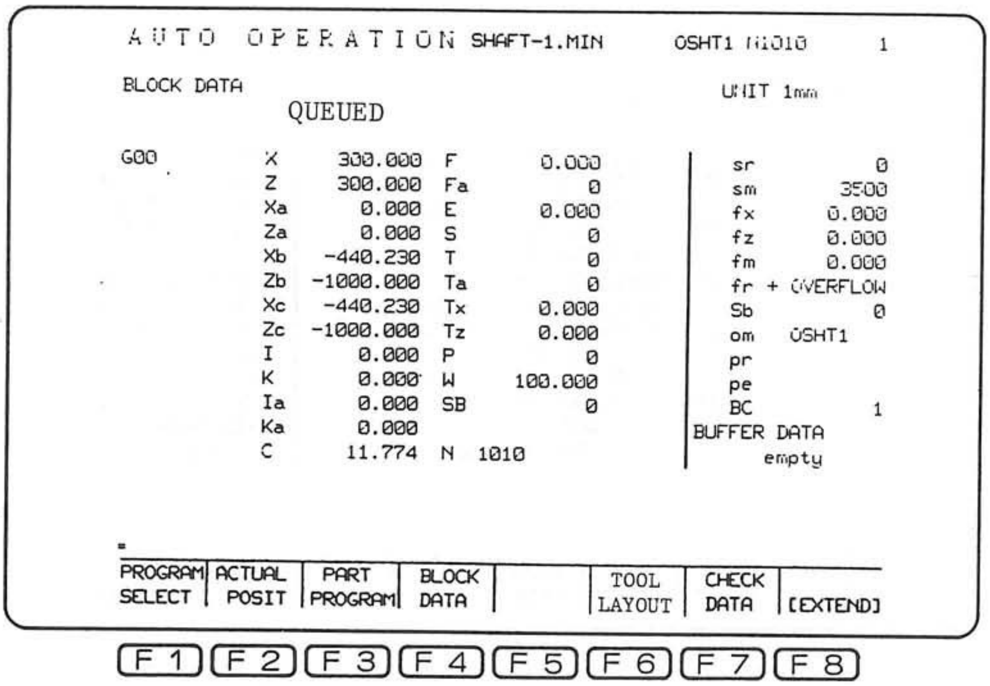
In this display S, T or M character blinks while S, T or M function is being executed. This blink display is cancelled when an answer signal is returned or the NC is reset.

(3-2) Display of Data in The Block to Be Executed Next



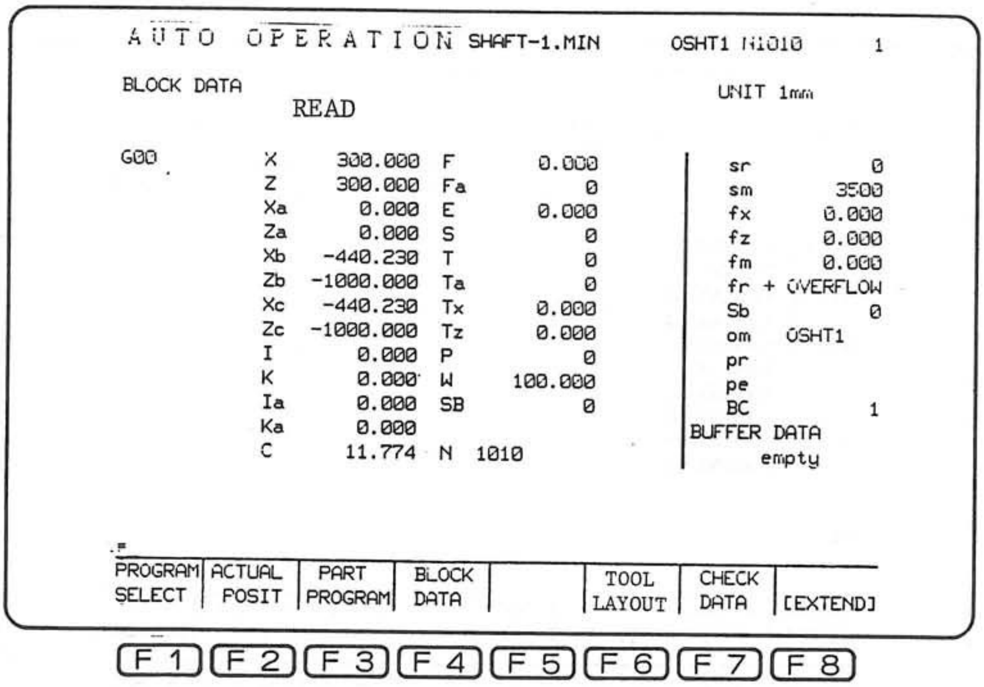
(a) Displays the data in the block to be executed next.

(3-3) Display of Data in The Block to be Executed after The "Next" Block shown in (3-2)



(a) Displays the data in the block after the "Next" block.

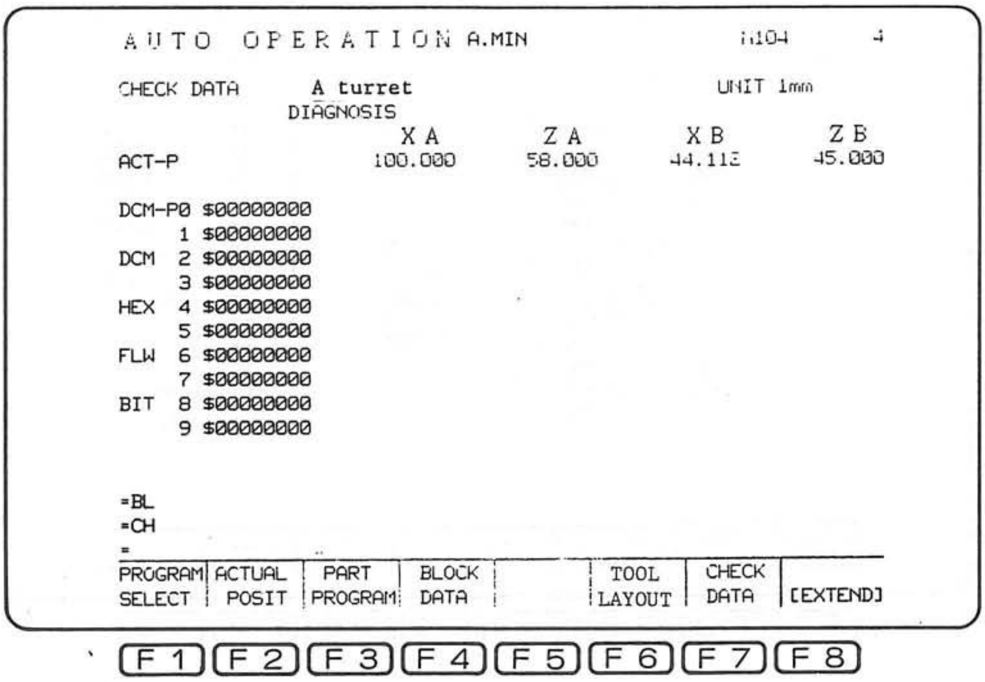
(3-4) Display of Data in The Block Stored in The Buffer Register Last



(a) Displays the data in the block stored in the buffer register last.

(4) Display of Various Check Data

(4-1) Status Display of Diagnosis Data



This screen is provided for checking the machine and control status. The information is necessary only for maintenance and thus displaying of this page is not required unless requested by Okuma.

(4-2) Display of Data Related to Axes

MDI OPERATION S.MIN N 1

CHECK DATA [A turret] UNIT 1mm

AXIS (1)

	XA	ZA	XB	ZB	
RDIF	0.000	0.000	0.000	0.000	→(a)
RAPA	0.000	0.000	0.000	0.000	→(b)
RCON	1562.540	2101.100	200.000	200.000	→(c)
RSKP1	0.000	0.000	0.000	0.000	→(d)
RSKP2	0.000	0.000	0.000	0.000	→(e)
QSPPC	0	0	0	0	→(f)
RSVPVAR1	0.000	0.000	0.000	0.000	→(g)
RSVPVAR2	0.000	0.000	0.000	0.000	
RDGPRD	0.000	0.000	0.000	0.000	→(h)
RIDSYND	0.000	0.000	0.000	0.000	→(i)
RLASER	0.000	0.000	0.000	0.000	→(j)
RTRTM	0.000	0.000	0.000	0.000	→(k)
RLOAD	0	0	0	0	→(l)

=

DATA INPUT	ACTUAL POSIT	PART PROGRAM	BLOCK DATA		TOOL LAYOUT	CHECK DATA	[EXTEND]
F1	F2	F3	F4	F5	F6	F7	F8

(a) Follow error of axis drive servomotors

Difference between calculated value (RCON) and output from position encoder (RAPA)

(b) Actual position data the OSP position encoder read

(c) Calculated current (actual) position data

(d) Coordinates of touch point (sensor 1)

(e) Coordinates of touch point (sensor 2)

(f) Spindle position (4Ø96/turn)

(g) Servo data

(h) Output from type F position encoder

(i) Output from Inductosyn scale

(j) Output from laser beam measuring device

(k) Tool rotation time

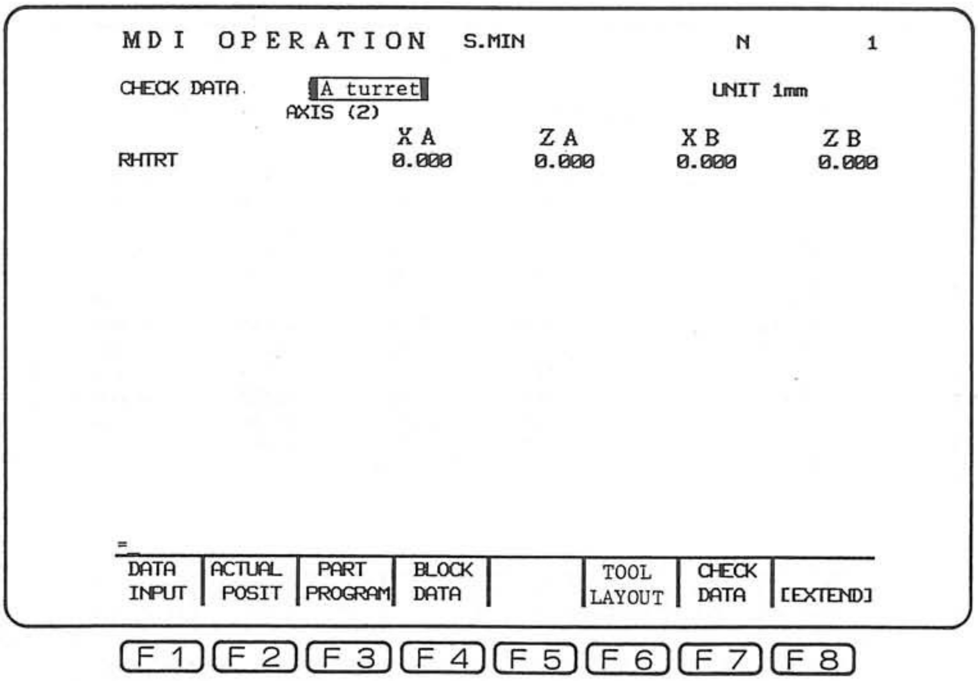
The same data is displayed for the X and Z axes for each turret. With the mirror image specification, the data for the turret to be displayed can be selected by pressing either  or  key on the operation panel.

(l) Torque

Torque* of individual axis drive servomotors is displayed.

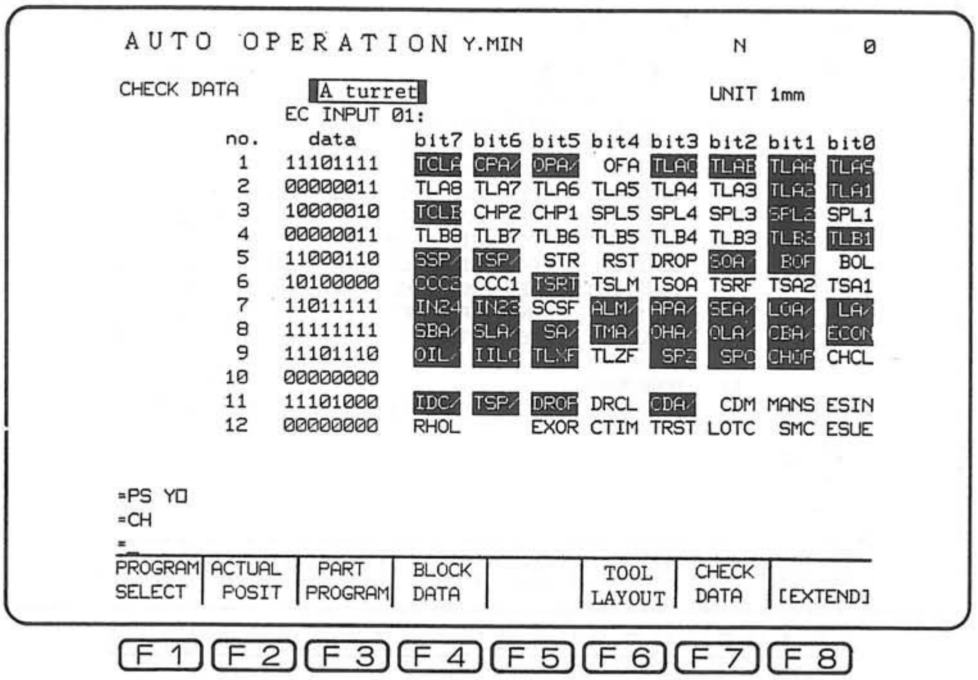
1ØØ% at rated torque

* Value calculated by servo processor



(a) Rotation speed of high-speed turret (rpm)

(4-3) Status Display of EC Input Signal (No. 1)



No. \ bit	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
1	Turret A Clamp	Chuck Pressure Low/	Hydraulic Source Pressure Low/	Alarm - Oil Filter Clogged	← Rotary Switch - Turret A, #9 through #12 →			
2	← Rotary Switch - Turret A, #1 through #8 →							
3	Turret B Clamp	Chuck Pedal #2	Chuck Pedal #1	← Spindle Gear Confirmation Limit Switch →				
4	← Rotary Switch - Turret B, #1 through #8 →							
5	External Cycle Stop/	External Slide Hold/	External Cycle Start	External Reset	Door Open Confirmation Switch	Spindle Lubrication Pressure Low/	Slideway Lube Oil Flow	Slideway Lube Oil Level
6	Chip Cover Close Confirmation Switch 2	Chip Cover Close Confirmation Switch 1	Tailstock Quill Retraction Confirmation Switch	Tailstock Quill In-position Confirmation Switch	Tailstock Quill Overadvance Confirmation Switch	Tailstock Quill Retraction Foot Switch	Tailstock Quill Advance Foot Switch 2	Tailstock Quill Advance Foot Switch 1
7	External Input 24	External Input 23	Spindle Orientation Completion	External Alarm/	SMW Chuck Pressure Low/	Alarm - Travel End/	Alarm - LDU Overload/	Alarm - LDU/
8	Alarm - Spindle Brush Wear/	Alarm - Spindle Overload/	Alarm - SDU/	Alarm - CPU Temperature/	Alarm - Transformer Overheat/	Alarm - EC Overload	Alarm - EC Circuit Breaker	Control Power to EC ON
9	External Interlock/	Internal Interlock Released	Turret X-axis Free	Turret Z-axis Free	Spindle Zero Speed	Spindle at Constant Speed	Chuck Open Confirmation Switch	Chuck Close Confirmation Switch
10								
11	Index Chuck Completion Limit/	Sensor Protect Limit/	Door Open	Door Close	Coupling Device Alarm/	Interlock Mode	Answer for Aux. M Code	External Spindle Jog
12	Robot In Hold		External Spindle Orientation	External program start	CEJ Transfer Start	Lot Completed	Datum Gauging Command	External Start Disabled

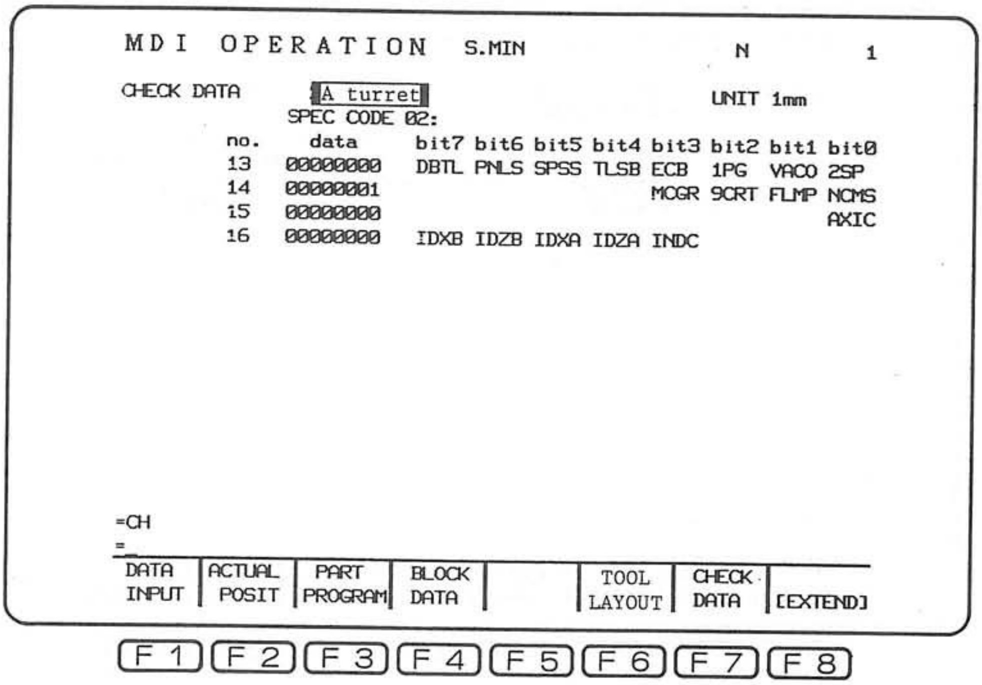
(4-4) Display of Specification Codes (No. 1)

```
AUTO  OPERATION Y.MIN                              N          0

CHECK DATA        [A turret]                   UNIT 1mm
                  SPEC CODE 01:
            no.    data      bit7 bit6 bit5 bit4 bit3 bit2 bit1 bit0
             1   00000000    IDC  LSCH 2SWC OLC  ROBT TATS SPRH SPID
             2   00000000    OMCB OMCA TSC  MSPR CEJ  XMS  NSMS TCSN
             3   00000000    CMK  SMW  IEC  IECD DRIB ECE3 ECE2 ECE1
             4   00000011    ACPC CMTR ATC  TSS  CCM  MIRR 2S   SC
             5   01000010    PBCD FIBM CTIM MOP  SORS OWKC TDIO PRIF
             6   00011000    CACB THDC CALC MTCL B60S TOF3 TOF2 THSP
             7   10001110    OABV CREF COCO AXCM SHOT TLFC RMNI WKMN
             8   11111111    CNVT IGFC IGF  CLGR UTSK INML NRC  LAP
             9   00000000    CD8  CD7  CD6  CD5  CD4  CD3  CD2  CD1
            10   00000000                                       TMPS
            11   00000000
            12   00001000    DNC3 DNC2 DNC1 DNCB DNCA EBCD EBST EBIT

=PS YO
=CH
=CH
=
PROGRAM|ACTUAL| PART  | BLOCK |      | TOOL | CHECK |
SELECT | POSIT|PROGRAM| DATA  |      |LAYOUT| DATA  |[EXTEND]
```

[F 1] [F 2] [F 3] [F 4] [F 5] [F 6] [F 7] [F 8]

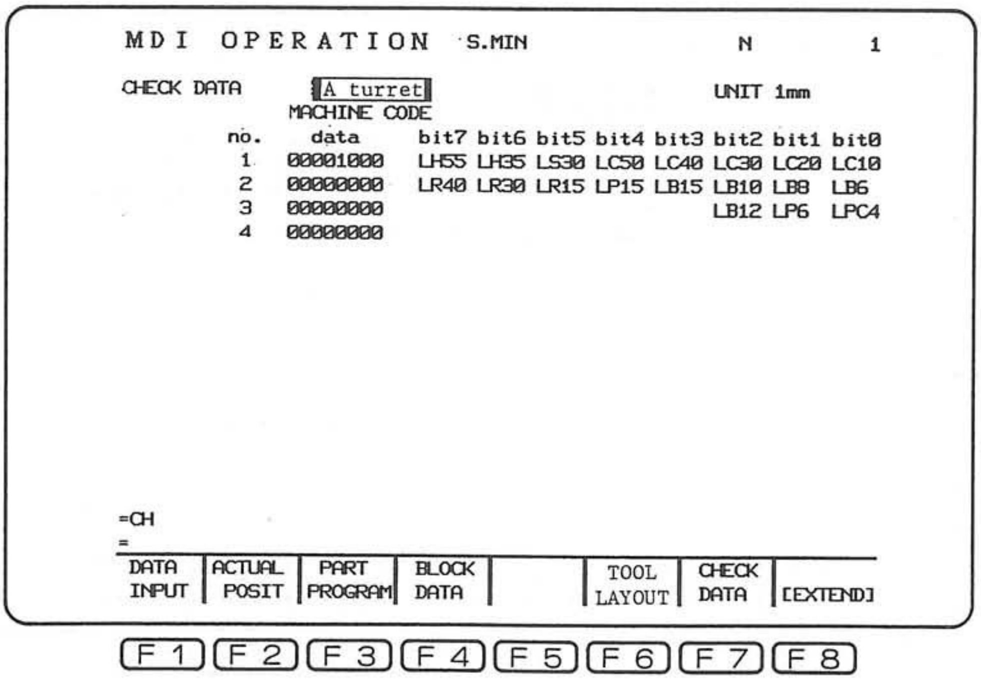
No. \ bit	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit Ø
1	Index Chuck	Long Stroke Chuck	2-saddle Work Catcher	Overload Detect	Okuma Robot	Program-mable Tailstock	Orientation (Electric)	Orientation (Pin/Brake)
2	← Load Monitor → B	A	Touch Setter	Gauging Data Print	CEJ Matic Gauging	Post-process Gauging	Tool Gauging	Touch Sensor Gauging
3	Chucking Error	Air Chuck	IEC Chuck	IEC Door	Door Interlock B	EC Board (Card) Addition 3	EC Board (Card) Addition 2	EC Board (Card) Addition 1
4	AC Motor Pole Change	Comb-type Turret	ATC	Tailstock Swing	Multi-machining	Mirror Image	4-axis 2-saddle	Center Work
5	Coupling External Device Program Selection	Floppy I/O (IBM)	Calendar Timer	MOP	Edit Interlock	External Work Counter	Tape Data Input/ Output	Robot Request Special
6	C-axis Connection B (high-speed)	Phase Matching for Thread Cutting	C-axis Connection (low-speed)	Cycle Time Calculation	Buffer 6Ø m	Tool Offset 96 Sets	Tool Offset 64 Sets	G84/85 Slide Hold
7	Arbitrary Angle Chamfering	Profile Generation	Coordinate System Conversion	Pitch Error Compensa-tion	Operation Hour Reduction Function	Tool Life Management	NC Operation Monitor	NC Work Counter
8	Tape Convert	IGF Convert	IGF	Graphic	User Task 2	Inch/Metric Switchable	Nose R 2B	LAP3
9	Coupling Spec. 8	Coupling Spec. 7	Coupling Spec. 6	Coupling Spec. 5	Coupling Spec. 4	Coupling Spec. 3	Coupling Spec. 2	Coupling Spec. 1
1Ø								Thermal Displace-ment Com-pensation
11								
12	DNC-C3	DNC-C2	DNC-C1	DNC-B	DNC-A	← External Program Selection → C	B	A

(4-5) Display of Specification Codes (No. 2)



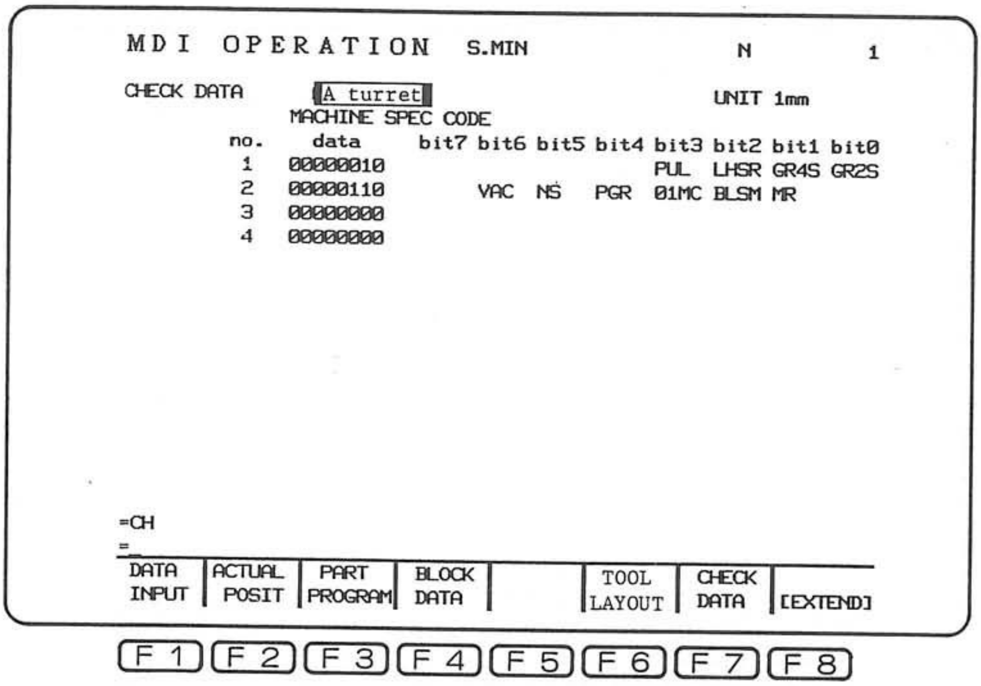
bit / No.	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit Ø
13	Double Tooling	Operation Panel Position Special	Spindle Stop Special	Tool Rotation Type B	EC Bus Spec.	1-phase Pulse Generator	VAC Runout	2-spindle
14	OMI Message Display			Conventional Monochrome Character Spec.	Monochrome Graphic Spec.	OSP5ØØL-G Operation Panel	Operation Panel Flat Key	NC Master
15								Inductosyn Pitch Error Compensation
16	←		Inductosyn		→			

(4-6) Display of Machine Codes



No. \ bit	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
1	LH55	LH35	LS30	LC50	LC40	LC30	LC20	LC10
2	LR40	LR30	LR15	LP15	LB15	LB10	LB8	LB6
3						LB12	LP6	LPC4
4								

(4-7) Display of Machine Specification Codes



No. \ bit	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit Ø
1					Pulley Change	LH5Ø Standard Spindle	Gear 4 steps	Gear 2 steps
2		VAC Motor	Minor Change	Pulse Generator Reverse Rotation	Ø.1 μm Control	Brushless Servomotor	ATC Magazine Position Encoder Reverse	
3								
4								

(4-8) Display of Alarm Message List

```
AUTO OPERATION                                  N        1
CHECK DATA                                      UNIT 1mm
            ALARM MESSAGE LIST
     No.  A-No.   TIME      CODE   CHARACTER
      1   105-1   0:10:0     1
      2   117     0:0:50
      3
      4
      5
      6
      7
      8
      9
     10
     11
     12

=
PROGRAM | ACTUAL | PART    | BLOCK |   | TOOL   | CHECK |
SELECT  | POSIT  | PROGRAM | DATA  |   | LAYOUT | DATA  | [EXTEND]
```

F 1 F 2 F 3 F 4 F 5 F 6 F 7 F 8

Up to 12 alarms which have previously taken place are displayed. However, the Alarm P and CPU alarm are not displayed. The larger the number is, the more previously the alarm took place. This list is not cleared when the power is turned off. In order to clear this display, execute the following command.

= ALMC ←

(Key-in [A][L][M][C] and press WRITE.)

Reverse display of signal names at the I/O CHECK DATA display screen:

Signal names corresponding to those for which bit data is "1" are displayed in reverse to allow easy checkup of the signal status. Note that reverse display is available only for OSP5ØØØL-G. With OSP5ØØL-G, display illuminance is changed between bit 1 and bit Ø. Full illuminance for bit 1 and half illuminance for bit Ø.

4-1-8. Tool Layout Function

When changing the setup, it is often required to know which tools are used in the program. After changing the cutting tools, it is also necessary to check if the tools set in the turret(s) correctly match the tools actually designated in the program.

The tool layout function displays all tools designated in a program.

(1) Display Data

The tool layout function displays the following data:

a) Sequence number which contains the tool command.

b) Designated tool number, tool offset number and the nose R compensation number.

c) The tool offset data called by the tool offset number displayed in b).

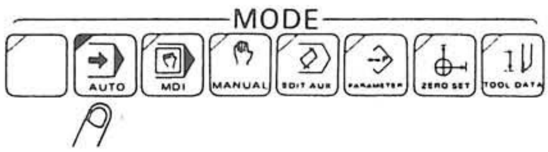
d) The tool nose R compensation number called by the tool nose R compensation number displayed in b).

e) Nose R compensation pattern number.

(2) Operation Procedure

The tool layout display is possible in the following steps.

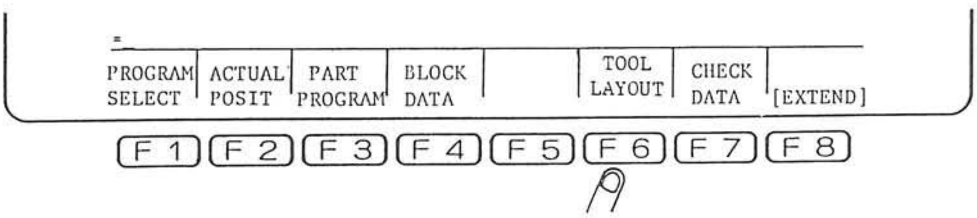
1) Select the AUTO OPERATION mode by pressing the AUTO key.



2) Select the program for which the tool layout is to be displayed.

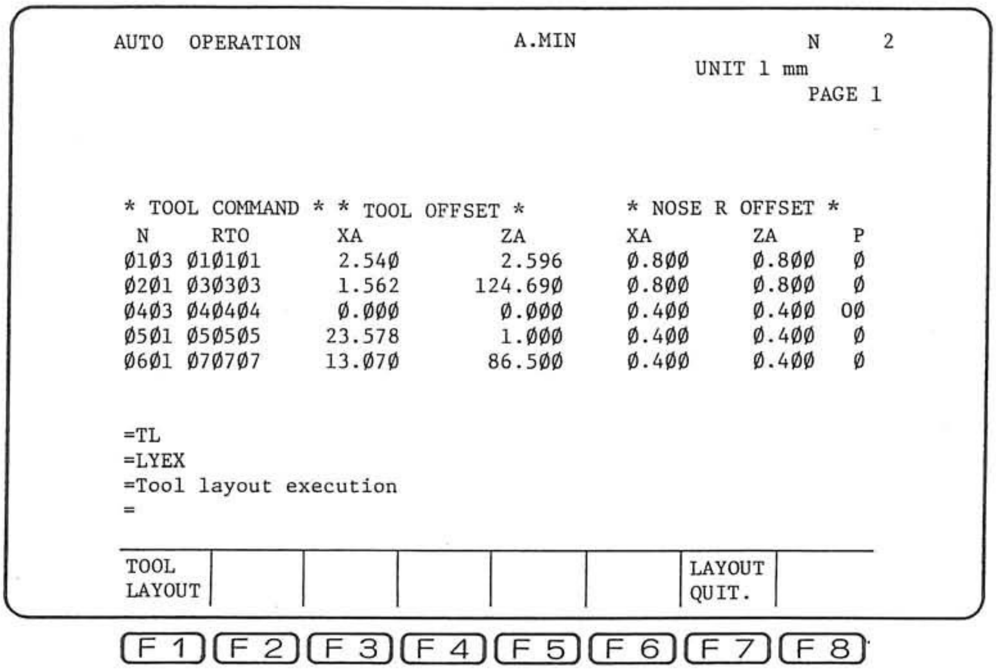
The program selection operation is explained in 4-1-1, "Program Selection and Operation". When the required program has already been selected, this program selection is not necessary.

3) Press the function key [F6] (TOOL LAYOUT).



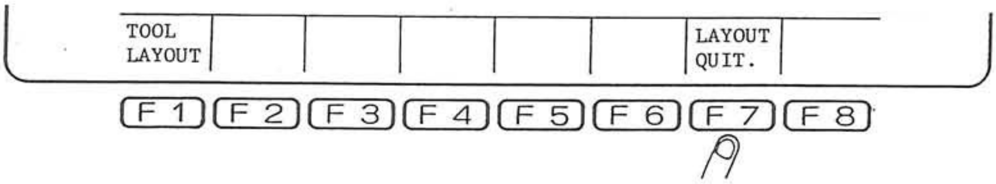
If the function name TOOL LAYOUT is not assigned to the function key [F6], press the function key [F8] (EXTEND). By pressing the function key [F6] (TOOL LAYOUT), the screen changes to the tool layout screen. However, the tool layout data is not displayed even when the function key [F6] (TOOL LAYOUT) is pressed unless the layout has not been executed after turning on power to the control.

4) Press the function key [F1] (LAYOUT EXEC.).



The selected program is read and the tool layout data is displayed on the screen. While the program is being read, message "tool layout execution" is displayed on the screen.

5) Press the function key [F7] (LAYOUT QUIT). This restores the screen having been displayed before starting the tool layout.



Once the tool layout display is given, the same data is displayed by simply pressing the function key [F6] (TOOL LAYOUT).

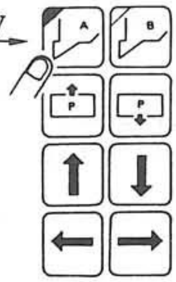
The tool layout display data remains active until tool layout is attempted for another program. The tool layout data is cleared when power supply is turned off.

(3) Supplements

1) For the two-saddle models, the tool layout display is possible for A and B saddles independently.

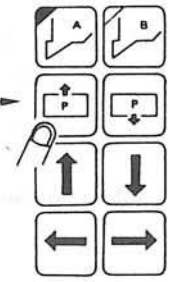
Selection of the saddle for which the tool layout data is to be displayed is made using the turret selection keys on the operation panel.

Turret selection key



2) One page of the tool layout screen display provides the tool data for 12 tools. Six pages of tool layout screens are provided (for two-saddle model, six pages for each saddle) and pages are advanced and returned by pressing the page keys on the operation panel.

Page key



3) For the machine equipped with the tool life management specification (optional), tool commands are given by the tool groups (TG) and the tool offset groups (OG). However, the display of the tool layout data is given using the tool number of the tool actually used in the designated tool group and the tool offset number actually called.

4-2. AVAILABLE OPERATIONS IN EDIT AUX MODE

There are three types of program operations:

1. Transfer .... Transfer of main program data is performed.
2. Editing .... Editing of main program data is performed.
3. Others .... Editing and other operations of files are performed.

(1) Transfer

"Transfer" refers to: storing the main program data into the NC memory using the tape reader, and punching out the stored main program data on a paper tape using the optional tape puncher.

A function to verify the tape data and the stored data is also available.

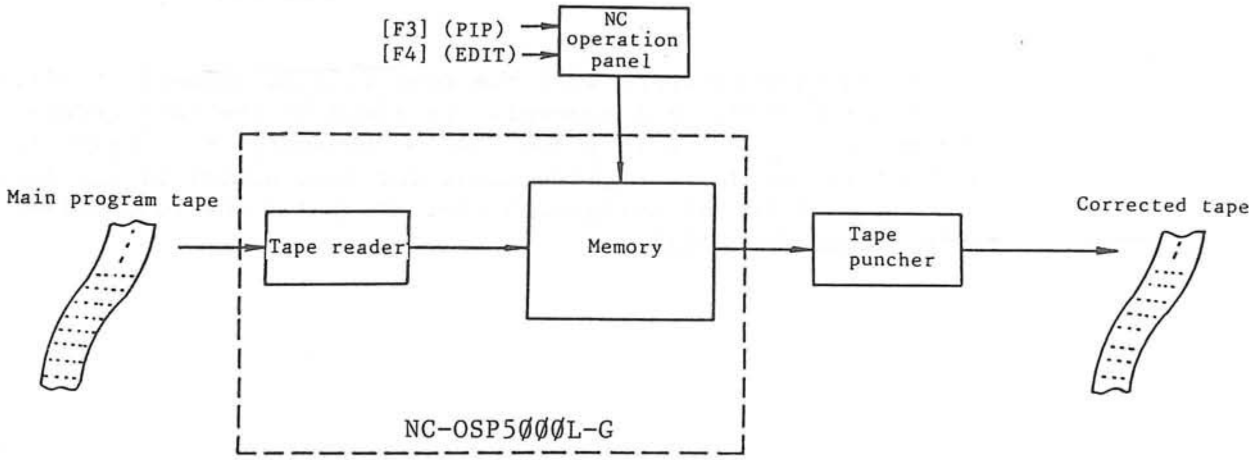
The standard tape storage capacity is about 12,ØØØ characters (3Ø meter (98.4 feet) tape length); if necessary a larger memory capacity is available as an optional feature.

(2) Edit

"Edit" means altering, inserting or deleting data stored in the main program. Editing is performed using the keyboard switches while observing the main program data displayed on the CRT.

After editing the main program data stored in the memory, it can be punched out on tape using the transfer function. The use of this function permits the operator to directly store the main program data into the memory using the keyboard switches without preparing a tape.

Note: The bubble memory is used to store the main program.



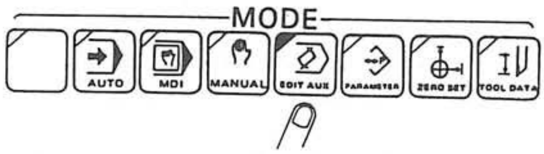
Transfer and Edit of Main Program Data

4-2-1. Transfer of Main Program Data

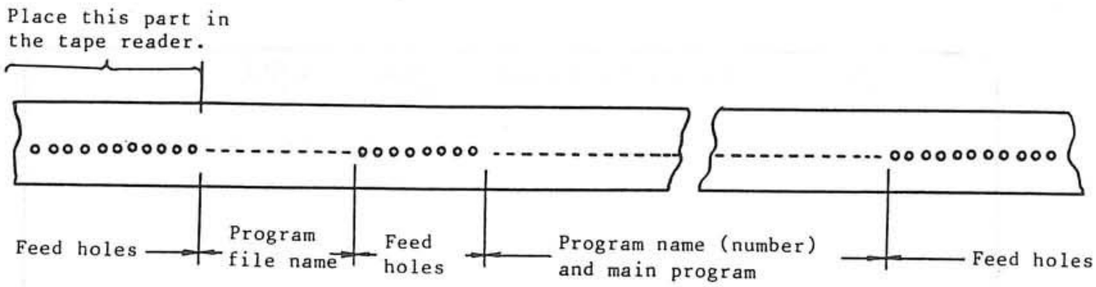
(1) Read-in of Main Program Data

The main program data on tape can be read into the bubble memory using the tape reader as follows:

1) Select the PROG OPERATION by pressing the EDIT AUX mode key.



2) Place the tape in the tape reader.



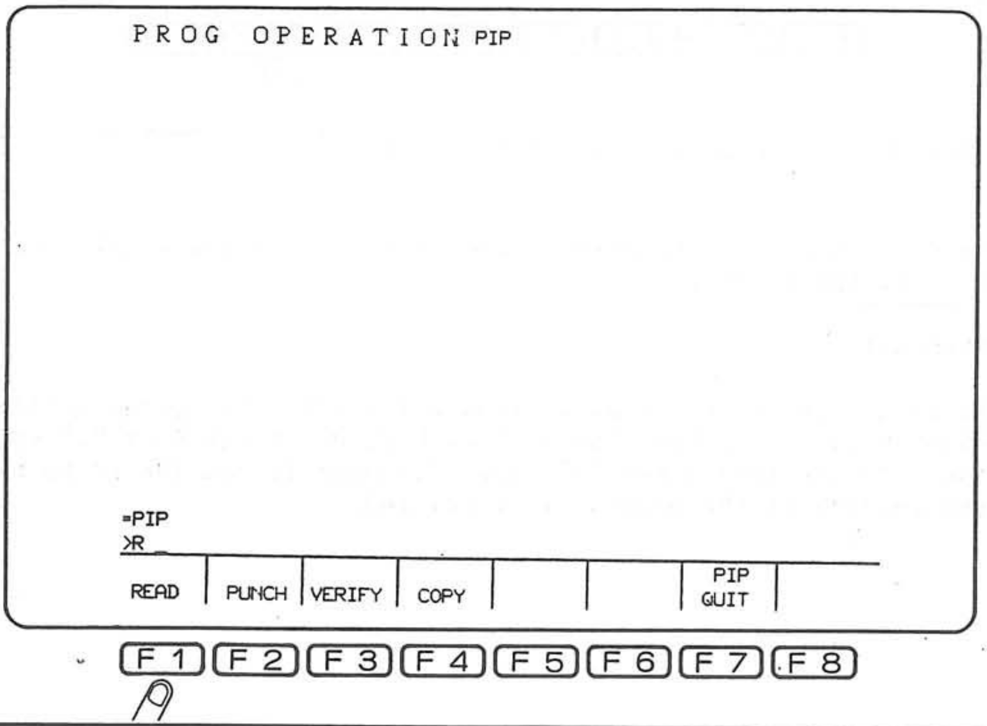
Note: Place the leading feed holes in the tape reader.

3) Press the function key [F3] (PIP).

Make sure that the display changes.

4) Press the function key [F1] (READ).

Prompt "R" appears on the console line of the CRT. The control is ready to read the tape.



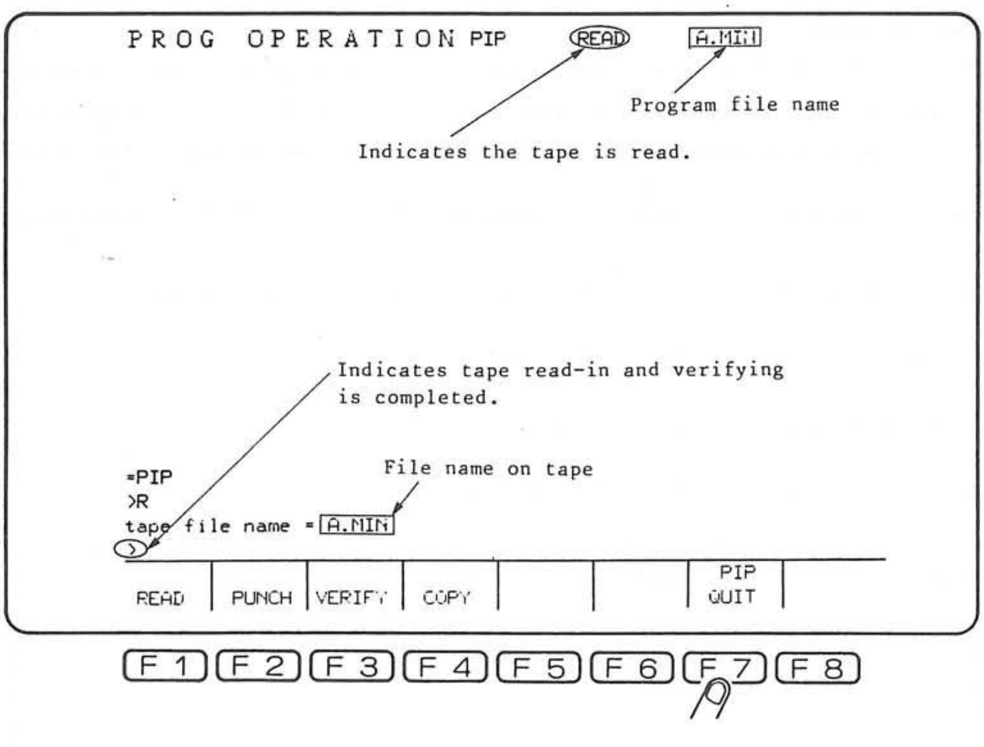
5) Press WRITE key.

Pressing the key starts the tape reader operation; the commands on the tape are read and stored into the memory.

While the tape is read, the CRT displays "READ" message along with the "file name" on the first line.

After the tape read-in and storing are concluded, the tape is fed backward to compare the tape data and the data stored in the memory; this is called "verifying".

When the tape read-in and verifying are completed, ">" appears on the console line on the CRT.



6) Press the function key [F7] (PIP QUIT).

This completes the read-in of the tape and the CRT display returns to the display of step 2).

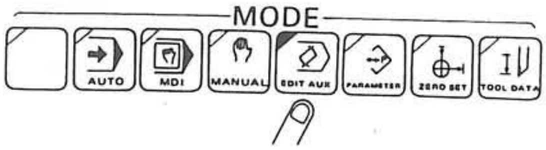
[SUPPLEMENT]

It is not necessary to punch feed holes after the program file name. When characters other than A through Z, Ø through 9 or "." (period) of ISO code are read after "$", the file name is considered to be over and the reading of the program is initiated.

(2) Punching Out the Stored Program (optional)

To punch out the program data after correcting cutting conditions, feedrates and other commands found improper in trial cut, follow the steps below:

1) Select the PROG OPERATION mode by pressing the EDIT AUX key.



2) Press the function key [F3] (PIP).

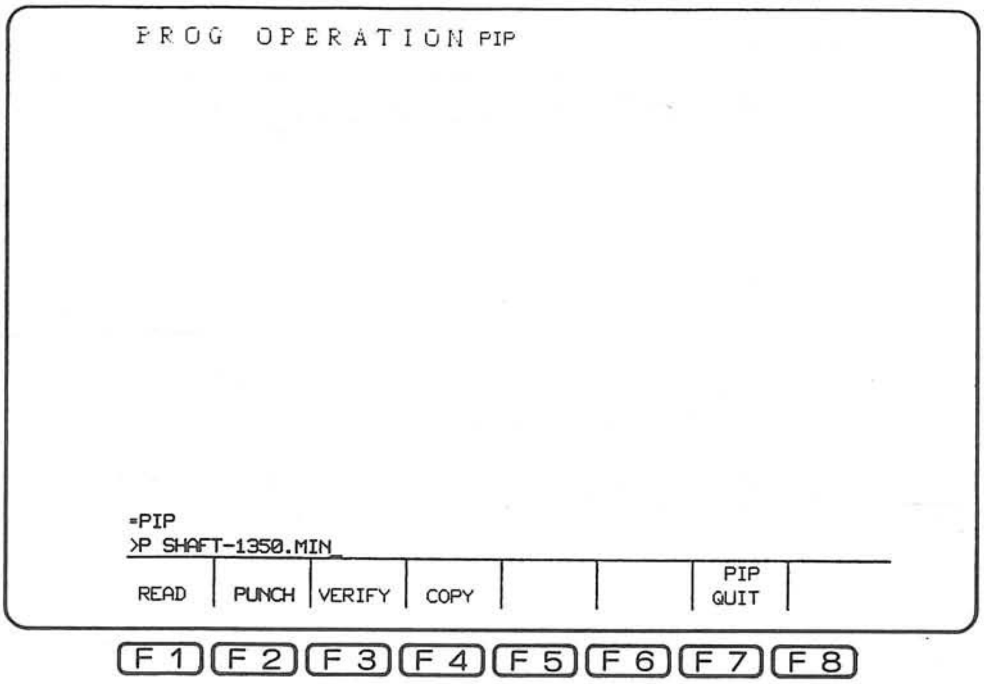
Make sure that the display has changed.

3) Press the function key [F2] (PUNCH).

Prompt "P" appears on the console line of the CRT. The control is ready to punch out the program data.

4) Enter the program file name of the program to be punched out through the keyboard, SHAFT-135Ø.MIN, for instance.

For a program for which a file is not designated, i.e., when the file name is "A.MIN", this operation is unnecessary.

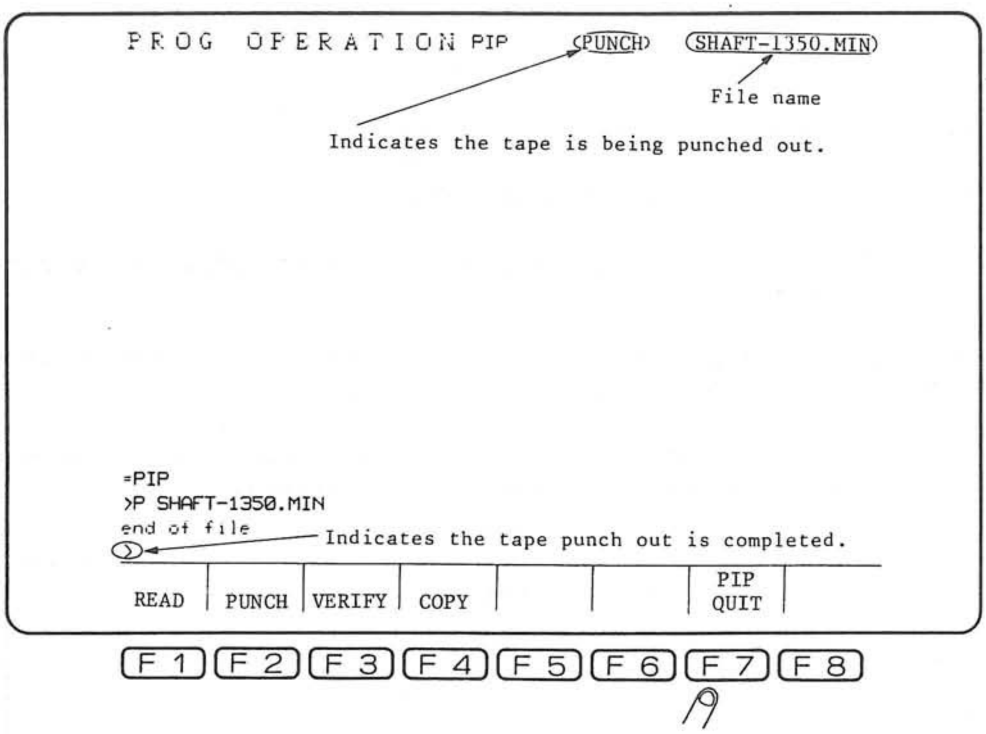


5) Press the WRITE key.

This starts the tape punch out.

While in tape punch out operation, the CRT displays "PUNCH" message along with the "file name" on the first line.

When tape punch out is complete, "end of file" message appears on the console line and ">" on the next line of the CRT.



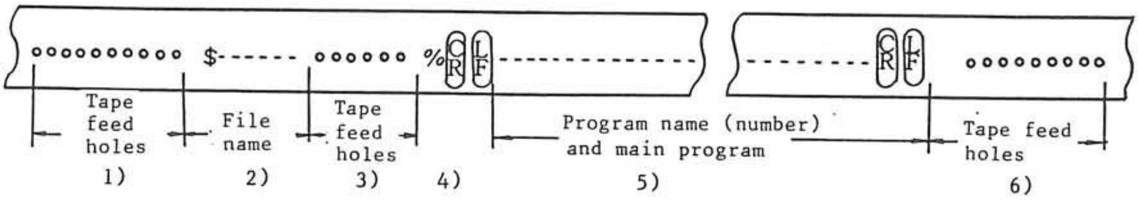
6) Press the function key [F7] (PIP QUIT).

This completes the punch out of the stored program and the CRT display returns to the display of step 2).

When the tape punch out is performed during machine operation, the tape punch out speed might be lower than normal.

[SUPPLEMENT]

The format of tape punch out is as follows:



1) 25Ø tape feed holes are punched in the tape leader section.

   The number of punched out feed holes can be set as desired in the range from 1ØØ to 2ØØØ with a parameter.

   For details, refer to 4-3, "Operation in Parameter Mode".

2) The file name is punched out following "$" code. (Program data is punched out in ISO coding system.)

3) 5Ø tape feed holes are punched.

   The number of feed holes cannot be changed.

4) "%", "CR" and "LF" code are punched in succession.

   A selection can be made at the parameters to designate "CR and LF" punching, or "LF" punching.

5) The main program data is punched out following the program name (number).

6) The same number of feed holes as in (1) are punched out in the tape trailing section.

7) Using a parameter setting, it is possible to set whether the file name is to be punched out or not. When bit 3 of parameter (bit) No. 2 is:

   Ø ..... File name is punched out
   1 ..... File name is not punched out

   Initial setting is Ø.

Note 1: When EIA coding system is selected for tape punch out, "CR" code is punched out instead of "CR" and "LF" codes.

Note 2: When punching out the program data in EIA code, the presence of a code not available in EIA coding system causes an error; tape punch out stops and an error message is indicated on the CRT.

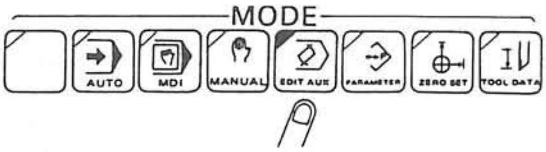
Note 3: When the tape delimiting codes is "% (ER)"*, the "%" code is punched out preceding the tape feed holes as explained in 6) above.

* Bit 3 of optional parameter (bit) No. 1 is "1".

(3) Verifying the Data Punched Out

To check whether the data punched out is all correct, follow the steps below:

1) Select the PROG OPERATION mode by pressing the EDIT AUX key.



2) Place the tape to be verified in the tape reader.

3) Press the function key [F3] (PIP).

Make sure that the display has changed.

4) Press the function key [F3] (VERIFY).

Prompt "V" appears on the console line of the CRT. The control is ready to verify the program data punched out.

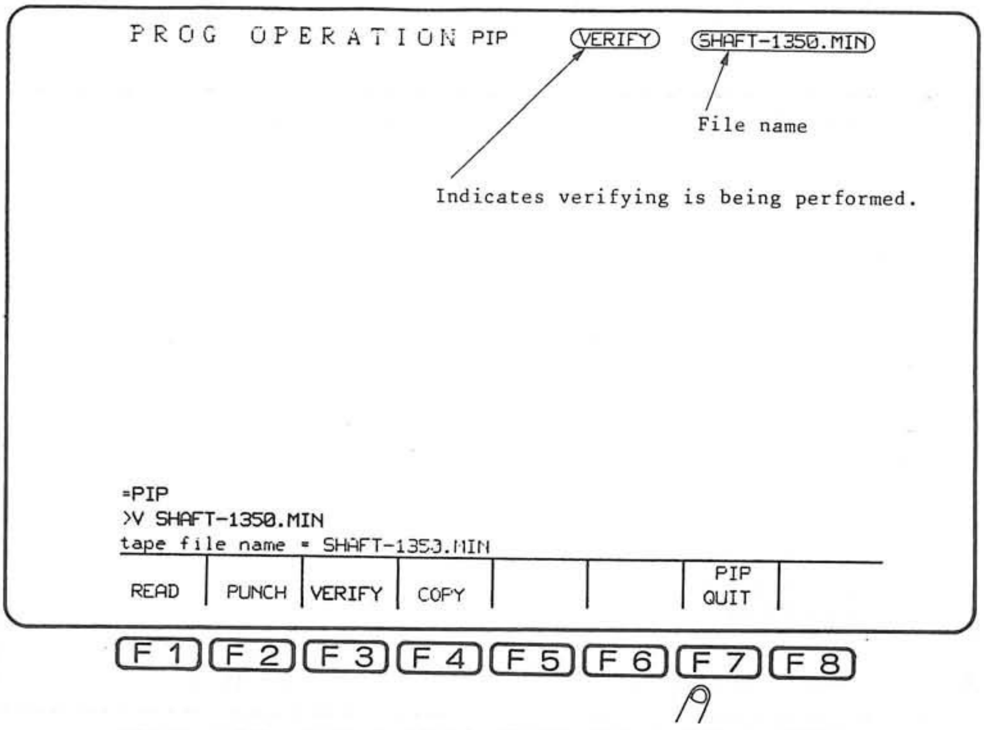
5) Enter the program file name of the program to be verified through the keyboard, SHAFT-135Ø.MIN, for instance.

For a program for which no file is designated, i.e., when the file name is "A.MIN", this operation is unnecessary.

6) Press the WRITE key.

This starts the tape reader, and program data on the tape is read and compared with the stored program data.

While in program data verifying operation, the CRT displays "VERIFY" message along with the "file name" on the first line.



7) Press the function key [F7] (PIP QUIT).

This completes verification of the punched out program data and the CRT display returns to the display of step 2).

Note: When data mismatch is found in tape verifying operation, the block (line) containing inconsistent data is shown in the console line of the CRT, and the address of that data blinks.

"verify continue (Y/N)!" message appears then asking the operator if he wants to continue verifying or stop.

When all the data match in verifying operation, the CRT shows the messages as:

```
end of tape
end of file
all same data
```

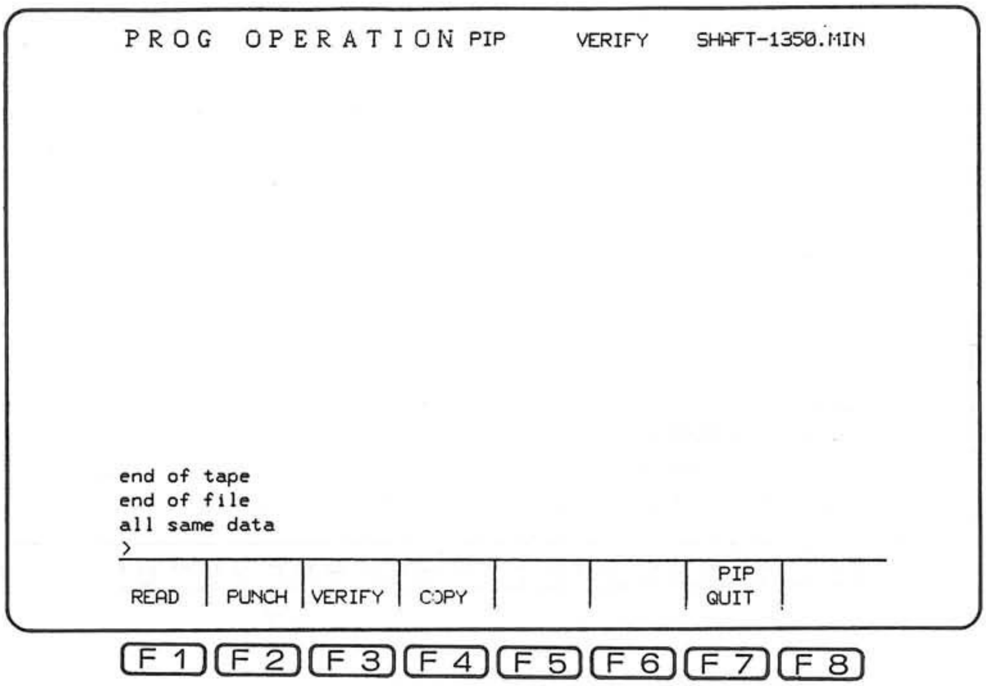
If remaining any file data remains even after all the program data on tape is read, messages are:

```
end of tape
all same data
```

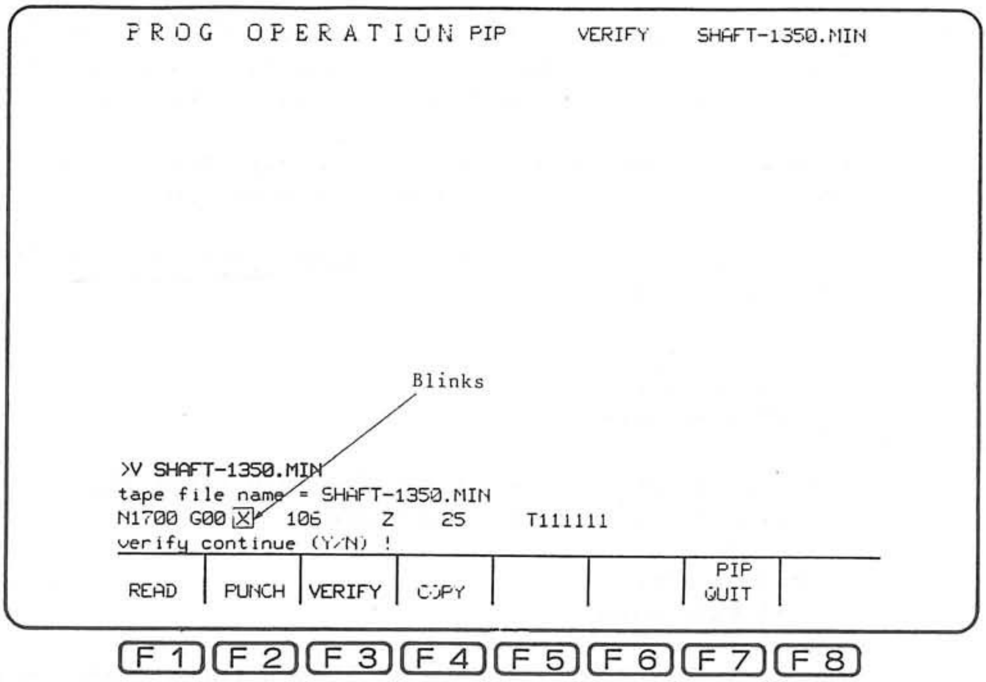
If program data on tape remains even after all the stored file data is read, messages are:

```
end of file
all same data
```

When all the data match in verifying operation:



When data mismatch is found:



(4) Precautions on Tape Read-in, Punch Out and Verifying Operations

There are two coding systems: EIA and ISO; selection of the coding system can be made by

a) Parameter setting, or

b) Designating the desired coding system each time, read-in, punch out or verifying operation is made.

a) Parameter Setting

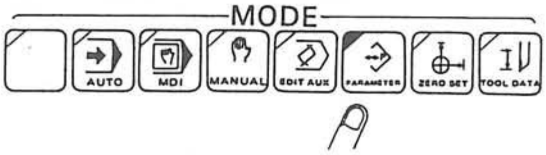
Two parameters are used to determine the coding system: "Tape Code Parity Discrimination" and "Tape Code ISO Code". The coding system in each program operation mode is determined by the combination of these two parameters.

	Tape Code Parity Recognition	Tape Code ISO Code	Operation Condition
(A)	1	1	In READ and VERIFY modes, the coding system is automatically recognized - ISO or EIA. In PUNCH mode, program data is punched in ISO coding system.
(B)	1	Ø	In READ and VERIFY modes, the coding system is automatically recognized - ISO or EIA. In PUNCH mode, the program data is punched in EIA coding system.
(C)	Ø	1	In READ and VERIFY modes, the control assumes the coding system is ISO. (If the actual coding system is not ISO, an error results.) In PUNCH mode, the program data is punched in ISO coding system.
(D)	Ø	Ø	In READ and VERIFY modes, the control assumes the coding system is EIA. (If the actual coding system is not EIA, an error results.) In PUNCH mode, the program data is punched in EIA coding system.

The standard parameter setting is (A), in which the control can read the data coded according to EIA and ISO coding systems. Punch out data is coded in ISO.

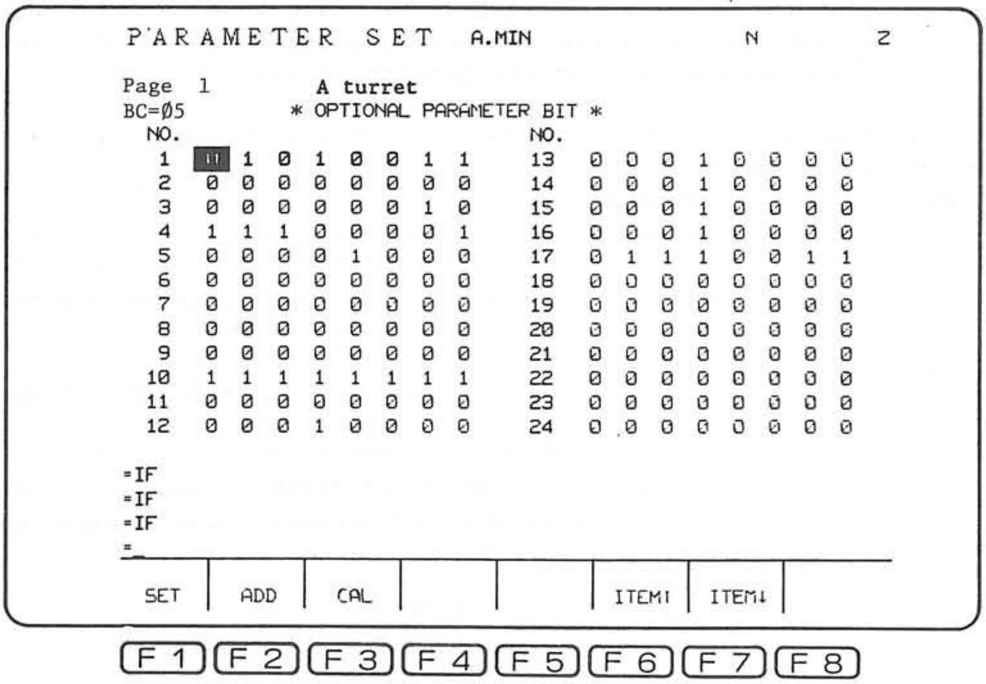
To change the parameter setting from (A) to (B), i.e., to punch out stored program data in EIA code, follow the steps below:

1) Select the PARAMETER SET mode by pressing the PARAMETER key.



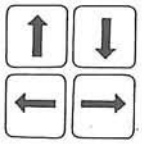
2) Press the function key [F7] (ITEM↓).

Press that key repeatedly until the display shown below is obtained.



3) Locate the cursor to No. 1 position, using the cursor control keys.

(The cursor is usually located at that position.)



The two lowest bits of No. 1 parameter correspond to "tape code parity recognition" and "tape code ISO code".

No.	7	6	5	4	3	2	1	Ø
1	Ø	1	Ø	1	Ø	Ø	1	1

Bit Ø — Tape code ISO code

Bit 1 — Tape code parity recognition

4) Pressing the function key [F1] (SET), key-in the data "Ø" through the keyboard.

PARAMETER SET A.MIN N 2

Page 1 A turret

BC=2A * OPTIONAL PARAMETER BIT *

NO.									NO.								
1	0	1	0	1	0	0	1	1	13	0	0	0	1	0	0	0	0
2	0	0	0	0	0	0	0	0	14	0	0	0	1	0	0	0	0
3	0	0	0	0	0	0	1	0	15	0	0	0	1	0	0	0	0
4	1	1	1	0	0	0	0	1	16	0	0	0	1	0	0	0	0
5	0	0	0	0	1	0	0	0	17	0	1	1	1	0	0	1	1
6	0	0	0	0	0	0	0	0	18	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	19	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	21	0	0	0	0	0	0	0	0
10	1	1	1	1	1	1	1	1	22	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	23	0	0	0	0	0	0	0	0
12	0	0	0	1	0	0	0	0	24	0	0	0	0.	0	0	0	0

=IF
=IF
=IF
=S 0

SET	ADD	CAL			ITEM↑	ITEM↓	
F 1	F 2	F 3	F 4	F 5	F 6	F 7	F 8

5) Press the WRITE key.

PARAMETER SET A.MIN N 2

Page 1 A turret

BC=ØE * OPTIONAL PARAMETER BIT *

NO.									NO.								
1	0	1	0	1	0	0	1	0	13	0	0	0	1	0	0	0	0
2	0	0	0	0	0	0	0	0	14	0	0	0	1	0	0	0	0
3	0	0	0	0	0	0	1	0	15	0	0	0	1	0	0	0	0
4	1	1	1	0	0	0	0	1	16	0	0	0	1	0	0	0	0
5	0	0	0	0	1	0	0	0	17	0	1	1	1	0	0	1	1
6	0	0	0	0	0	0	0	0	18	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	19	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	21	0	0	0	0	0	0	0	0
10	1	1	1	1	1	1	1	1	22	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	23	0	0	0	0	0	0	0	0
12	0	0	0	1	0	0	0	0	24	0	0	0	0	0	0	0	0

=IF
=IF
=S 0
=

SET	ADD	CAL			ITEM↑	ITEM↓	
F 1	F 2	F 3	F 4	F 5	F 6	F 7	F 8

This transfers the data set in step 4) to No. 1 parameter and old parameter data is substituted by the newly entered one.

b) ISO or EIA Designation for Respective Program Operation
- READ, VERIFY and PUNCH

By performing the following steps when executing the required tape operation, READ, VERIFY and/or PUNCH, the operator can directly select the coding system, ISO or EIA, disregarding the coding system selected by parameter setting.

Example:

To punch out the stored program data in EIA code.

Key-in the following command in step 4) for punching out stored program data.

(Represents EIA)

SHAFT-135Ø.MIN ; E

After designating the file to punch out, key-in ";E".

Note 1: Designation of EIA, ISO and Verifying.

;E .... EIA code
;I .... ISO code
;V .... Verifying

Note 2: To operate the machine by storing a main program in the memory, there are two cases:

1) One main program is stored in the memory and machine operation is controlled by it.

2) More than two main programs are stored in the memory, and the necessary program is read out and executed as needed.

These two cases are explained below.

1) Where one main program is stored in the memory:

In this case it is not necessary to assign the main program with a file name. In the memory, however, it is assigned with the file name "A.MIN".

2) Where two or more programs are stored in the memory:

In this case, there are two methods to execute a program:

a) One file for one program

Only one program is registered in one file.

b) One file for several programs

More than two main programs are registered in one file.

In either case, it is advisable to make a program by assigning a tape with a file name. When storing a main program not assigned with a file name on the tape, follow the steps below to assign it with a file name.

i) Press the function keys for READ operation.

ii) Key-in ",$\boxed{\text{file name}}$" through the keyboard.

iii) Press the WRITE key.

Through the steps above, the program data on tape is stored in the memory and assigned with the keyed-in file name.

For easy control of main program tapes, it is advisable to employ filing system (a) "one file for one program".

Note 3: To store a main program data following the program data in the file already registered in the memory, follow the steps below:

1) Press the function keys for READ operation.

2) Key-in ",$\boxed{\text{file name}}$;A" through the keyboard.

3) Press the WRITE key.

Note 4: A file name can be assigned or changed as required following the format below:

[F1] (READ) "input-file-name", "output-file-name"

When no input file name is provided, the file name on the tape is used as the "input-file-name". If no file name is punched on the tape, the program is assigned with the file name "A.MIN".

When the "input-file-name" is designated, the control checks whether the designated input file name matches the file name on the tape. If they do not match, and error results.

When an "output-file-name" is provided, that file name is created in the memory.

When no "output-file-name" is provided, the "input-file-name" serves as an "output-file-name".

When designation of an output file name is omitted, the delimiter "," can be omitted, too.

When only an output file name is provided without an input file name, it is necessary to enter the delimiter ",".

Example 1:

[F1] (READ) SHAFT-1.MIN, SHAFT-2.MIN [WRITE]

A program assigned with the file name "SHAFT-1.MIN" is stored in the memory, with its file name changed to "SHAFT-2.MIN".

Example 2:

[F1] (READ), SHAFT-2.MIN [WRITE]

A program is stored in the memory assigned with the file name "SHAFT-2.MAIN" disregarding its current file name.

Example 3:

[F1] (READ) SHAFT-2.MIN [WRITE]

The control first checks whether the file name of the program tape, is "SHAFT-2.MIN". After that the program is stored in the memory assigned with the file name "SHAFT-2.MIN".

Example 4:

[F1] (READ) [WRITE]

The program is stored in the memory assigned with the file name on the tape. If no file name is on the tape, the program is assigned with the file name "A.MIN".

Example 5:

Program is to be stored in memory following another program already stored.

[F1] (READ) SHAFT-1.MIN, SHAFT-2.MIN; A1

ISO code designation

The program data coded in ISO coding system and assigned with the file name "SHAFT-1.MIN" is stored in the memory and filed with "SHAFT-2.MIN", which is already registered in the memory.

Note 5: a) For reading and punching operation of programs in the EIA code, codes not supported by the EIA code cannot be handled. These codes are $, *, =, [and]. However, if the EIA code patterns corresponding to them at the optional parameter (bit) data Nos. 26 through 3Ø, they can be used in the EIA code mode operation.

For the read operation, if the first code is the EIA code corresponding to the code "$" (code data matches with the pattern set at optional parameter (bit) No. 3Ø), file name can be read in the EIA code.

When the EIA codes corresponding to the codes =, *, [,] and $ are present in the program while the program is being read in the EIA code setting, they can be read as they are.

For the tape punch operation, file name is punched out in the EIA code if the EIA code (optional parameter (bit) No. 3Ø) corresponding to the code "$" is set.

When codes =, *, [,] and # are present in a program, they are punched in the corresponding EIA code as set by the parameters.

b) Both in the EIA and ISO codes, certain codes may be used assuming different codes for program read and punch operations.

Set the code (irregular code) to be regarded as a different code at optional parameter (bit) data No. 31 and the code (correct code) corresponding to the irregular code at optional parameter (bit) data No. 32. Note that the correct code must be set in the ISO code.

If an irregular code appears in the program during reading operation, it is read as the correct code.

If a correct code appears during tape punch operation, the irregular code corresponding to the correct code is punched.

c) Conversion explained in b) is given priority to conversion a).

Note 6: When designating the read or verify operation, option C code may be added. When the option C code is designated, the read or verify operation can be continued even when an error (parity error, EIA code error, special code error, TV check error) is detected during the operation. The detected error code is converted into the "!" code.

Option C designation format:

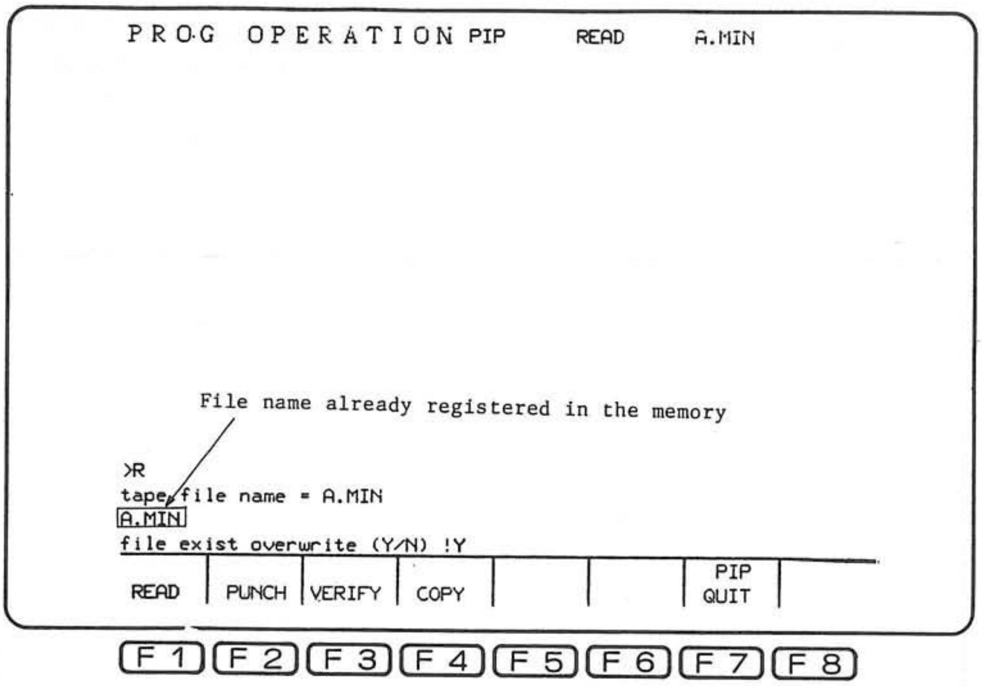
```
[F1] (READ) "input-file-name", "output-file-name" ;C
```

```
[F1] (VERIFY) "input-file-name", "output-file-name" ;C
```

Note 7: To store a new program data in the file already registered in the memory after deleting the existing data in that file, follow the steps on the following page.

1) [F1] (READ) $\boxed{\text{file-name}}$ [WRITE]

2) "file exist overwrite (Y/N)!" message appears on the console line of the CRT display.



3) After keying-in "Y" through the keyboard, press the WRITE key.

This deletes the data in the designated file, and stores the new data through the tape reader.

Remarks:

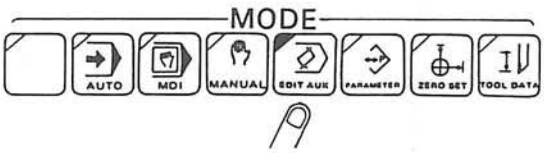
1. When the operator does not require the new data to be stored, key-in "N" through the keyboard and then press the WRITE key.

2. When new data is to be stored under the file name "A.MIN" which is used to file a program not assigned with a file name, and when there is no file name on the tape of the new program data, it is not necessary to designate the file name as in step 1).

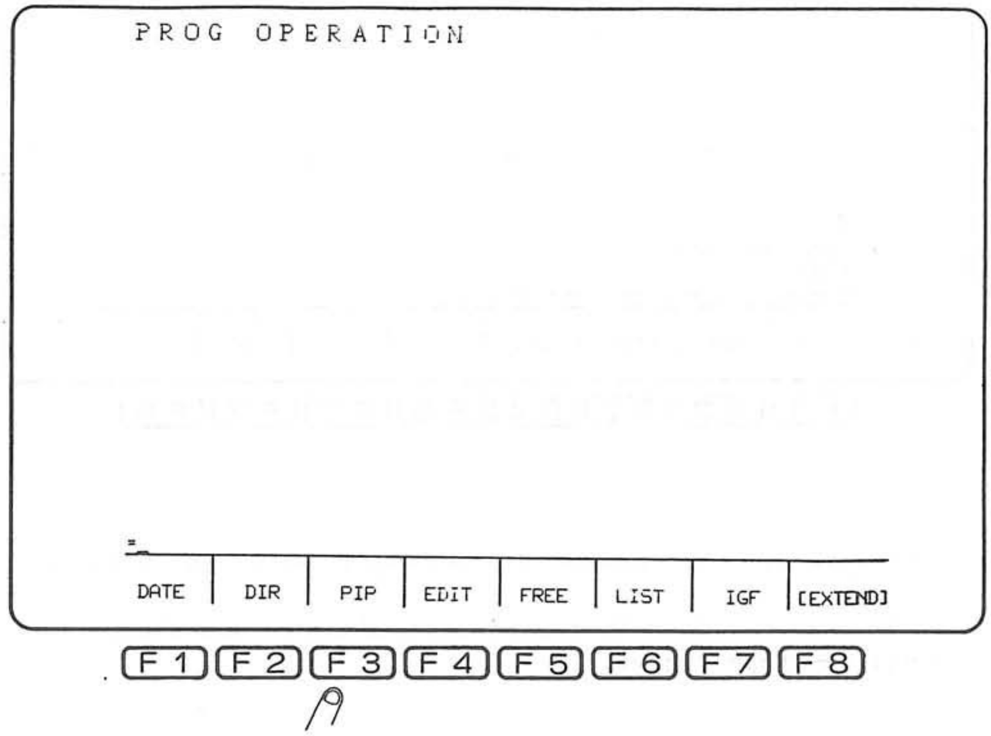
(5) Back Up of the Main Program Data

Back up of the file data in the bubble memory is possible. Follow the steps below:

1) Select the PROG OPERATION mode by pressing the EDIT AUX key.

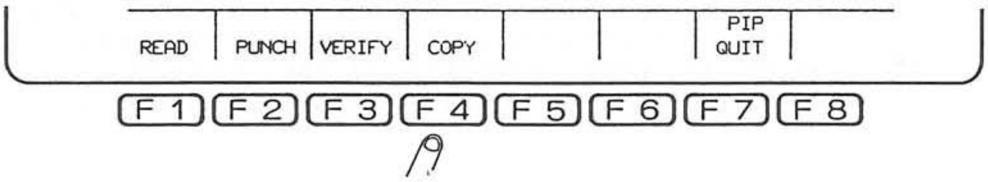


2) The CRT display is as shown below.



3) Press the function key [F3] (PIP).

Make sure that function key display changes.



4) Press the function key [F4] (COPY).

Prompt "CO" appears on the console line of the CRT, telling the operator that the control is ready to back up the program data.

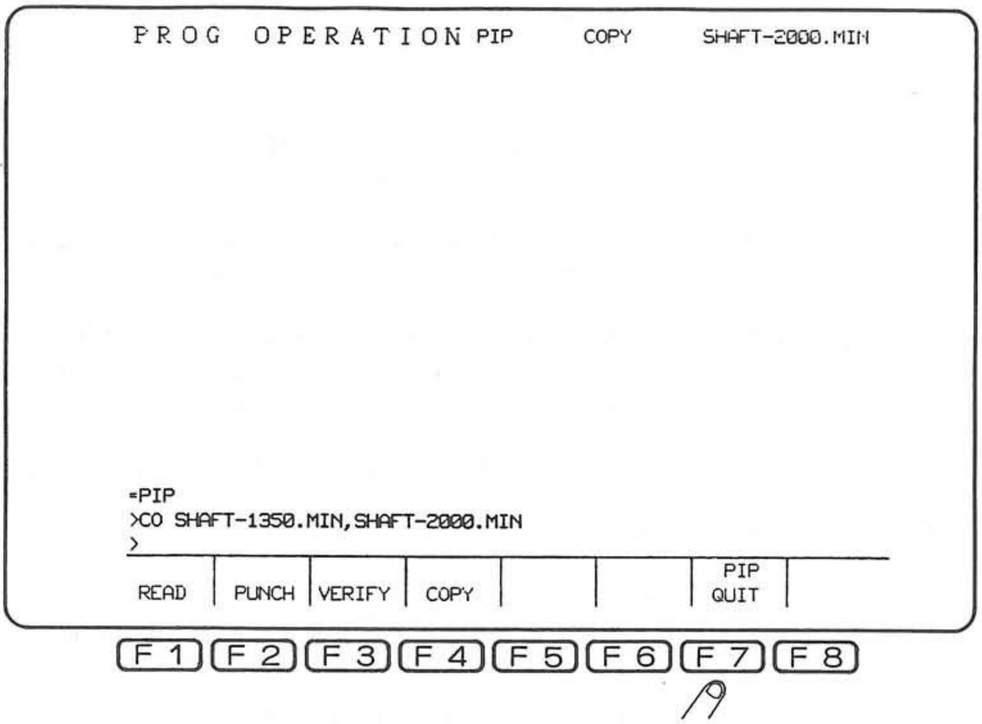
5) Enter the file name of the program to be backed up through the keyboard.

Example: SHAFT-135Ø.MIN, SHAFT-2ØØØ.MIN

Input file name Output file name

6) Press the WRITE key.

With this, the file data "SHAFT-135Ø.MIN" in the bubble memory is backed up under the file name "SHAFT-2ØØØ.MIN".



7) Press the function key [F7] (PIP QUIT).

This completes back up of the program data. The CRT display is restored to 2).

Note 1: When the file name "SHAFT-135Ø.MIN" designated is not in the bubble memory, the CRT displays:

file not found

Note 2: When the file name "SHAFT-2ØØØ.MIN" newly designated is already in the bubble memory, the CRT displays:

SHAFT-2ØØØ.MIN
file exist overwrite (Y/N)!

Enter "Y" by pressing [Y] and WRITE keys, to have the old file data deleted and the designated file data duplication is performed.

Enter "N" by pressing [N] and WRITE keys, and the control does not perform duplication.

Note 3: When the output file name is the same as the input file name, the output file name can be omitted.

Note 4: When the output file name is omitted, "*" and "?" can be used in the input file name. In this case, all corresponding files are duplicated.

For details, refer to the instructions related to Index.

Note 5: The control has optional features:

[F4] "input-file-name", "output-file-name"<u>;A</u>

File data designated by the "input-file-name" is duplicated following the existent file data of the file designated by the output file name.

[F4] "input-file-name", "output-file-name"<u>;V</u>

Before the back up of the file data, message "copy OK (Y/N)!" appears on the console line of the CRT.

Press [Y] and WRITE keys, and the intended back up is performed.

Press [N] and WRITE keys, and the back up is not performed.

Note 6: This back up function is effective when an optional external memory device such as the bubble memory cassette is selected.

4-2-2. Edition of Main Program Data

The operator can edit the program data stored in the memory by observing the display on the CRT. This is generally called "Screen Editor".

When editing the program data, it is read out from the memory in units of files.

Provided below are the explanations of technical terms used in the editing operation:

Edit Line

This line permits the edition of the data.
">>" symbol is located at the left of the edit line.
One line can contain up to 63 characters.

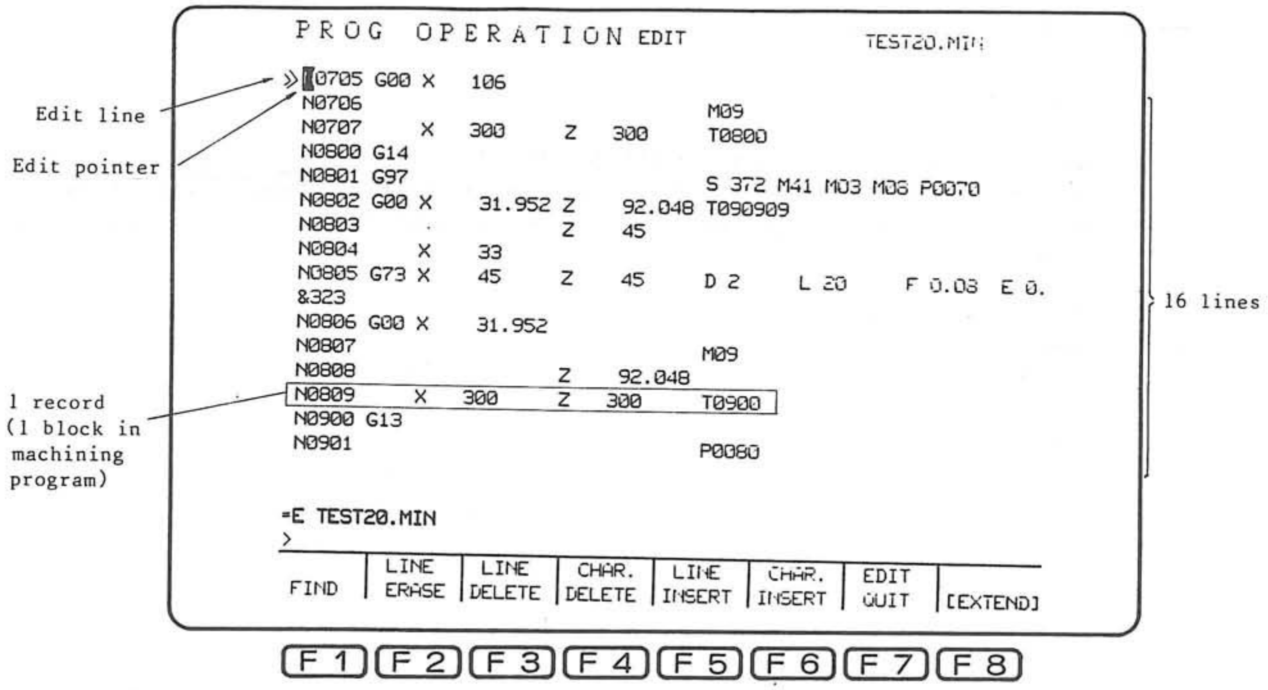
Edit Pointer

This position indicating the intended start of data edition.
The address character or numeral data is identified by a bright square.

Record

Called block in a part program.

A unit of data beginning with the character preceded by "LF" and ending with the next "LF". Since the number of characters shown in one line of the CRT is 63, a record is displayed in more than one lines if it contains more than 63 characters. In this case, the symbol "&" is displayed at the beginning of the second line.



Detailed procedures for program editing are provided below. DO NOT FORGET TO PRESS FUNCTION KEY [F7] (EDIT QUIT) WHEN EDITING IS COMPLETED.

If the operator forgets to press that key, the data edited is not stored in the memory.

4-2-2-1. Fundamental Editing Operation

(1) Read out program to be edited:

There are two methods which can be used to read out a program file from memory for editing:

a) Selection from program edit directory display
b) Direct selection of program to be edited

a) Selection from Program Edit Directory Display

Programs may be selected for editing by accessing the Program Edit Directory on the CRT and using the cursor (reverse display) to indicate the program to be edited.

1) Select the PROG OPERATION mode by pressing the EDIT AUX key.

2) Press the function key [F4] (EDIT).

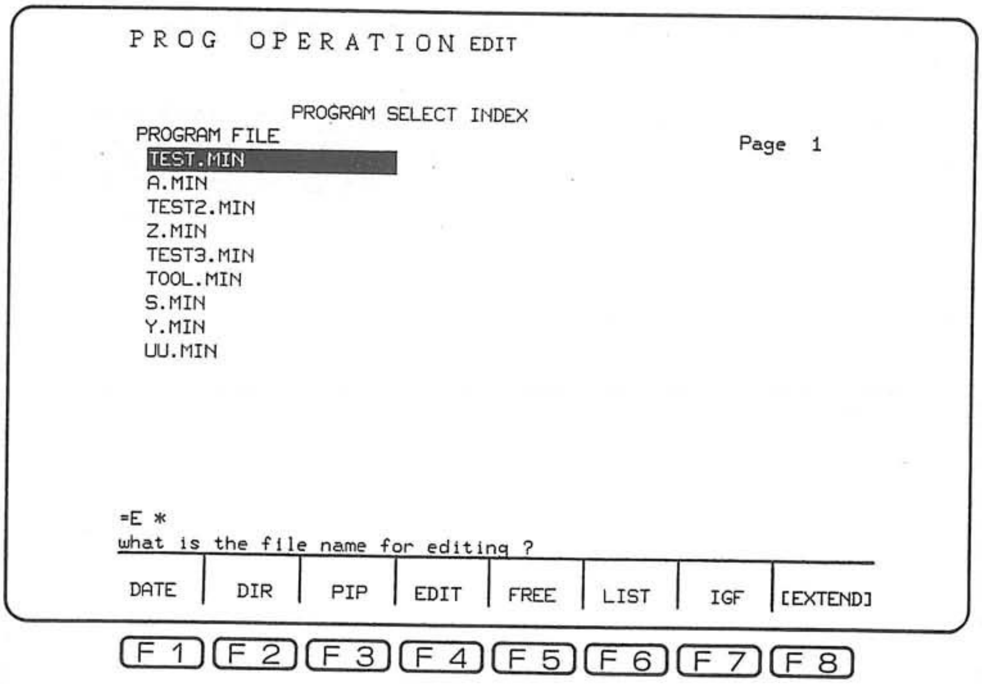
3) Key in an asterisk (*) through the keyboard.

The CRT will display:

=E *

4) Press the WRITE key.

The program directory page will be displayed by the operations above. One page of this display shows a total of 12 files names and if more than 12 files names are registered, press the PAGE key to display the second page.



5) Locate the cursor to the file name desired.

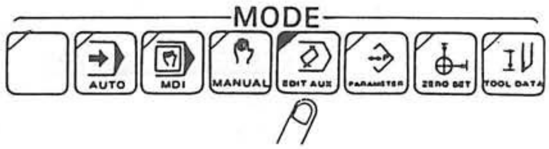
6) Press the WRITE key.

The program at the cursor location will be searched, then read out in the edit area. It will also be displayed on the display screen.

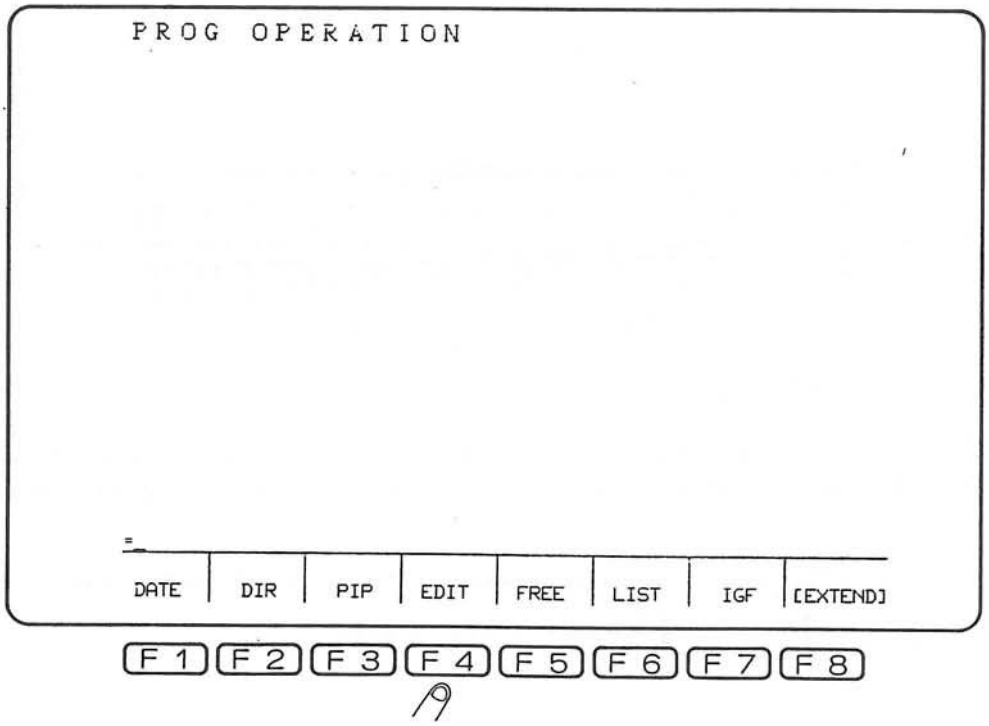
Note: During the operations in steps 4) through 6), keys other than , , and are not operative.

b) Direct Selection of the Program to be Edited

1) Select the PROG OPERATION mode by pressing the EDIT AUX key.



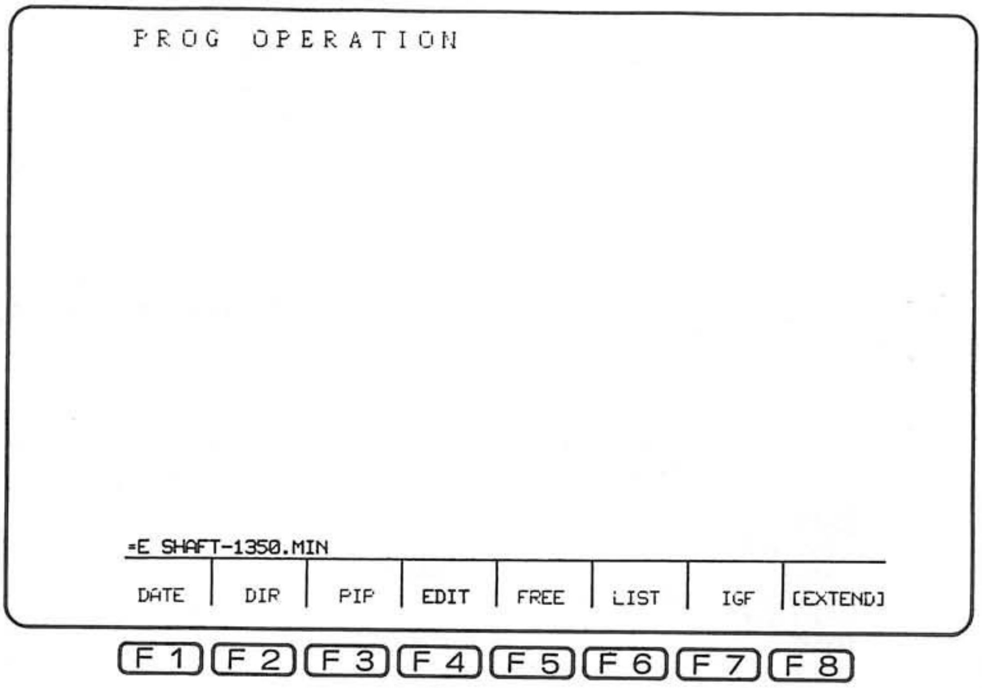
2) The CRT display is as shown below.



3) Press the function key [F4] (EDIT).

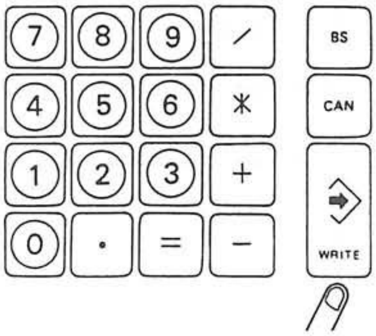
4) Key-in the file name of the main program through the keyboard.

Example: SHAFT-135Ø.MIN



When the file name is not registered, i.e,. when the file name is "A.MIN", it is not necessary to key-in the file name.

5) Press the WRITE key.



With this, the program data of the designated file is searched for, read and transferred to the editing area. The read out program data is displayed on the CRT at the same time.

```
PROG OPERATION EDIT                              SHAFT-1350.MIN

>>SHT2
  N0001 G13
  N0002                                P0010
  N0003 G00 X    300     Z   300
  N0004 G14
  N0005                                P0020
  N0006 G00 X    300     Z   300
  N0007 G50                            S3500
  N0100 G13
  N0101                                P0030
  N0102 G97                            S 424 M41 M03 M08
  N0103 G00 X    105     Z    92.048 T020202
  N0104                  Z    90
  N0105 G96 G110                       S 140
  N0106 G85 N0107 D 2      F 0.25  U 0.2   W 0.1
  N0107 G82


 =E SHAFT-1350
 >
       | LINE  | LINE   | CHAR.  | LINE   | CHAR.  | EDIT |
 FIND  | ERASE | DELETE | DELETE | INSERT | INSERT | QUIT | [EXTEND]
```

F 1 F 2 F 3 F 4 F 5 F 6 F 7 F 8

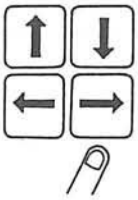
(2) Moving edit pointer with cursor control keys

Edit pointer and edit line can be shifted by pressing the cursor control keys:

1) Cursor [→] key

Pressing [→] key shifts the edit pointer rightward. Each time it is pressed, the edit pointer shifts rightward by one character.

When it is kept pressed, the edit pointer shifts continuously.



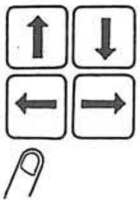
```
PROG OPERATION EDIT                         SHAFT-1350.MIN

>>SHT2
  N0001 G13
  N0002                             P0010
  N0003 G00 X   300    Z   300
  N0004 G14
  N0005                             P0020
  N0006 G00 X   300    Z   300
  N0007 G50                         S3500
  N0100 G13
  N0101                             P0030
  N0102 G97                         S 424 M41 M03 M08
  N0103 G00 X   105    Z    92.048  T020202
  N0104                Z    90
  N0105 G96 G110                    S 140
  N0106 G85 N0107 D 2     F 0.25  U 0.2   W 0.1
  N0107 G82

=E SHAFT-1350
>
       | LINE  | LINE   | CHAR.  | LINE   | CHAR.  | EDIT |
 FIND  | ERASE | DELETE | DELETE | INSERT | INSERT | QUIT | [EXTEND]
```

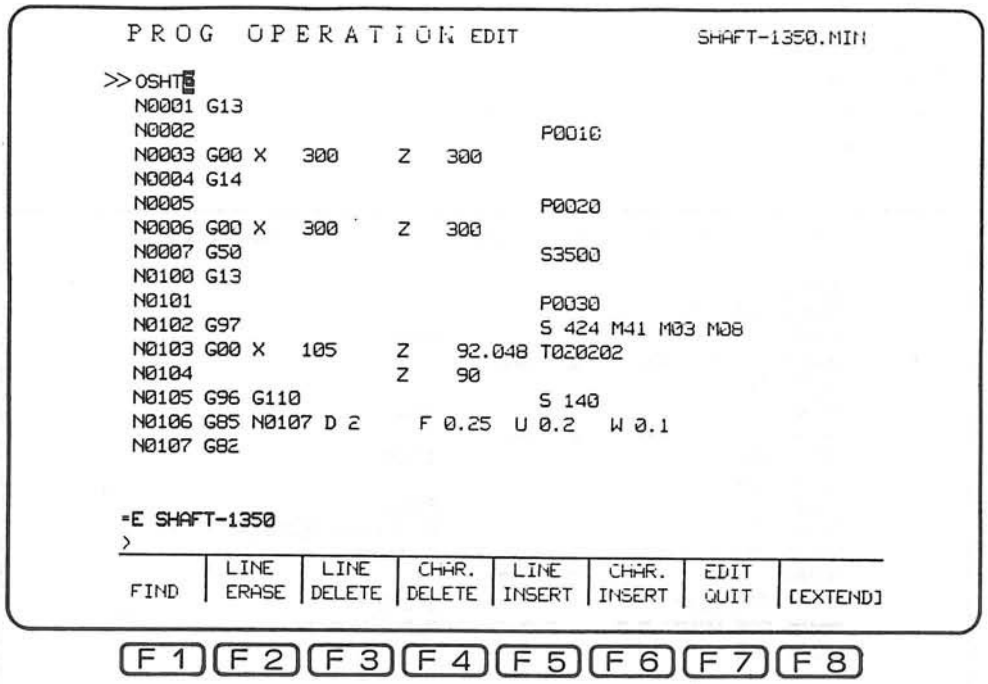
F1 F2 F3 F4 F5 F6 F7 F8

2) Cursor [←] key

Pressing [←] key shifts the edit pointer leftward. Each time it is pressed, the edit pointer shifts leftward by one character.

When it is kept pressed, the edit pointer shifts continuously.



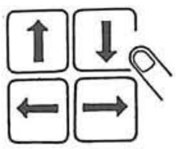


3) Cursor [↓] key

Each time [↓] is pressed, both the edit pointer and the edit line shift downward by one line.

When it is kept pressed, the edit pointer and the ">>" shift continuously.

When it is pressed while the edit line marked by ">>" is at the lowermost line, the edit line returns to the top line.



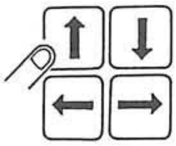
```
PROG  OPERATION EDIT                         SHAFT-1350.MIN

>>▮SHT2
  N0001 G13
  N0002                                 P0010
  N0003 G00 X    300     Z   300
  N0004 G14
  N0005                                 P0020
  N0006 G00 X    300     Z   300
  N0007 G50                             S3500
  N0100 G13
  N0101                                 P0030
  N0102 G97                             S 424 M41 M03 M08
  N0103 G00 X    105     Z     92.048 T020202
  N0104                  Z     90
  N0105 G96 G110                        S 140
  N0106 G85 N0107 D 2      F 0.25  U 0.2    W 0.1
  N0107 G82


=E SHAFT-1350
>
      | LINE  | LINE   | CHAR.  | LINE   | CHAR.  | EDIT |
FIND  | ERASE | DELETE | DELETE | INSERT | INSERT | QUIT | [EXTEND]

 F 1     F 2     F 3     F 4      F 5      F 6      F 7     F 8
```

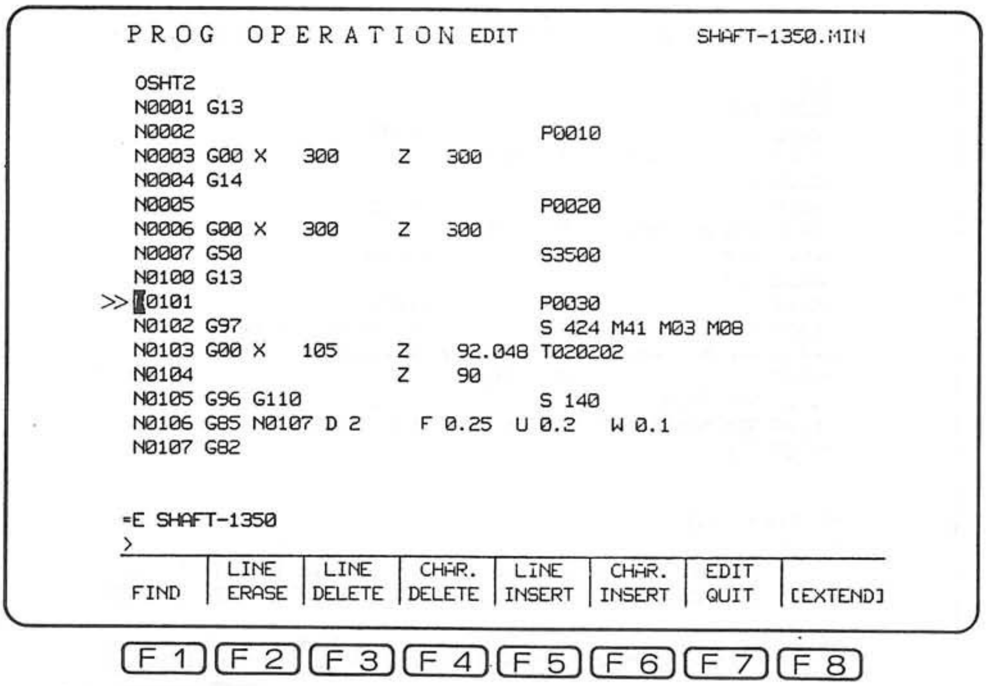
4) Cursor [↑] key

Each time [↑] is pressed, both the edit pointer and the edit line shift upward by one line.

When it is kept pressed, the edit pointer and the ">>" shift continuously.

When it is pressed while the edit line marked by ">>" is at the top line (at OSHT2 on the CRT page), the edit line returns to the bottom line.





[SUPPLEMENTS]

While shifting the edit pointer by pressing [→] or [←] key, the edit line shifts downward or upward when the key is still pressed and the edit pointer is located at the right or left end of the line.

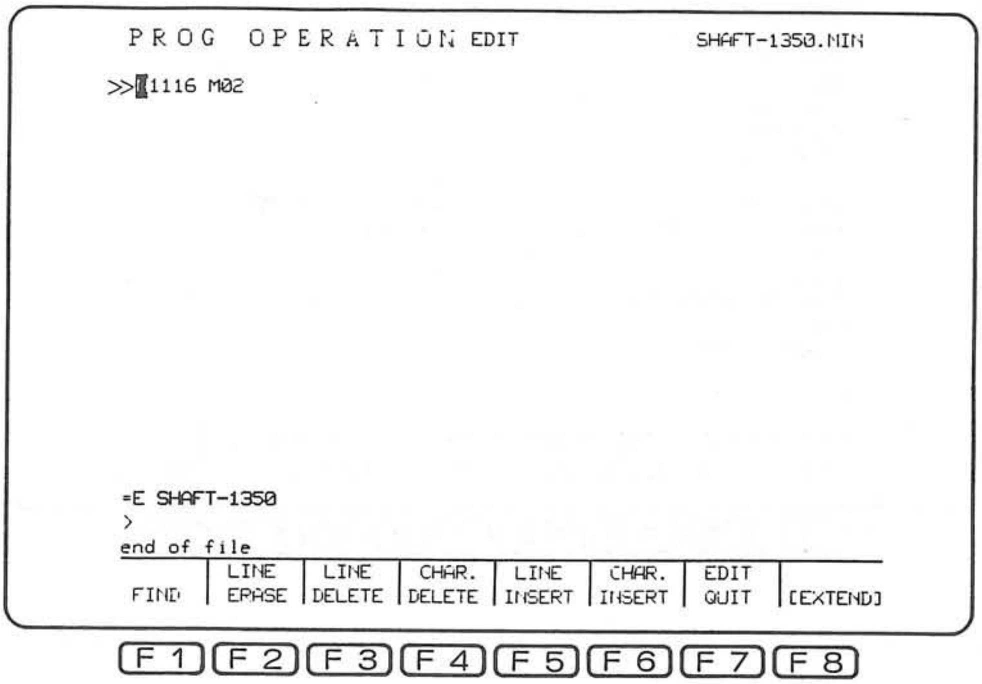
The edit pointer is always on the edit line. In other words, the edit pointer and the edit line indicating symbol ">>" move in pair.

Therefore, when the edit line moves up or down, the edit pointer also shifts up or down along with ">>" symbol.

(3) Page feeding

Pressing the key on the NC operation panel advances the CRT display to the next page.

The CRT can display program data of only 16 lines at a time. Therefore, a long program of many lines cannot be displayed in one CRT display. The page key is used to turn the CRT display page.



The location of the edit pointer and the edit line does not change.

When the final page of the data is displayed on the CRT, message "end of file" appears on the CRT at the console line indicating there is no further data.

(4) Page reversing

Pressing the  key on the NC operation panel returns the CRT display by one page.

```
PROG OPERATION EDIT                      SHAFT-1350.MIN

>>▮SHT2
  N0001 G13
  N0002                             P0010
  N0003 G00 X    300    Z   300
  N0004 G14
  N0005                             P0020
  N0006 G00 X    300    Z   300
  N0007 G50                         S3500
  N0100 G13
  N0101                             P0030
  N0102 G97                         S 424 M41 M03 M08
  N0103 G00 X    105    Z    92.048 T020202
  N0104                 Z    90
  N0105 G96 G110                    S 140
  N0106 G85 N0107 D 2     F 0.25  U 0.2   W 0.1
  N0107 G82
 =E SHAFT-1350
 >
 end of file
 begin of file
       | LINE  | LINE   | CHAR.  | LINE   | CHAR.  | EDIT |
  FIND | ERASE | DELETE | DELETE | INSERT | INSERT | QUIT | [EXTEND]
```

F 1 F 2 F 3 F 4 F 5 F 6 F 7 F 8

Location of the edit pointer and the edit line does not change.

When the first page is displayed on the CRT with  kept pressed, message "begin of file" appears on the CRT at the console line and pressing  key cannot renew the page any more.

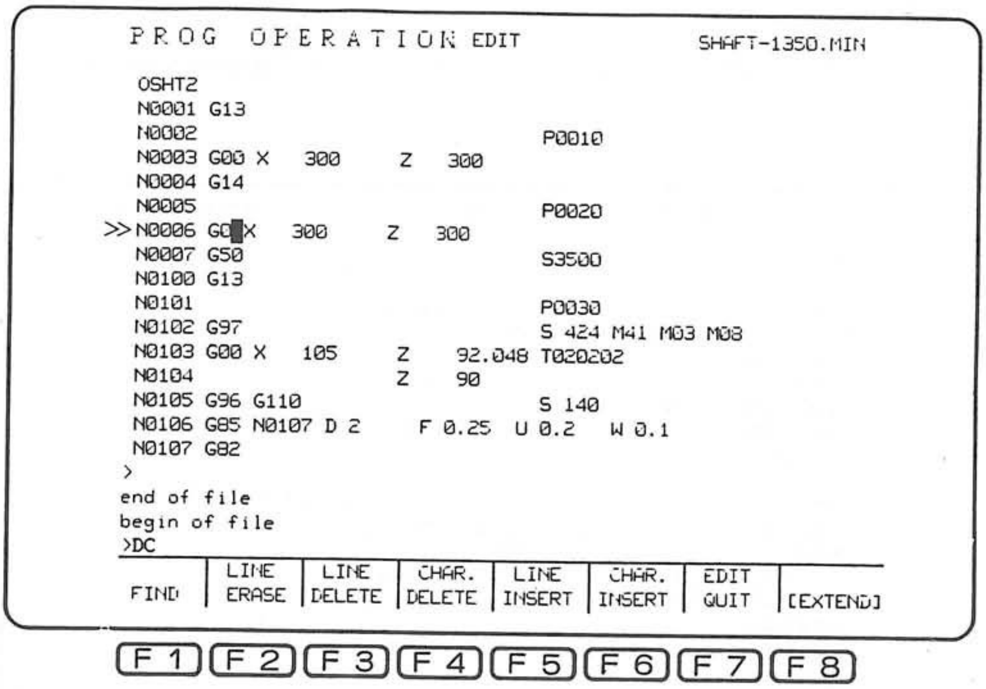
(5) Deleting character [F4] (CHAR. DELETE)

Pressing the function key [F4] (CHAR. DELETE) deletes the character indicated by the edit pointer.

The character deleted by pressing the [F4] key disappears from the CRT and all the characters on the edit line after the edit pointer move left by one space.

The position of the edit pointer does not change.

Prompt "DC" appear on the console line of the CRT.



(6) Inserting character [F6] (CHAR. INSERT)

Pressing the function key [F6] (CHAR. INSERT) inserts a space right before the edit pointer.

All the characters on the edit line after the edit pointer move right by one space.

If there is a character requiring other than a space at the end of the edit line, message "insert character impossible" appears on the CRT and the insertion operation cannot be performed.

This operation is effective when inserting characters (numerical values).

When the insertion is made, prompt "IC" appear on the console line of the CRT.

```
  PROG  OPERATION EDIT                          SHAFT-1350.MIN

   OSHT2
   N0001 G13
   N0002                            P0010
   N0003 G00 X    300    Z   300
   N0004 G14
   N0005                            P0020
>>N0006 G0  X    300    Z   300
   N0007 G50                        S3500
   N0100 G13
   N0101                            P0030
   N0102 G97                        S 424 M41 M03 M08
   N0103 G00 X    105    Z    92.048 T020202
   N0104                 Z    90
   N0105 G96 G110                   S 140
   N0106 G85 N0107 D 2     F 0.25  U 0.2   W 0.1
   N0107 G82
  end of file
  begin of file
  >DC
  >IC
        | LINE  | LINE   | CHAR.  | LINE   | CHAR.  | EDIT |
  FIND  | ERASE | DELETE | DELETE | INSERT | INSERT | QUIT | [EXTEND]

  (F 1) (F 2) (F 3) (F 4) (F 5) (F 6) (F 7) (F 8)
```

(7) Deleting line [F3] (LINE DELETE)

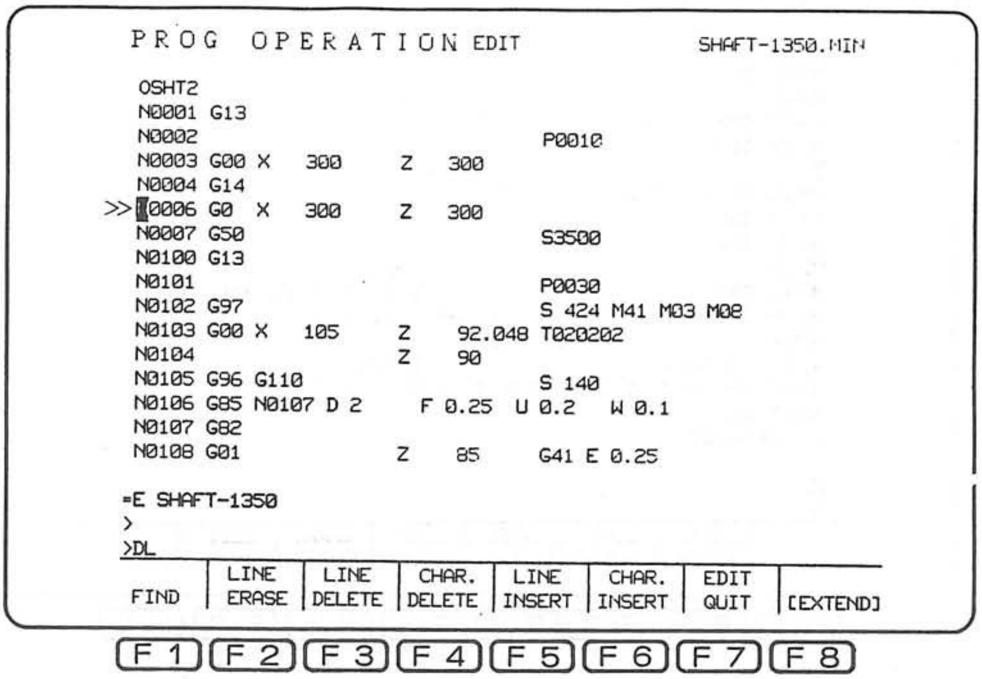
Pressing the function key [F3] (LINE DELETE) deletes one line of the data identified by ">>".

The lines after that shift up to fill the deleted line, and the first line of the next page is displayed at the bottom line.

The edit pointer (reverse display) moves to the first character of the next line.

Prompt "DL" appear on the console line of the CRT.

This operation is effective when deleting all the data in one line.



(8) Inserting line [F5] (LINE INSERT)

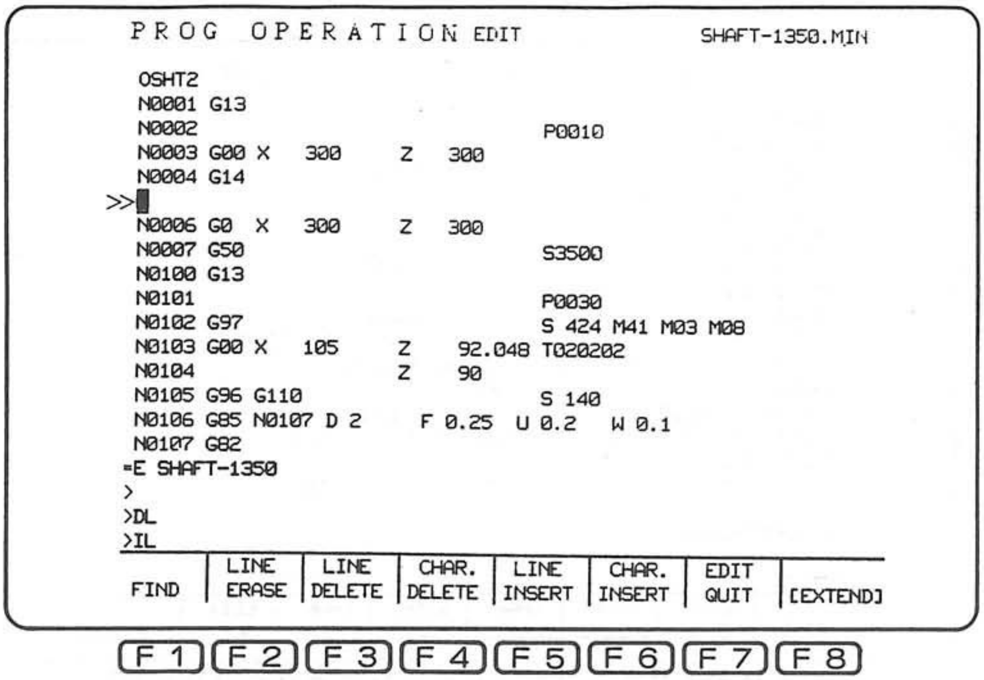
Pressing the function key [F5] (LINE INSERT) inserts a blank line right before the edit line identified by ">>".

Lines after that all shift downward and the line at the bottom of the CRT is transferred to the next page, thus disappearing from the display.

The edit pointer moves to the beginning of the blank line.

Prompt "IL" appear on the CRT.

This operation is effective when inserting a line.



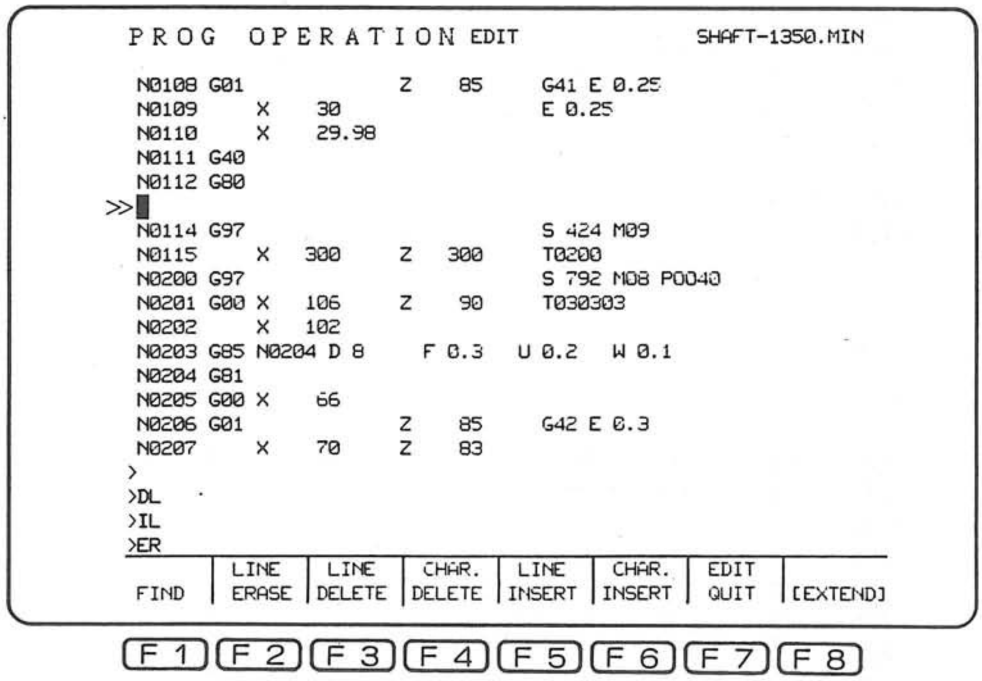
(9) Erasing line [F2] (LINE ERASE)

Pressing the function key [F2] (LINE ERASE) erases one line of the data, leaving a blank line.

The edit pointer is located at the beginning of that line.

Prompt "ER" appear on the console line of the CRT.

This operation is effective when erasing all the data in one line and adding another data in the same line.



4-2-2-2. Application of Fundamental Editing Operation

Provided in this paragraph are the explanations for actual editing operation, in which program data in Program A is edited in to Program B.

Program A

```
OGR1
NG13   G13
NØØ1   GØØ  X8ØØ  Z8ØØ  F.1   MØ4  M42  S25Ø  TØ1Ø1Ø1
NØØ2   G42  X2ØØ  Z1ØØ
NØØ3   GØ1        Z75
NØØ4        X225  Z5Ø
NØØ5   GØ3  X25Ø  Z2Ø   L2Ø
NØØ6   GØ2  X255  Z17.5 L2.5
NØØ7   GØ1        Z1Ø
NØØ8        X275
NØØ9   GØØ  X8ØØ  Z8ØØ
NØ1Ø                          MØ2
```

Program B

```
OGR1
NG13   G13              (a)
NØØ1   GØØ  X8ØØ  Z8ØØ  F.15  MØ4  M42  S25Ø  TØ1Ø1Ø1
NØØ2   G42  X2ØØ  Z1ØØ
NØØ3   GØ1        Z75
NØØ4        X225  Z5Ø
NØØ5   GØ3  X25Ø  Z2Ø   L2Ø
NØØ6   GØ1  X26Ø  Z15 (b)
NØØ7(c)           Z1Ø
NØØ8(d)G4Ø  X275
NØØ9   GØØ  X8ØØ  Z8ØØ
NØ1Ø                          MØ2
```

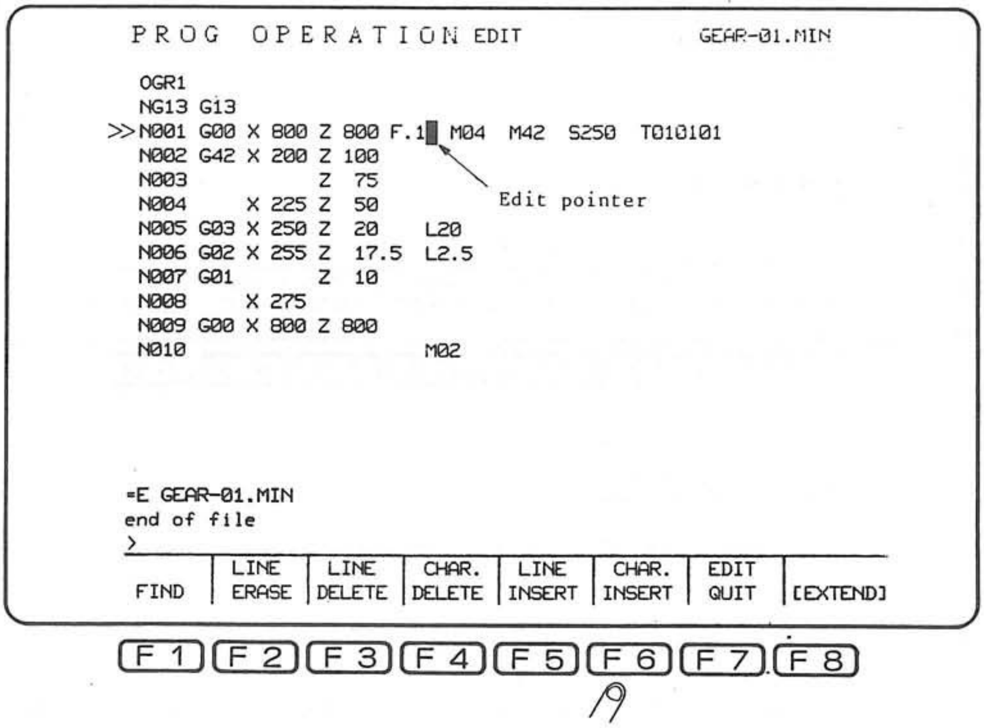
Correction is made on underlined commands in Program B; (a) through (d).

Follow the steps below:

<u>Correction of command (a):</u>

F.1" on NØØ1 line is to be corrected to "F.15".

1) Advance the edit pointer to the location after numeral "1" of "F.1".

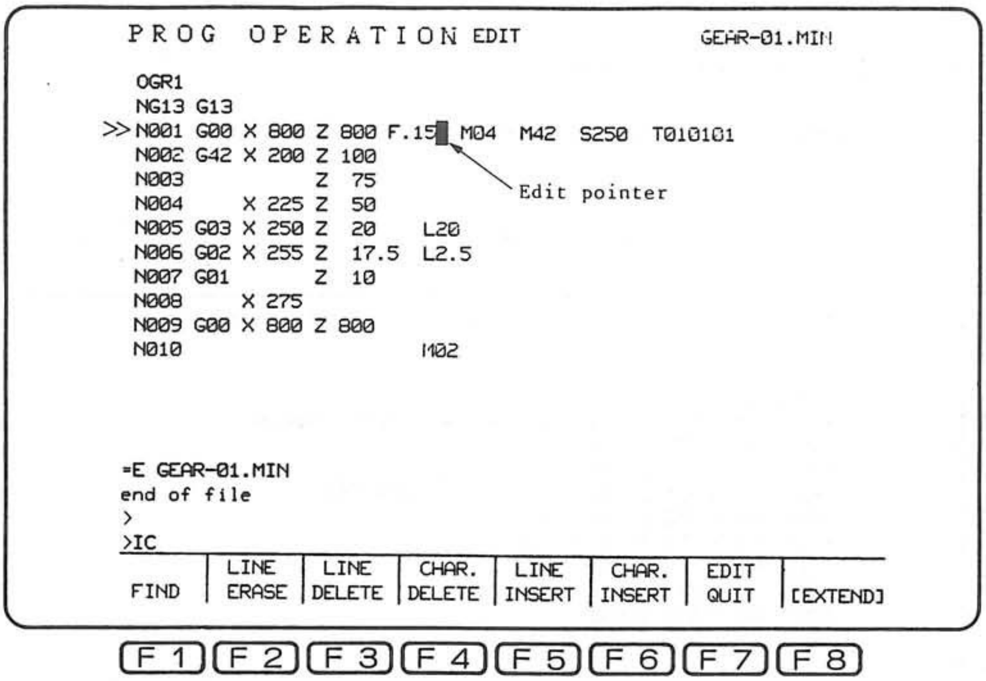


2) Press the function key [F6] (CHAR. INSERT).

This shifts all the commands after the edit pointer rightward by one character, leaving a space for the entry of numeral "5".

3) Press numeral key [5] on the keyboard.

Numeral "5" appears where edit pointer is located.

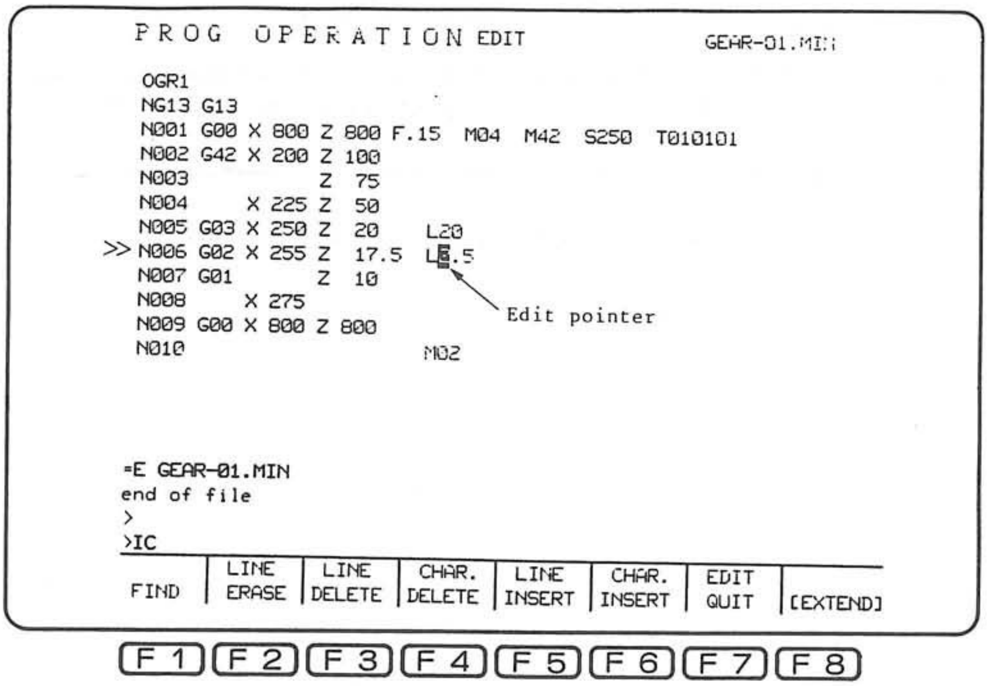


Correction of commands (b):

Commands on NØØ6 line are to be corrected.

1) Shift the edit pointer to NØØ6 line.

The edit pointer may be located at any character in NØØ6 line.



2) Press the function key [F2] (LINE ERASE).

The commands in NØØ6 line all disappear from the CRT and the edit pointer comes to the first character position of erased NØØ6 line.

```
PROG  OPERATION EDIT                       GEAR-01.MIN
 OGR1
 NG13 G13
 N001 G00 X 800 Z 800 F.15  M04  M42  S250  T010101
 N002 G42 X 200 Z 100
 N003           Z  75
 N004      X 225 Z  50
 N005 G03 X 250 Z  20    L20
>>█ ◄──────────────────────────── Edit pointer
 N007 G01       Z  10
 N008      X 275
 N009 G00 X 800 Z 800
 N010                    M02



end of file
>
>IC
>ER
      | LINE  | LINE   | CHAR.  | LINE   | CHAR.  | EDIT |
FIND  | ERASE | DELETE | DELETE | INSERT | INSERT | QUIT | [EXTEND]
```

[F 1] [F 2] [F 3] [F 4] [F 5] [F 6] [F 7] [F 8]

3) Key-in new data through the keyboard.

The new data is entered in the blank line.

```
PROG  OPERATION EDIT                       GEAR-01.MIN
 OGR1
 NG13 G13
 N001 G00 X 800 Z 800 F.15  M04  M42  S250  T010101
 N002 G42 X 200 Z 100
 N003           Z  75
 N004      X 225 Z  50
 N005 G03 X 250 Z  20    L20
>>N006 G01 X 260 Z  15█ ◄──── Edit pointer
 N007 G01       Z  10
 N008      X 275
 N009 G00 X 800 Z 800
 N010                    M02



end of file
>
>IC
>ER
      | LINE  | LINE   | CHAR.  | LINE   | CHAR.  | EDIT |
FIND  | ERASE | DELETE | DELETE | INSERT | INSERT | QUIT | [EXTEND]
```

[F 1] [F 2] [F 3] [F 4] [F 5] [F 6] [F 7] [F 8]

Deletion of command (c):

GØ1 in NØØ7 is to be deleted.

1) Shift the edit pointer to GØ1 in NØØ7 line.

```
PROG  OPERATION EDIT                    GEAR-01.MIN

 OGR1
 NG13 G13
 N001 G00 X 800 Z 600 F.15  M04  M42  S250  T010101
 N002 G42 X 200 Z 100
 N003           Z  75
 N004     X 225 Z  50
 N005 G03 X 250 Z  20     L20
 N006 G01 X 260 Z  15
>>N007 G01        Z  10
 N008     X 275
 N009 G00 X 800 Z 800
 N010                     M02
      Edit pointer

end of file
>
>IC
>ER
FIND | LINE  | LINE   | CHAR.  | LINE   | CHAR.  | EDIT | [EXTEND]
     | ERASE | DELETE | DELETE | INSERT | INSERT | QUIT |
```

F1 F2 F3 F4 F5 F6 F7 F8

2) Press the function key [F4] (CHAR. DELETE) three times to delete three characters.

This deletes "GØ1".

```
PROG  OPERATION EDIT                    GEAR-01.MIN

 OGR1
 NG13 G13
 N001 G00 X 800 Z 800 F.15  M04  M42  S250  T010101
 N002 G42 X 200 Z 100
 N003           Z  75
 N004     X 225 Z  50
 N005 G03 X 250 Z  20     L20
 N006 G01 X 260 Z  15
>>N007       Z  10 <------------ Display here changes.
 N008     X 275
 N009 G00 X 800 Z 800
 N010                     M02
      Edit pointer

>ER
>DC
>DC
>DC
FIND | LINE  | LINE   | CHAR.  | LINE   | CHAR.  | EDIT | [EXTEND]
     | ERASE | DELETE | DELETE | INSERT | INSERT | QUIT |
```

F1 F2 F3 F4 F5 F6 F7 F8

Pressing the SP key three times has the same effect; however, when a command is deleted with the SP key, commands following the deleted one are not shifted leftward. (Program B is this case.)

Addition of command (d):

G4Ø is to be added in NØØ8.

1) Shift the edit pointer to the space right after "NØØ8".

```
PROG  OPERATION EDIT                          GEAR-01.MIN

  OGR1
  NG13 G13
  N001 G00 X 800 Z 800 F.15  M04  M42  S250  T010101
  N002 G42 X 200 Z 100
  N003           Z  75
  N004     X 225 Z  50
  N005 G03 X 250 Z  20      L20
  N006 G01 X 260 Z  15
  N007         Z  10
>>N008 █   X 275
  N009 G00 X 800 Z 800
  N010                     M02



>ER
>DC
>DC
>DC
      | LINE  | LINE   | CHAR.  | LINE   | CHAR.  | EDIT |
 FIND | ERASE | DELETE | DELETE | INSERT | INSERT | QUIT | [EXTEND]
```

F 1 F 2 F 3 F 4 F 5 F 6 F 7 F 8

2) Key-in "G4Ø" through the keyboard.

"G4Ø" is entered from the position where the edit pointer is located.

```
PROG  OPERATION EDIT                          GEAR-01.MIN

  OGR1
  NG13 G13
  N001 G00 X 800 Z 800 F.15  M04  M42  S250  T010101
  N002 G42 X 200 Z 100
  N003           Z  75
  N004     X 225 Z  50
  N005 G03 X 250 Z  20      L20
  N006 G01 X 260 Z  15
  N007         Z  10
>>N008 G40█X 275
  N009 G00 X 800 Z 800
  N010                     M02



>ER
>DC
>DC
>DC
      | LINE  | LINE   | CHAR.  | LINE   | CHAR.  | EDIT |
 FIND | ERASE | DELETE | DELETE | INSERT | INSERT | QUIT | [EXTEND]
```

F 1 F 2 F 3 F 4 F 5 F 6 F 7 F 8

This completes the edition of Program A to Program B.
Press the function key [F7] (EDIT QUIT).

```
PROG  OPERATION EDIT

 OGR1
 NG13 G13
 N001 G00 X 800 Z 800 F.15  M04  M42  S250  T010101
 N002 G42 X 200 Z 100
 N003           Z  75
 N004     X 225 Z  50
 N005 G03 X 250 Z  20     L20
 N006 G01 X 260 Z  15
 N007         Z  10
>>N008 G40 X 275
 N009 G00 X 800 Z 800
 N010                  M02


>DC
>DC
>Q
■
DATE | DIR | PIP | EDIT | FREE | LIST | IGF | [EXTEND]
 F 1    F 2   F 3   F 4    F 5    F 6    F 7    F 8
```

4-2-2-3. Extended Function of Editing

This section deals with extended functions of editing. Read the instructions in this section only after fundamental editing procedures are well understood.

The explanation below is provided on the assumption that the function key [F8] (EXTEND) has been pressed.

```
PROG  OPERATION EDIT                     GEAR-01.MIN

>>GR1
  NG13 G13
  N001 G00 X 800 Z 800 F.15  M04  M42  S250  T010101
  N002 G42 X 200 Z 100
  N003           Z  75
  N004      X 225 Z  50
  N005 G03 X 250 Z  20     L20
  N006 G01 X 260 Z  15
  N007         Z  10
  N008 G40 X 275
  N009 G00 X 800 Z 800
  N010                     M02

=E GEAR-01.MIN
end of file
>
       | LINE  | LINE   | CHAR.  | LINE   | CHAR.  | EDIT |
  FIND | ERASE | DELETE | DELETE | INSERT | INSERT | QUIT | [EXTEND]

 F 1     F 2     F 3      F 4      F 5      F 6     F 7     F 8
```

Display of function line changes.

```
PROG  OPERATION EDIT                     GEAR-01.MIN

>>GR1
  NG13 G13
  N001 G00 X 800 Z 800 F.15  M04  M42  S250  T010101
  N002 G42 X 200 Z 100
  N003           Z  75
  N004      X 225 Z  50
  N005 G03 X 250 Z  20     L20
  N006 G01 X 260 Z  15
  N007         Z  10
  N008 G40 X 275
  N009 G00 X 800 Z 800
  N010                     M02

=E GEAR-01.MIN
end of file
>
>EX
       | LINE  | LINE   | CHAR.  | LINE   | CHAR.  | SEQ.NO. |
  FIND | ERASE | DELETE | DELETE | INSERT | INSERT | ARRANGE | [EXTEND]

 F 1     F 2     F 3      F 4      F 5      F 6     F 7     F 8
```

(1) Find [F1]

This function can search for the character-string or the block by specifying the desired character-string or by specifying the desired blocks in terms of the number of lines from the present edit line.

a) Searching for character-string

The character-string specified by pressing the keyboard is searched for from the character after the one identified by the edit pointer.

When the specified character-string is searched for, the edit pointer is located at its first character.

When specifying a character-string, it is necessary to enclose it by the same character other than the characters appearing in the specified character-string and those specified below:

+, -, ', ;, :, Ø through 9, space

Example: /GØ2/

"?" in the character-string to be designated is used to indicate one arbitrary character.

Example: /N?Ø1/

With this, the control searches for three digits N word consisting of "Ø1" at its lower two digits.

Once the required character-string is specified, the control performs the searching operation each time [F1] (FIND) and WRITE keys are pressed.

"@" in the character-string to be designated is used to indicate one character except numerical characters and decimal point.

Example: F␣/X1Ø@/

This allows the search of "X1Ø" in such as "X1ØZ1Ø".

Compare with the following commands:

F␣/X1Ø/ ..... This searches X1ØØ and X1Ø.5 also.

F␣/X1Ø␣/ ... Search of "X1Ø" in "X1ØZ1Ø" is impossible.

Once the character-string is designated, its search is activated each time [F1] (FIND) and WRITE are pressed.

When spaces are placed before character-string, these spaces are handled as characters.

Example: To search X␣␣␣3Ø,

/X␣␣␣3Ø/

When searching for "4Ø" from the program shown on the previous page:

Key-in "/4Ø/" through the keyboard.

↓

Press the WRITE key.

↓

```
PROG  OPERATION EDIT                    GEAR-01.MIN

OGR1
NG13 G13
N001 G00 X 800 Z 800 F.15  M04  M42  S250  T010101
N002 G42 X 200 Z 100
N003           Z  75
N004     X 225 Z  50
N005 G03 X 250 Z  20     L20
>> N006 G01 X 260 Z  15
N007         Z  10
N008 G40 X 275
N009 G00 X 800 Z 800
N010                      M02


>EX
>F /40/
end of file
begin of file
FIND | CHANGE | DELETE | COPY | MOVE | EXTRACT | SEQ.NO. ARRANGE | [EXTEND]
```

(F 1) (F 2) (F 3) (F 4) (F 5) (F 6) (F 7) (F 8)

b) Searching for the required block by specifying the number of lines.

">>" moves from the present edit line as much as the specified number of lines.

The CRT display changes so that the line searched for is displayed at the first line of the display.

When the specified number is so large as to exceed the final line of the file, the edit pointer is located at the line right after the final line of the file. In this case, the program of 15 lines from the last line (block) is displayed on the CRT with the last line at the bottom, and the message "end of file" appears on the console line of the CRT.

When a negative number is specified, the edit line shifts backward by the specified number of lines, and the edit pointer is located at the first character of the new edit line. When a negative number to pass the first line of the file is specified, the edit pointer is located at the first character of the file. The CRT then displays the message "begin of file" on the console line.

When specifying the fifth block from the edit line:

```
PROG  OPERATION EDIT                              GEAR-01.MIN

>>OGR1
  NG13 G13
  N001 G00 X 800 Z 800 F.15  M04  M42  S250  T010101
  N002 G42 X 200 Z 100
  N003           Z  75
  N004     X 225 Z  50
  N005 G03 X 250 Z  20     L20
  N006 G01 X 260 Z  15
  N007        Z  10
  N008 G40 X 275
  N009 G00 X 800 Z 800
  N010                     M02

=E GEAR-01.MIN
end of file
>
>F 5_
         LINE   LINE    CHAR.   LINE    CHAR.   EDIT
FIND     ERASE  DELETE  DELETE  INSERT  INSERT  QUIT   [EXTEND]
```

[F 1] [F 2] [F 3] [F 4] [F 5] [F 6] [F 7] [F 8]

Key-in "5" through the keyboard.

Press the WRITE key.

```
PROG  OPERATION EDIT                              GEAR-01.MIN

  OGR1
  NG13 G13
  N001 G00 X 800 Z 800 F.15  M04  M42  S250  T010101
  N002 G42 X 200 Z 100
  N003           Z  75
>>N004     X 225 Z  50
  N005 G03 X 250 Z  20     L20
  N006 G01 X 260 Z  15
  N007        Z  10
  N008 G40 X 275
  N009 G00 X 800 Z 800
  N010                     M02

>
>F 5
end of file
begin of file
         LINE   LINE    CHAR.   LINE    CHAR.   EDIT
FIND     ERASE  DELETE  DELETE  INSERT  INSERT  QUIT   [EXTEND]
```

[F 1] [F 2] [F 3] [F 4] [F 5] [F 6] [F 7] [F 8]

(2) Change [F2]

This function permits the operator to replace a command (character-string) with another command (character-string) by keying-in those through the keyboard.

The edit pointer is located at the first character of the new character-string.

When the specified character-string cannot be found within the file, the message "string not found" appears on the console line of the CRT and the edit pointer does not move.

Enclose the character-string in the same manner as explained in (2) Find.

Character "?" can also be used in the same manner as in "find" operation.

If several character-strings identical to the specified character-string to be changed are in a program, the change of the character-string may be performed simply be pressing [F2] (CHANGE) and WRITE keys.

Note: ;A option specification

If ";A" option is designated, global search and replace of the character-string is possible.

After keying in the character-strings, key in "A" (ALL) preceded by delimiter ";".

Example: >C /S175Ø/S16ØØ/;A [WRITE]

With the input as indicated above, all the designated character-strings are replaced with the designated one in the area from the word on which the edit pointer is located up to the end of the file.

After the completion of replacement, the total number of character-strings which have been replaced is displayed at the CRT as indicated below.

**** change

When changing "S175Ø" in NØØ3 to "S16ØØ":

```
PROG OPERATION EDIT                          GEAR-01.MIN

>>OGR1
  NG13 G13
  N001 G00 X 800 Z 800 F.15  M04  M42  S250  T010101
  N002 G42 X 200 Z 100
  N003           Z  75    S1750
  N004       X 225 Z  50
  N005 G03 X 250 Z  20    L20
  N006 G01 X 260 Z  15
  N007         Z  10
  N008 G40 X 275
  N009 G00 X 800 Z 800
  N010                    M02



>EX
>EX
>EX
>C /S1750/S1600/
                                               SEQ.NO.
FIND  CHANGE  DELETE  COPY  MOVE  EXTRACT  ARRANGE  [EXTEND]
```

[F 1] [F 2] [F 3] [F 4] [F 5] [F 6] [F 7] [F 8]

Key-in "/S175Ø/S16ØØ" through the keyboard.

Press the WRITE key.

```
PROG OPERATION EDIT                          GEAR-01.MIN

  OGR1
  NG13 G13
  N001 G00 X 800 Z 800 F.15  M04  M42  S250  T010101
  N002 G42 X 200 Z 100
>>N003           Z  75    S1600
  N004       X 225 Z  50
  N005 G03 X 250 Z  20    L20
  N006 G01 X 260 Z  15
  N007         Z  10
  N008 G40 X 275
  N009 G00 X 800 Z 800
  N010                    M02



>EX
>C /S1750/S1600/
end of file
begin of file
                                               SEQ.NO.
FIND  CHANGE  DELETE  COPY  MOVE  EXTRACT  ARRANGE  [EXTEND]
```

[F 1] [F 2] [F 3] [F 4] [F 5] [F 6] [F 7] [F 8]

(3) Delete [F3]

After pressing function key [F3] (DELETE), enter the required number of lines to be deleted from the keyboard. This deletes the specified number of lines of the program data from the line identified by ">>".

The edit pointer is located at the first character of the line right after the deleted lines.

If the specified number of lines to be deleted is so large as to exceed the final line of that file, all the data up to the final line is deleted. ">>" symbol indicates the edit line is located in the line right after the final line of the file. Message "end of file" appears on the console line of the CRT.

After the deletion, the number of deleted lines is indicated on the console line of the CRT as "** record deleted".

When the lines are deleted, those following them are shifted upward to fill the deleted blank lines.

[F3] (DELETE) -8 [WRITE]

This deletes eight lines before the edit line (edit line is not deleted.).

[F3] (DELETE) [WRITE]

This deletes only the edit line.

To delete two lines (blocks) from NØØ6 to NØØ7:

Locate the cursor to the sequence number NØØ6.

```
PROG OPERATION EDIT                          GEAR-01.MIN
 OGR1
 NG13 G13
 N001 G00 X 800 Z 800 F.15  M04  M42  S250  T010101
 N002 G42 X 200 Z 100
 N003           Z  75     S1600
 N004     X 225 Z  50
 N005 G03 X 250 Z  20     L20
>>N006 G01 X 260 Z  15
 N007           Z  10
 N008 G40 X 275
 N009 G00 X 800 Z 800
 N010                     M02

>EX
>EX
>EX
>DEL 2
FIND | CHANGE | DELETE | COPY | MOVE | EXTRACT | SEQ.NO. ARRANGE | [EXTEND]
```

F 1 F 2 F 3 F 4 F 5 F 6 F 7 F 8

Key-in "2" through the keyboard.

Press the WRITE key.

The console line of the CRT displays the following:

```
PROG OPERATION EDIT                          GEAR-01.MIN
 OGR1
 NG13 G13
 N001 G00 X 800 Z 800 F.15  M04  M42  S250  T010101
 N002 G42 X 200 Z 100
 N003           Z  75     S1600
 N004     X 225 Z  50
 N005 G03 X 250 Z  20     L20
>>N008 G40 X 275
 N009 G00 X 800 Z 800
 N010                     M02

>DEL 2
   2 record deleted
end of file
begin of file
FIND | CHANGE | DELETE | COPY | MOVE | EXTRACT | SEQ.NO. ARRANGE | [EXTEND]
```

F 1 F 2 F 3 F 4 F 5 F 6 F 7 F 8

(4) Copy [F4]

This function permits the operator to copy (duplicate) the data in the specified number of blocks to another memory area.

The commands in the specified number of lines (blocks) from the edit line identified by ">>" (edit line included) are duplicated in another area of the memory.

The edit pointer shifts to the first character of the line following the duplicated blocks.

The data already stored in the area where the data is duplicated is deleted.

When the number of lines specified is so large as to exceed the final line of the file, commands up to the final line of the file are duplicated.

When a negative number is specified, blocks before the edit line (excluding the edit line) are duplicated. If the specified number exceeds the first block of the file, the data up to the first block of the file is duplicated.

Pressing the WRITE key after pressing the function key [F4] (COPY) without keying-in the numeral data, duplicates the present edit line.

If the volume of the data to be duplicated is larger than the available capacity of the area for data duplication, the message "extract buffer overflow" appears on the CRT, and duplication of the data is not performed.

The data saved in the extract buffer by the copy operation can be inserted at any required location in a program by pressing the function key [F6] (EXTRACT). See (6) Extract [F6].

When duplicating blocks from NØØ6 through NØØ7:

Locate the cursor to the sequence number NØØ6.

```
PROG OPERATION EDIT                              GEAR-01.MIN

OGR1
NG13 G13
N001 G00 X 800 Z 800 F.15  M04  M42  S250  T010101
N002 G42 X 200 Z 100
N003           Z  75    S1600
N004     X 225 Z  50
N005 G03 X 250 Z  20    L20
>>N006 G01 X 260 Z  15
N007           Z  10
N008 G40 X 275
N009 G00 X 800 Z 800
N010                    M02

>EX
>EX
>EX
>CO 2_
FIND | CHANGE | DELETE | COPY | MOVE | EXTRACT | SEQ.NO. ARRANGE | [EXTEND]
```

F1 F2 F3 F4 F5 F6 F7 F8

Key-in "2" through the keyboard.

Press the WRITE key.

```
PROG OPERATION EDIT                              GEAR-01.MIN

OGR1
NG13 G13
N001 G00 X 800 Z 800 F.15  M04  M42  S250  T010101
N002 G42 X 200 Z 100
N003           Z  75    S1600
N004     X 225 Z  50
N005 G03 X 250 Z  20    L20
N006 G01 X 260 Z  15
N007           Z  10
>>N008 G40 X 275
N009 G00 X 800 Z 800
N010                    M02

>EX
>CO 2
end of file
begin of file
FIND | CHANGE | DELETE | COPY | MOVE | EXTRACT | SEQ.NO. ARRANGE | [EXTEND]
```

F1 F2 F3 F4 F5 F6 F7 F8

(5) Move [F5]

This function permits the operator to transfer the data in the specified number of blocks from the editing area.

The commands in the specified number of lines (blocks) from the edit line identified by ">>" (edit line included) are transferred from the editing area.

The lines of those transferred blocks are deleted.

The edit pointer shifts to the first character of the line following the transferred blocks.

The data already stored in the area where the transferred data is stored is deleted.

When the number of lines specified is so large as to exceed the final line of the file, commands up to the final line of the file are transferred.

After the completion of transfer, the message "** record deleted" appears on the console line of the CRT.

When a negative number is specified, blocks before the edit line (excluding the edit line) are transferred. If the specified number exceeds the first block of the file, the data up to the first block of the file is transferred.

If the volume of the data to be transferred is larger than the available capacity of the area for data transfer, the message "extract buffer overflow" appears on the CRT, and the transfer of the data is not performed.

Pressing the WRITE key after pressing the function key [F5] (MOVE) without keying-in the numeral data, transfers the present edit line.

The data saved in the extract buffer by the move operation can be inserted at any required location in a program by pressing the function key [F6] (EXTRACT). See (6) Extract.

When transferring blocks NØØ6 through NØØ7:

Locate the cursor to the sequence number NØØ6.

```
PROG  OPERATION EDIT                          GEAR-01.MIN

OGR1
NG13 G13
N001 G00 X 800 Z 800 F.15  M04  M42  S250  T010101
N002 G42 X 200 Z 100
N003           Z  75     S1600
N004     X 225 Z  50
N005 G03 X 250 Z  20     L20
>>N006 G01 X 260 Z  15
N007           Z  10
N008 G40 X 275
N009 G00 X 800 Z 800
N010                     M02


>CO 2
end of file
begin of file
>M 2_
                                                      SEQ.NO.
FIND | CHANGE | DELETE | COPY | MOVE | EXTRACT | ARRANGE | [EXTEND]
```

F 1 | F 2 | F 3 | F 4 | F 5 | F 6 | F 7 | F 8

Key-in "2" through the keyboard.

Press the WRITE key.

The console line of the CRT displays the following:

```
PROG  OPERATION EDIT                          GEAR-01.MIN

OGR1
NG13 G13
N001 G00 X 800 Z 800 F.15  M04  M42  S250  T010101
N002 G42 X 200 Z 100
N003           Z  75     S1600
N004     X 225 Z  50
N005 G03 X 250 Z  20     L20
>>N008 G40 X 275
N009 G00 X 800 Z 800
N010                     M02


>M 2
    2 record deleted
end of file
begin of file
                                                      SEQ.NO.
FIND | CHANGE | DELETE | COPY | MOVE | EXTRACT | ARRANGE | [EXTEND]
```

F 1 | F 2 | F 3 | F 4 | F 5 | F 6 | F 7 | F 8

(6) Extract [F6]

This function permits the operator to insert the data stored in another memory area to the line before the one preceded by the edit line indicator ">>" each time WRITE key is pressed.

Data stored in another memory area is inserted in to the line(s) before the present edit line.

When the insertion of the data stored in another memory area is performed, that data is not cleared.

Position of the edit pointer does not change.

If no data is stored in another memory area when insertion is intended, the CRT displays the message "extract buffer empty" and insertion is not performed.

To delete the data stored in another memory area, perform as follows:

[F6] (EXTRACT); C [WRITE]

File data is not changed.

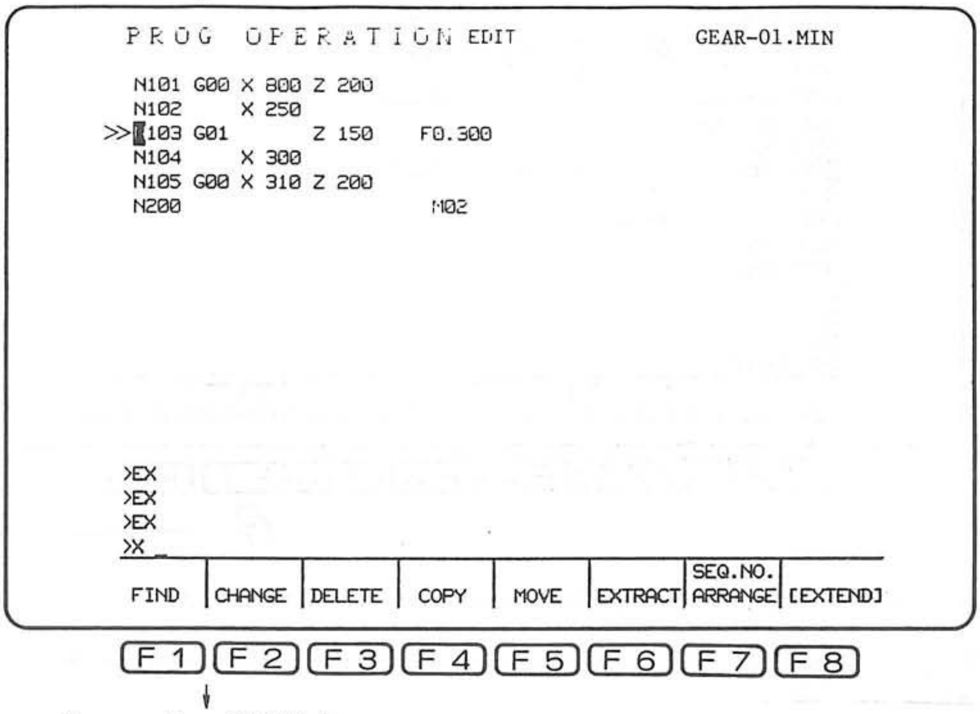
When inserting two blocks of data in another memory area before N1Ø3:

(Another memory data)

```
N111                Z19Ø
N112  GØ1  X22Ø            FØ.4ØØ
```

```
  N1Ø1  GØØ  X8ØØ  Z2ØØ
  N1Ø2       X25Ø
>>N1Ø3  GØ1        Z15Ø  FØ.3ØØ
  N1Ø4       X3ØØ
  N1Ø5  GØØ  X31Ø  Z2ØØ
```

Locate ">>" to N1Ø3 with the cursor control keys.



Press the WRITE key.

```
N1Ø1  GØØ  X8ØØ  Z2ØØ
N1Ø2       X25Ø
N111             Z19Ø
N112  GØ1  X22Ø        FØ.4ØØ
N1Ø3  GØ1        Z15Ø  FØ.3ØØ
N1Ø4       X3ØØ
N1Ø5  GØØ  X31Ø  Z2ØØ
```

(7) Sequence Number Arrange [F7]

This function rearranges the sequence numbers of the program after the completion of editing. Pressing the function key [F7] (SEQ. NO. ARRANGE) begins this function.

1) Designate the first line of the sequence number rearrangement operation by the edit pointer (>>).

In this example, the sequence numbers from N227 is rearranged.

2) Press the function key [F7] (SEQ. NO. ARRANGE).

The prompt ">AR" will appear on the console line.

```
PROG OPERATION EDIT                              SHAFT-1350.MIN

 N212                              M09
 N213               Z    92.048
 N214     X   300   Z   300        T0400
 N215 G13
 N216                              P0050
 N217 G97                          S 716 M08
 N218 G00 X    80   Z    92.048 T050505
 N219               Z    90
 N220 G96 G110                     S 180
 N221 G87 N0407
 N222 G82
>>N223 G01          Z    85        G41 F 0.2
 N224     X    40
 N225     X    39.98
 N226 G40
 N227 G80
>EX
>EX
>EX
>AR 300,10
                                                       SEQ.NO.
FIND | CHANGE | DELETE | COPY | MOVE | EXTRACT | ARRANGE | [EXTEND]

 F1      F2       F3      F4     F5      F6        F7       F8
```

3) Key in the starting sequence number and increments.

In this example, the new sequence number starts from "N3ØØ" in increments of "1Ø".

If the sequence number increment value is omitted, it indicates "1".

4) Press the WRITE key.

This assigns the new sequence numbers to the program from N3ØØ up to the program end sequence (MØ2, M3Ø, RTS).

```
PROG  OPERATION EDIT                               SHAFT-1350.MIN

N212                                  M09
N213                   Z    92.048
N214     X    300      Z   300        T0400
N215 G13
N216                                  P0050
N217 G97                              S 716 M08
N218 G00 X     80      Z    92.048 T050505
N219                   Z    90
N220 G96 G110                         S 180
N221 G87 N0407
N222 G82
>>N300 G01             Z    85        G41 F 0.2
N310     X     40
N320     X     39.98
N330 G40
N340 G80
>EX
>EX
>AR 300,10
end of file
                                                     SEQ.NO.
FIND  | CHANGE | DELETE | COPY | MOVE | EXTRACT | ARRANGE | [EXTEND]

 F 1     F 2      F 3     F 4    F 5     F 6       F 7       F 8
```

Note 1: Destination sequences of GOTO and IF statements and LAP shape definition sequences should be assigned with sequence name. This arrangement operation does not change sequence names.

Note 2: Spaces, tabs, slashes placed in front of and after the previous sequence number are all left as they were specified.

Note 3: Previous sequence names must not be preceded any characters other than space, tab and slash.

Note 4: Sequences assigned with neither sequence number nor sequence name are newly assigned with sequence numbers.

Sequences in the program name and within control OUT area are not assigned with sequence numbers.

Note 5: If the sequence located by the edit pointer is assigned with the sequence name, sequence numbers are rearranged from the sequence assigned with a sequence number and appearing first after the sequence located by the edit pointer.

Note 6: If sequence number reaches a five digit number, an alarm occurs and sequence number rearrange is not effective for those which are to be assigned with five digit sequence numbers.

Note 7: Leading zeros in sequence numbers should be suppressed.

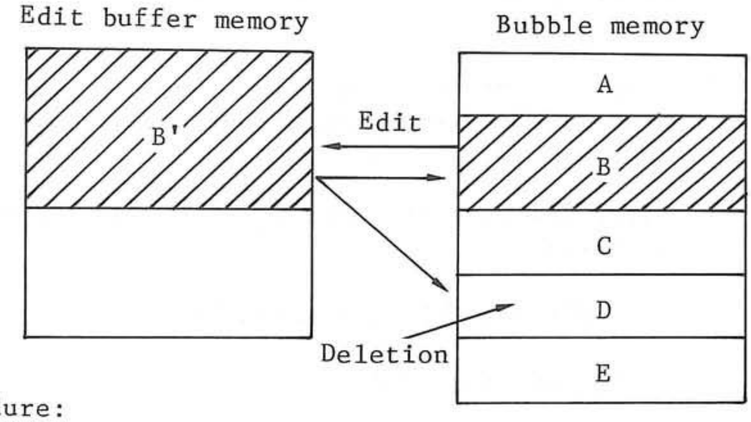
Note 8: Rearrangement of sequence numbers is carried out in units of programs. In other words, sequence numbers are rearranged only up to the sequence containing MØ2, M2, M3Ø or RTS.

Note 9: For the line beginning with the symbol "&", sequence number is not assigned because such a line is the interpreted as the line continuing from the previous line.

(8) Restoration and preserving of edit data

Outline:

This function is useful when there is no area to store the edited program after finishing program edit. First, save the edited program in memory and then secure blank area in the bubble memory. Thus the temporarily saved program can be stored in the bubble memory.



Procedure:

1) When completing program editing by pressing the function key [F7] (EDIT QUIT), if the bubble memory is full, "2154 SAT full" is displayed on the console line and editing cannot be completed.

2) Press the function key [F7] (EDIT QUIT) to save it in memory. Then "edit buffer restore" is displayed and editing can be completed temporarily.

3) Secure blank area by deleting unnecessary data in the bubble memory.

4) Press [F4] (EDIT) again and input the file name. Then input the option code R and press WRITE.

   =E␣(file-name);R [WRITE]

   "edit buffer preserve" is displayed and the editing operation of 1) can be continued.

5) Press the function key [F7] (EDIT QUIT) and store the data saved in memory in the bubble memory.

Note 1: When floppy input/output function (optional) is selected, the same procedure should be taken for the files on the floppy disk.

Note 2: After finishing editing with "edit data store", turning off power or execution of tape convert, IGF or IGF convert erases the saved data. When proceeding with the next operation after editing, be sure to delete unnecessary file and store the edited data in the bubble memory.

(9) Other extended functions

By modifying one portion of a program already stored in the bubble memory, such as outside diameter, cutting conditions or other, a new main program can be created on that base without affecting the previous program.

Follow the steps below:

Assume the program file name is "SHAFT-135Ø.MIN".

1) Since the program above must not be changed, assign a new file name for the newly created program. (Let the new file name be "SHAFT-135Ø-1.MIN".)

2) After pressing the function key [F4] (EDIT), key in as follows:

   SHAFT-135Ø.MIN, SHAFT-135Ø-1.MIN

3) Press the WRITE key.

   This creates a new file name, SHAFT-135Ø-1.MIN. If the bubble already contains a file named SHAFT-135Ø-1.MIN, the message "file exist overwrite (Y/N)!" appears on the console line of the CRT.

   Pressing [Y] and WRITE keys deletes the previous file data.

4) After editing the necessary data, press the function key [F7] (EDIT QUIT) to indicate the completion of editing.

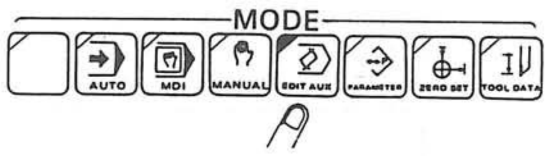
With the steps above, a new program is created with the name SHAFT-135Ø-1. MIN: select this program in AUTO mode and carry out machining with those commands.

4-2-3. Other Program Operation Functions

(1) Entry of File Generating Date

When a new file is registered, or when the program tape with a new file name is read, it is stored in the bubble memory with the assigned date. Therefore, it is necessary to enter the date of program entry without fail. If no date is entered, the date determined by the system is entered.

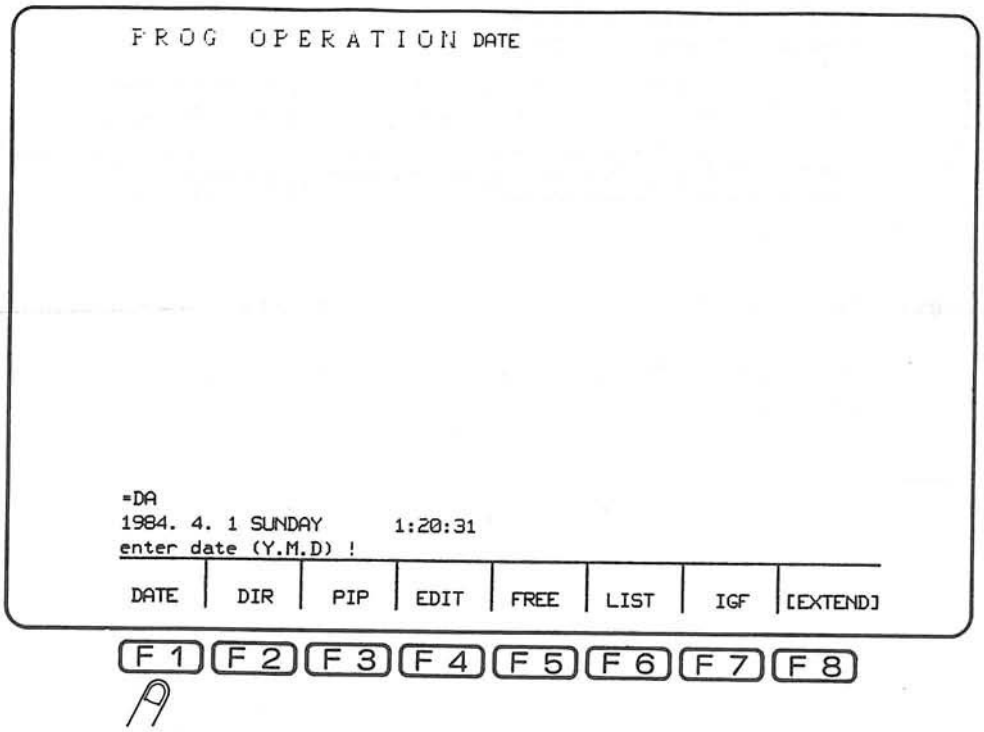
1) Select the PROG OPERATION mode by pressing the EDIT AUX key.



2) Press the function key [F1] (DATE).

The message below appears on the console line of the CRT, and the control is ready for date entry.

=DA
1984.4.1 SUNDAY 1:2Ø:31
enter date (Y.M.D)!



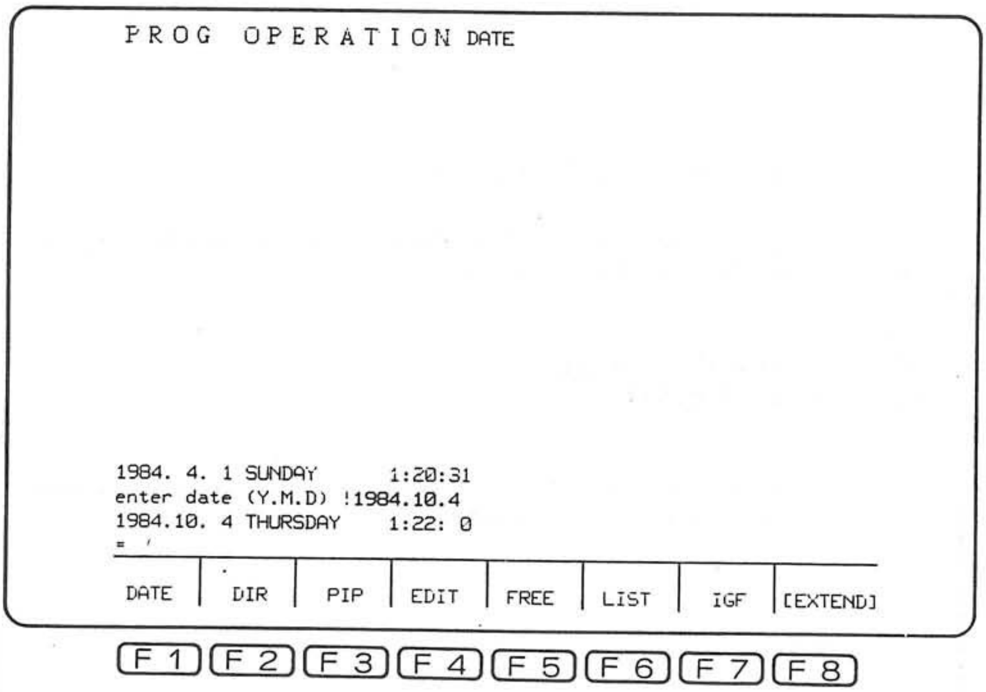
3) Through the keyboard, enter "year", "month" and "day" in that order each separated by a period from each other.

Example: 1984.1Ø.4

4) Press the WRITE key.

When the entered data is correct, the CRT shows the entered date along with a day of the week.

If the data entered is not correct, the control requires the data again.



Notes: To enter the year, the lower two digits data is acceptable.

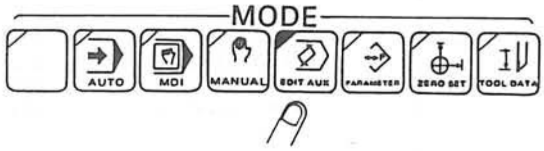
When the WRITE key is pressed without data entry, no display is obtained.

(2) Display of File Names

The operator can check the files stored in the bubble memory by making the CRT display them as a list. The list shows the file names, how each file uses the memory, and the registered date.

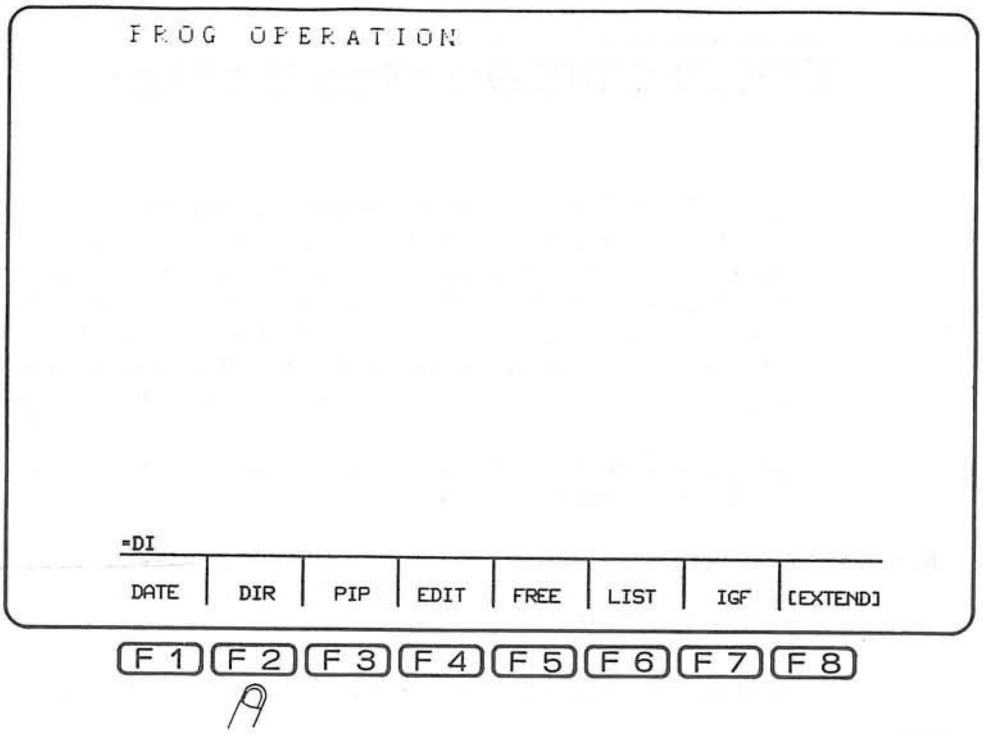
Follow the steps below:

1) Select the PROG OPERATION mode by pressing the EDIT AUX key.

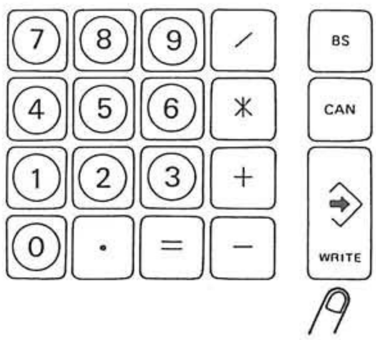


2) Press the function key [F2] (DIR).

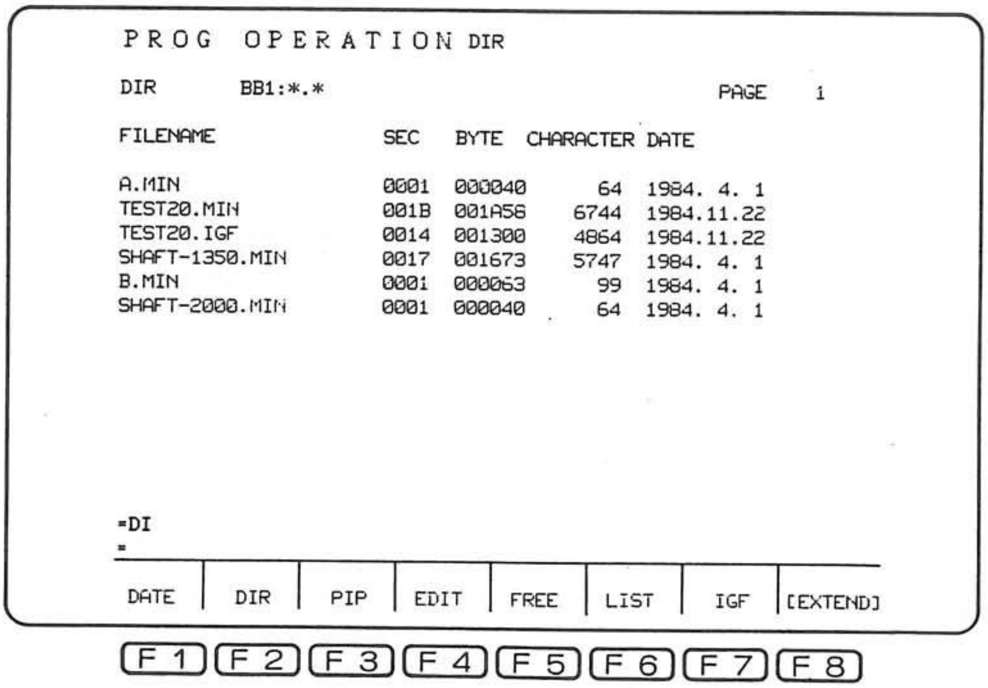
"DI" appears on the console line of the CRT.



3) Press the WRITE key.



4) The CRT shows the list of files.



Note 1: Up to 12 files can be displayed on one CRT display. If all the files cannot be shown on one CRT display, "=" symbol indicating the control is waiting for next instruction does not appear and the cursor remains still. In this case, press either the BS or the WRITE key. The BS key is used to turn the display page forward. The WRITE key turns pages continuously up to the end of the file display.

Note 2: When the bubble has no file, the CRT shows the message "file not found".

Note 3: The operator can check whether the required file is stored in the bubble memory or not, by entering the file name following "DI".

There, "*" and "?" can be used to enter the file name:

* : Arbitrary character-string (can be used only once in file name and extended name)

? : Arbitrary one character

Therefore, designating a file name containing "*" and "?" can produce a list showing the file names related to the entered data.

Example 1:

```
=DI *MIN.  [WRITE]
```

All the files assigned with extention MIN. are displayed.

Example 2:

```
=DI SHAFT*.MIN  [WRITE]
```

All the files beginning with SHAFT and having extension MIN are displayed.

Example 3:

```
=DI *.*  [WRITE]
```

All the files are displayed. This data entry has the same effect as if no data is entered for file name display.

Example 4:

```
=DI  ???.SUB  [WRITE]
```

All the files having a file name with less than three characters and possessing the extension SUB are displayed.

Example 5:

```
=DI SHAFT-1???.*  [WRITE]
```

All the files with a file name that begins with SHAFT-1 and suffixed by up to three characters are displayed.

Note 4: Option C function

Writing in of ;P following the depression of the function key [F2] will result in a protect status display for each file.

```
=DI;P  [WRITE]
```

With the operation above, the display will show the date followed by a code:

ØØ = File not protected
Ø1 = File protected

(3) Display of Available Memory Capacity

On OSP500/5000L-G, it has the capacity to store program data up to 30 meter tape long. However, the available capacity area decreases as files are stored. The control has the feature to show the remaining available memory capacity.

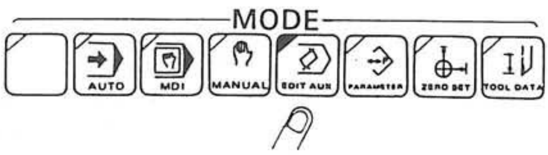
The display is obtained in "sectors" and "bytes": those two expressions have the same character and have the relation shown below.

Number of bytes = Number of sectors x 252

One byte corresponds to one character. Since data is stored in the memory in the unit of a sector, data comprising only one or two characters occupy one sector. When the data comprises 253 characters, 252 characters occupy one sector and the last 253rd character occupies one sector.

Note that the bubble memory stores the data file name and others in addition to program data; actual available capacity might be smaller than the capacity expressed in the number of bytes.

1) Select the PROG OPERATION mode by pressing the EDIT AUX key.



2) Press the function key [F5] (FREE).

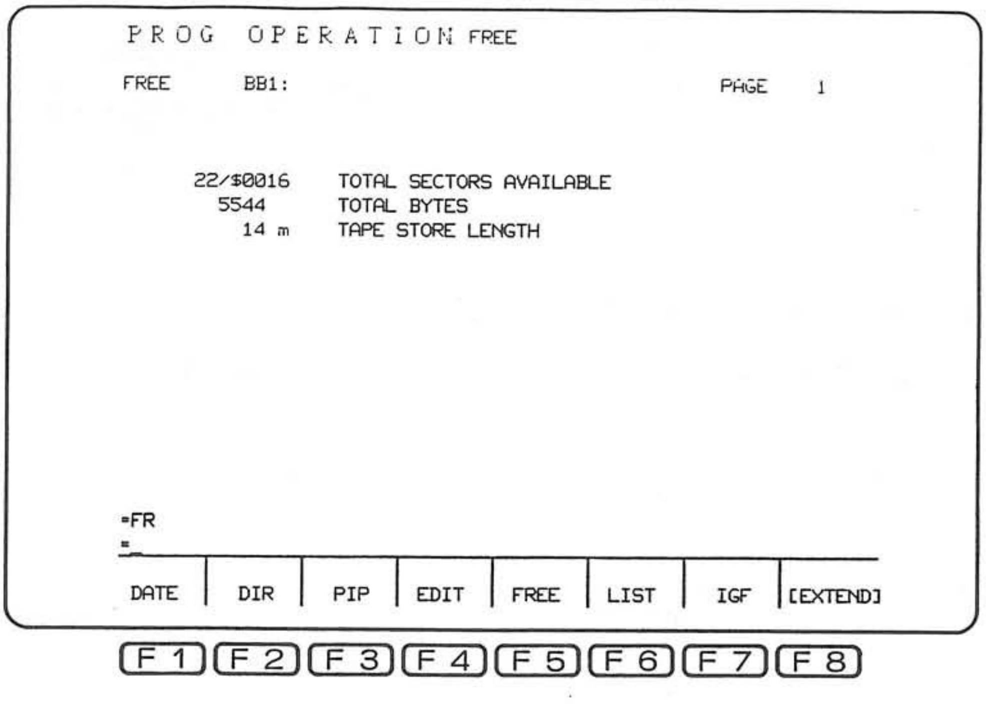
Prompt "FR" appears on the console line of the CRT.

Option code ";C" following the FR command is used to display the contiguous available sectors and bytes.

3) Press the WRITE key.

Now, the CRT displays the remaining capacity of the memory.

22/\$ØØ16 TOTAL SECTORS AVAILABLE
5544 TOTAL BYTES

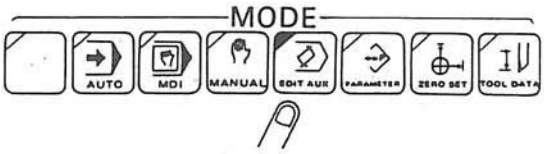


Note: \$ØØ16 is hexadecimal notation of "22".
22 = 16 x 1 + 6.

(4) Listing Specified File

As explained in (2), file names can be checked using the function key [F2] (DIR). However, the contents of the files cannot be checked. This paragraph deals with the method used to check the contents of the file.

1) Select the PROG OPERATION mode by pressing the EDIT AUX key.



2) Press the function key [F6] (LIST).

The CRT displays "=L" on the console line of the CRT.

3) Enter the file name directly following "=L".

Example:

=L␣<u>SHAFT-1.MIN</u> ← Entered file name

4) Press the WRITE key.

This displays the contents of file SHAFT-1.MIN on the CRT.

```
PROG  OPERATION LIST
LIST      BB1:SHAFT-1.MIN                         PAGE   1


OSHT1
N0001 G13
N0002                          P0010
N0003 G00 X   300   Z   300
N0004 G14
N0006 G0  X   300   Z   300
N0007 G50                      S3500
N0100 G13
N0101                          P0030
N0102 G97                      S 424 M41 M03 M08
N0103 G00 X   105   Z    92.048 T020202
N0104               Z    90


=L SHAFT-1.MIN
DATE | DIR | PIP | EDIT | FREE | LIST | IGF | [EXTEND]
```

F 1 F 2 F 3 F 4 F 5 F 6 F 7 F 8

Note 1: Up to 12 lines can be displayed on one CRT display. If all the contents cannot be shown on one CRT display, "=" symbol indicating the control is waiting for the next instruction does not appear and the cursor remains. In this case, press either the BS or the WRITE key. The BS key is used to turn the display page forward. The WRITE key turns pages continuously up to the end of the file display.

Note 2: When the file name following "=L␣" is omitted, contents of file A.MIN are displayed.

That is, " =L␣, [WRITE]"
= " =L␣,A.MIN [WRITE]"

Note 3: The operator can specify the device name used for output.

The type of output device and corresponding code are as follows:

CRT screen .... PN:
Printer (optional)* .... PR:
Printer (optional)** .... CNØ: - CN4:

* Printer connected through the data board Centronics interface

** Printer connected through RS232C interface

CNØ: .... RS232C interface on main card 3
CN1: - CN4: ..... RS232C interface on RS board

To specify the output device, use a delimiter "," before the output device code and use ":" after it.

When no output device name is specified, the data is displayed on the CRT.

Example 1:

=L␣,PR: [WRITE]

Contents of A.MIN are output on the printer.

Example 2:

=L␣SHAFT-1.MIN,CNØ: [WRITE]

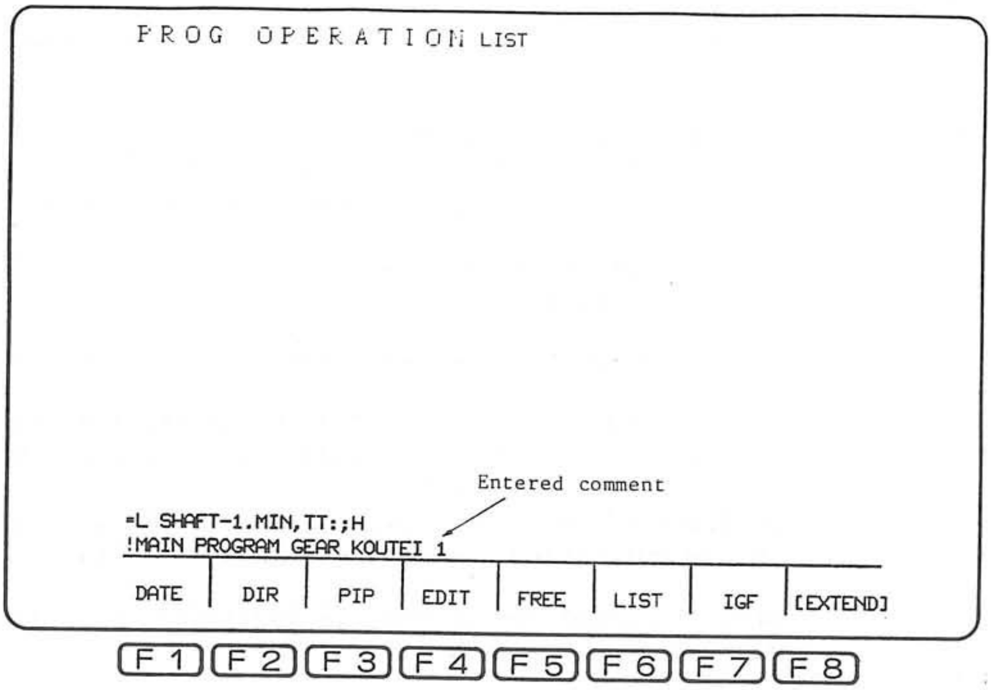
Contents of the file SHAFT-1.MIN are output to the printer which is connected to channel CNØ.

Note 4: The use of ";H" (option code) statement following the commands for file listing permit the operator to add a comment at the beginning of the list page.

Example:

=L GEAR-1.MIN,TT:;H [WRITE]

With the commands indicated above, "!" appears on the console line of the CRT, and the control waits for the entry of a comment. A comment up to 6Ø characters can be entered through the keyboard. Pressing the WRITE key after that initiates the output of a list.



Output using an RS232C device is as follows:

The entered comment is output on each output page.

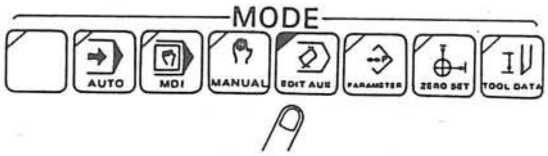
```
L        BB1:GEAR-1.MIN                                PAGE 1
MAIN PROGRAM GEAR KOUTEI 1
OGR-1
G14
G00      X800    Z150
N2 G42   X200    Z130    T010101  S200M03
N3 G01           Z80
N4       X60     Z100
N5               Z40
```

(5) Entry of Time

The control can time with reference to the set time, and allow the operator to check the time.

This feature can be effectively used to print the time at which the measuring cycle was executed when the machine is equipped with the optional measuring data printout specification.

1) Select the PROG OPERATION mode by pressing the EDIT AUX key.

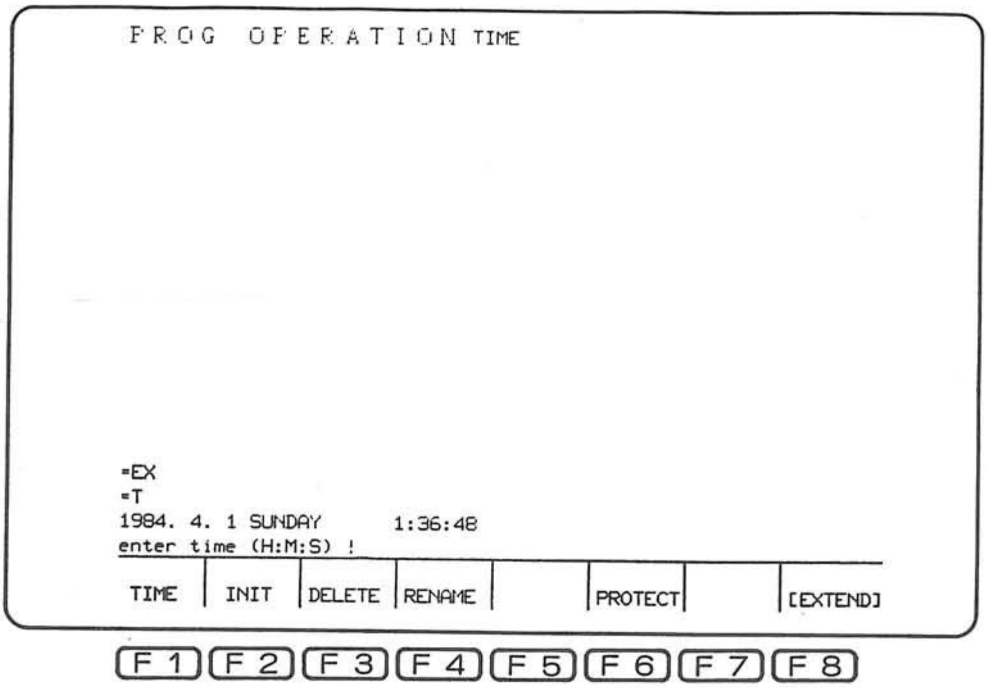


2) Press the function key [F8] (EXTEND).

3) Press the function key [F1] (TIME).

With this, the following display is obtained on the console line of the CRT, and the control is ready for the entry of time data.

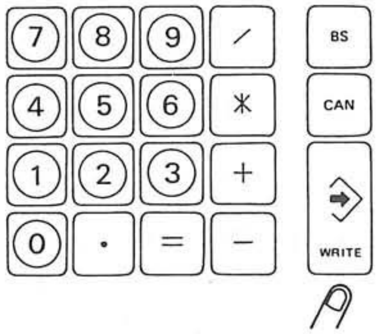
=T
1981.4.1 SUNDAY 1:36:48
enter time (H:M:S)!

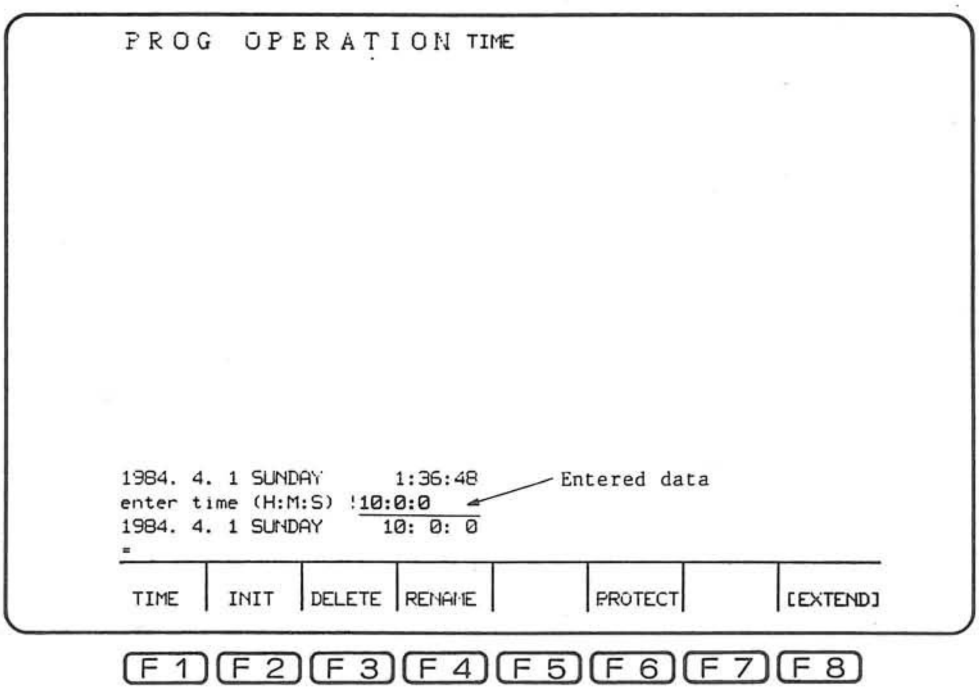


4) Enter hour, minute, and second data, each separated by ":" from the keyboard.

Example: 1Ø:Ø:Ø

5) Press the WRITE key.





The CRT displays the entered time data including date and day of the week if the entry is correct.

When the set data is not correct, the CRT again displays the message "enter time (H:M:S)!". Enter the correct data, then.

Note 1: When the operator wants to check the time and when no setting is necessary, simply press the[WRITE]key after completing step 3). This terminates the time function.

Note 2: Range of numeral values entered is:

Ø through 23 for hour
Ø through 59 for minute
Ø through 59 for second.

Note 3: After 23 hours 59 minutes 59 seconds, the time is restored to Ø hour Ø minute Ø second. Along with such change, the day of the month and day of the week also change.

Note 4: The time is counted from the moment the control is ready with power supply turned on.

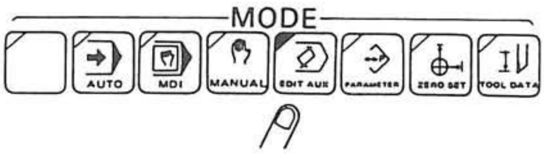
(6) Clearing The Entire Stored Data

This is to initialize the bubble memory. Be sure to initialize it after turning power supply to the control on for the first time after control tape loading.

CAUTION

> The following step erases all the data stored in the bubble memory.

1) Select the PROG OPERATION mode by pressing the EDIT AUX key.



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

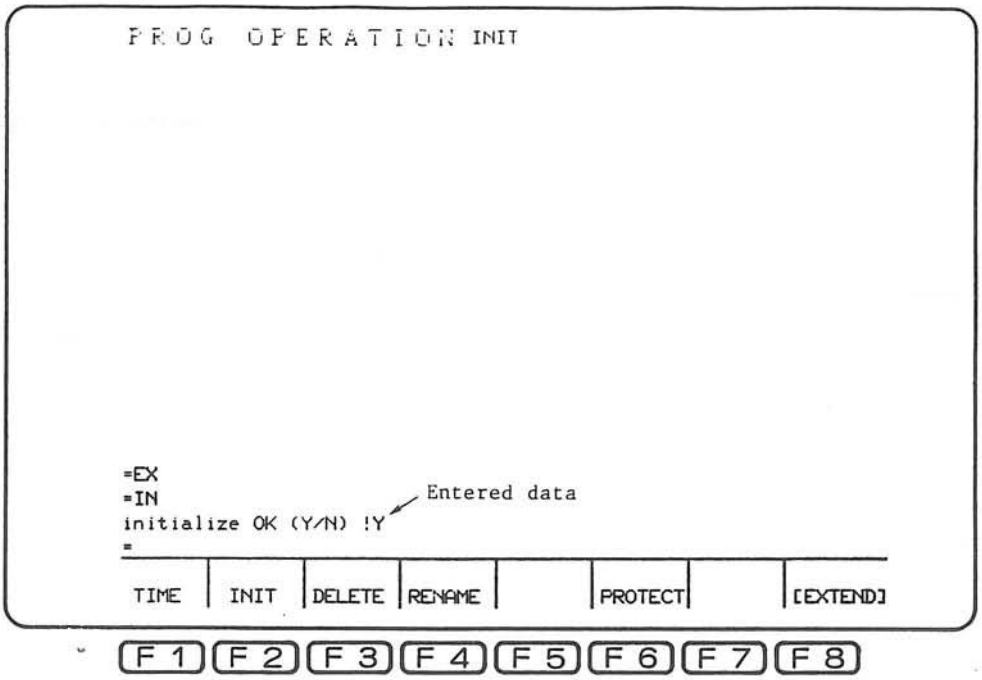
3) Press the function key [F2] (INIT).

The message below appears on the console line of the CRT, and the CRT waits for an answer from the operator.

```
=IN
initialize OK (Y/N)!
```

Enter "Y" through the keyboard to initialize the bubble memory. If not, enter "N".

4) Press the WRITE key.



When [Y] key is pressed in step 4), the bubble memory is initialized.

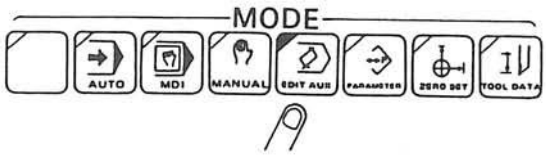
Pressing [N] causes no initialization of the bubble memory. This is used when the function key [F2] is pressed erroneously.

Note: After NC control software is loaded, be sure to initialize the bubble memory.

(7) Deleting Entire Files

Files stored in the bubble memory can be deleted.

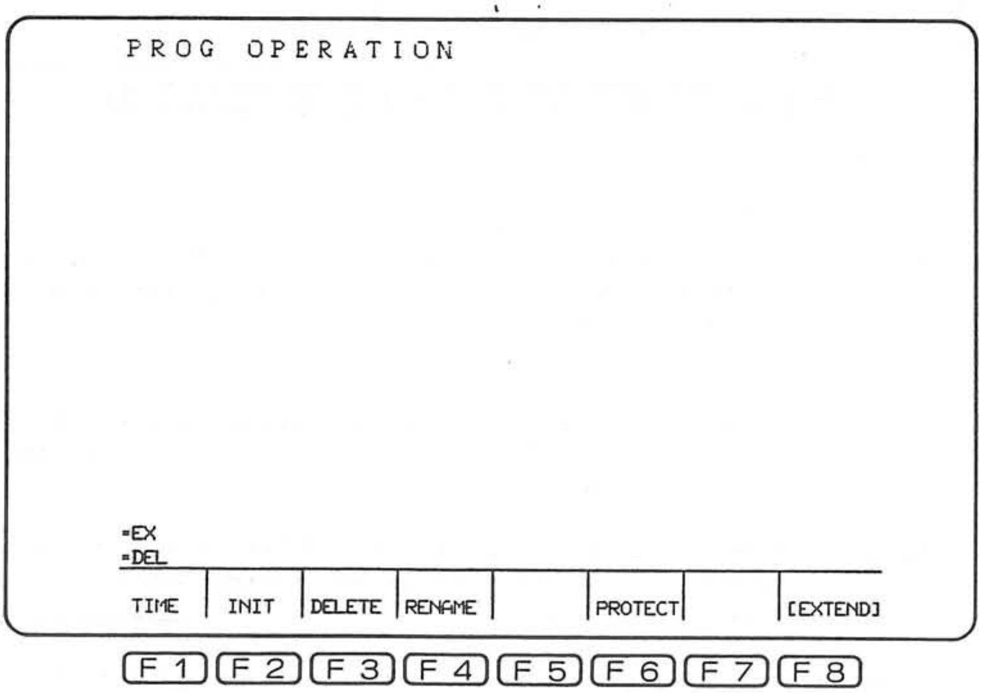
1) Select the PROG OPERATION mode by pressing the EDIT AUX key.



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

3) Press the function key [F3] (DELETE).

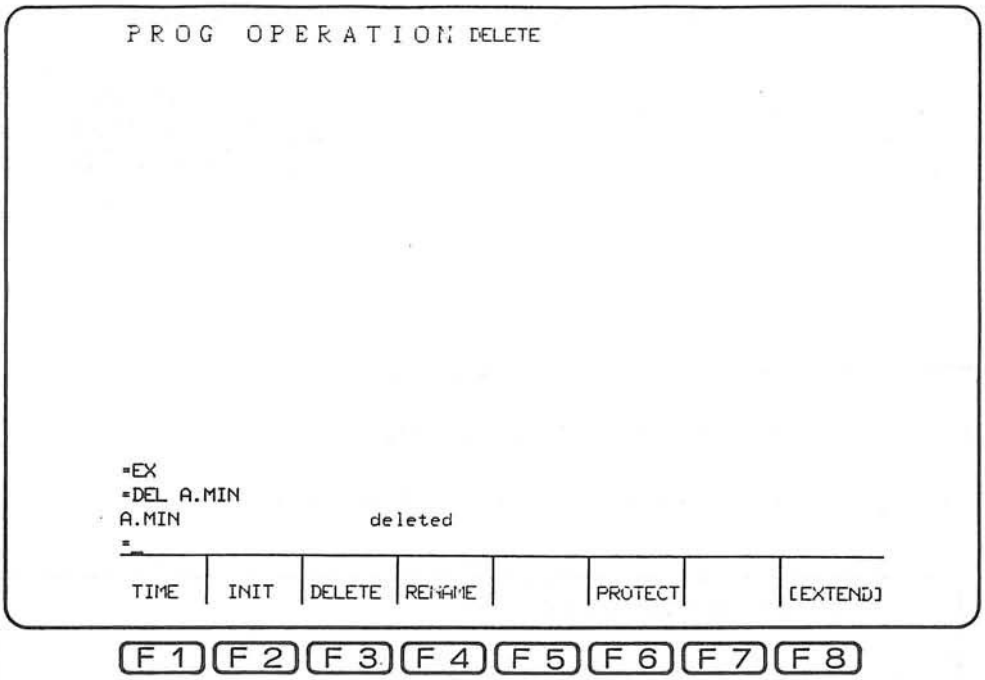
"DEL" appears on the console line of the CRT.



4) Press the WRITE key.

This deletes the file A.MIN and the following message appears on the console line of the CRT.

A.MIN deleted



Note 1: If the name of the file to be deleted is other than A.MIN, designate the file name. When the extention of a file name is .MIN, it can be omitted.

Example: ABC.MIN .... DEL ABC Omissible
ABC.SUB .... DEL ABC.SUB

Note 2: When the file designated for deletion is not in the bubble memory, the message "file not found" appears on the console line of the CRT.

Note 3: "*" and "?" can be used for designating a file name.

See Note 3 in (2).

Example:

DEL *	All the files with extension .MIN are deleted.
DEL * .SUB	All the files with extension .SUB are deleted.
DEL SHAFT*.*	All the main files beginning with SHAFT are deleted.

DEL *.* All the files are deleted.

DEL ???.SUB Main files with a file name containing up to three characters and with the extension .SUB are deleted.

Note 4: Option for file deletion

By specifying ";V" after the name of a file to be deleted, the operator can visually check the file name on the console line of the CRT; he can determine whether that file should be deleted or not.

Example: DEL*.*;V

Pressing the WRITE key after entering as above, will display.

SHAFT-A1.MIN delete OK (Y/N)! on the console line.

Press the WRITE key after entering "Y", and the file is deleted.

Entry of "N" followed by the WRITE key does not delete it.

The CRT then displays:

SHAFT-A2.MIN delete OK (Y/N)! on the console line.

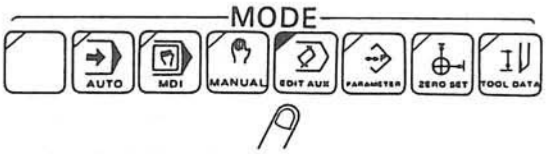
Repeat as explained above.

In this example, "*.*" has specified all the files, requesting the operator to determine for all the files whether the file is to be deleted or not.

(8) Renaming File

The file name of the stored program can be changed.

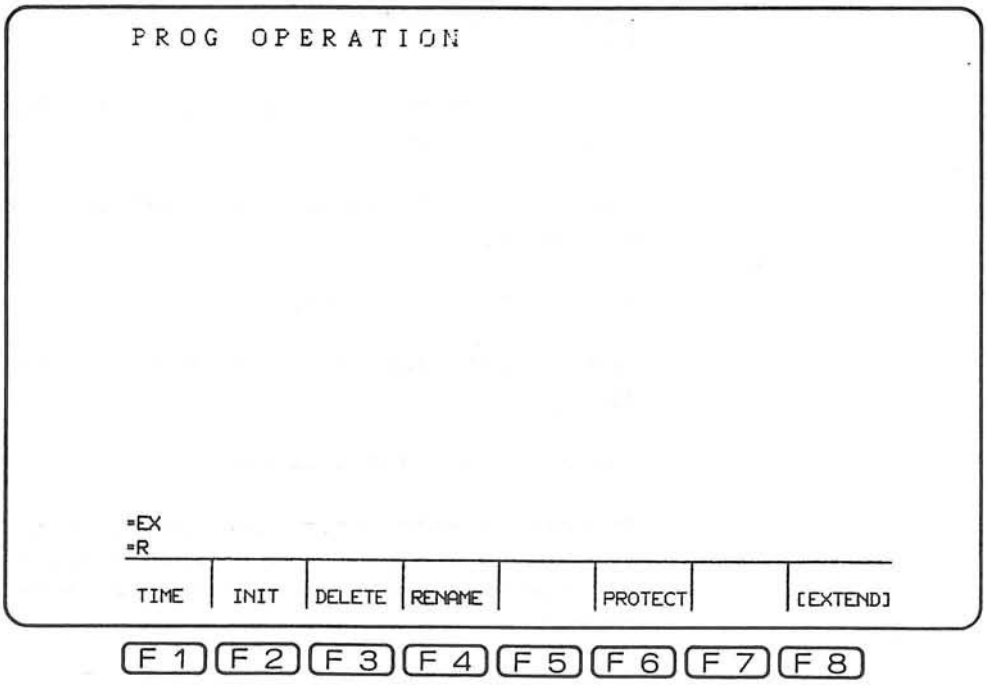
1) Select the PROG OPERATION mode by pressing the EDIT AUX key.



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

3) Press the function key [F4] (RENAME).

"R" appears on the console line of the CRT.



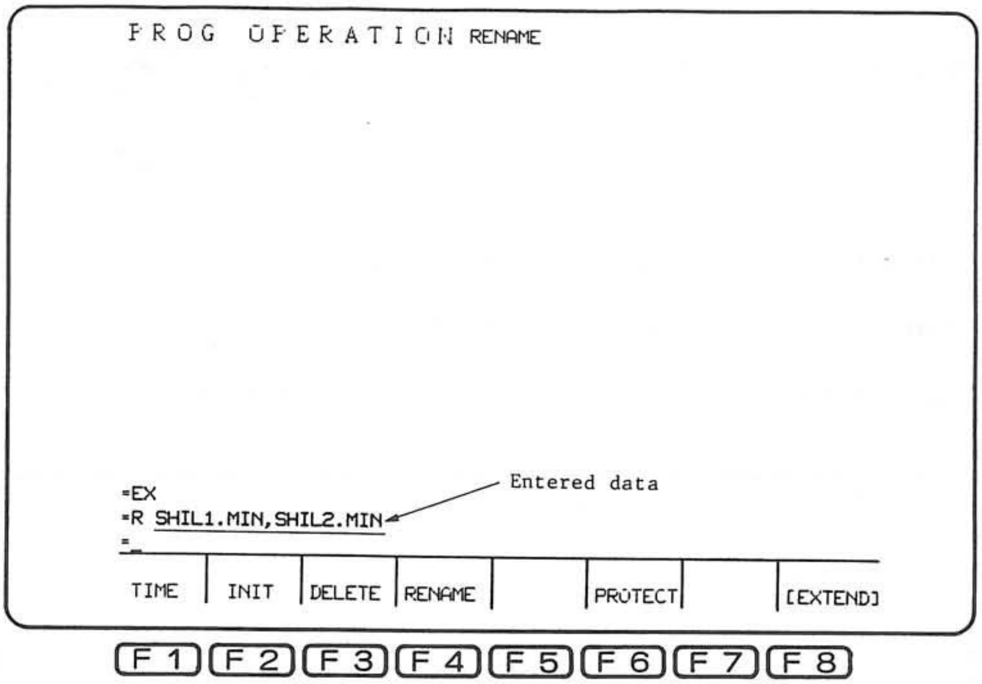
4) Enter the file names, old file name and new file name separated by a delimiter "," through the keyboard.

Example:

SHIL1,SHIL2	Changing SHIL1.MIN to SHIL2.MIN.
SHIL1.SUB,SHIL1.SSB	Changing SHIL1.SUB to SHIL1.SSB.
SHIL1.SUB,SHIL2.SUB	Changing SHIL1.SUB to SHIL2.SUB.

5) Press the WRITE key.

This completes the change of file name.



Note 1: When the file name specified is not found in the bubble memory, the message "file not found" appears on the console line of the CRT.

Note 2: When the newly assigned file name is already in the bubble memory, the CRT shows the message "file exist".

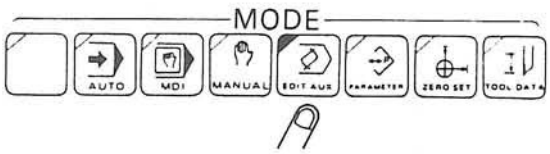
Note 3: "*" and "?" cannot be used in specifying the file name and extension.

If used, the message "file name error" appears on the CRT.

(9) Protection of specified files

The file specified is protected from unexpected writing, editing and deletion operations.

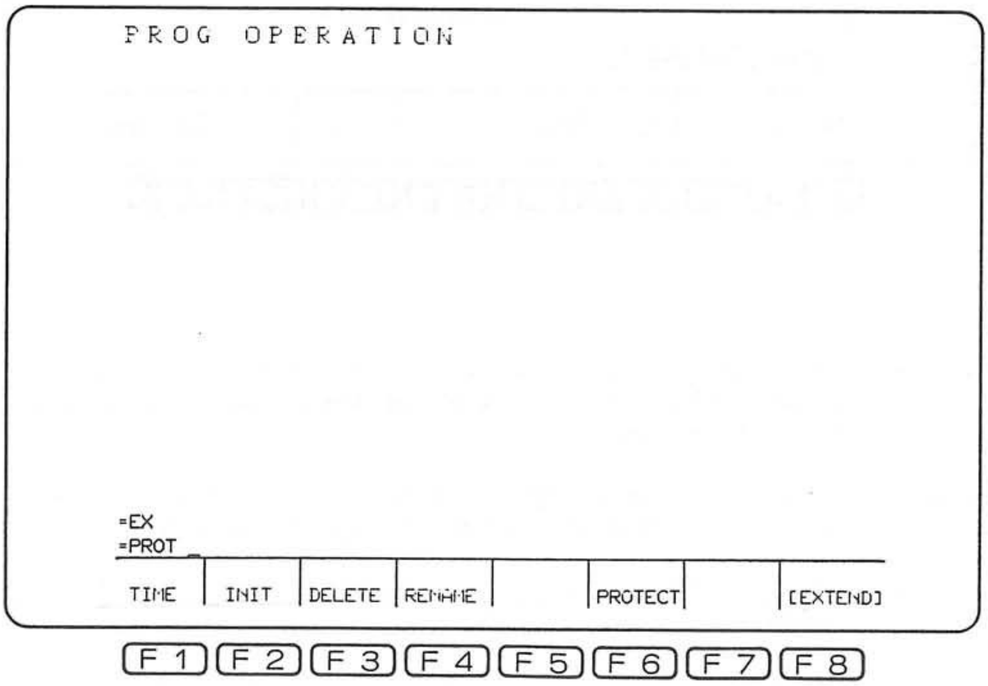
1) Select the PROG OPERATION mode by pressing the EDIT AUX key.



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

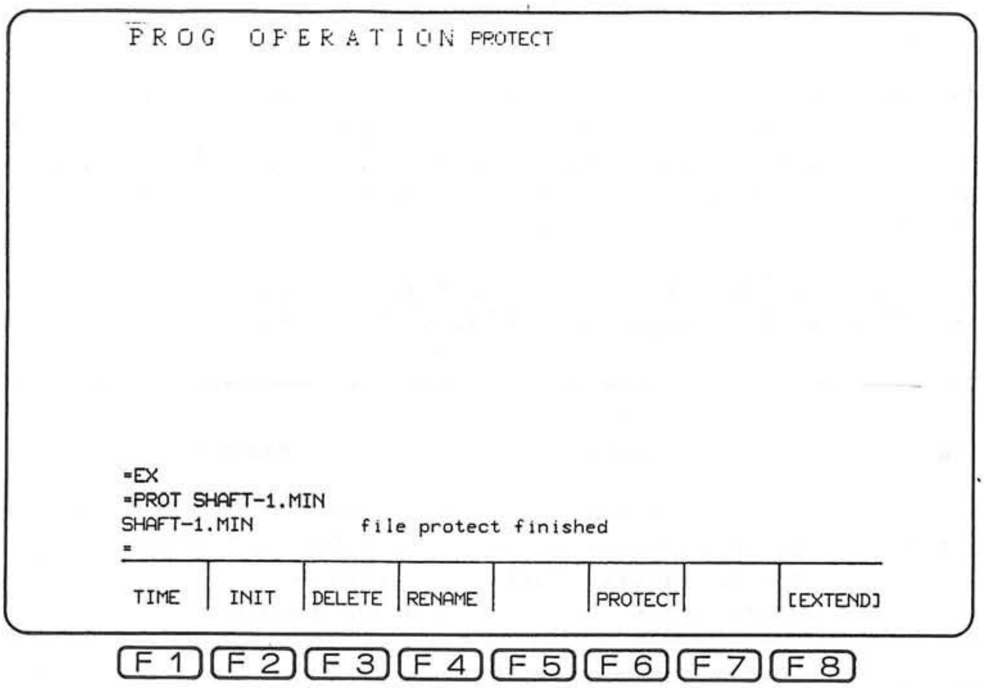
3) Press the function key [F6] (PROTECT).

The prompt "=PROT" will be displayed on the console line.



4) Key in the names of files to be protected.
SHAFT-1.MIN, for example.

5) Press the WRITE key.



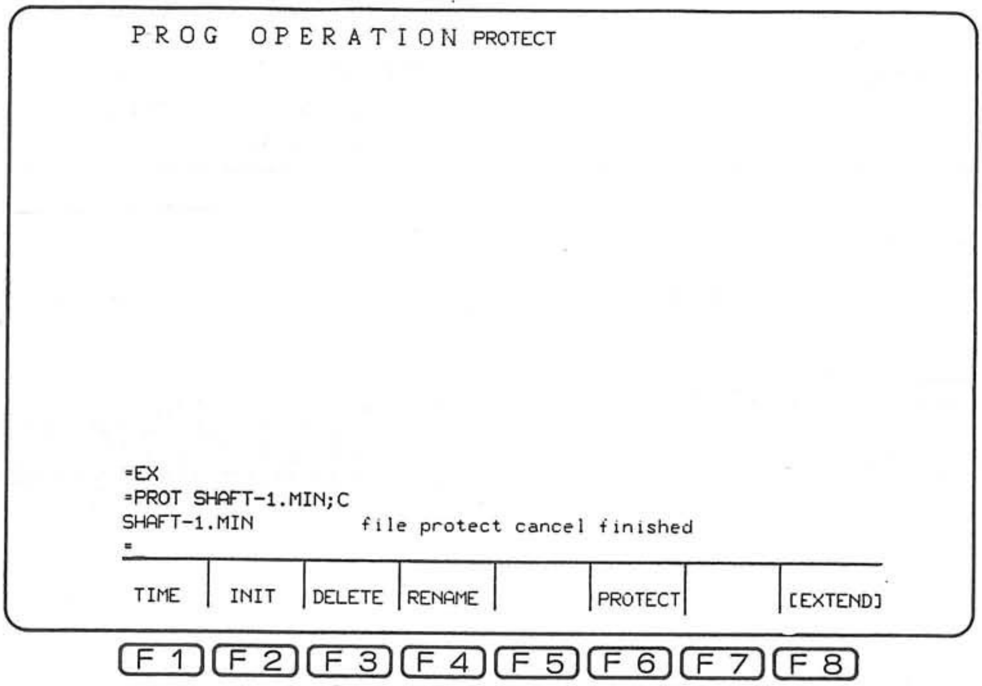
This completes the file protection operation.

Memory initialization operation erases file-protected programs also.

Canceling protection:

Key in ";C" after the file name in step 4).

SHAFT-1.MIN;C, for example.



4-3. OPERATION IN PARAMETER MODE

(1) Parameter

To position axes or edit a part program using the control, the axis travel range and tape output code are predetermined in accordance with the functions and the specifications of the OSP5ØØ/5ØØØL-G and the machine. However, it is sometimes necessary to change the matching conditions.

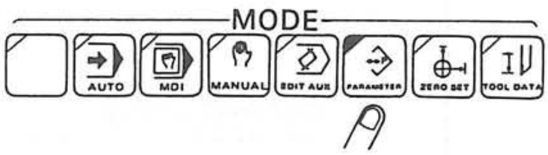
The data necessary to control NC functions is called parameter; the OSP5ØØ/5ØØØL-G employs the following parameters:

Type of Parameter	Contents	Example	CRT Display Page
User parameter	Parameter determined for respective work-piece types	Variable soft-limit positions Droop amount	1
Common variable	System common variable	V1 - V32	1
System parameter	Parameter determined depending on machine	Stroke end positions, backlash, etc.	1
Optional parameter (long word)		Unit amount of rapid traverse rate, etc.	1
Optional parameter (word)	Functional variable	Spindle oscillation speed Power save timer, etc.	3
Optional parameter (bit)		Edit function Position of decimal points, etc.	1

(2) Outline of Parameter Setting

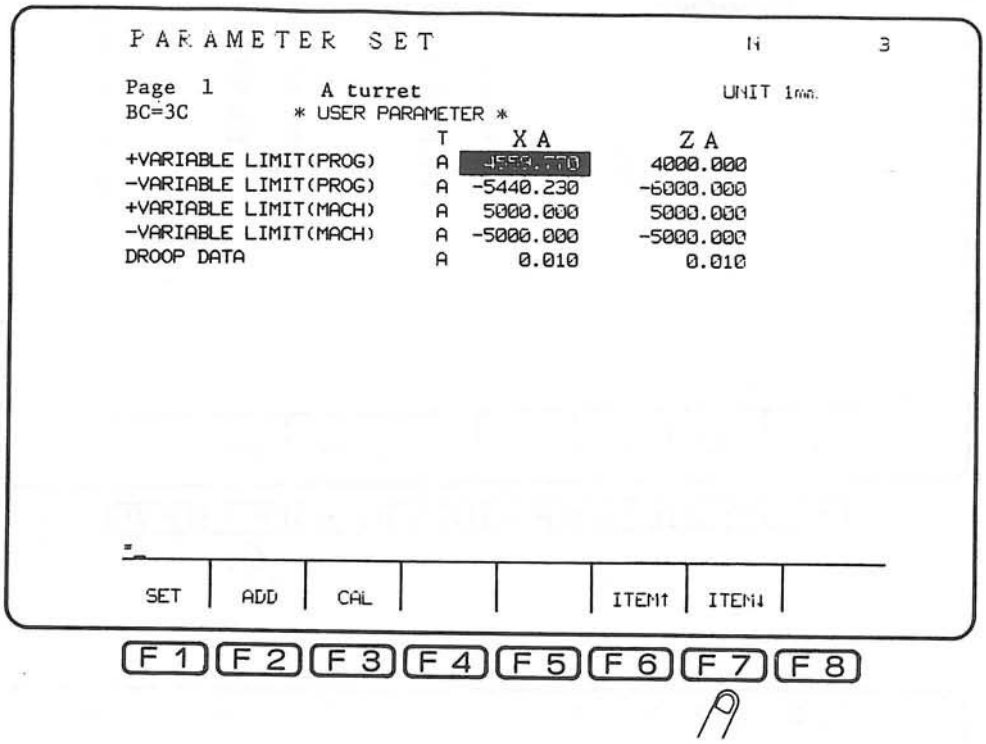
Example: For setting "5ØØ" at optional parameter (word) No. 9

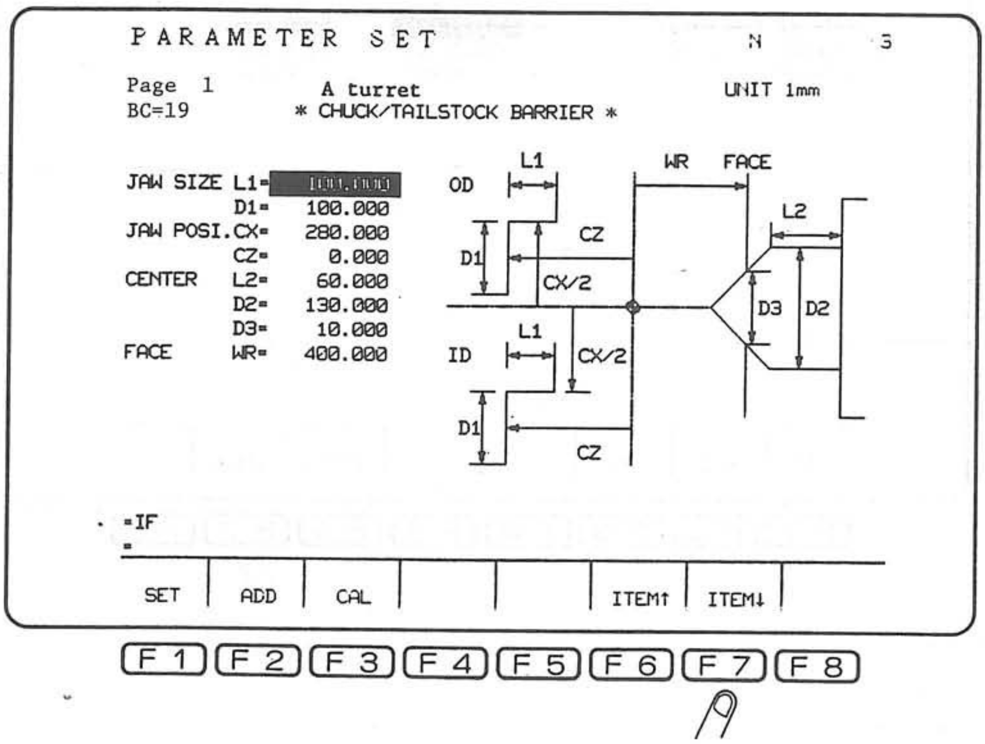
1) Select the PARAMETER SET mode by pressing the PARAMETER key.

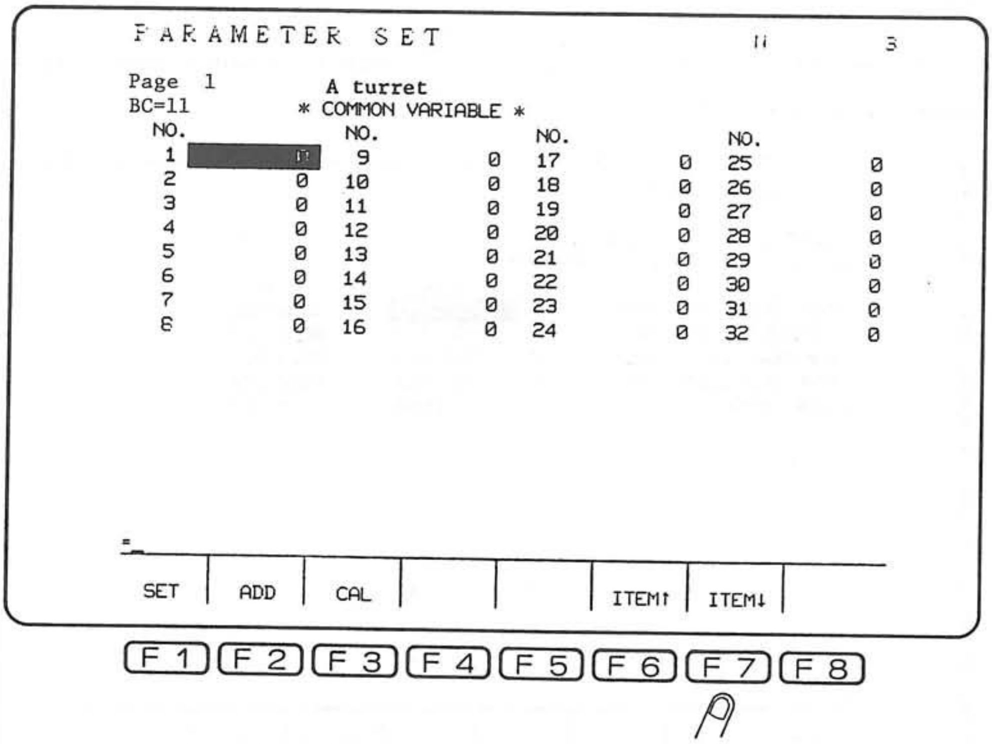


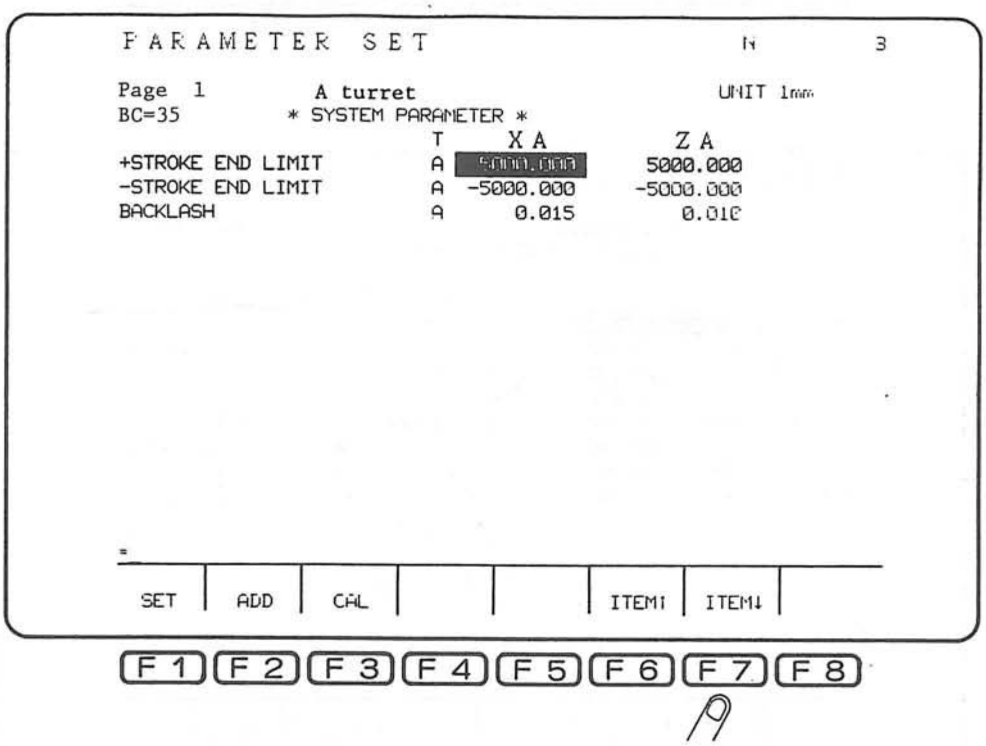
2) Select the type of parameter to set by pressing the function key [F6] (ITEM ↑) or [F7] (ITEM ↓); lists of parameters are displayed on the CRT.

If necessary, press the [P↑] or [P↓] key to change the page within the same parameter category.






PARAMETER SET
N 3
Page 1
BC=11
A turret
* COMMON VARIABLE *
NO. 1 0 2 0 3 0 4 0 5 0 6 0 7 0 8 0
NO. 9 0 10 0 11 0 12 0 13 0 14 0 15 0 16 0
NO. 17 0 18 0 19 0 20 0 21 0 22 0 23 0 24 0
NO. 25 0 26 0 27 0 28 0 29 0 30 0 31 0 32 0
SET
ADD
CAL
ITEM↑
ITEM↓
F1 F2 F3 F4 F5 F6 F7 F8


PARAMETER SET
N 3
Page 1
BC=35
A turret
UNIT 1mm
* SYSTEM PARAMETER *
T XA ZA
+STROKE END LIMIT A 5000.000 5000.000
-STROKE END LIMIT A -5000.000 -5000.000
BACKLASH A 0.015 0.010
SET
ADD
CAL
ITEM↑
ITEM↓
F1 F2 F3 F4 F5 F6 F7 F8

PARAMETER SET N 3

Page 1 A turret

BC=28 * OPTIONAL PARAMETER LONG WORD *

NO.		NO.		NO.		NO.	
1	2560	13	9	25	0	37	0
2	328	14	500	26	0	38	0
3	512	15	0	27	0	39	0
4	164	16	0	28	0	40	0
5	20	17	0	29	0	41	0
6	100	18	200000	30	0	42	0
7	500	19	200000	31	0	43	0
8	512	20	50000	32	0	44	0
9	512	21	200000	33	0	45	0
10	512	22	40000	34	0	46	0
11	9	23	150000	35	0	47	0
12	256	24	0	36	0	48	0

=_

SET	ADD	CAL			ITEM↑	ITEM↓	
F 1	F 2	F 3	F 4	F 5	F 6	F 7	F 8

3) Use the cursor control keys to locate the cursor to the desired data position.

4) Press the function key [F1] (SET).

5) Enter the required new data, "5ØØ" for instance, through the keyboard.

PARAMETER SET N 3

Page 1 A turret

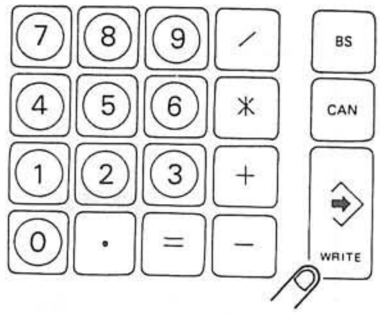
BC=32 * OPTIONAL PARAMETER WORD *

NO.		NO.		NO.		NO.	
1	250	9	500	17	0	25	0
2	30	10	0	18	0	26	0
3	40	11	50	19	0	27	0
4	100	12	0	20	0	28	2097
5	100	13	0	21	30	29	0
6	0	14	60	22	40	30	0
7	30	15	200	23	0	31	0
8	500	16	5	24	0	32	0

=S 500

SET	ADD	CAL			ITEM↑	ITEM↓	
F 1	F 2	F 3	F 4	F 5	F 6	F 7	F 8

6) Press the WRITE key.



This replaces the data of the selected parameter number with the newly entered data. The CRT displays new data.

PARAMETER SET N 3

Page 1 A turret
BC=16 * OPTIONAL PARAMETER WORD *

NO.		NO.		NO.		NO.	
1	250	9	500	17	0	25	0
2	30	10	0	18	0	26	0
3	40	11	50	19	0	27	0
4	100	12	0	20	0	28	2097
5	100	13	0	21	30	29	0
6	0	14	80	22	40	30	0
7	30	15	200	23	0	31	0
8	500	16	5	24	0	32	0

=S 500
=

SET	ADD	CAL			ITEM↑	ITEM↓	
F1	F2	F3	F4	F5	F6	F7	F8

Data setting is possible using the function keys and ten key pads. The keyed in numerical value may be set as keyed in or added to the value stored in memory depending on the function key pressed.

The example above shows the case in which function key [F1] (SET) is used.

(3) Parameters Requiring Power Reapplication

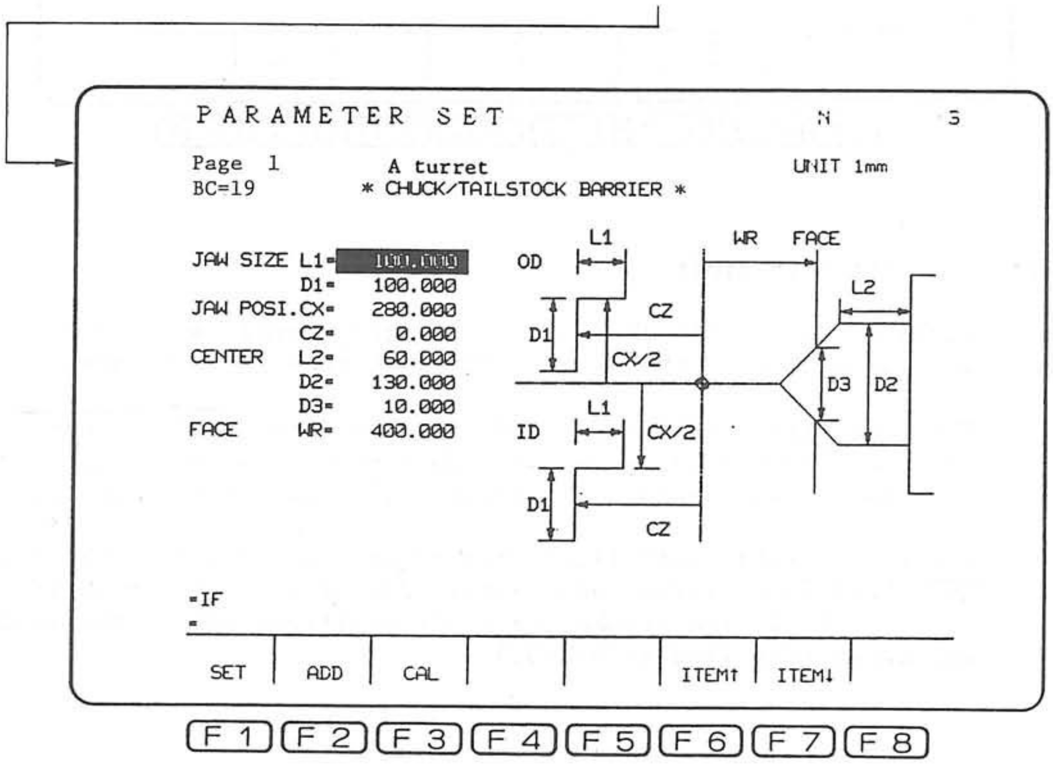
The droop data, the RS232C related parameters, etc. require power supply to be turned off once and then turned on again after setting the parameter data. Such parameters are called the power reapplication parameters.

When these data is set, the screen displays the message "ALARM-D WØ1 power on effective parameter set" on the upper area. In this case, check the counter data of the backup counter when the WRITE key is pressed after setting the data and turn off power supply when the counter displays the same counter data. For example, if the backup counter data is "15" when the parameter data is set, turn off power supply after making sure that the counter displays the same value "15" again. If power is turned off before the counter shows "15" again, the parameter data might not be set even if power supply is turned on again.

After reapplying power, confirm that the parameters have been changed to the new setting.

Note 1: Backup counter

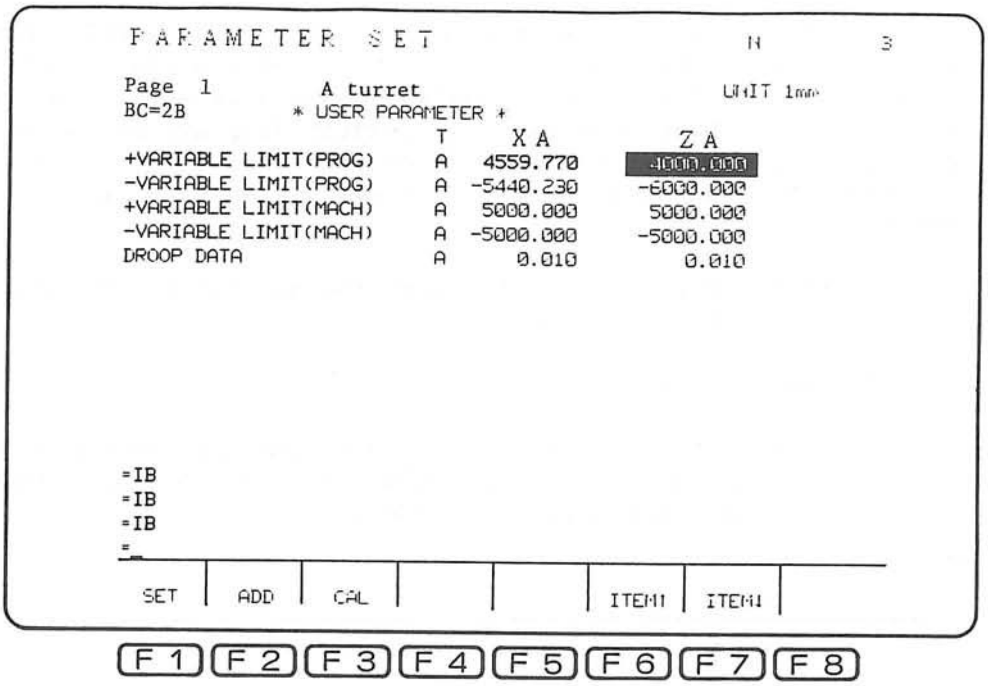
The backup counter data is displayed at the upper left area of the CRT on the TOOL DATA SET, ZERO SET, and PARAMETER SET screens in the form of "BC=␣␣".



Parameters used with OSP5ØØ/5ØØØL-G are explained in details hereafter: after:

4-3-1. User Parameter

User parameters are the determined depending on the types of workpieces.



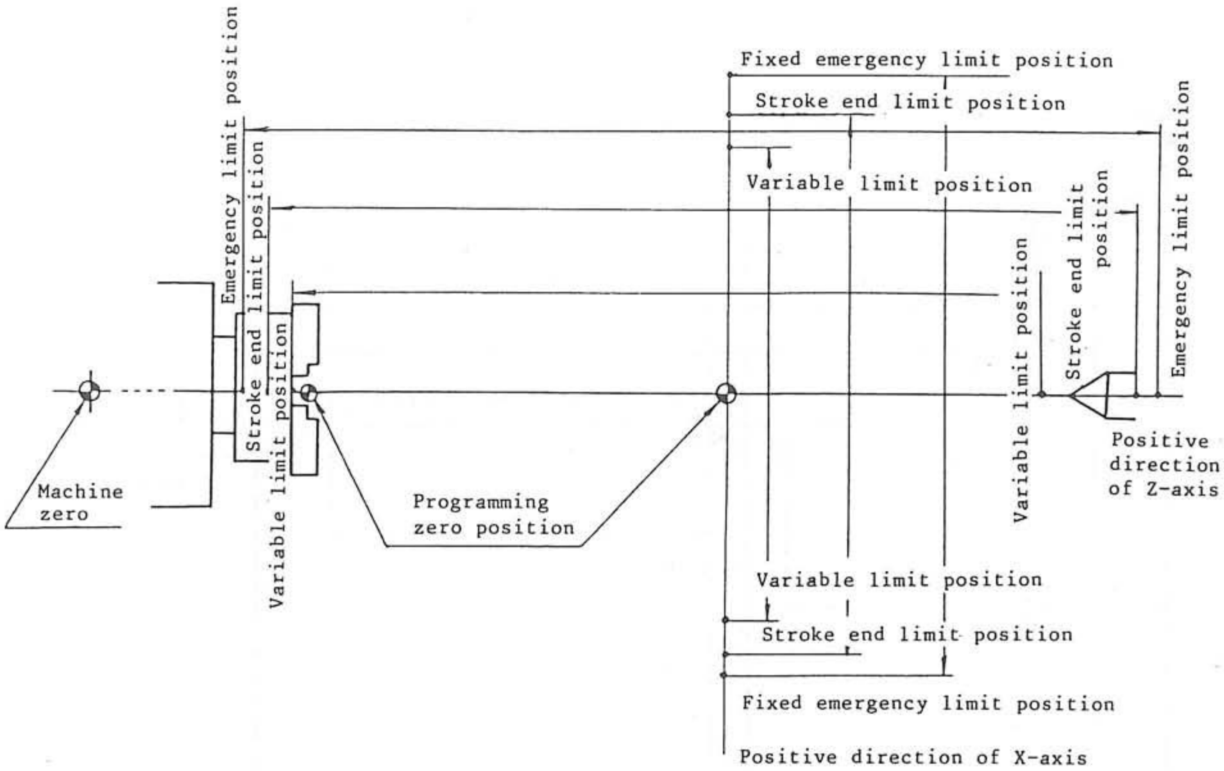
(1) Variable Soft-Limit

Variable soft-limit determines the axis travel range on X- and Z-axis according to the size of the workpiece to be turned.

This determines the turret indexing positions, and inhibits positioning within a dangerous area thus protecting the chuck and the tailstock from unexpected collision with the cutting tools.

For the variable soft-limit, two positions are set on the respective axes both in positive and negative directions. However, they cannot be set outside the stroke end limit positions set by the system parameter (detailed in 4-3-3.).

Relations of various limit positions set on the machine:



Emergency Limit Position (Hard-Limit Position)

If the limit switch confirming the emergency limit position is tripped, servo power for X- and Z-axis drive is turned OFF and the entire machine operation is stopped.

The limit switch for emergency limit position is not actuated during normal machine operation. However, if this limit is actuated, power supply to the X- and Z-axis drive systems is turned off and the machine operation is stopped immediately.

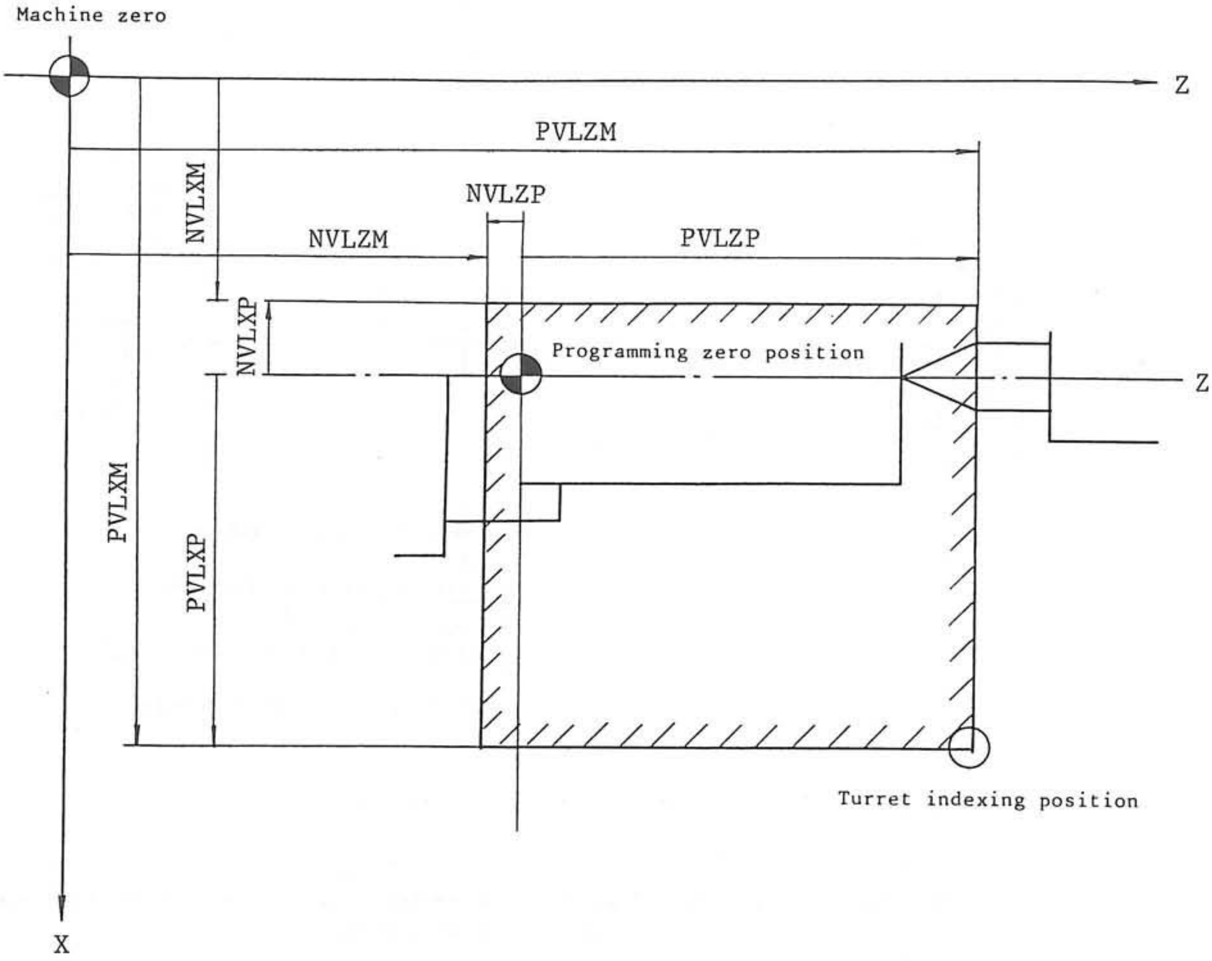
Stroke End Limit Position (Soft-Limit Position)

The stroke end limit positions set the nominal axis travel of each machine. (For the setting procedure, refer to 4-3-3.)

Variable Soft-Limit

These limit positions are variable by setting parameters as desired to meet the size of the workpiece to be turned. However, they cannot be set outside the stroke end limit positions.

Turret indexing is carried out on the stroke end limit position in the positive direction.



Axis / CRT Display	X-axis	Z-axis
+ VARIABLE LIMIT (PROG)	PVLXP	PVLZP
- VARIABLE LIMIT (PROG)	NVLXP	NVLZP
+ VARIABLE LIMIT (MACH)	PVLXM	PVLZM
- VARIABLE LIMIT (MACH)	NVLXM	NVLZM

Fig. 4-3 Variable Soft-Limit

<Coordinate system for variable soft-limit>

As seen in Fig. 4-3, coordinates of the soft-limit positions can be designated both on the coordinate systems having the origin at the machine zero or the programming zero.

The relationship between the variable soft-limit expressed on those two different coordinate systems is:

Coordinates of the variable soft-limit position on the coordinate system of the machine zero

= | Coordinates of the variable soft-limit position on the coordinate system of the programming zero |

+ | Zero offset value |

Therefore, setting the variable soft-limit positions on either of these two coordinate systems can automatically set them on another coordinate system. It is advisable to set them on the coordinate system of the programming zero.

There are three methods to set the variable soft-limit positions;

a) Playback method

Use this method when the variable soft-limit positions are unknown.

b) Numerical data entry method

Use this method when the variable soft-limit positions are known.

c) Data renewal method

Use this method to change the currently stored stroke limit position data.

Detailed procedure for the respective methods is explained below:

a) Playback Method
- Variable soft-limit positions are unknown:

This method is used to set the variable soft-limit positions for the first time, or re-set them after changing the tooling.

Procedure:

The explanation below is provided assuming the setup of the chuck and tooling, and the setting of various data such as zero offsets and tool offsets are all complete.

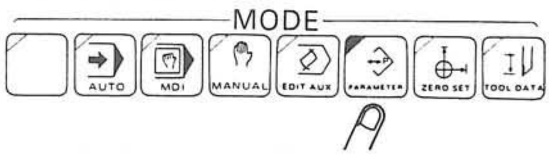
1) Move the axis to the desired variable stroke end position manually, observing the following points:

- To move the turret to the variable stroke end position in the positive direction, index the turret face mounting the longest tool (drill, boring bar, etc.); locate the turret at a position where the indexed tool does not interfere with the workpiece or the tailstock.

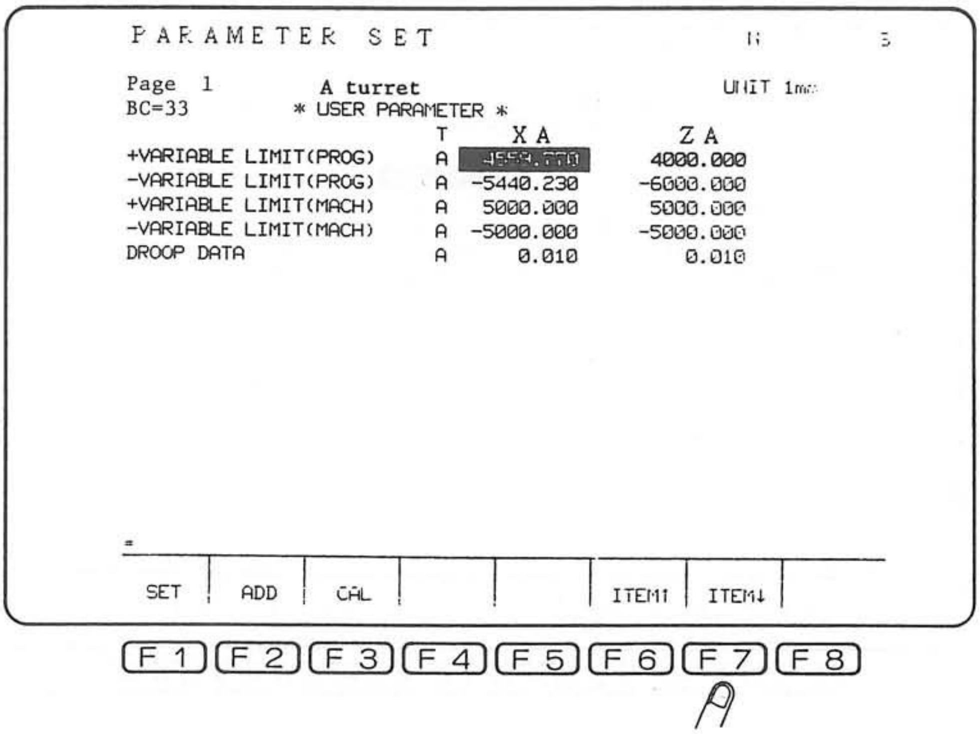
- To move the turret to the variable stroke end position in the negative direction, index the turret face mounting the standard tool; locate the turret at a position where the indexed tool does not interfere with the workpiece and the chuck.

- To set the variable stroke end positions after loading control software or outside the currently set stroke end positions, first set the stroke end positions referring to the data in the OSP CONTROL CARD which is contained inside the OSP box according to the method detailed in b).

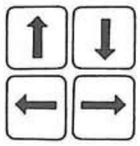
2) Select the PARAMETER SET mode by pressing the parameter key.



3) If the CRT display is not as shown below, press the function key [F7] (ITEM↓) until this display appears.

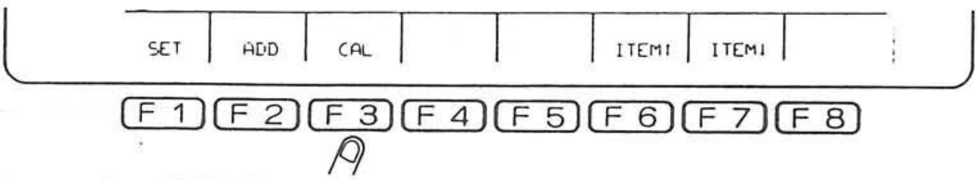


4) Locate the cursor to the position where the data is to be set:

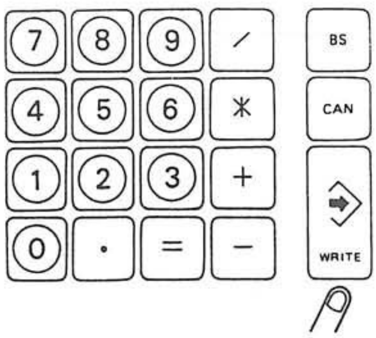


Positive/Negative
X/Z

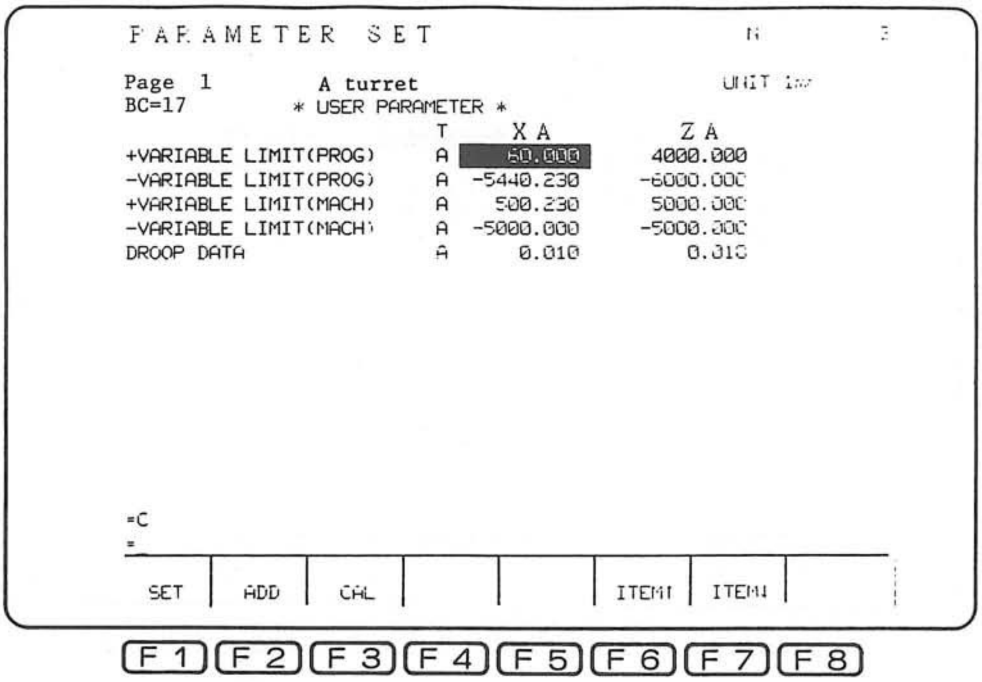
5) Press the function key [F3] (CAL).



6) Press the WRITE key.



This sets the presently located turret position as the variable stroke end position. The CRT displays the newly set data.



Note: When the variable stroke end position is to be set at a point away from the currently located axis position by a certain distance, enter such distance data through the keyboard after step 6) and pressing the function key [F2] (ADD) and then press the WRITE key.

To set the variable stroke end position at a point -5Ø mm away from the position where the turret is located, proceed as:

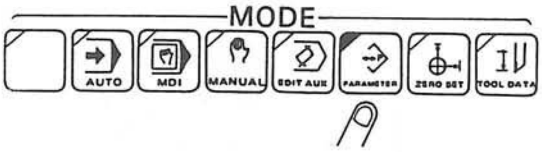
[F2] (ADD), [-][5][Ø], [WRITE]

b) Numerical Data Entry Method

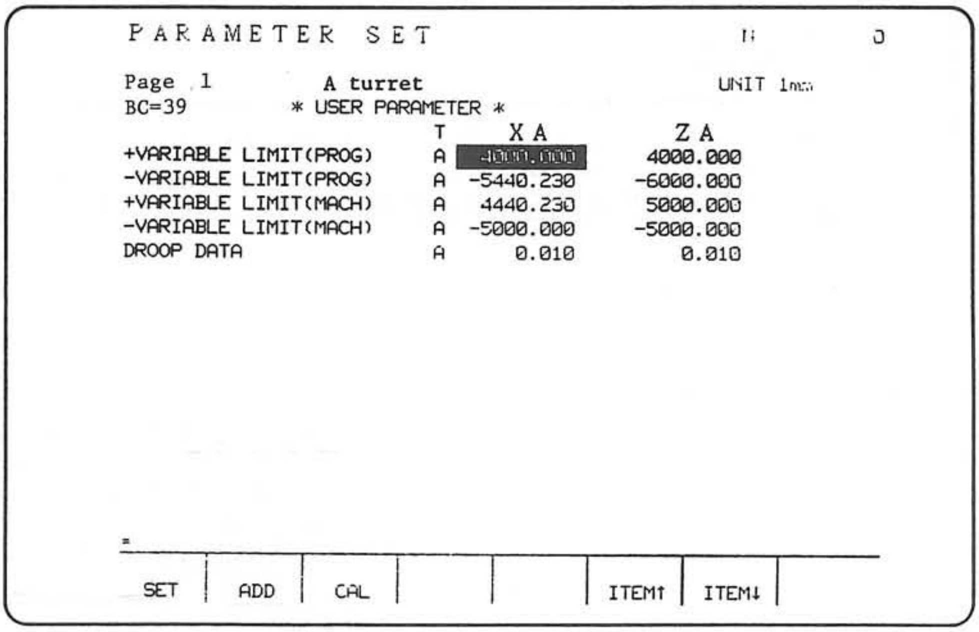
Set the variable stroke end positions when their coordinates are known beforehand:

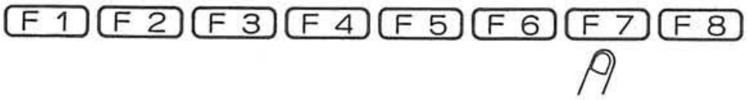
Procedure:

1) Select the PARAMETER SET mode by pressing the PARAMETER key.



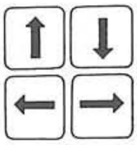
2) If the CRT display is not as shown below, press the function key [F7] (ITEM↓) until this display appears.





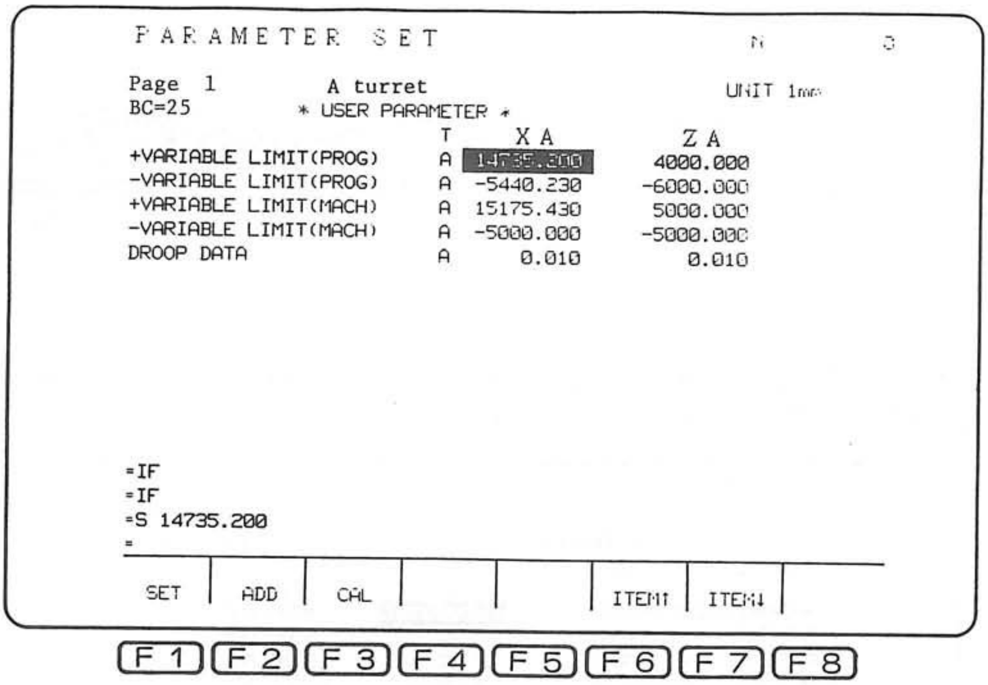
3) Locate the cursor to the position where the data is to be set:

Positive/Negative
X/Z

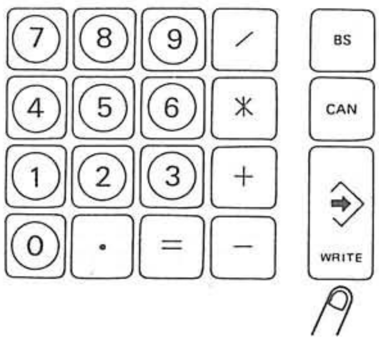


5) Press the function key [F1] (SET) and then enter the known variable stroke end position data from the upper digit through the keyboard.

Example: [F1] [1][4][7][3][5][.][2][Ø][Ø]



6) Press the WRITE key.



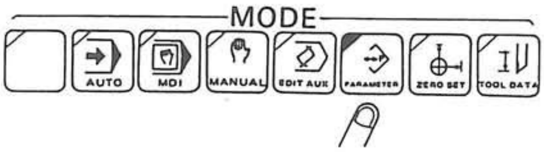
This sets the entered data as the variable stroke end position data and the CRT displays it.

c) Data Renewal Method

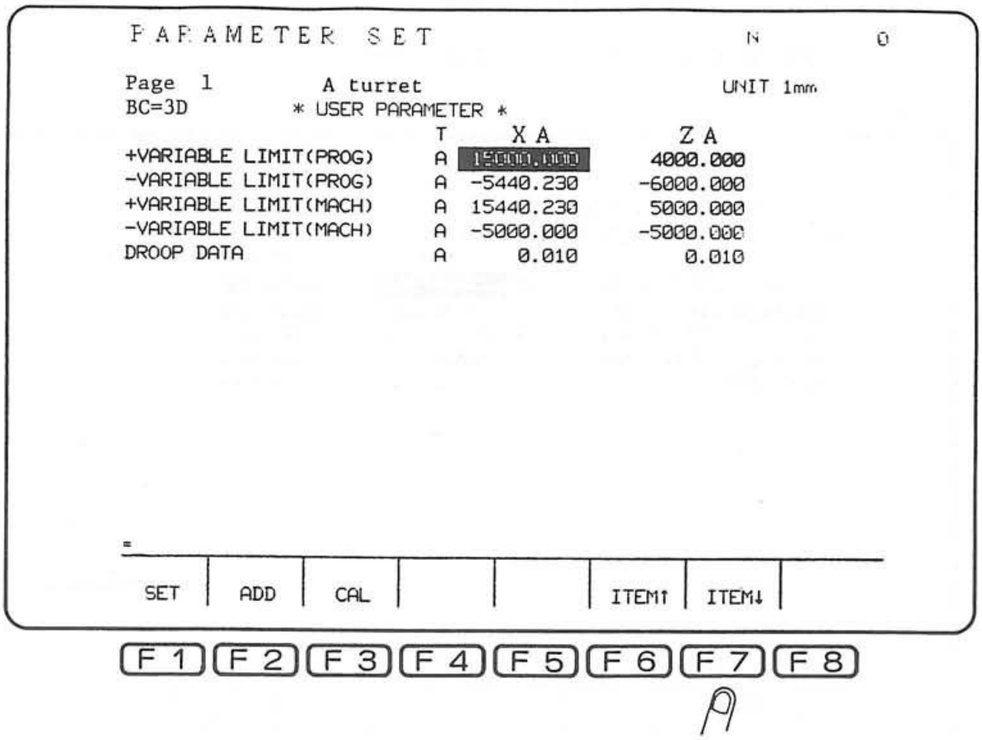
This method is used for slightly changing the soft-limit data, which has been set.

Procedure:

1) Select the PARAMETER SET mode by pressing the PARAMETER key.

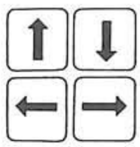


2) If the CRT display is not as shown below, press the function key [F7] (ITEM ↓) until this display appears.



3) Locate the cursor to the position where the data is to be set:

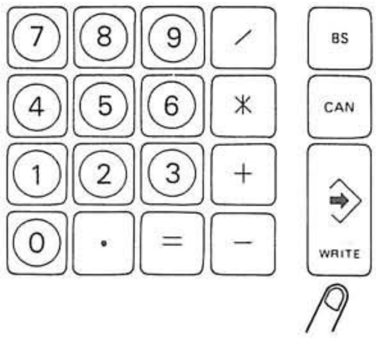
Positive/Negative
X/Z



4) Press the function key [F2] (ADD) and then enter the amount to be added.

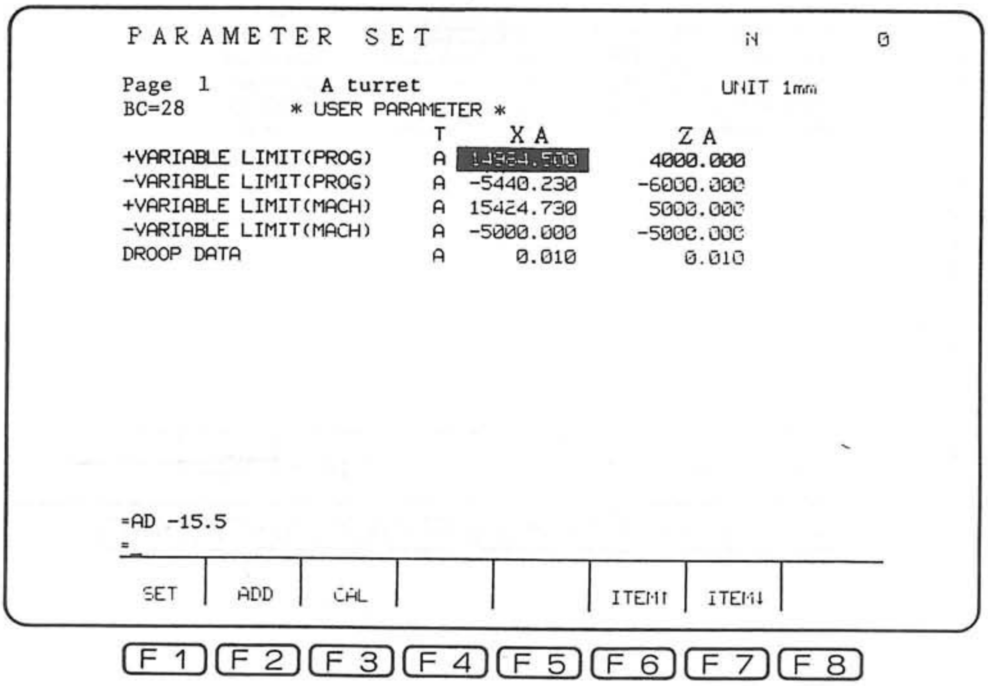
Example: [F2] [-][1][5][.][5]

5) Press the WRITE key.



This adds "-15.5" to the currently stored data, "15ØØØ.ØØØ" in this example, and the result of the addition, "14984.5ØØ" is then stored.

15ØØØ.ØØØ + (-15.5) = 14984.5ØØ



Note 1: After carrying out the operations below, set the stroke end limit positions and the variable soft-limit positions stroke end limit positions without fail. Otherwise X- and Z-axis do not move at all, or they move only up to a certain point.

- Loading of control software No. 3,
- Replace of memory board,
- Replace of OSP position encoder (X and/or Z) (Setting should be made only on the replaced axis.)

Note 2: When the stroke end limit position is changed, the variable soft-limit position is also changed to the same position.

(2) Chuck

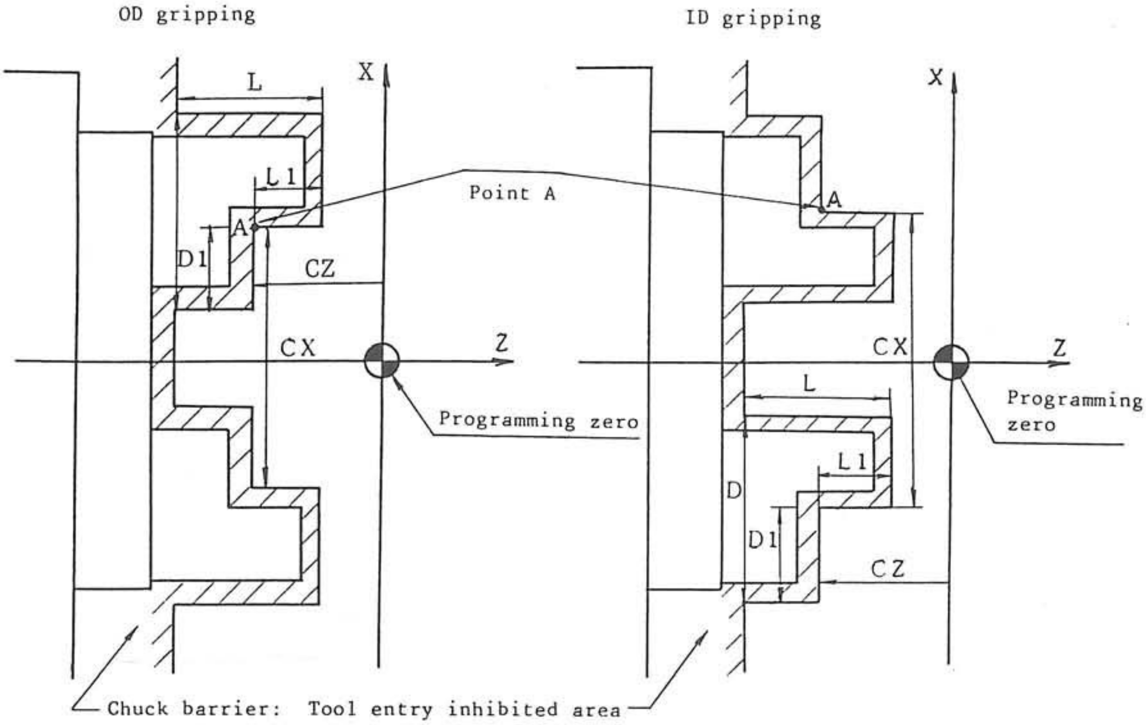
Selecting of chuck ID/OD mode
(for OSP5ØØL-G, OSP5ØØØL-G flat panel)

Note: For OSP5ØØØL-G, this selection is made with the key switch, and therefore, parameter setting is not required.

a) Chuck barrier

The chuck barrier function can set the inhibited area for tool entry around the chuck, that cannot be set by variable soft-limit position data.

Activation or deactivation of the chuck barrier function can be selected by programming proper M codes. Therefore, check of the tool motion using the chuck barrier function can made only when required.



Symbol	Description	Method
L	Chuck jaw length	Optional parameter (long word) No. 18
D	Chuck jaw size	Optional parameter (long word) No. 19
L1	Chuck jaw gripping length	Chuck/tailstock barrier
D1	Chuck jaw gripping face width	Chuck/tailstock barrier
CX	Chuck gripping diameter	Chuck/tailstock barrier
CZ	Distance from programming zero	Chuck/tailstock barrier

<Coordinate System for Chuck Barrier Setting>

The chuck barrier is set using the coordinate system which has an origin at the programming zero. Therefore, the chuck barrier is shifted according to the change of programming zero which is shifted according to the change of workpiece.

Procedure:

1) The chuck barrier can be set only after the setup and setting of tool offsets are complete.

2) After selecting the manual mode, select the standard tool which has a zero tool offset value.

3) Move the tool to Point A and note down the actual position data display of both X and Z.

4) After selecting the parameter mode, display the CHUCK/ TAILSTOCK BARRIER page by pressing the function key [F7] (ITEM ↓).

5) Locate the cursor to JAW POS. CX data, key in the value known in step 3) and press the function key [F1] (SET). After that locate it to JAW POS. CZ and enter the value in the same manner as entering JAW POS. CX data. With this, the coordinates of the current turret position are stored in the NC memory.

6) Locate the cursor at JAW SIZE L1 and D1 data position and enter the data using the keyboard and the function key [F1] (SET).

Note 1: If a point defining the chuck barrier is set outside the variable soft-limit position, the variable soft-limit is effective as the chuck barrier setting point.

Note 2: Loading Control Software No. 3 clears the chuck barrier setting point data to zero.

(3) Tailstock

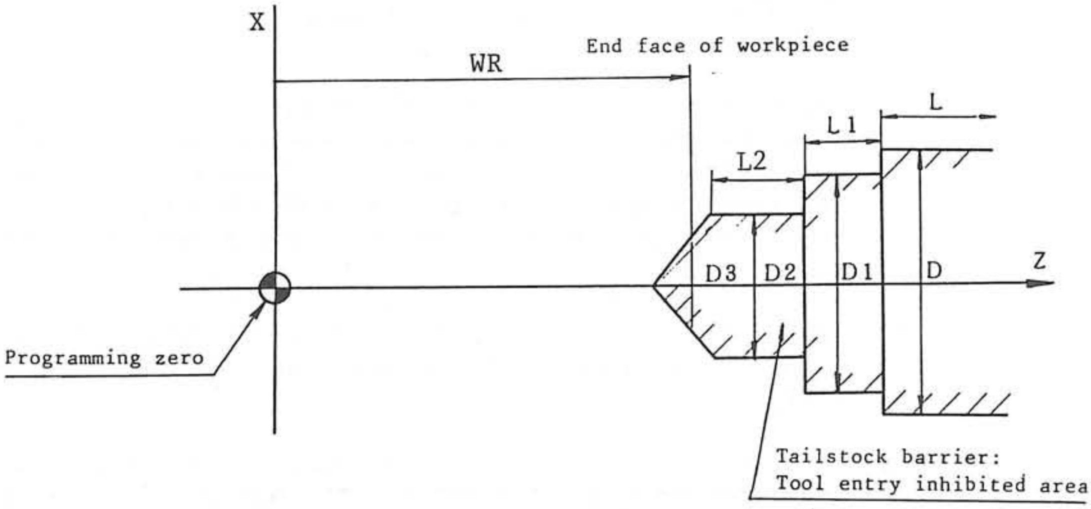
Selection of CHUCK/CENTER WORK mode
(for OSP5ØØL-G, OSP5ØØØL-G flat panel)

Note: For OSP5ØØØL-G, this selection is made with the key switch, and therefore, parameter setting is not required.

a) Tailstock barrier

The tailstock barrier can set the inhibited area for tool entry around the tailstock, that cannot be set by variable soft-limit position data.

Activation or deactivation of the tailstock barrier function can be selected by programming proper M codes. Therefore, check of the tool motion using the tailstock barrier function can be made only when required.



Symbol	Description	Method
L	Chuck jaw length	Optional parameter (long word) No. 2Ø
D	Tailstock spindle diameter	Optional parameter (long word) No. 21
L1	Tailstock spindle length (1)	Optional parameter (long word) No. 22
D1	Tailstock spindle diameter (1)	Optional parameter (long word) No. 23
L2	Tailstock spindle length (2)	Chuck/tailstock barrier
D2	Tailstock spindle diameter (2)	Chuck/tailstock barrier
D3	Tailstock spindle center diameter	Chuck/tailstock barrier
WR	Tailstock spindle position (Z)	Chuck/tailstock barrier

Procedure:

1) The tailstock barrier can be set only after the setting of the tailstock and tool offset are completed with the setup including workpiece chucking and turret completed.

2) After selecting the manual mode, select the standard tool which has a zero tool offset value.

3) Move the tool to the end face of the workpiece. Note down the actual position data of Z-axis.

4) After selecting the parameter mode, display the CHUCK/ TAILSTOCK BARRIER page by pressing the function key [F7] (ITEM ↓).

5) Locate the cursor to WR data and enter the value noted down after pressing the function key [F1] (SET).

6) Set the tailstock barrier data at CENTER L2, CENTER D2, and CENTER D3 by entering the proper data after pressing the function key [F1] (SET).

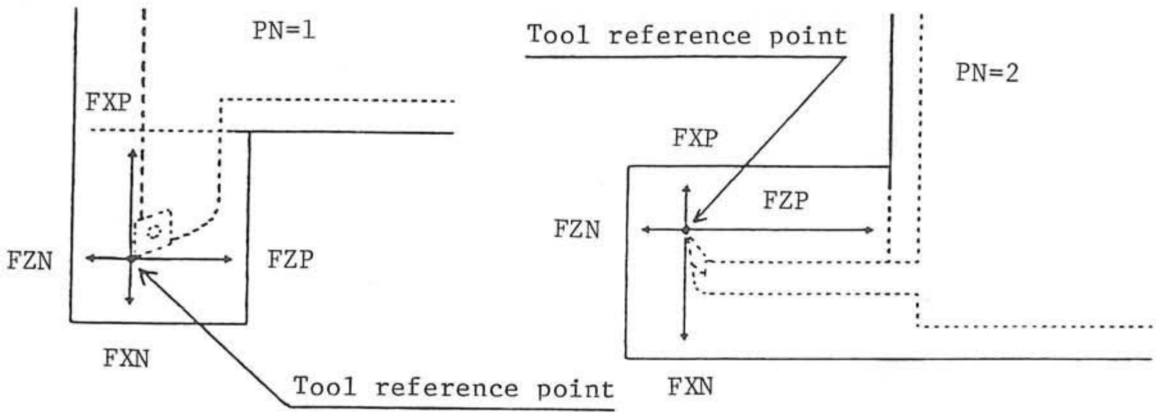
(4) Tool interference area (for the graphic specification)

The procedure to set the tool interference area differs depending on whether the graphic specification is selected or not.

Explanation below is given assuming the graphic specification.

No special operations for setting the tool interference area data is required since the tool interference area data is registered with the tool shape data. selection of the tool shape in the TOOL DATA setting mode automatically selects the interference area setting data. However, if the change of the registered data is required, it is possible in the PARAMETER SET mode.

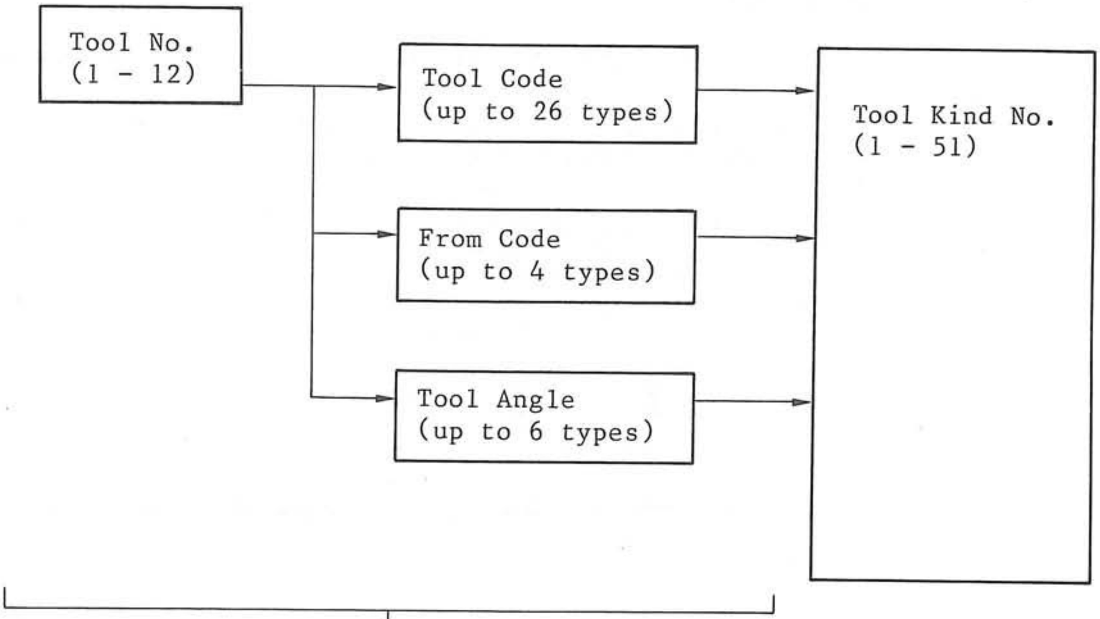
Tool interference area pattern and tool interference area setting data are registered with the tool kind number (They are common to both of A/B turrets). The tool interference area pattern is selected from the OD tool pattern and the ID tool pattern. The tool interference area is defined by four lines. See the figure below.



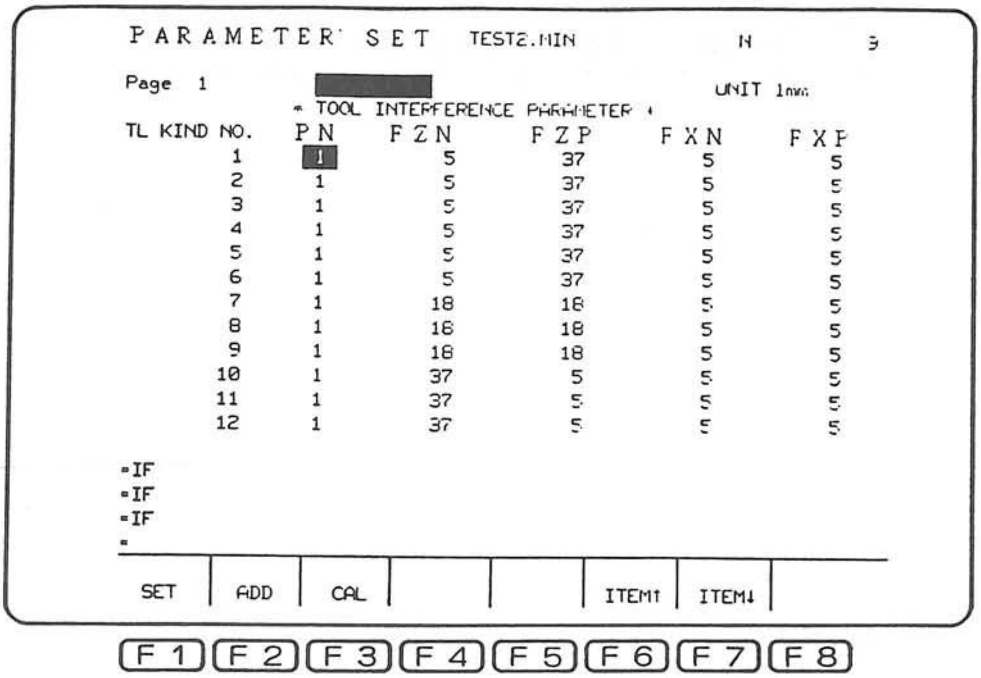
(a) Pattern No. 1 (for OD tools) (b) Pattern No. 2 (for ID tools)

Tool Interference Area Pattern and Area Defining Data

The tool kind number is determined from the tool code and form code for individual tool numbers, and the tool angle. Refer to Section 7, "Barrier Check Function" explained in details in the Programming Manual (Publication No. 2452-E).



These are set in the tool form selection step.



PARAMETER SET TEST2.MIN N 3

Page 1 UNIT 1mm

* TOOL INTERFERENCE PARAMETER *

TL KIND NO.	PN	FZN	FZP	FXN	FXP
1	1	5	37	5	5
2	1	5	37	5	5
3	1	5	37	5	5
4	1	5	37	5	5
5	1	5	37	5	5
6	1	5	37	5	5
7	1	18	18	5	5
8	1	18	18	5	5
9	1	18	18	5	5
10	1	37	5	5	5
11	1	37	5	5	5
12	1	37	5	5	5

=IF
=IF
=IF
=

SET | ADD | CAL | | | ITEM↑ | ITEM↓ |

F1 F2 F3 F4 F5 F6 F7 F8

Procedure:

a) Select the PARAMETER SET mode by pressing the PARAMETER key.

b) Press the function key [F7] (ITEM ↓) to display the *TOOL INTERFERENCE PARAMETER* page.

c) Press the or key to display the page which contains the desired tool kind number. One page contains 12 tool type numbers and a total of five pages are available (1 to 12, 13 to 24, 25 to 36, 37 to 48 and 49 to 6Ø).

d) Use the ↓ or ↑ key to locate the cursor on the desired tool kind number.

e) Use the → or ← key to locate the cursor on the data to be changed.

f) Press the function key [F1] (SET) and key in the desired data.

g) Press the WRITE key.

Repeat steps c) through g) to change the tool interference area setting data. In this operation, A and B TURRET selection may be ignored since the data is registered with the tool kind number.

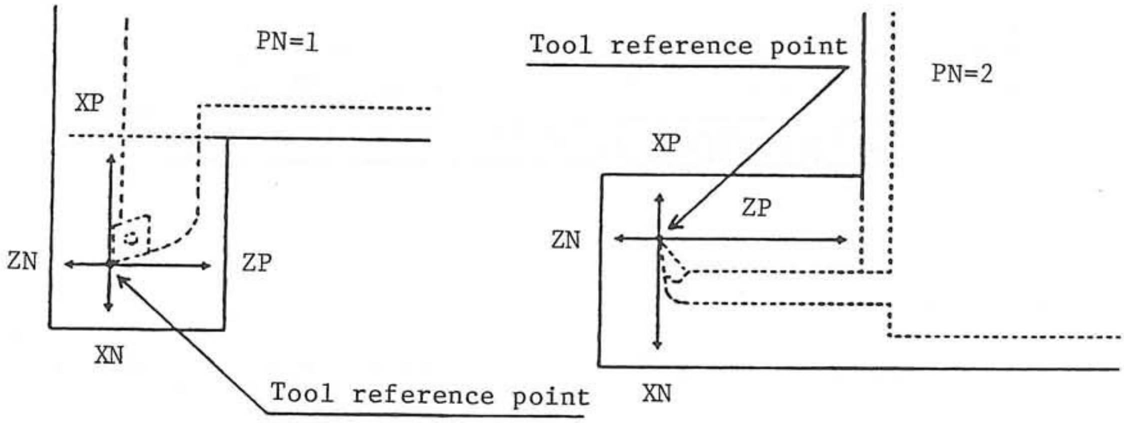
(5) Tool interference area (for the character specification)

The procedure to set the tool interference area differs depending on whether the graphic specification is selected or not.

Explained below is the procedure to be used for the character display.

The data to define the tool interference area is set in the TOOL DATA SET mode.

Enter the tool interference area pattern and tool interference area setting data for each of the tools (Enter for each of A/B turrets.). The tool interference area pattern is selected from the OD tool pattern and the ID tool pattern. The tool interference area is defined by four lines. See the figure below.



(a) Pattern No. 1 (for OD tools) (b) Pattern No. 2 (for ID tools)

Tool Interference Area Pattern and Area Defining Data

PN: Tool interference area pattern selection number

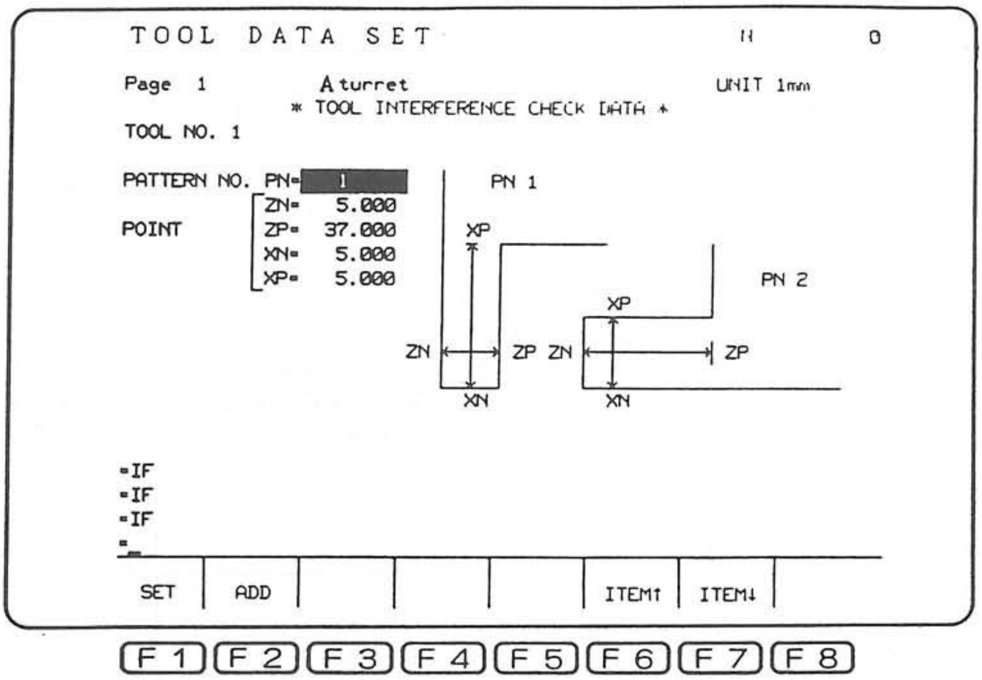
1 = for OD tools
2 = for ID tools

ZN: Position of the area defining line in the negative direction of Z-axis in reference to the tool reference point

ZP: Position of the area defining line in the positive direction of Z-axis in reference to the tool reference point

XN: Position of the area defining line in the negative direction of X-axis in reference to the tool reference point

XP: Position of the area defining line in the positive direction of X-axis in reference to the tool reference point



Procedure:

a) Select the TOOL DATA SET mode by pressing the TOOL DATA key.

b) Press the function key [F7] (ITEM ↓) to display the *TOOL INTERFERENCE CHECK DATA* page. See the CRT above.

c) Press the key to select A-turret.

d) Press the or key to display the page listing the tool number for which the tool interference area is to be set.

e) Press the ↑ or ↓ key to designate the data to be set.

f) Press the function key [F1] (SET) and key in the desired data.

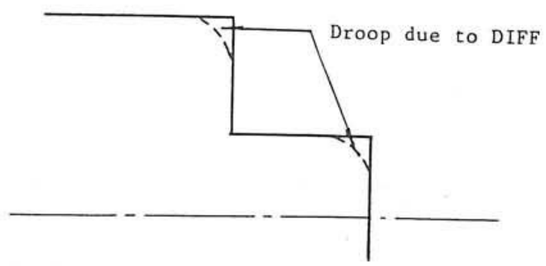
g) Press the WRITE key.

Repeat steps c) through g) to set the necessary tool interference area setting data.

For the tools on B-turret, set the data in the similar manner.

(6) Droop

Any servo system basically has a servo error, delay (DIFF) to the function generation. Especially in high speed cutting, droop due to servo error (DIFF) results when a corner is cut. Such droop amount can be decreased by proper designating commands and also by setting the required parametric data.



Procedure:

1) After pressing the PARAMETER key, select the USER PARAMETER page on the CRT.

2) After locating the cursor to "Droop - X", set the desired droop amount using [F1] (SET) key. Then set the desired amount on Z-axis after locating the cursor to "Droop - Z" and then press function key [F1].

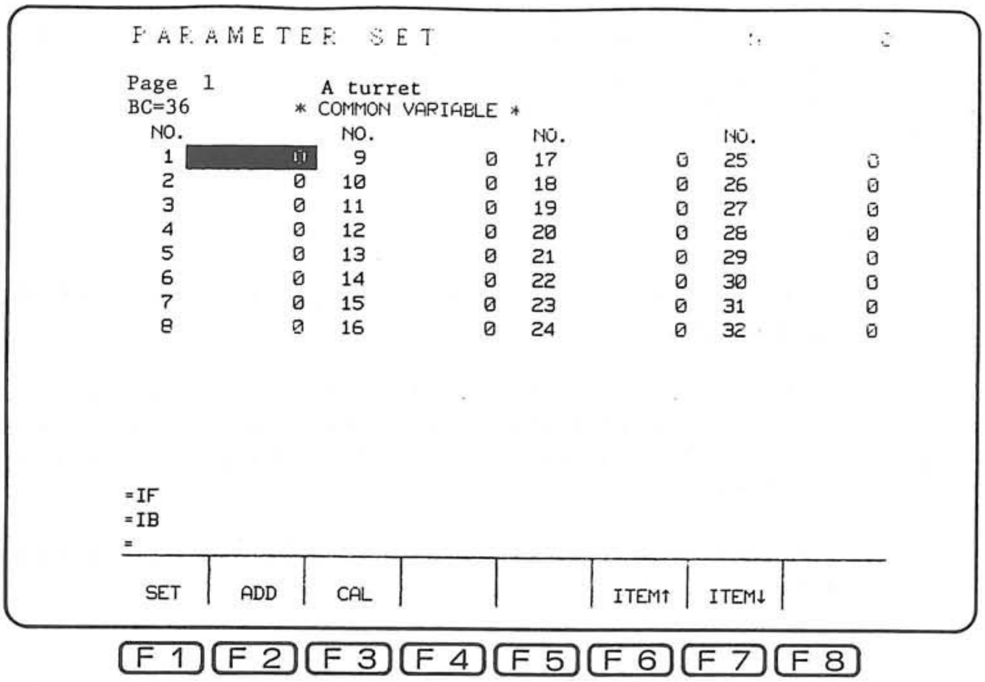
   The larger the set amount is, the larger the droop amount becomes.

Note: Loading Control Software No. 3 sets droop amount to 1Ø μm.

4-3-2. Common Variables

The OSP500/5000L-G can use 32 common variables, V1 through V32, which can be used both for A- and B-turret. The use of these variables can be determined by the user independently of the system.

Procedure:



1) After pressing the PARAMETER key, select the COMMON VARIABLE page on the CRT.

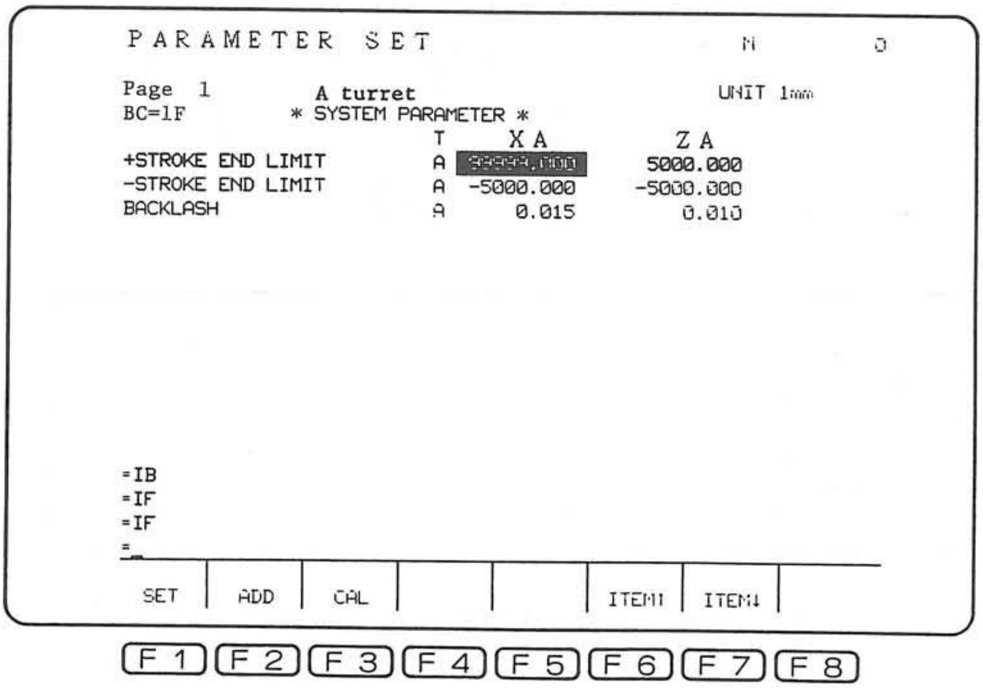
2) Locate the cursor to the position for data setting or change.

3) Set the required data using the function keys [F1] (SET) or [F2] (ADD).

Note: Since the data for common variables is stored as a data with floating zero, display right to the decimal point may not be the same as set due to rounding.

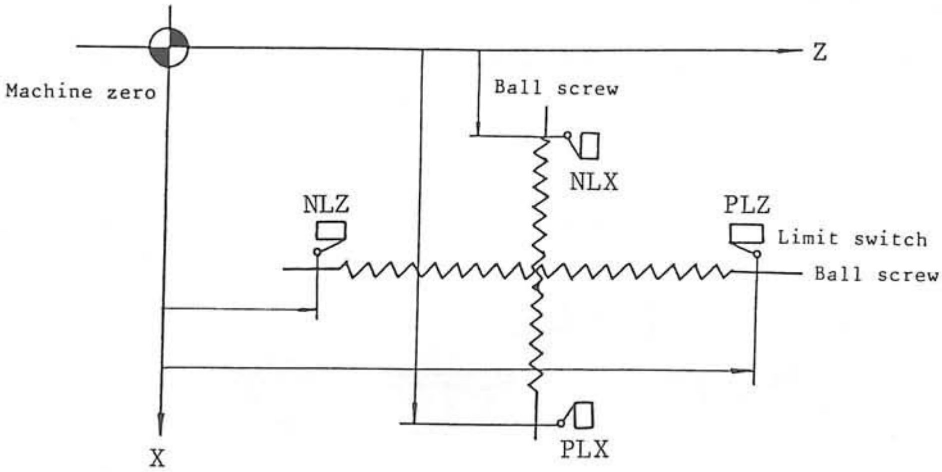
4-3-3. System Parameter

System parameter are the parameters determined by the data specific to the respective machines. Data should be set for A- and B-turret, independently.



(1) Stroke End Limit

The stroke end limit determines the limit of axis travel. With this, the ball screw is protected from overrun. However, the machine is equipped with stroke end protective limit switches, which mechanically protect the machine; if any of these limit switches is actuated, power supply to the machine, with the exception of the control, is shut off and machine operation is brought to a complete stop. Set the stroke end positions inside the area determined by those limit switches.



Axis / CRT Display	X-axis	Z-axis
+ STROKE END LIMIT	PLX	PLZ
- STROKE END LIMIT	NLX	NLZ

The stroke end limit positions are factory-set and these data are recorded on the OSP CONTROL CARD.

NEVER CHANGE THESE DATA AFTER INSTALLATION.

Procedure:

1) After pressing the PARAMETER key, select the SYSTEM PARAMETER page on the CRT.

2) After locating the cursor to "+STROKE END LIMIT - XA", set the data recorded on the OSP CONTROL CARD using the function key [F1] (SET).

3) Set the stroke end limit data of -X, +Z and -Z in the same manner.

4) If the stroke end limit data is unknown, record the actual position data of the turret, and set it as the stroke end data for both the negative and positive directions on respective axes.

5) Actually measure the available axis travel from the current turret position in both the positive and negative directions.

6) Set the measured axis travel in the positive direction using the function key [F2] (ADD): the data should be positive.

   Set the measured axis travel in the negative direction using the function key [F2] (ADD): the data should be negative.

(2) Backlash

Backlash elimination function serves to compensate for lost motion on each axis when the axis feed direction is reversed from the negative to the positive direction.

That is, the set backlash compensation value is subtracted from the value read by the OSP position encoder when the axis motion is reversed from negative to positive, and the result of the subtraction is handled as the true position data.

The backlash compensation data is set before delivery; however, it can be changed if desired using a parameter.

Procedure:

1) After pressing the PARAMETER key, select the SYSTEM PARAMETER page on the CRT.

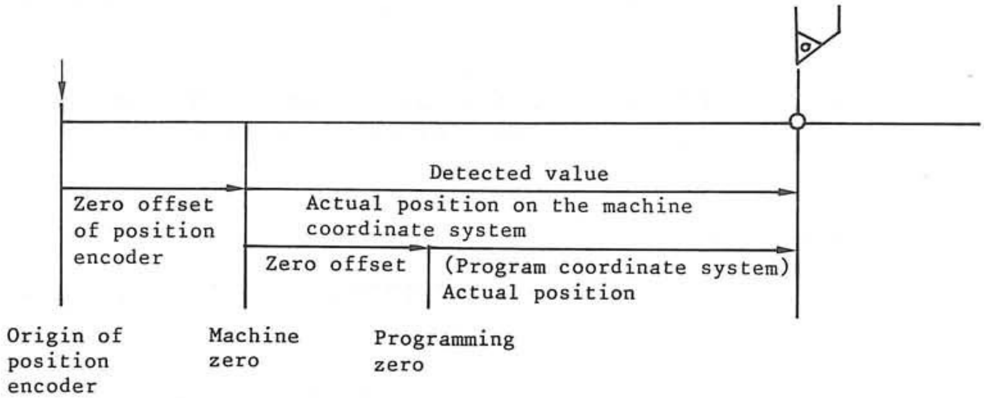
2) Locating the cursor to "BACKLASH - XA", set the desired backlash compensation data using the function key [F1] (SET).

3) Set the backlash compensation data of Z-axis in the same manner.

Note: Loading Control Software No. 3 sets the backlash compensation data at "1Ø μm". (15 μm for X-axis of the LC1Ø)

(3) Zero Offset of Position Encoder

Zero offset of the position encoder is to compensate the current location which has not been compensated (to be referred to as detected value hereinafter) to make it into the actual position on the machine coordinate system. The diagram below expresses the relationship between the origin of the position encoder, machine zero, programming zero, offset of position encoder, and zero offset.



Origin of the position encoder indicates the position when the the value of the position encoder is Ø.

Since the value of the machine zero can be set arbitrarily by the position encoder zero offset, this function is effective in the following cases.

When the position encoder is changed:

Set the offset value of the position encoder zero position so that the position of machine zero does not change before and after the position encoder is changed. Resetting the position encoder offset value permits the values that are set in relation with the machine zero such as travel end limit, variable soft-limit and zero offset to be used without resetting.

When the detected value exceeds 8 digits in decimal numbers within the machine travel range (movable range):

This kind of case can take place depending on the machine model. However, it is possible to set the machine zero so that the output value from the position encoder does not exceed 8 digits in decimal numbers by taking advantage of position encoder zero offset.

Procedure:

1) After pressing the PARAMETER key, select the SYSTEM VARIABLE page on the CRT.

2) Move the cursor to the X (Y) of the position encoder offset.

3) Set the data by pressing the function key [F1] (SET) (or [F2] (ADD) or [F3] (CAL)).

Note 1: Ø is set for both X and Z right after control software loading.

Note 2: Wait for more than 3 minutes after data setting before turning off and then on power again.

Note 3: When the CAL function is used, the input data should indicate where the present position should be located on the machine coordinate system.

Note 4: Setting range is within 9 digits in decimal numbers and the negative values cannot be set.

Note 5: When no setting is conducted (setting value is Ø), the position encoder origin and the machine zero share the same point.

Note 6: No setting can be carried out for the C-axis and W-axis.

(4) Unit Amount and Acceleration Unit Amount

Special attention must be paid when changing or setting the unit amount or acceleration unit amount since they are fundamental amount in axis control.

What is "unit amount"?

On the OSP5ØØ/5ØØØL-G, axis motion is controlled as the control calculates RCON every 12.8 msec. The change of variation amount in the repetitive calculation is called "unit amount".

The feed unit amount is expressed as follows:

Feed unit amount (μm/12.8 msec.)

$$= \frac{x \text{ m/min} \times 1\emptyset^6}{6\emptyset \times 1\emptyset^3 \text{ msec.}} \times 12.8 \text{ msec.}$$

where, x: feed rate (m/min)

For example, when the feedrate is 1Ø m/min, the unit amount is 2134 μm/12.8 msec.

What is "acceleration unit amount"?

On the OSP5ØØ/5ØØØL-G, automatic acceleration and deceleration is available for starting and ending of rapid feed or manual feed. Acceleration or deceleration means the change of unit amount described above.

While the axis is at a still, unit amount is "zero". However, when feeding starts, the unit amount increases every 12.8 msec. until it reaches the feed unit amount. The variation of the unit amount is called "acceleration unit amount".

The time required for acceleration and deceleration for feeding can be calculated from the equation below:

Acceleration/deceleration time (msec.)

$$= \frac{\text{Feed unit amount}}{\text{Feed acceleration unit amount}} \times 12.8 \text{ msec.}$$

CAUTION

If the acceleration unit amount is changed to a value larger than the preset one, it could adversely affect motor and machine performance. Therefore, be sure to contact Okuma when a change of the acceleration unit amount is desired.

PARAMETER SET N 0

Page 1
BC=22 * SYSTEM PARAMETER *

	X	Z
RAPID	2134	2134
ACCEL RAPID	273	273
JOG FEED	512	512
ACCEL JOG FEED	164	164

=IF
=IF
=IB
=_

SET	ADD	CAL			ITEM↑	ITEM↓	
F 1	F 2	F 3	F 4	F 5	F 6	F 7	F 8

4-3-4. Optional Parameter (Long Word)

```
PARAMETER SET

Page 1           A turret
BC=2C          * OPTIONAL PARAMETER LONG WORD *
  NO.               NO.                NO.                NO.
   1  [illegible]   13        9        25          0      37          0
   2        328     14      500        26          0      38          0
   3        512     15        0        27          0      39          0
   4        164     16        0        28          0      40          0
   5         20     17        0        29          0      41          0
   6        100     18   200000        30          0      42          0
   7        500     19   200000        31          0      43          0
   8        512     20    50000        32          0      44          0
   9        512     21   200000        33          0      45          0
  10        512     22    40000        34          0      46          0
  11          9     23   150000        35          0      47          0
  12        256     24        0        36          0      48          0

=IF
=IF
=IF
=

 SET | ADD | CAL |     |     | ITEM↑ | ITEM↓ |

 F 1   F 2   F 3   F 4   F 5   F 6   F 7   F 8
```

Optional parameter (long word) indicates the fundamental amounts.

Loading Control Software No. 3 sets the standard data. If change of the data is to be executed, proceed very carefully since it is a very delicate element of NC operation.

Standard values of the optional parameter (long word) are indicated below:

Parameter No.	Description	Unit	Initial Value	Maximum Value	Minimum Value
1	Not used		∅		
2	Not used		∅		
3	Not used		∅		
4	Not used		∅		
5	Allowable error in circular interpolation	μm	2∅	2∅∅	2
6	Relieving amount in LAP - bar turning	μm	1∅∅	1∅∅∅	1

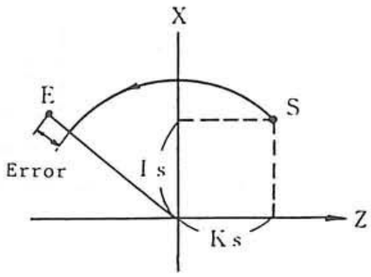
Parameter No.	Description	Unit	Initial Value	Maximum Value	Minimum Value
7	Pecking amount in grooving in "mm/min. feed" mode and drilling cycle	μm	500	10000	1
8	Unit amount of chamfering in thread cutting cycle	μm/12.8 msec.	512	1024	21
9	Unit amount in dry run	μm/12.8 msec.	512	1024	21
10	Not used		0		
11	Not used		0		
12	Not used		0		
13	Not used		0		
14	Pecking amount in drilling cycle for multi-machining model	μm	500	10000	1
15	Number of workpieces (FMS)	pcs.	0	(7FFFFFFF) 2.1 billion	0
16	Counted number of machined workpieces (FMS)	pcs.	0	(7FFFFFFF) 2.1 billion	0
17	Not used		0		
18	Jaw dimension L	μm	200000	9999999	1000
19	Jaw dimension D	μm	200000	9999999	1000
20	Tailstock dimension L	μm	50000	9999999	1000
21	Tailstock dimension D	μm	200000	9999999	1000
22	Tailstock dimension L1	μm	40000	9999999	1000

Parameter No.	Description	Unit	Initial Value	Maximum Value	Minimum Value
23	Tailstock dimension D1	μm	15ØØØØ	9999999	1ØØØ
24	Sensor protection distance	μm	5ØØ	3ØØØØ	Ø
25	Allowable distance of touch setter for measurement	μm	3ØØØØ	9999999	Ø
26	M spindle BL motor, zero offset	Ø.ØØ1°	Ø	359999	Ø
27	M spindle BL motor, acceleration unit	Ø.ØØ1°/ 12.8 $msec^2$	288ØØ	576ØØ	288
28	ATC second barrier range, X-axis (LR15M-ATC)	μm	Ø	99999999	Ø
29	ATC second barrier range, Z-axis (LR15M-ATC)	μm	Ø	99999999	Ø
3Ø	ATC first barrier range, X-axis (LR15M-ATC)	μm	Ø	99999999	Ø
31	ATC first barrier range, Z-axis (LR15M-ATC)	μm	Ø	99999999	Ø
32	Tool offset, nose R compensation Fixed amount addition/deduction	μm (1/1ØØØ in.)	Ø	1ØØØ	Ø
33	Tool offset, nose R compensation Limit value for addition	μm	1ØØØ	1ØØØ	Ø

<Meaning of optional parameter (long word)>

Parameter #1	Not used
Parameter #2	Not used
Parameter #3	Not used
Parameter #4	Not used
Parameter #5	Allowable error in circular interpolation

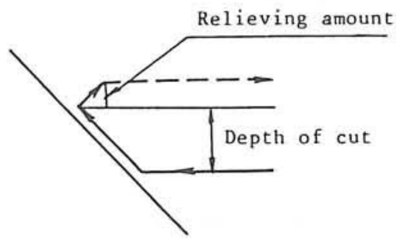
When commanding an arc, its center is dimensioned with reference to the arc starting point (S) using I and K words (Is, Ks). The programmed coordinates of the end point (E) might not correctly lie on the arc generated by the circular interpolation commands due to an error in the commanded values. The allowable error amount is indicated by parameter. Standard setting is 2Ø μm.



Parameter #6	Relieving amount in LAP - bar turning

In bar turning mode operation in the LAP, the axes, after completion of a cutting with the specified depth of cut, shift away from the workpiece by the set relieving amount and then move to the starting point for the consequent cutting. This amount is set with a parameter. Both X- and Z-axis relieve the same amount from the workpiece.

Standard setting is Ø.1 mm.



Parameter #7

Pecking amount in grooving in "mm/min. feed" mode and drilling cycle

With the compound drilling and grooving fixed cycle, if pecking amount is not designated in the program, the amount set in this parameter is taken as the pecking amount. Standard setting is 5ØØ μm.

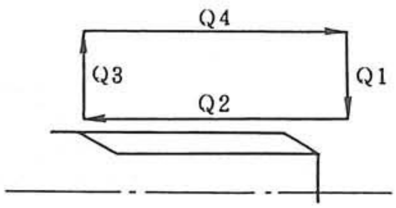
Standard setting is Ø.5 mm.

Parameter #8

Unit amount of chamfering in thread cutting cycle

In thread cutting cycle, thread cutting is performed in path Q2 and chamfering is performed in path Q3. Unit amount in path Q3 is set as a parametric data.

Standard setting is 512 μm/12.8 msec. and feedrate in chamfering with this setting is 2.4 m/min.



Parameter #9

Unit amount in dry run

With the dry run function activated, all feed commands in a program are executed in the same feedrate. The value set in parameter #9 is the unit amount for dry run operation.

Standard setting is 512 μm/12.8 msec. and the feedrate with this setting is 2.4 m/min.

Parameter #1Ø Not used

Parameter #11 Not used

Parameter #12 Not used

Parameter #13 Not used

Parameter #14

Pecking amount in drilling cycle for multi-machining model

This sets the tool pecking amount in the grooving and drilling cycles.

Standard setting is 5ØØ μm.

Parameter #15 Number of workpieces (FMS)

The number of workpieces to be machined is set when the control is used in the FMS.

Parameter #16 Counted number of machined workpieces (FMS)

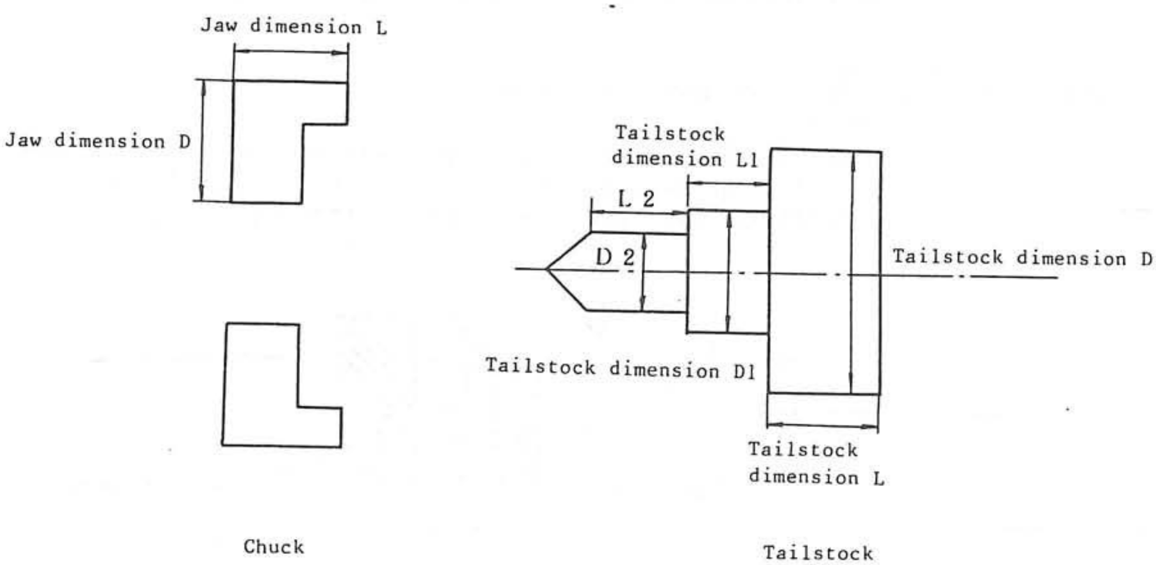
The number of workpieces having been machined is counted when the control is used in the FMS.

Parameter #18 - #23 Chuck and tailstock dimensions

Chuck and tailstock dimensions are set on the display (graphic animated display). The dimensions set on this page are used as the data for establishing the chuck and tailstock barrier.

#18 ..... Jaw dimension L (200000 μm)
#19 ..... Jaw dimension D (200000 μm)
#20 ..... Tailstock dimension L (50000 μm)
#21 ..... Tailstock dimension D (200000 μm)
#22 ..... Tailstock dimension L1 (40000 μm)
#23 ..... Tailstock dimension D1 (150000 μm)

Values in parentheses are standard setting values.



Parameter #24 Sensor protection distance

Movable distance after the contact with the sensor

Standard setting is 0.5 mm.

Parameter #25 | Allowable distance of touch setter for measurement

Allowable moving distance between the touch setter measurement start and the contact with the sensor.

Standard setting is 3Ø mm.

Parameter #26 | M spindle BL motor, zero offset

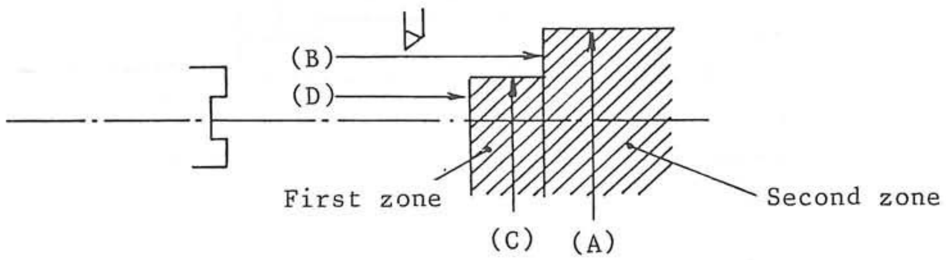
In the synchronized control mode of the spindle and the M spindle for the machine equipped with the BL motor driven M spindle, the M spindle must be set at Ø° position when the spindle is positioned at the Ø° position. For this purpose, zero offset of the M spindle drive BL motor is set to change the relative position of the M spindle to the spindle, thus synchronizing the spindle and the M spindle. The setting unit is Ø.ØØ1°.

Parameter #27 | M spindle BL motor, acceleration unit

When the M spindle is driven by a BL motor, acceleration and deceleration are conducted for spindle rotation. Acceleration and deceleation duration can be changed by setting proper parameter data. Standard setting is 288ØØ (1 μm/12.8 msec^2), which sets acceleration duration of Ø.1 sec. at a spindle speed of 3ØØØ rpm.

Parameter #28 - #31 | ATC barrier range

ATC barrier can be set to prevent interference between the ATC units and the turret. ATC barrier is set with the first and the second zone setting points.



(A) parameter #28 (X-axis second zone)

(B) Parameter #29 (Z-axis second zone)

(C) Parameter #3Ø (X-axis first zone)

(D) Parameter #31 (Z-axis first zone)

Parameter #32	Tool offset, nose R compensation Fixed amount addition/deduction

The parameter is used to set an amount used for carrying out addition or deduction of a fixed amount to compensate the offset data.

Standard setting is Ø (in units of μm).

Parameter #33	Tool offset, nose R compensation Limit value for addition

This parameter is used to set the limit value of offset data in compensating the data through fixed amount addition operation. This limit is ignored when optional parameter (bit) No. 3 bit 5 is "1".

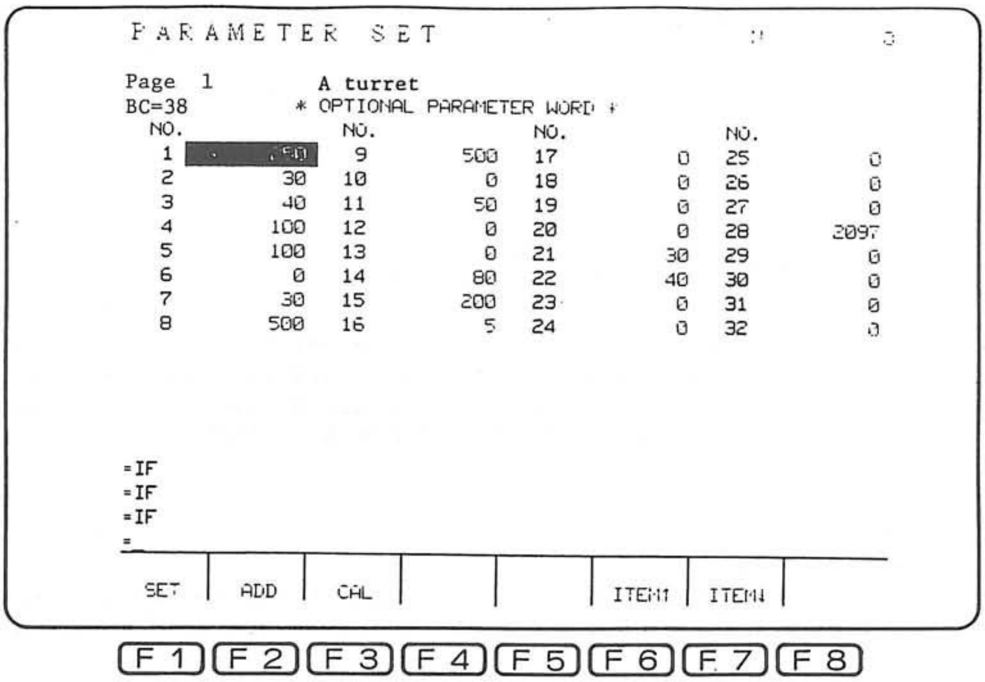
Procedure:

1) After pressing the PARAMETER key, select the OPTIONAL PARAMETER (LONG WORD) page by pressing the function key [F7] (ITEM ↓).

2) Locate the cursor to the data to be set or changed.

3) Using the function key [F1] (SET) and the keyboard switches, set the desired data.

4-3-5. Optional Parameter (Word)



Optional parameter (word) is used to control miscellaneous operations such as chuck open/close and spindle start/stop.

The Control Software No. 3 sets the data to the standard values. If necessary, set or change the data to the required value.

Parameter No.	Description	Unit	Initial Value	Maximum Value	Minimum Value
1	Tape feed	Number of holes	250	10000	1
2	Spindle oscillation speed	Motor speed rpm	30	500	1
3	Spindle jog speed	Motor speed rpm	40	500	1
4	Spindle speed override in machine lock operation	%	100	1000	1
5	Chuck clamp timer	10 msec.	100	1000	0
6	Chuck unclamp timer	10 msec.	0	1000	0

Parameter No.	Description	Unit	Initial Value	Maximum Value	Minimum Value
7	Power save timer	minute	3Ø	1ØØØØ	Ø
8	SMW chuck clamp timer	1Ø msec.	5ØØ	3ØØØ	Ø
9	SMW chuck unclamp timer	1Ø msec.	5ØØ	3ØØØ	Ø
1Ø	Not used		Ø		
11	Feedrate in gauging cycle 1	mm/min	5Ø	5ØØ	1
12	Zero position for spindle orientation	Ø.1°	Ø	3599	Ø
13	Work runout detection timer	Ø.1 sec.	Ø	6ØØØ	Ø
14	Tailstock spindle in-position timer	Ø.1 sec.	8Ø	2ØØØ	Ø
15	Feedrate in gauging cycle 2	mm/min	2ØØ	5ØØ	1
16	Lubrication motor operation interval (motor OFF time)	min	5	59	1
17	Overload detection time (load monitoring immune time)	Ø.1 sec.	4	5Ø	Ø
18	Post-process gauging data read timer	1Ø msec.	Ø	6ØØØ	Ø
19	Chucking error detection air output timer	Ø.1 sec.	3Ø	6ØØØ	Ø
2Ø	Lubrication motor ON time	sec.	15	6Ø	1
21	Rotary tool inching speed	Motor speed rpm	3Ø	5ØØ	1
22	Rotary tool oscillation speed	Motor speed rpm	4Ø	5ØØ	1
23	ATC magazine backlash	μm	Ø	1ØØ	-1ØØ

Parameter No.	Description	Unit	Initial Value	Maximum Value	Minimum Value
24	ATC zero offset	μm	Ø	4999	-4999
25	Machine number in FMS		1	9999	1
26	STM time over timer	Ø.1 sec.	Ø	6ØØØ	Ø
27	Cycle time over timer	sec.	Ø	144ØØ	Ø
28	Acceleration/deceleration coefficient for acceleration/deceleration of precision lathe	None	2Ø97	32767	Ø
29	Not used		Ø		
3Ø	Number of automatically recognizable large diameter tools for ATC	pcs.	Ø	63	Ø
31	Air output timer for work pressing error detection	Ø.1 sec.	Ø	6ØØØ	Ø
32	Selection of display of servo processor internal variables	None	Ø	9999	Ø
33	Not used		Ø		
34	RS232C busy time (CNØ)	sec.	3Ø	9999	1
35	RS232C busy time (CN1)	sec.	3Ø	9999	1
36	RS232C busy time (CN2)	sec.	3Ø	9999	1
37	RS232C busy time (CN3)	sec.	3Ø	9999	1
38	RS232C busy time (CN4)	sec.	3Ø	9999	1
39	RS232C baud rate (CNØ)	Baud	24ØØ	192ØØ	11Ø
4Ø	RS232C baud rate (CN1)	Baud	24ØØ	192ØØ	11Ø
41	RS232C baud rate (CN2)	Baud	24ØØ	192ØØ	11Ø
42	RS232C baud rate (CN3)	Baud	24ØØ	192ØØ	11Ø
43	RS232C baud rate (CN4)	Baud	24ØØ	192ØØ	11Ø

Parameter No.	Description	Unit	Initial Value	Maximum Value	Minimum Value
44	Punch device number	Number	5	5	Ø
45	Gauging data print device number	Number	Ø	5	Ø
46	DNC output device number	Number	Ø	4	Ø
47	Number of tools on turret A	pcs.	Ø	12	Ø
48	Number of tools on turret B	pcs.	Ø	12	Ø
49	Number of dots for scale frame shifting	dots	4	16	1
5Ø	Output dot interval in INT	dots	2	4	2
51	Margin for automatic determination	%	1ØØ	1ØØ	Ø
52	Spindle orientation angle for C-axis connection	Ø.1°	Ø	3599	Ø
53	Not used		Ø		
54	Read device number	Number	Ø	5	Ø
55	Display distance of tool contour on the front view	%	5Ø	1ØØ	1Ø
56	Not used		Ø		
57	Timer for waiting time for command response from the host computer in the DNC mode	sec.	3Ø	999	1
58	Number of average load monitoring value collection	times	16	8Ø	4

Parameter No.	Description	Unit	Initial Value	Maximum Value	Minimum Value
59	Overload alarm duration	x 12.8 msec.	1Ø	999	1
6Ø	Tool breakage alarm duration	x 12.8 msec.	5	999	1
61	Lower end of load trace display	%	Ø	195	Ø
62	Upper end of load trace display	%	1ØØ	2ØØ	5
63	Automatic setting of the first limit level	%	11Ø	2ØØ	1ØØ
64	Automatic setting of the second limit level	%	12Ø	2ØØ	1ØØ
65	Percent value at the maximum input of the load monitoring spindle	%	Ø	5ØØ	Ø
66	Percent value at the maximum input of the M-tool spindle	%	Ø	5ØØ	Ø
67	Averaging number of temperature data sampling times for thermal displacement compensation	times	1Ø	1Ø	1
68	Allowable temperature difference for thermal displacement compen-sation	Ø.1°C	1ØØ	1ØØ	Ø
69	Bed influence coef-ficient for thermal displacement compen-sation	None	2	1Ø	Ø
7Ø	The number of bytes in a block in the program reverse transmission opera tion using DNC-B protocol A	byte	Ø	4ØØØ	Ø

Parameter No.	Description	Unit	Initial Value	Maximum Value	Minimum Value
71	Spindle orientation completion confirmation timer	1Ø msec.	2Ø	9999	Ø
72	Not used		Ø		
73	Allowable chuck rotation speed	rpm	Ø	Max. spindle speed (depends on machine models)	Ø
74	Allowable door interlock spindle speed	rpm	5Ø	5ØØ	1
75	Not used		Ø		
76	Not used		Ø		
77	Not used		Ø		
78	Not used		Ø		
79	Not used		Ø		
8Ø	Not used		Ø		
81	Not used		Ø		
82	Not used		Ø		
83	Not used		Ø		
84	Not used		Ø		
85	Not used		Ø		
86	Not used		Ø		
87	Not used		Ø		
88	Not used		Ø		
89	Not used		Ø		
9Ø	Not used		Ø		
91	Not used		Ø		

Parameter No.	Description	Unit	Initial Value	Maximum Value	Minimum Value
92	Not used		Ø		
93	Not used		Ø		
94	LR15M-ATC magazine positioning pin IN signal output position	parts	Ø	256Ø	Ø
95	LR15M-ATC magazine rotation signal output position	parts	Ø	256Ø	Ø
96	LR15M-ATC magazine deceleration brake ON signal output position	parts	Ø	256Ø	Ø

<Meaning of optional parameter (word)>

Parameter #1 Tape feed

In the tape punch operation with the information transferred from memory in the program operation mode, tape feed holes must be punched before punching out the program data. The length of the leader section which contains only feed holes can be set as a parametric data of parameter #1.

Standard setting is 25Ø feed (approx. 6Ø cm).

Parameter #2 Spindle oscillation speed

Spindle oscillation speed can be set in terms of the motor speed.

Standard setting is 3Ø rpm.

Parameter #3 Spindle jog speed

Spindle jog speed can be set in terms of the motor speed.

Standard setting is 4Ø rpm. The relationship between the motor speed and the spindle speed is detailed later in this section.

Parameter #4

Spindle speed override in machine lock operation

During the machine lock mode, simulation is conducted using the programmed spindle speeds. It is possible to override the programmed spindle speeds.

Standard setting is 100%.

Parameter #5

Chuck clamp timer

The duration of the chuck clamp signal, i.e., from chuck clamped confirmation limit switch signal ON to chuck clamp signal turning OFF, can be set.

Standard setting is one second.
The timer is set in the unit of 10 msec.; setting is 100 for one second.

Parameter #6

Chuck unclamp timer

The duration of chuck unclamp signal, i.e., from chuck unclamped confirmation limit switch signal ON to chuck unclamp signal turning OFF, can be set.

Standard setting is zero.
The timer is set in the unit of 10 msec.

Parameter #7

Power save timer

The power save timer sets the time to activate the power save functions after one complete automatic cycle is finished with SINGLE BLOCK mode OFF, or after machine operation is stopped due to alarm condition (type A) in continuous automatic mode operation.

Power save function is effective on:

Hydraulic power unit pump motor	1500 W
Guideway lubrication motor	5 W
Headstock lubrication motor	75 W
Work lamp	200 W
Total	1780 W

To cancel the power save mode, reset the control.

Standard setting is 30 minutes.
The timer setting unit is "minute".

Parameter #8	SMW chuck clamp timer

This is the chuck clamp timer for SMW chuck.

Standard setting is five seconds.
The unit of timer setting is 10 msec.; 500 for five seconds.

Parameter #9	SMW chuck unclamp timer

This is the chuck unclamp timer of SMW chuck.

Standard setting is five seconds.
The unit of timer setting is 10 msec.; 500 for five seconds.

Parameter #10	Not used

Parameter #11	Feedrate in gauging cycle 1

This sets the feedrate from the approach point to the contact point in the gauging cycle using the touch sensor. The feedrate in the second gauging cycle in the case of two-contact gauging cycle and the feedrate to be employed in the one-contact gauging cycle. The unit of data setting is mm/min.

The standard setting is 50 and the range of the settable data is 1 through 500.

Parameter #12	Zero position for spindle orientation

For the spindle orientation specification, zero position of C-axis command is set.

Parameter #13	Work runout detection timer

Sets time duration for detecting runout of a workpiece.

Parameter #14	Tailstock spindle in-position timer

In the tailstock spindle advance movements, the time duration in which the tailstock spindle advance command is completed after the in-position signal has been inputted.

Standard setting is 8 seconds.

Parameter #15

Feedrate in gauging cycle 2

This sets the feedrate from the approach point to the contact point in the first gauging cycle for the two-contact gauging cycle. The unit of data setting is mm/min.

The standard setting is 2ØØ and the range of the settable data is 1 to 5ØØ.

Parameter #16

Lubrication motor operation interval (motor OFF time)

The operation interval of the way lubrication pump motor for the LB series lathes is set. For other models, this parameter is not effective.

Standard setting is 5 minutes.

Parameter #17

Overload detection time (load monitoring immune time)

Effective for the overload detection specification. When an overload state continues exceeding the time duration set by this parameter, an alarm occurs.

During monitoring or automatic setting, collection of cutting load is suspended for a period set at this parameter after the feedrate is switched from rapid to cutting feed.

Parameter #18

Post-process gauging data read timer

Gauging data is read after the elapse of the time duration set by this parameter after the gauging cycle start command was output.

Parameter #19

Chucking error detection air output timer

Time duration in which chucking error detection air is kept on is set.

Parameter #2Ø

Lubrication motor ON timer

For the lubrication motor soft control specification, the lubrication motor ON time can be set with this parameter.

Parameter #21	Rotary tool inching speed (Motor speed)

For the multi-machining model, the inching speed of the rotary tool is determined by this parameter.

Parameter #22	Rotary tool oscillation speed (Motor speed)

For the multi-machining model, the oscillation speed of the rotary tool is determined by this parameter.

Parameter #23	ATC magazine backlash

For the ATC specification, the lost motion of the ATC magazine is compensated by setting the proper backlash amount this parameter.

Parameter #24	ATC zero offset

For the ATC specification, the offset data used for aligning the ATC magazine position is set by this parameter.

Parameter #25	Machine number in FMS

The machine number of this machine when it is used as the cell in the FMS

Parameter #26	STM time over timer

The maximum allowable time duration in which S, T and M functions may be executed (optional)

Parameter #27	Cycle time over timer

The maximum allowable time duration in which one cycle may be executed (optional)

Parameter #28	Acceleration/deceleation coefficient for acceleration/deceleration of precision lathe

Acceleration/deceleration coefficient
= 1/Time constant x sampling time x 2^{16}

1/Time constant = KV value

Initial setting: $1\emptyset \times 3.2 \times 1\emptyset^{-3} \times 2^{16} = 2\emptyset97$
Setting range : $\emptyset$ - 32767

Parameter #29 | Not used

Parameter #3Ø | Number of automatically recognizable large diameter tools for ATC

1 - (set value -1): Standard tool
Set value - 63 : Large diameter tool

Initial setting: Ø (all tools are standard size tools)
Setting range : Ø - 63

Parameter #31 | Air output timer for work pressing error detection

Setting unit is Ø.1 sec.

Initial setting: Ø
Setting range : Ø - 6ØØØ

Parameter #32 | Selection of display of servo processor internal variables

Upper two digits: Display data 1 (RSVPVAR1)
Lower two digits: Display data 2 (RSVPVAR2)

Parameter #33 | Not used

Parameter #34 - #38 | RS232C busy time

Duration of time to wait for the response after the output of the request signal is set for individual channels. Setting unit is second. If no response is received within the set duration of time, an alarm occurs.

Parameter #34 .... CNØ: (RS232C interface on main card 3)
#35 .... CN1:
#36 .... CN2:
#37 .... CN3:
#38 .... CN4:
(RS232C interface on RS board)

Standard setting is 3Ø sec.

Parameter #39 - #43 RS232C baud rate

These parameters set baud rate for individual channels.

Parameter #39 .... CNØ: (RS232C interface on main card 3)
#4Ø CN1:
#41 .... CN2:
#42 .... CN3:
#43 .... CN4:
} (RS232C interface on RS board)

Standard setting is 24ØØ (bit/second).

Parameter #44 Punch device number

This sets the device used for punching by the number.

No. Ø .... CNØ: (RS232C interface on main card 3)
1 .... CN1:
2 .... CN2:
3 .... CN3:
4 .... CN4:
} (RS232C interface on RS board)
5 .... PP: (Parallel interface on main card 3)

Standard setting is 5.

Parameter #45 Gauging data print device number

The device used for printing the gauging data is designated by the number.

No. Ø .... CNØ: (RS232C interface on main card 3)
1 .... CN1:
2 .... CN2:
3 .... CN3:
4 .... CN4:
} (RS232C interface on RS board)
5 .... Centronics (data board)

Standard setting is Ø.

Parameter #46 DNC output device number

The device used for outputting data in the DNC mode operation is designated by the number.

No. 0 .... CN0: (RS232C interface on main card 3)
1 .... CN1:
2 .... CN2:
3 .... CN3:
4 .... CN4:
(RS232C interface on RS board)

Standard setting is 0.

Parameter #47, #48 Number of tools on turret

These parameters set the number of tools which can be set on the turret.

According to this setting, the turret rotation direction is automatically selected to choose the shorter path if bit data at bit 7 of parameter (bit) No. 4 is "1".

Parameter #47: Number of tools on turret A
Parameter #48: Number of tools on turret B

Parameter #49 Number of dots for scale frame shifting

This sets the number of dots the scale setting frame is shifted for each pushing of the enlarge/contract key or cursor key if the scale setting is carried on the graphic animated display page.

Standard setting is 4.

Parameter #50 Output dot interval in INT

This sets the minimum number of dots the tool is moved on the graphic animated display. When the setting number is small, the display will be smooth.

Standard setting is 2.

Parameter #51 Margin for automatic determination

On the graphic animated display, when automatically setting the scale from the data in the read part program, this sets the scale expansion ratio in reference to the read-in data. The unit of setting is percent.

Standard setting is 100.

Parameter #52

Spindle orientation angle for C-axis connection

Unit of setting is Ø.1 deg.

Initial setting: Ø
Setting range : Ø - 3599

Parameter #53

Not used

Parameter #54

Read device number

The device used for tape reading is specified by the coded number.

No. Ø ..... TR:
1 ..... CNØ:
2 ..... CN1:
3 ..... CN2:
4 ..... CN3:
5 ..... CN4:

Standard setting is Ø.

Parameter #55

Display distance of tool contour on the front view

On the graphic display of the compound fixed cycle, the distance between the two adjacent contour lines to be drawn is set in percent in relation to the cutter diameter.

Standard setting is 5Ø (%).

Parameter #56

Not used

Parameter #57

Timer for waiting time for command response from the host computer in the DNC mode

This is the parameter used for the DNC specification. Time duration between the output of the request to send of NC program and the reception of its answer from the host computer in the INPUT and VERIFY functions in the DNC mode.

Standard setting is 3Ø (sec).

Parameter #58

Number of average load monitoring value collection

Cutting load of individual motors is calculated as the average of the number of data sets which is preset at this parameter. Since data is collected at intervals of 12.8 msec., an average value of cutting load is calculated every 2Ø4.8 msec. if setting is 16.

Parameter #59 Overload alarm duration

If the cutting load detected exceeds the first limit level for a period calculated as the overload alarm duration from the value set at this parameter continuously, it generates an overload alarm. The overload alarm value is calculated as indicated below:

Setting x 12.8 msec. = Overload alarm duration

When the setting is 1Ø msec., the overload alarm value is calculated as 128 msec.

Parameter #6Ø Tool breakage alarm duration

If the cutting load detected exceeds the second limit level for a period calculated as the tool breakage alarm duration from the value set at this parameter continuously, it generates a tool breakage alarm. The tool breakage alarm value is calculated in the same manner as the overload alarm duration.

Parameter #61 Lower end of load trace display

This parameter determines the display range of vertical axis for the load trace display (broken line chart) and it sets the lower end value in units of percents.

The display range is set in combination with the parameter No. 62 indicated below. If No. 61 = Ø and No. 62 = 15Ø, the display range of the vertical axis is Ø% to 15Ø%.

Parameter #62 Upper end of load trace display

This parameter determines the display range of vertical axis for the load trace display and it sets the upper end value in units of percents.

Parameter #63 Automatic setting of the first limit level

The first limit level in the load monitoring and automatic setting mode (model-cutting) is calculated by the following equation:

$$\begin{matrix}\text{Reference level (\%)} \\ \left(\begin{matrix}\text{max. value within} \\ \text{monitoring part}\end{matrix}\right)\end{matrix} \times \frac{\text{Setting value}}{100}$$

= First limit level (%)

Parameter #64 Automatic setting of the second limit level

The second limit level in the automatic setting mode of the load monitoring is calculated by the following equation:

$$\text{Reference level (\%) (max. value within monitoring part)} \times \frac{\text{Setting value}}{100}$$

= Second limit level (%)

Parameter #65 Percent value at the maximum input of the load monitoring spindle

After loading the control software, the optimum value must be set in accordance with the spindle drive motor capacity and type as indicated below.

Type	Motor Capacity (kW)	Models	Setting Value (%)
DC motor	45	LC4Ø, LC5Ø spindle	185
	37	LC4Ø, LC5Ø, LH55 spindle	193
	22	LC3Ø, LC4Ø, LH35-N spindle	182
	15	LC2Ø, LC3Ø, LH35-N spindle	182
	11	LC2Ø, LC3Ø, LS3Ø-N spindle	184
	7.5	LC2Ø, LS3Ø-N spindle	356
	5	LB8, LC1Ø spindle	383
VAC	7.5	LB1Ø, LB15, LP15 spindle	18Ø
	5.5	LB1Ø, LB15, LP15 spindle	18Ø
	3.7	M-tool spindle on LC4ØM-ATC	18Ø
	11	LC2Ø, LR15, LS3ØN spindle	18Ø
	15	LR15, LS35-N spindle	18Ø
	18.5	LC2Ø spindle	15Ø

Initial value: Ø

Parameter #66 Percent value at the maximum input of the M-tool spindle

After loading the control software, the optimum value must be set in accordance with the spindle drive motor capacity and type as indicated above.

Parameter #7Ø The number of bytes in a block in the program reverse transmission operation using DNC-B protocol A

When transmitting the NC program to the host computer in protocol A, this parameter designates the number of bytes at the data portion of [DAT] command. That is, the units of data transmission is set. If this is not set (set to Ø), the value follows the parameter Nb sent from the host computer.

Initial value: Ø
Setting range: Ø - 4ØØØ

Parameter #71 Spindle orientation completion confirmation timer

This sets the duration in which the spindle orientation is assumed to have completed after the spindle position is set within θ4° from the target position.

Initial value: 2Ø

Note: Setting unit is 1Ø msec., and thus the setting value "2Ø" indicates 2ØØ msec.

Parameter #72 Not used

Parameter #73 Allowable chuck rotation speed

This parameter sets the allowable speed for a chuck. (After replacing the chuck, be sure to set the data.)

Parameter #74 Allowable spindle speed in door interlock mode

In the door interlock function on mode, spindle jogging, oscillation, and orientation are allowed even when the door is open. However, if the spindle speed in these operations exceeds the speed set with parameter, an alarm occurs.

Parameter #75 - #93 Not used

Parameter #94	LR15M-ATC magazine positioning pin IN signal output position

This parameter sets the position where the pin IN signal is turned on by the number of parts (encoder value) in reference to the magazine positoning pin IN position.

Parameter #95	LR15M-ATC magazine rotation signal output position

This parameter sets the position where the magazine rotation output signal is turned off by the number of parts (encoder value) in reference to the magazine positioning pin IN position.

Parameter #96	LR15M-ATC magazine deceleration brake ON signal output position

This parameter sets the position where the brake ON signal is turned on by the number of parts (encoder value) in reference to the magazine positioning pin IN position.

Procedure:

1) In the PARAMETER SET mode, press the function key [F7] (ITEM) to select the OPTIONAL PARAMETER (WORD).

2) Locate the cursor to the data of the parameter number to be changed or set.

3) Set the new parametric data using function key [F1] (SET).

4-3-6. Optional Parameter (Bit)

PARAMETER SET N C

Page 1 A turret
BC=Ø6 * OPTIONAL PARAMETER BIT *

NO.									NO.								
1	0	1	0	1	0	0	1	0	13	0	0	0	1	0	0	0	0
2	0	0	0	0	0	0	0	0	14	0	0	0	1	0	0	0	0
3	0	0	0	0	0	0	1	0	15	0	0	0	1	0	0	0	0
4	1	1	1	0	0	0	0	1	16	0	0	0	1	0	0	0	0
5	0	0	0	0	1	0	0	0	17	0	1	1	1	0	0	1	1
6	0	0	0	0	0	0	0	0	18	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	19	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	21	0	0	0	0	0	0	0	0
10	1	1	1	1	1	1	1	1	22	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	23	0	0	0	0	0	0	0	0
12	0	0	0	1	0	0	0	0	24	0	0	0	0	0	0	0	0

=IF
=IF
=IF
=_

SET	ADD	CAL			ITEM↑	ITEM↓	
F 1	F 2	F 3	F 4	F 5	F 6	F 7	F 8

Optional parameter (bit) controls the turning on and off of respective functions in program operations, such as data transfer.

One set of data is made up of eight coded numerals, "1" and "Ø", and each digit is called "bit".

There are two types of data, one which means with a single bit and the other several bits.

Eight bits in one set of data specified with a parameter number are assigned with the numbers "Ø" through "7"; the leftmost digit is assigned with "7", the second leftmost with "6", ...

Example: No. 3 Ø Ø Ø Ø Ø Ø 1 Ø

bit 7 bit 4 bit Ø

bit / No.	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
1	Tape special code ignore	Tape special code alarm	Tape special code read in	Tape read verify	Tape delimiter % (ER) code	Tape TV check	Tape code parity recognition	Tape code ISO
2	Output space code instead of NULL code when punching	Output of only LF for record end code	Verify data output at punching in DNC-1 mode	No file name output at punching in DNC mode	No file name output at punching	Dry run active in rapid traverse		Single block reading in
3			Tool offset addition limit cancel			10 μm unit	Decimal point command mm unit	Inch command
4	Automatic turret rotation direction control for shorter path	Externally input variable held	Alarm occurrence by tool life expiration	G30 F command feed	← Tool life management → Result of gauging cycle - NG	Tool wear amount	Total cutting time	Number of machined workpieces
5	MOP specification	Creation of gauging data print file	Shape designation in compound fixed cycle	No alarm display at an occurrence of error during print out of gauging data	Gauging data print out			Pitch error compensation ignore
6	MOP tool life management combined use	Overload alarm in tool life management	Coupled device alarm check designation	Load monitor interruption request effective for tool retraction cycle		Omission of selection of the identical program in external program selection	Switching program to be selected in external program	Mode conditions for program start
7	ATC 0 tool time reduction	ATC dummy tool 0 tool check ignore	Robot interlock release	Overload detection alarm A	Tool gauging sensor head interlock release	Cycle stop completion of robot lot	Spindle orientation by M04	Spindle orientation by M03
8	No confirmation of program selection in coupled device	← MOP automatic setting → Tool data	Current pattern	Tool path data		Coupling external device alarm C	CEJ matic NG processing	Display of MSB
9	M236/M237 hold output	M234/M235 hold output	M232/M233 hold output	M230/M231 hold output	M107/M108 hold output	M105/M106 hold output	M103/M104 hold output	M101/M102 hold output
10	← Data relating to graphic animated display → Blank actually cut in animated display	Tool contour in front view	Tailstock	Chuck	Blank material	Cutting feed tool path	Rapid feed tool path	Manual feed tool movement
11	File finish code	← IBM format data code →		IBM format file directory 1 file/sector type	FMS communication error reset		Cycle time over check	STM time over check
12	← RS232C (CN0:) → File name read	DC code control type 2	DC code control	8 bit JIS	Even parity	Parity check yes	Ready signal no	Stop bit 1 bit

Parameters in rectangle indicate those set at initial values.

Blank blocks indicate parameters not used.

No. \ bit	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit Ø
13	RS232C (CN1:)							
	File name read	DC code control type 2	DC code control	8 bit JIS	Even parity	Parity check yes	Ready signal no	Stop bit 1 bit
14	RS232C (CN2:)							
	File name read	DC code control type 2	DC code control	8 bit JIS	Even parity	Parity check yes	Ready signal no	Stop bit 1 bit
15	RS232C (CN3:)							
	File name read	DC code control type 2	DC code control	8 bit JIS	Even parity	Parity check yes	Ready signal no	Stop bit 1 bit
16	RS232C (CN4:)							
	File name read	DC code control type 2	DC code control	8 bit JIS	Even parity	Parity check yes	Ready signal no	Stop bit 1 bit
17		Data relating to hour meter output						
		Single block off	Feedrate override 1ØØ%	Spindle speed override 1ØØ%	Axis moving	Spindle in rotating	RUN lamp on	Automatic operation mode
18	Data relating to operation mode display							
	Specification code	Panel output 1, 2, 3	Panel input 1, 2, 3	EC output (extended) 1, 2	EC output 1, 2	EC input (extended) 1, 2	EC input 1, 2	Axis data
19	Front view for multi-machining model	Actual position display No CA display	NC operation monitor setting disabling bit	Tow-along tailstock XB interlock release	Spindle not stopping in MØ2, 3Ø, ØØ, Ø1	Spindle jogging in M155	Spindle jogging in M51	Spindle jogging in M89
2Ø					Alarm lamp off			
					Alarm A	Alarm B	Alarm C	Alarm D
21				CNC slave station				
				CN4:	CN3:	CN2:	CN1:	CNØ:
22								
23	DNC-B parameter (protocol A)							
24	DNC-B parameter (protocol A)							
25	Touch setter (B) standard sensor				Touch setter (A) standard sensor			
	Sensor 4	Sensor 3	Sensor 2	Sensor 1	Sensor 4	Sensor 3	Sensor 2	Sensor 1

Parameters in rectangle indicate those set at initial values.
Blank blocks indicate parameters not used.

bit / No.	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit Ø
26	← EIA code pattern to be replaced with ASCII "=" code →							
27	← EIA code pattern to be replaced with ASCII "*" code →							
28	← EIA code pattern to be replaced with ASCII "[" code →							
29	← EIA code pattern to be replaced with ASCII "]" code →							
3Ø	← EIA code pattern to be replaced with ASCII "$" code →							
31	← Irregular code →							
32	← Correct code (ISO) corresponding to irregular code →							
33								
34								
35								
36								
37							Thermal displacement compensation (°F indication)	Thermal displacement compensation effective
38	← Thermal displacement compensation; sensor numbers →							
	Sensor 8	Sensor 7	Sensor 6	Sensor 5	Sensor 4	Sensor 3	Sensor 2	Sensor 1
39	← Thermal displacement compensation; sensor numbers →							
	Sensor 16	Sensor 15	Sensor 14	Sensor 13	Sensor 12	Sensor 11	Sensor 1Ø	Sensor 9
4Ø								High speed turret, low speed

<Meaning of optional parameter (bit)>

Parameter #1

Program operation

Bit Ø .... Tape Code ISO
Bit 1 .... Tape code parity recognition

Bits "Ø" and "1" are used to specify the coding system of tape punch out and tape verify.

	Bit 1	Bit Ø	Operation Condition
A	1	1	In READ and VERIFY modes, parity check is automatically performed disregarding the tape code, whether ISO or EIA. In PUNCH mode, ISO code is selected.
B	1	Ø	In READ and VERIFY modes, parity check is automatically performed disregarding the tape code, whether ISO or EIA. In PUNCH mode, EIA code is selected.
C	Ø	1	The control selects ISO code for VERIFY operation. (Tape code nonconformity results in alarm.) In PUNCH mode, ISO code is selected.
D	Ø	Ø	The control selects EIA code for VERIFY operation. (Tape code nonconformity results in alarm.) In PUNCH mode, EIA code is selected.

Standard setting is A.

Bit 2 .... Tape TV check

The number of characters in one block is checked: from the character preceded by LF (EOB) character to the next LF (EOB) character. The number of characters in one block must be even.

	Bit 2	Operation Condition
A	Ø	No TV check is performed in READ mode operation. In PUNCH mode, the number of characters in one block is not adjusted.
B	1	In READ mode operation, the number of characters in one block is checked and if the number of characters in one block is odd, an alarm results. In PUNCH mode, the number of characters in one block is adjusted so that one block contains an even number of characters.

Standard setting is A.

Bit 3 .... Program end code, % or ER (Program delimiter)

"%" or "ER" code can be used as a delimiter of programs on a tape instead of using feed holes.

	Bit 3	Operation Condition
A	Ø	The control accepts feed holes as the delimiter of a program.
B	1	The control accepts "%" or "ER" code as the delimiter of a program.

Standard setting is A.

Note: Tape data between the first CR (or LF) and the following one is ignored.

Bit 4 .... Tape read verify

Program data is verified when it is read.

	Bit 4	Operation Condition
A	Ø	Verify is not made after completion of tape reading in.
B	1	Verify is made after completion of tape reading in.

Standard setting is B.
Note: File name is not verified.

Bit 5 .... Tape special code read in

Bit 6 .... Tape special code alarm
Bit 7 .... Tape special code ignore

These bits determine whether the control triggers an alarm state, and ignores or accepts the special codes when they are read from the tape.

	Bit 7	Bit 6	Operation Condition
A	*	1	Alarm is constituted when a special code is read in READ mode operation.
B	1	Ø	A special code when read in READ mode operation is ignored.
C	Ø	Ø	A special code when read in READ mode operation is accepted.

Standard setting is A.

Note: For acceptable standard codes, refer to the Programming Manual.

* Ø or 1

Parameter #2 Automatic operation

Bit Ø .... Single block reading in

Even when the operation is executed in the SINGLE BLOCK mode, blocks containing only the commands not calling for actual machine operation (NOEX command) are continuously executed to the block that contains the actual machine operation command when the CYCLE START button is pressed. This type of reading operation is handled as the single block function.

	Bit Ø	Operation Condition
A	Ø	Blocks not calling for actual machine operation are continuous by executed even in SINGLE BLOCK mode.
B	1	SINGLE BLOCK function is active on the blocks calling for no actual machine operation.

Standard setting is A.

Bit 1 .... Not used

Standard setting is Ø.

Bit 2 .... Dry run active in rapid traverse

Even when DRY RUN function is active, rapid traverse rate is not changed. However, it is possible to activate dry run function on rapid traverse rate by setting a proper parametric data.

	Bit 2	Operation Condition
A	Ø	Rapid traverse rate is not changed in DRY RUN mode.
B	1	Rapid traverse rate is changed to dry run speed in DRY RUN mode.

Bit 3 .... No file name output at tape punch out

This specifies whether a file name is to be output or not in tape punch out operation.

=Ø Outputted
=1 Not outputted

Standard setting is Ø.

Bit 4 .... No file name output at punching out in DNC mode

This specifies whether a file name is to be outputted or not at file output.

=Ø Outputted
=1 Not outputted

Standard setting is Ø.

Bit 5 .... Verify data output at punching out in DNC-1 mode

This specifies whether the data for verifying is to be outputted or not after punch out in the DNC mode.

=Ø Not outputted
=1 Outputted

Standard setting is Ø.

Bit 6 .... Output of only LF for record end code

=Ø CR, LF outputted
=1 Only LF outputted

Standard setting is Ø.

Bit 7 .... Output of space code instead of NULL code at punching in slave station

=Ø NULL code outputted
=1 Space code outputted

Standard setting is Ø.

Parameter #3 Unit System

Bit Ø .... Inch command
Bit 1 .... Decimal point mm unit command
Bit 2 .... 1Ø μm unit

Combination of bits Ø through 2 can select a desired unit system for programming.

	Bit 2	Bit 1	Bit Ø	Operation Condition
A	*	1	Ø	1 mm unit system
B	1	Ø	Ø	1Ø μm unit system
C	Ø	Ø	Ø	1 μm unit system
D	*	1	1	1 inch unit system
E	*	Ø	1	1/1ØØØØ inch unit system

* 1 or Ø (usually "Ø" is set)
Standard setting is A.

If the control is not equipped with inch/metric switchable feature, bit Ø cannot be set to "1".

Bit 5 .... Addition of tool offset or tool nose R compensation value exceeding 1 mm (or Ø.1 inches) is effective or ineffective

=Ø Ineffective
(when exceeding 1 mm)
=1 Effective
(even when exceeding 1 mm)

Bit 3, 4, 6 and 7 ...... Not used

Standard setting is Ø.

Parameter #4 Tool Life Management (optional)

Bit Ø .... Number of machined workpieces
Bit 1 .... Total cutting time
Bit 2 .... Tool wear amount
Bit 3 .... Result of gauging cycle - NG

Any tool life expiration determination factor can be selected from bits Ø through 2. Combination with bit 3, alarm signal output is available when tool life is determined to have expired in terms of the tool life factor selected by bits Ø through 2.

	Bit 3	Bit 2	Bit 1	Bit Ø	Tool Life Management and Alarm Signal Output
A	Ø	Ø	Ø	1	Tool life is managed in terms of the number of machined workpieces.
A'	1	Ø	Ø	1	Tool life is managed in terms of the number of machined workpieces. Alarm signal output available.
B	Ø	Ø	1	Ø	Tool life is managed in terms of total cutting time.
B'	1	Ø	1	Ø	Tool life is managed in terms of total cutting time. Alarm signal output available.
C	Ø	1	Ø	Ø	Tool life is managed in terms of tool wear amount.
C'	1	1	Ø	Ø	Tool life is managed in terms of tool wear amount. Alarm signal output available.

Standard setting is A.

Bit 4 .... G3Ø F command feed

=Ø Feed by the value set at parameter (word) No. 11
=1 F command feed

Bit 5 .... Alarm occurrence by tool life expiration

=Ø Cycle stop
=1 Stop by alarm B

Standard setting is 1.

Bit 6 .... Holding externally input variable

=Ø No processing
=1 External outputs 41 through 48 are available with external input 1 through 8 turned on

Standard setting is 1.

Bit 7 .... Automatic turret rotation direction control for shorter path

=Ø Automatic control is not effective.
=1 Turret rotation direction is automatically determined independent of turret rotation direction command (M86, M87) programmed so that tool index path will be shorter.

Settings of parameters No. 47 and 48 are necessary.

Standard setting is Ø.

Parameter #5 Data relating to graphic display and gauging data printout

Bit Ø .... Pitch error compensation ignore

With the ball screw pitch error compensation and the inductosyn pitch error compensation specifications, this specifies whether the pitch error compensation is to be carried out or not.

=Ø Compensation carried out
=1 Compensation not carried out

(Standard setting is Ø.)

Bit 1 and 2 ... Not used

Standard setting is Ø.

Bit 3 .... Gauging data printout

=Ø Gauging data printed out
=1 Gauging data not printed out

Standard setting is Ø.

Bit 4 .... No alarm display at an occurrence of error during printing out of gauging data

This specifies whether alarm message (982 measure data out) is to be displayed or not when an error occurs during printing out of gauging data.

=Ø Alarm message displayed
=1 Alarm message not displayed

Standard setting is Ø.

Bit 5 .... Shape designation in compound fixed cycle

=Ø Starting point of cutting
=1 Starting point of GØØ movement

Bit 6 .... Creation of gauging data print file

=Ø Printout on device specified by optional parameter (word) No. 45
=1 File created

Bit 7 .... MOP specification

=Ø MOP specification not executed
=1 MOP specification executed

Parameter #6	Data relating to cycle starting

Bit Ø .... Program start mode requirements

=Ø Auto mode
=1 Cycle start in other than auto mode possible except for MDI and manual.

Standard setting is Ø.

Bit 1 .... Switching program to be selected in external program selection

This specifies whether a program to be selected using the external program selection function is a main program or a schedule program.

=Ø Main program
=1 Schedule program

Standard setting is Ø.

Bit 2 .... Omission of selection of identical program in external program selection

This specifies whether the program identical to the one presently selected is to be loaded again or not when it is selected in the external program selection function.

=Ø Loaded
=1 Not loaded

Standard setting is Ø.

Bit 3 .... Not used

Standard setting is Ø.

Bit 4 .... Load monitor interruption request effective for tool retraction cycle

With the machine equipped with the tool retraction cycle specification, whether the interruption request from the load monitor function is made effective or not is determined by the setting of this parameter.

=Ø Effective
=1 Not effective

Bit 5 .... Coupled device alarm check designation

For the machine equipped with the coupled device specification, whether the alarm check for the coupled device is always made or only when the coupled device is controlled in the automatic mode is determined by the setting of this bit.

=Ø Always checked
=1 Checked only in the automatic mode

Bit 6 .... Overload alarm in tool life management

=Ø Alarm occurs
=1 No alarm

Bit 7 .... MOP tool life management combined use

=Ø Combined use
=1 Not combined use

Parameter #7

Data relating to spindle rotation direction in spindle orientation

Bit Ø .... Spindle orientation by MØ3

=Ø No processing
=1 After spindle stop, orientation is carried out in the MØ3 direction

Standard setting is Ø.

Bit 1 .... Spindle orientation by MØ4

=Ø No processing
=1 After spindle stop, orientation is carried out in the MØ4 direction

Standard setting is Ø.

Bit 2 .... Cycle stop at completion of robot lot

=Ø Cycle stop not activated
=1 Cycle stop activated

Standard setting is Ø.

Bit 3 .... Tool gauging sensor head interlock ON/OFF

=Ø Interlock ON
=1 Interlock OFF

Standard setting is Ø.

Bit 4 .... Overload detection alarm A

=Ø Alarm C at overload detection
=1 Alarm A at overload detection

Standard setting is Ø.

Bit 5 .... Robot interlock ON/OFF

=Ø Interlock ON
=1 Interlock OFF
(spindle rotation, turret movement, door close)

Standard setting is Ø.

Bit 6 .... ATC dummy tool Ø tool check ignore

=Ø Sub arm operation executed for Ø tool
=1 Sub arm operation ignored for Ø tool

Standard setting is Ø.

Bit 7 .... Dummy tool interlock cancel

=Ø An alarm occurs if axis is moved without dummy tool for either L or M tool on turret A
=1 Axis movement without dummy tool possible

Standard setting is Ø.

Parameter #8

MSB

Bit Ø .... Display of MSB

=Ø No display
=1 MSB display at program selection

Standard setting is Ø.

Bit 1 .... No alarm occurrence for NG state of CEJ matic

This allows the operator to control an occurrence of alarm when the control is equipped with the tool life management function using the CEJ matic gauging function.

=Ø Alarm
=1 No alarm occurrence and NG flag in the tool life management table is set ON.

Standard setting is Ø.

Bit 2 .... External device alarm C

=Ø Alarm A at an occurrence of alarm with coupled external device
=1 Alarm C at an occurrence of alarm with coupled external device

Standard setting is Ø.

Bit 3 .... Not used

Standard setting is Ø.

Bit 4 -
Bit 6 .... MOP automatic setting

This selects the model machining data to be stored during the MOP automatic setting mode.

Bit 4: Tool path data
Bit 5: Current pattern
Bit 6: Tool data

=Ø Data is ignored
=1 Data is stored

Bit 7 .... Coupled device program selection without confirmation

This bit data allows the program to be selected without confirmation when a program selection command is given to the coupled device. In this case, by setting "1" to this bit, the program actually selected by the coupled device is not confirmed whether its program number is the same as the one designated.

=Ø Not confirmed
=1 Confirmed

Standard setting is Ø.

Parameter #9 Data relating to M code

Bit Ø .... M1Ø1/M1Ø2 hold output

=Ø Output not held
=1 Output held

Standard setting is Ø.

Bit 1 .... M1Ø3/M1Ø4 hold output

=Ø Output not held
=1 Output held

Standard setting is Ø.

Bit 2 .... M1Ø5/M1Ø6 hold output

=Ø Output not held
=1 Output held

Standard setting is Ø.

Bit 3 .... M1Ø7/M1Ø8 hold output

=Ø Output not held
=1 Output held

Standard setting is Ø.

Bit 4 .... M23Ø/M231 hold output

=Ø Output not held
=1 Output held

Standard setting is Ø.

Bit 5 .... M232/M233 hold output

=Ø Output not held
=1 Output held

Standard setting is Ø.

Bit 6 .... M234/M235 hold output

=Ø Output not held
=1 Output held

Standard setting is Ø.

Bit 7 .... M236/M237 hold output

=Ø Output not held
=1 Output held

Standard setting is Ø.

Parameter #1Ø

Data relating to graphic animated display

This specifies whether the display element on the graphic animated display in the operation mode is to be displayed or not for individual display elements.

Bit Ø -
Bit 7 .... =Ø Corresponding display element is not displayed.
=1 Corresponding display element is displayed.

Standard setting is 1.

Display element:

Bit Ø	Manual tool movement path
Bit 1	Rapid feed tool path
Bit 2	Cutting feed tool path
Bit 3	Blank material
Bit 4	Chuck
Bit 5	Tailstock
Bit 6	Tool contour in front view
Bit 7	Progress of cutting

Parameter #11	Data relating to time over check

Bit Ø .... STM time over check

=Ø Time over check not executed
=1 Time over check executed in accordance with parameter (word) No. 26

Bit 1 .... Cycle time check over

=Ø Time over check not executed
=1 Time over check executed in accordance with parameter (word) No. 27

Bit 2 .... Not used

Standard setting is Ø.

Bit 3 .... FMS communication error reset

=Ø FMS communication error reset is impossible.
=1 FMS communication error reset is possible.

Bit 4 .... IBM format file directory 1-file/sector type

In the IBM format, file directory is usually written in the 2-file/sector. However, it is possible to change this into 1-file/sector only for side 1, cylinder Ø (when 2DD floppy disk is used.).

=Ø File directory 2-file/sector
=1 File directory 1-file/sector

Bit 5, 6 ...... IBM format data code

=ØØ ISO
=Ø1 EBCDIC
=1Ø ASCII
=11 EBCDIC

Standard setting is ØØ.

Bit 7 .... File end code

This specifies the file end code in file output in IBM format.

=Ø NULL
=1 %

Parameter #12

Data relating to communication channel CNØ: (channel Ø)
(Standard setting is 1 for only bit 4.)

Bit Ø .... RS232C stop bit check

=Ø Stop bit 2
=1 Stop bit 1

Bit 1 .... Availability of ready signal for RS232C interface

=Ø Ready signal available
=1 Ready signal not available

Bit 2 .... RS232C parity check

=Ø Parity check carried out
=1 Parity check not carried out

Bit 3 .... RS232C every parity

=Ø Odd parity
=1 Even parity

Bit 4 .... RS232C 8 bit JIS

=Ø 7 bit JIS
=1 8 bit JIS

Bit 5, 6 ...... Designation of DC code control

	Bit 6	Bit 5	Operation Conditions
A	Ø	Ø	No DC code control
A'	1	Ø	No DC code control
B	Ø	1	Standard DC code control
C	1	1	DC code control type 2

Bit 7 .... File name read

=Ø File name not read when data is read
=1 File name is read with the data

Parameter #13

Data relating to communication channel CN1: (channel 1)

Parameter #14 Data relating to communication channel CN2: (channel 2)

Parameter #15 Data relating to communication channel CN3: (channel 3)

Parameter #16 Data relating to communication channel CN4: (channel 4)

Contents of parameters #13 through #16 are the same as that of parameter #12.

Parameter #17 Data relating to hour meter output

The hour meter operation signal is output when the conditions corresponding to the bits designated are met.

=Ø Condition ignored
=1 Condition specified

Conditions:

Bit Ø	Automatic operation mode
Bit 1	RUN lamp on
Bit 2	Spindle in rotation
Bit 3	Axis moving
Bit 4	Spindle speed override 1ØØ%
Bit 5	Feedrate override 1ØØ%
Bit 6	Single block OFF
Bit 7	Not used

Standard setting of bits Ø, 1, 4, 5 and 6 is 1.

Parameter #18 Data relating to display of operation mode

This sets the check data display page assigned to the bits designated.

=Ø Page displayed
=1 Page not displayed

Standard setting is Ø.

Display page:

Bit Ø	Axis data
Bit 1	EC input 1, 2
Bit 2	EC input (extended) 1, 2
Bit 3	EC output 1, 2
Bit 4	EC output (extended) 1, 2
Bit 5	Panel input 1, 2, 3
Bit 6	Panel output 1, 2, 3
Bit 7	Specification code

Parameter #19

Spindle jogging operation, NC work counter, display of actual position

Bits Ø to 2 ... Spindle jog

=Ø Spindle jog not carried out during air blow
=1 Spindle jog carried out during air blow

Bit Ø At M89
Bit 1 At M51
Bit 2 At M155

Bit 3 .... Spindle does not stop with MØ2, M3Ø, MØØ or MØ1. (optional)

With the special spindle stop specification:

=Ø Spindle stop with MØ2, M3Ø, MØØ and MØ1
=1 No spindle stop with MØ2, M3Ø, MØØ or MØ1

Bit 4 .... Tow-along tailstock XB-axis interlock cancel (optional)

Cancellation of positive limit interlock on XB-axis with the tow-along tailstock specification

=Ø Interlock effective
=1 Interlock cancel

Bit 5 .... NC operation monitor setting disabling bit

=Ø Setting enabled
=1 Setting disabled

Bit 6 .... CA spindle position display disabling bit

=Ø Setting enabled
=1 Setting disabled

Bit 7 .... No front view for multi-machining model

This specifies whether the front view is displayed in graphic function for multiple-machining model.

=Ø Front view is displayed.
=1 Front view is not displayed.

Parameter #2Ø Related to alarm lamp of each alarm

Bit Ø .... =Ø Alarm lamp is turned on at an occurrence of alarm of level D.
=1 Alarm lamp is not turned on at an occurrence of alarm of level D.

Bit 1 .... =Ø Alarm lamp is turned on at an occurrence of alarm of level C.
=1 Alarm lamp is not turned on at an occurrence of alarm of level C.

Bit 2 .... =Ø Alarm lamp is turned on at an occurrence of alarm of level B.
=1 Alarm lamp is not turned on at an occurrence of alarm of level B.

Bit 3 .... =Ø Alarm lamp is turned on at an occurrence of alarm of level A.
=1 Alarm lamp is not turned on at an occurrence of alarm of level A.

Standard setting is ØØØØ.

Bit 4 -
Bit 7 .... Not used

Standard setting is Ø.

Parameter #21 Related to CNC slave station control

Bit Ø .... =1 CNØ: is the slave station.
=Ø CNØ: is not the slave station.

Bit 1 .... =1 CN1: is the slave station.
=Ø CN1: is not the slave station.

Bit 2 .... =1 CN2: is the slave station.
=Ø CN2: is not the slave station.

Bit 3 .... =1 CN3: is the slave station.
=Ø CN3: is not the slave station.

Bit 4 .... =1 CN4: is the slave station.
=Ø CN4: is not the slave station.

Standard setting is ØØØØ.

Bit 5 -
Bit 7 .... Not used

Standard setting is Ø.

Parameter #22	Not used

Parameter #23	Related to DNC-B parameter

Parameter #24	Related to DNC-B parameter

Data of the 41st to 44th bytes in [SAT] and [SET] commands which are transferred to and from the host computer.

Bit Ø .... =Ø Buffer memory is not cleared by NC reset.
=1 Buffer memory is cleared by NC reset.

Standard setting is Ø.

Not decided for other bits.
(Standard setting is all Ø.)

Parameter #25	Related to touch setter

This specifies the sensor to be referenced to.
(When the position of the reference sensor has changed, the variation amount should be added to the sensor on the other side. Addition is not carried out if it is not the reference sensor.)

Bit Ø .... =1 Sensor 1 on A side is taken as the standard sensor.
=Ø Sensor 1 on A side is not taken as the standard sensor.

Bit 1 .... =1 Sensor 2 on A side is taken as the standard sensor.
=Ø Sensor 2 on A side is not taken as the standard sensor.

Bit 2 .... =1 Sensor 3 on A side is taken as the standard sensor.
=Ø Sensor 3 on A side is not taken as the standard sensor.

Bit 3 .... =1 Sensor 4 on A side is taken as the standard sensor.
=Ø Sensor 4 on A side is not taken as the standard sensor.

Bit 4 .... =1 Sensor 1 on B side is taken as the standard sensor.
=Ø Sensor 1 on B side is not taken as the standard sensor.

Bit 5 .... =1 Sensor 2 on B side is taken as the standard sensor.
=Ø Sensor 2 on B side is not taken as the standard sensor.

Bit 6 .... =1 Sensor 3 on B side is taken as the standard sensor.
=Ø Sensor 3 on B side is not taken as the standard sensor.

Bit 7 .... =1 Sensor 4 on B side is taken as the standard sensor.
=Ø Sensor 4 on B side is not taken as the standard sensor.

Standard setting is all Ø.

Parameter #37 Thermal displacement compensation

Bit Ø .... Thermal displacement compensation effective/ineffective

This bit sets whether the thermal displacement compensation is made effective or not.

=Ø Thermal displacement compensation not effective
=1 Thermal displacement compensation effective

Bit 1 .... Temperature indication in °F

Temperature measured can be indicated in either Centigrade or Fahrenheit according to the setting of this bit data.

=Ø Indication in °C
=1 Indication in °F

Bit 2 -
Bit 7 .... Not used

Standard setting is Ø.

Parameter #38

Sensors used for thermal displacement compensation function

The bit data selects the sensor(s) (Ø - 8 channels) to be used for the thermal displacement compensation function.

=Ø Sensor used
=1 Sensor not used

Bit Ø .... Sensor 1
Bit 1 .... Sensor 2
Bit 2 .... Sensor 3
Bit 3 .... Sensor 4
Bit 4 .... Sensor 5
Bit 5 .... Sensor 6
Bit 6 .... Sensor 7
Bit 7 .... Sensor 8

Parameter #39

Sensors used for thermal displacement compensation function

The bit data selects the sensor(s) (9 - 16 channels) to be used for the thermal displacement compensation function.

=Ø Sensor used
=1 Sensor not used

Bit Ø .... Sensor 9
Bit 1 .... Sensor 1Ø
Bit 2 .... Sensor 11
Bit 3 .... Sensor 12
Bit 4 .... Sensor 13
Bit 5 .... Sensor 14
Bit 6 .... Sensor 15
Bit 7 .... Sensor 16

Procedure:

1) After pressing the function key [F7] (ITEM ↓), select the OPTIONAL PARAMETER (BIT) page.

2) Locate the cursor to the data of the parameter number to be changed or set.

3) Set the new parametric data using function key [F1] and the keyboard.