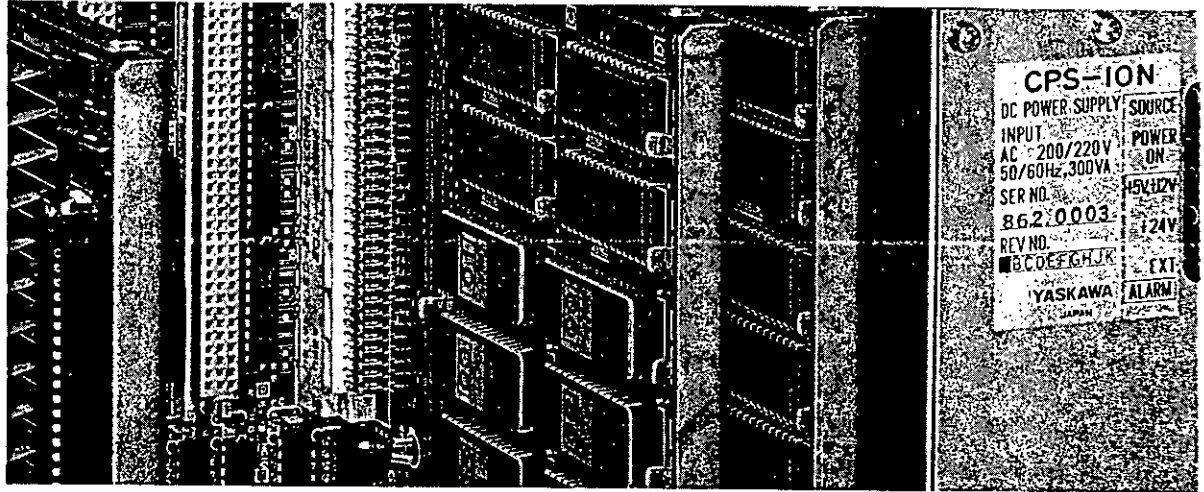


YASNAC LX3

FOR TURNING APPLICATIONS

COMPACT PROGRAMMING FUNCTION
OPERATOR'S MANUAL



Before initial operation, read these instructions thoroughly, and retain for future reference.



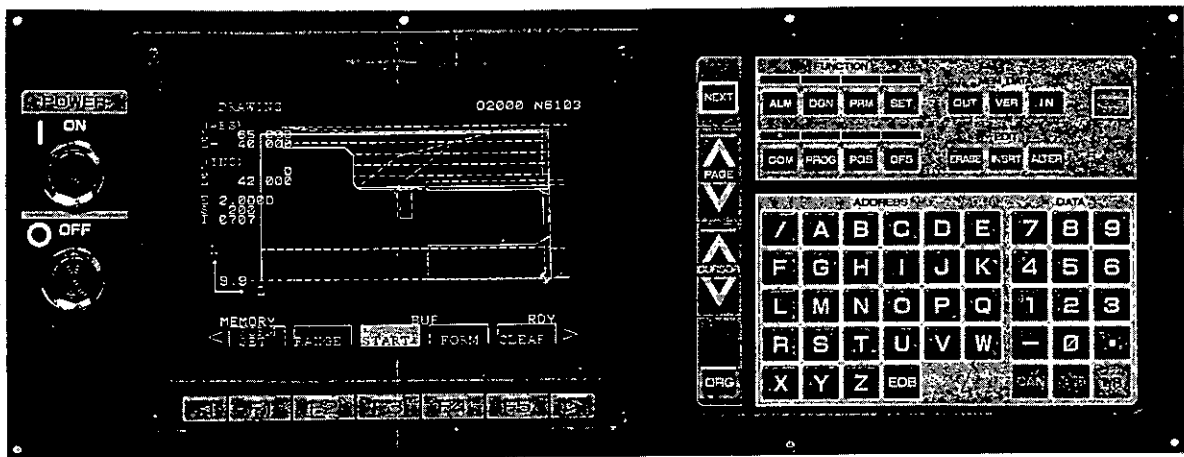
YASKAWA

This manual describes the operator procedures for "Compact Programming Function" which is an optional function for YASNAC LX3.

For the operator procedures for the basic control, refer to the manual "YASNAC LX3 Operation Manual".

Easy-handling Functions and Latest Technology are Supplied.

1. Easy to Operate
2. Easy Preparation
3. Designed for Space Saving



588-1
588-17

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1. FUNCTION OUTLINES AND FEATURES

The compact interactive function has been designed to enable NC machining part programs to be automatically generated through simple interactive operations conducted in accordance with the displayed process menu on the CRT.

Since the generated programs mainly use "canned cycles G70 through G76", they are short, and process comments are also automatically attached to them. For this reason, the generated programs are easy to understand and easy to modify.

This interactive automatic programming function allows the utilization of almost all types of turning operations including end facing, O.D. turning, I.D. turning, grooving, drilling, and threading, despite its easy operation.

- (1) "Compact interactive" automatic programming can be executed even while the NC is engaged in turning operations.
- (2) When finished state data is input, the finished work piece shape is automatically displayed on the CRT for visual check convenience.
- (3) Because the automatically generated programs mainly consist of canned cycles, they occupy only small part program memory capacity, allowing easy modifications and changes.
- (4) Where canned cycles are undesirable (for rough surface removing, etc.) or short cycle time is important, turning menus for free shapes is available.
- (5) During the interactive mode program generation, any programs can be manually added or change.
- (6) The generated programs can be checked by means of the "Drawing function". During the drawing process, the material shape is also displayed.

• Turning menu setting table

The table below may be used to find information regarding the display during the interactive programming operation.

Turning Menu / Display	End Facing	O.D. Turning	I.D. Turning	Grooving	Drilling	Threading
Approach Setting	P 51 to 53	P 51 to 53	P 51 to 53	P 54	P 54	P 55
Basic Data Setting	P 55 to 56	P 55 to 56	P 55 to 56	P 56		
Finish Shape Setting	P 57 to 70	P 57 to 70	P 57 to 70	P 71 to 76	P 77 to 78	P 79 to 80
Program Insertion	P 81	P 81	P 81			
Escape Setting	P 82 to 84	P 82 to 84	P 82 to 84	P82 to 84	P 82 to 84	P 82 to 84

2. NC OPERATOR PANEL AND DISPLAY

2.1 NC OPERATOR PANEL FUNCTION OUTLINES

The operator panel of YASNAC LX3 incorporating the compact interactive function is shown in Fig. 2.1. The names and functions of the elements are as follows:

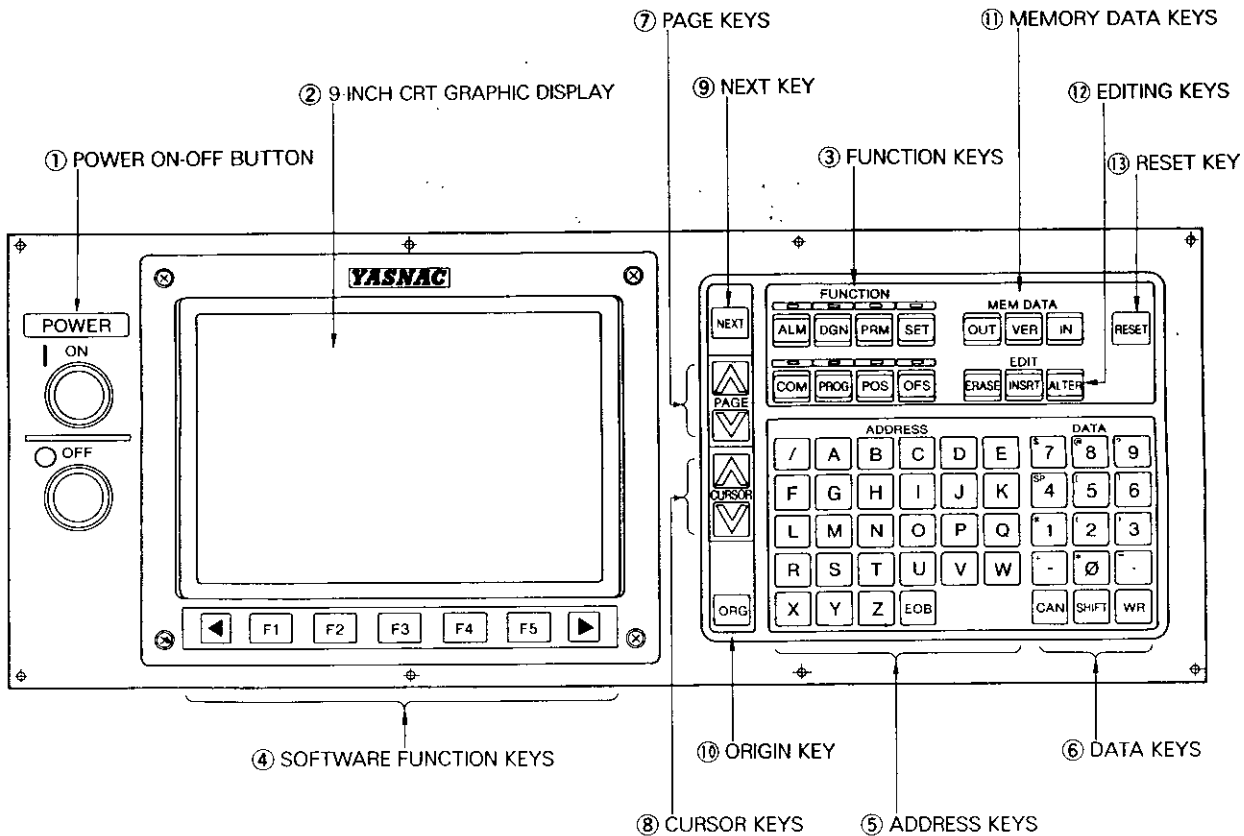


Fig. 2.1 YASNAC LX3 Operator Panel

① Power ON-OFF Button

(1) POWER ON button

The button for turning on Power to the NC unit. Pushing it once energizes the control circuit only, and pushing it once more energizes also the servo power system.

This button is also pushed after an emergency stop, etc. to re-energize the servo power system.

(2) POWER OFF button

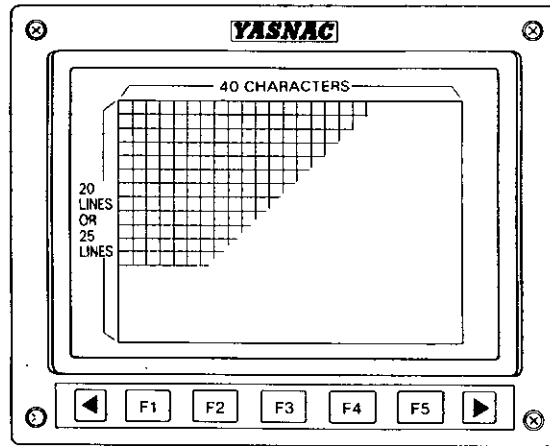
The button for turning off power to the NC unit.

Depressing this button de-energizes both the control circuit and the servo power system of the NC unit.

② CRT Graphic Display

This CRT screen displays data in alphanumeric characters in 1×1 through 3×3 sizes, in response to various operator manipulations.

- Maximum number of characters:
40 × 20 (or 25) lines
= 800 (or 1000) characters.
[single size characters]
- Character types:
Digits (0 to 9, -, and .)
Alphabets (A to Z)
Special codes
(/, EOB, +, #, SP, =, etc.)
- Graphic display: 640 × 400 dots











CRT Graphic Display

③ FUNCTION Keys

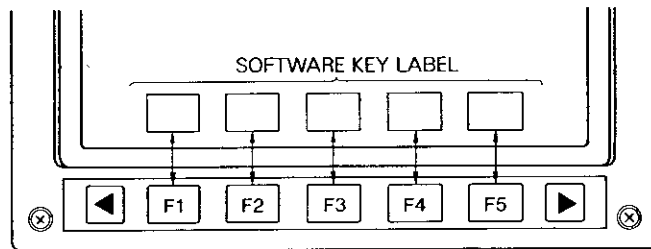
Display and writing function selection keys.

The 8 keys are used to selectively call up the following functions. While the specific functions are called up, the respective keys light.

- (1)  Alarm key: For displaying alarm codes.
- (2)  Diagnostic key: For displaying I/O signal states.
- (3)  Parameter key: For parameter display and writing.
- (4)  Setting key: For setting data displaying and writing.
- (5)  Command key: For displaying automatic operation command values and for calling up the drawing mode.
- (6)  Program key: For part program display and writing.
Interactive mode starts with the selection of this program key.
- (7)  Position key: For displaying various current values. When the system is energized, this function is selected automatically.
- (8)  Offset key: For displaying and writing tool offset values.

④ Software Function Keys

Selection keys for displaying and writing



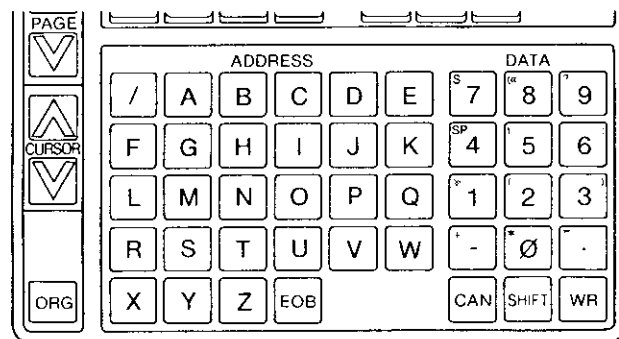
Software key labels corresponding to the software keys are displayed on the CRT.

Depressing keys **F1** through **F5** calls up the corresponding functions.

Left menu **◀** key and right menu **▶** key are effective only when ◁ ▷ are displayed, and depressing **◀** or **▶** displays additional cyclic functions other than those of the current functions on the CRT.

⑤ ADDRESS Keys

The keys for keying the address characters when writing in various data.



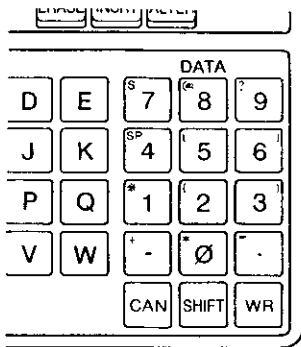
[Note] Meanings of special characters

/ key: For commanding optional block skip

EOB key: For commanding the end of one block.
On the CRT, ";" is displayed instead of EOB.

⑥ DATA Keys

There are 15 data keys \emptyset through 9, -, ., CAN, SHIFT and WR. They are used for writing MDI command values, tool offset values, setting values, parameters, and all other numerical values.

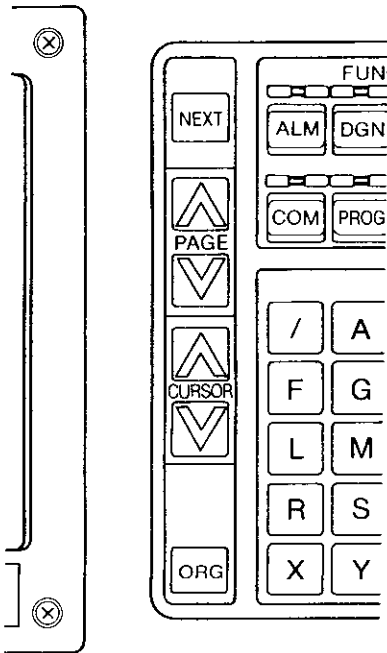




- (1) \emptyset to 9 keys
- key] : For numeral inputting
- (2) . (decimal point) key: For keying decimal points
- (3) CAN (cancel) key: for deleting wrong keying of numerical values or address data.
- (4) WR (write) key: For storing the address data keyed by the address keys and data keys into the buffer.
- (5) SHIFT key: For inputting the special codes \square to \square , \square and \square marked on the upper left corner of the keys of \emptyset to 9, - and ., depress this key after depressing the respective keys.

These special codes are used as macroprogram operators, etc.


⑦ PAGE Keys




With the screen display regarded as one page, these keys are used to display the next or preceding page.




- (1)  key: For displaying the next page.
- (2)  key: For displaying the preceding page.
- (3) Depressing the above keys continuously calls up the series of subsequent or preceding pages.
- (4) In addition, they have the following special functions:
 - For moving the graphic cursor on the finished shape display in the interactive function.
 - For selecting answers in the calculation function.

⑧ CURSOR Keys

For moving the cursor on the CRT display backward or forward. For example, when  (parameter) has been selected, and a group of parameters are displayed, the cursor is moved with these keys to the desired parameter.

- (1)  key: For moving the cursor backward.
- (2)  key: For moving the cursor forward.
- (3) Depressing these keys continuously moves the cursor continuously backward or forward.
- (4) When the  key is depressed after keying a numeral, the cursor moves to the position of the keyed numeral.

⑨ Next () Key: For special usages in data display and writing, and function expansion.

- (1) Reading in additional tapes in the edit mode.
- (2) Selecting search type in the edit mode.
- (3) Selecting between line cursor and word cursor in the edit mode.
- (4) Other special usages and function expansion.

⑩ Origin (**ORG**) Key

For setting the current tool position as the origin of the new coordinate system. This setting can be made for each axis independently.

- (1) For resetting the current values such as external.
- (2) For resetting the cumulative operation time.
- (3) For clearing the input data in the interactive or calculation mode.
- (4) For clearing the selected buffer of the copy or move function.

⑪ Memory Data Keys

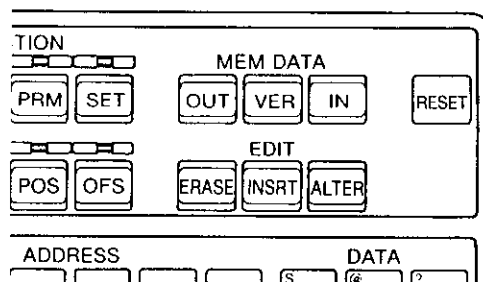
The **OUT** , **VER** and **IN** keys are for starting various tape operations. They are effective only in the edit mode.

However, when inputting and outputting interactive data in the interactive I/O display, other modes are ineffective.

- (1) **OUT** key: For starting outputting data in the memory to the outside via the data I/O interface.
- (2) **IN** key: For starting storing various data via the tape reader or the data I/O interface.
- (3) **VER** (verify) key: For starting the collation of the data in the memory against the punched tape data or data input through data I/O interface.

⑫ EDIT Keys

The **ERASE** , **INSRT** and **ALTER** keys are for editing the part programs stored in the memory.



- (1) **ERASE** key: For erasing data in the memory
- (2) **INSRT** (insert) key: For inserting data in the memory
- (3) **ALTER** key: For changing data in the memory.

⑬ RESET Key

For resetting the internal conditions of the NC

(1) Depressing the RESET key executes the following

- Move command cancel
- Buffer clear
- Alarm clearing if fault has been cleared
- Tool offset cancel
- Aux. function cancel
- Label skip function on
- Memory rewind
- RST signal sending
- G code reset
- Key buffer clear
- Edit program on edit display storing in memory

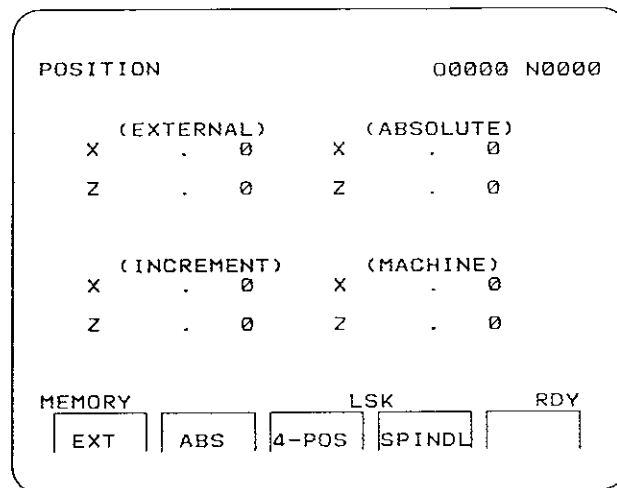
(2) However, the following are not reset with this key.

- Each axis current value
- F commands
- S and T commands
- Tool offset values setting data and parameter data

2.2 DISPLAY IMMEDIATELY AFTER TURNING POWER ON

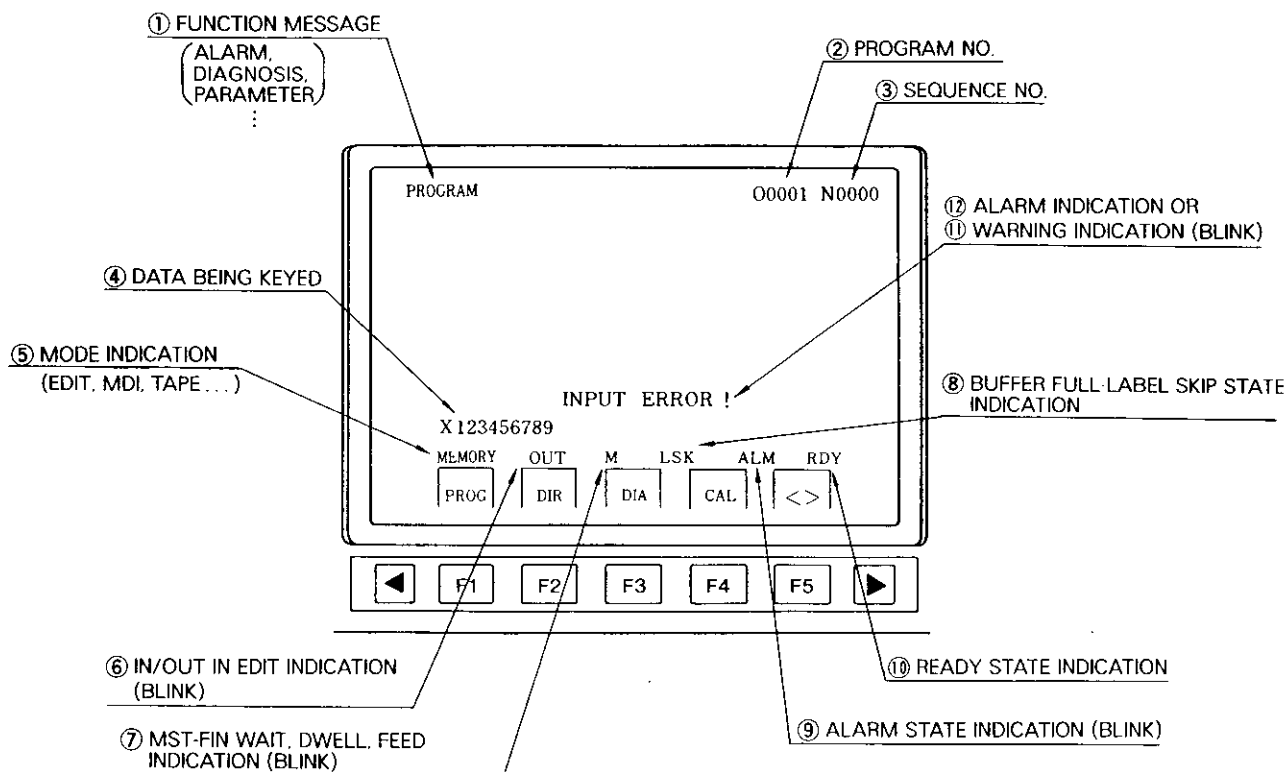
The following position summary display appears immediately after turning on the power.

For a detailed description of the position summary display, refer to par. 2.4.7.



2.3 CONSTANT DISPLAY MESSAGES

The following messages are always displayed on the top line and in the three bottom lines of the CRT display, regardless of the function key selection.



① Function Message

Any of the following messages corresponding to the function keys is displayed in the top line of the CRT display:

ALARM, DIAGNOSIS, PARAMETER, SETTING, COMMAND,
PROGRAM, POSITION, OFFSET, ETC.

② Program No.

The current program No. is displayed in the top line of the CRT display, in four digits after O, irrespective of the function key.

③ Sequence No.

The current sequence No. is displayed in the top line of the CRT display, in four digits after N, irrespective of the function key.

④ Data Being Keyed

The data being keyed is displayed, up to 32 characters.

Depressing one of the following keys **ERASE**, **INSRT**, **ALTER**, etc. makes the data to be processed as a unit of data.

⑤ Mode Indication

Indicates the current mode among edit, memory, MDI, tape and manual.

⑥ IN/OUT in Edition Indication (Blink)

While punched tape data is under input, output or edit, the following messages are displayed by blinking.

- "IN"Tape under reading
- "VER"Tape under collation
- "OUT"Tape under output
- "ALT"Data under change in edit mode
- "INS"..... Data under insertion in edit mode
- "ERS"Data under erasure in edit mode

⑦ MST-FIN wait, Dwell, Feed Indication (Blinking)

- "M" M command FIN waiting
- "S" S command FIN waiting
- "T" T command FIN waiting
- "F" During feed, while rapid feed, "R" is displayed.
- "P" During tape reading
- "DWELL" During dwelling

M, S, T, F, and P are all displayed independently.

⑧ Buffer-Full, Label Skip State Indication

- "BUF" Displayed when forward reading is completed.
- "LSK" Displayed when label skip is on.

⑨ Alarm State Indication (Blinking)

An alarm indication continues blinking until the cause is eliminated and resetting is effected.

- "ALM" Alarm state is ON.
- "BAT" Battery alarm is ON.
- "A/B" Both alarm state and battery alarm are ON.

⑩ Ready State Indication

- "RDY" System is in order, and ready for operation.

⑪ Warning Indication (Blinking)

The following warnings are minor errors caused by keying, searching manipulation, etc., and not verifiable alarms.

When any of these warning is displayed, depressing any key (usually CAN) turns them off.

When an alarm and a warning occur simultaneously, the warning display has the priority.

- "INPUT ERROR!" Format error during data keying.
Collation error with the VER key.
- "ALREADY IN" Already part program with same No. is stored.
- "EDIT LOCK!" Edit process is attempted with EDIT LOCK.
- "PROGRAM OVER!" More than 99 (basic) or 199 (optional) part programs registration is attempted.
- "MEMORY OVER!" Memory capacity is exceeded in storing part programs.
- "TH PARITY ERROR!" Horizontal parity check error in tape reading.
- "TV PARITY ERROR!" Vertical parity check error in tape reading.
- "ILLEGAL CHARACTER!" .. Code which cannot be understood occurs in tape reading.
- "NOT FOUND!" No intended code found through searching.
- "MACRO INTERLOCK!" Operation of programs interlocked by O8000 or O9000 level is attempted.
- "AREA OVER!" Designation of range over permissible 1024 characters by editor is attempted.
- "EDIT MEMORY FULL !" .. Any part program exceeding 40 m of meter length is displayed or edited.

The above indications all blink.

⑫ Alarm Indication

The above indications all blink.

When a NC alarm occurs on the same line as the line for which a warning has been indicated, that alarm content is displayed in one line. However, "alarm 310 SERVO OFF" is not displayed, because this alarm is of a different nature from other NC alarms. When two or more alarms occur, only the top most one in the alarm list is displayed. When an alarm and a warning occur simultaneously, only the warning is displayed with priority.

2.4 FUNCTION DISPLAY

With a unit equipped with the Compact Interactive Function, the operation and display for the FUNCTION keys are partly different from those described in YASNAC LX3 Manual (TOE-C843-9.20), as described below:

2.4.1 Display with FUNCTION Key

The operator manipulations for displaying alarm codes and other data are as follows:



(1) Depress  FUNCTION key.

One of the following is displayed.

(a) Alarm No. and message

(b) Operating time display

(c) Maintenance history display

(2) Depressing the page   keys changes the above displays one after another.

In addition, depressing the software keys [ALARM], and [TIMER] directly calls up (a) (ALARM) and (b) (TIMER) displays respectively.


(3) For details of the above displays, refer to the standard YASNAC LX3 Manual.

(a) (ALARM) 4.3.9.1 Alarm No. display
4.3.9.2 Message display

(b) (TIMER) 4.3.9.4 Operating time display

(c) (MAINTENANCE) ... 4.3.9.5 Maintenance history display

2.4.2 Display by  (DIAGNOSIS) FUNCTION Key

Depressing the  FUNCTION key displays the I/O signal ON/OFF state.

The I/O signal state display can be called up at any time, including the automatic operation time.

DIAGNOSIS		00000 N0000								
		7	6	5	4	3	2	1	0	
#1000		0	1	0	0	0	0	0	0	40
#1001		1	1	0	1	1	0	0	0	08
#1002		1	0	0	1	0	0	0	1	91
#1003		0	1	0	1	0	0	1	0	52
#1004		0	0	0	0	0	0	1	0	02
#1005		1	1	0	1	1	0	0	1	09
#1006		1	0	1	1	1	1	1	1	BF
#1007		0	0	0	0	1	0	0	0	00
#1008		0	0	0	0	0	0	0	0	00
#1009		0	0	0	0	0	0	0	0	00
*=0		0:OPEN		1:CLOSE						



MEMORY		LSK		RDY
SELECT	CANCEL			

For the details of this display, refer to Appendix 4, "Standard I/O Diagnostic No. Display", of the Standard YASNAC LX3 Manual.

For convenience in maintenance, etc., the I/O signal state display indicates the right end numerals in hexadecimal.

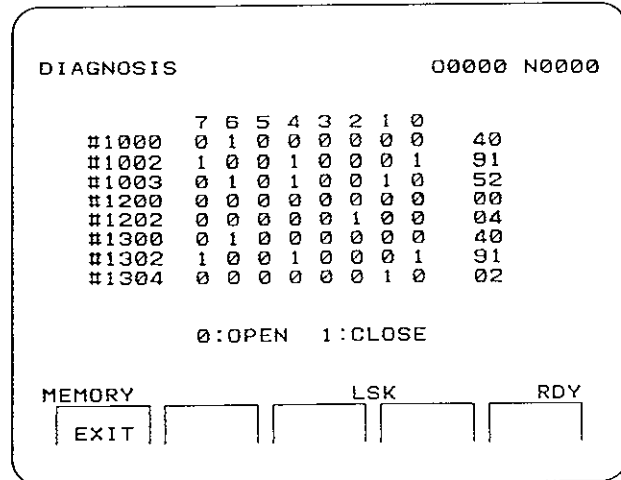
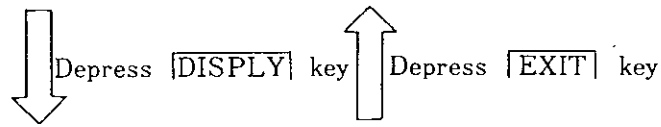
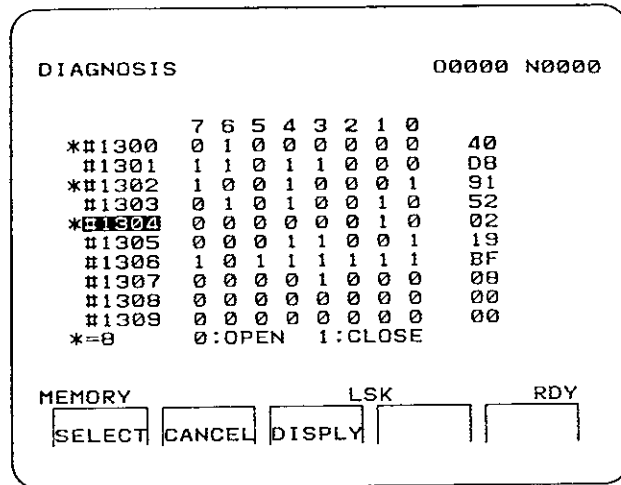
2.4.2.1 I/O signal selective display function

With this unit, any desired input or output signal among these listed can be selected for display by means of the number.

- (1) Depress the CURSOR   keys to bring the cursor to the desired No., or utilize the search function for this purpose.
- (2) Depress the **SELECT** key; "*" is displayed to indicate the selection, and the count of the selected Nos. is indicated in the lower left area.
- (3) Repeat steps (1) and (2) to select all the Nos. to be displayed. Up to 10 Nos. can be selected.
- (4) Depress the **DISPLAY** key. Only the selected Nos. are displayed.
- (5) Depress the **EXIT** key. The total No. list display is called up again.
- (6) To cancel the selection, depress the **CANCEL** key.

To cancel the selection of any one No., bring the cursor to that No. and depress the **SELECT** key.

The selected Nos. are memorized even when the power supply is turned off. However, the display returns to that of #1000 when the power is turned off.




2.4.3 Display by means of FUNCTION Key

With this unit, various parameters are stored, and various operation conditions such as tape codes and rapid feed rates are determined with them.

For the details of parameter display and writing operator manipulations, refer to the standard YASNAC LX3 manual.

2.4.3.1 Setting RS-232C parameters

Since the parameters related to RS-232C are frequently used, they are designed for interactive setting possibility as follows.

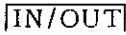


- (1) Depress the  FUNCTION key to display the parameter display.


PARAMETER	7	6	5	4	3	2	1	0	00000	N0000
#6000	0	1	0	1	0	0	1	0	82	
#6001	0	0	0	0	0	0	0	1	1	
#6002	1	0	0	0	0	0	0	0	128	
#6003	0	0	0	1	0	0	0	1	17	
#6004	0	1	0	1	0	0	0	1	81	
#6005	0	1	1	0	0	0	1	0	98	
#6006	0	0	1	1	0	0	0	0	48	
#6007	0	1	0	0	0	1	0	0	68	
#6008	0	0	1	1	0	0	0	0	48	
#6009	0	0	0	1	0	1	1	0	22	
	0:OFF									1:ON

MEMORY	LSK	RDY
RS232C		

- (2) Depress the RS-232C key. One of the following two displays are called up.

- (a) RS-232C input
- (b) RS-232C output

- (3) When the  key or the PAGE   key is depressed, the above two displays are alternately called up.

- (4) To call up, the parameter display again, depress the  key.




2.4.3.2 Setting RS-232C input parameters






Set the RS-232C input parameters as follows:

- (1) Call up the RS-232C input display by following the processes of par. 2.4.3.1.

PARAMETER	00000	N0000
RS232C INPUT		
CHANNEL	NO.1	
CONTROL CODE	0 N	
STOP BIT	2	
BAUD RATE	4800	
PARITY	0 N	

MEMORY	LSK	RDY
EXIT	IN/OUT	

- (2) The RS-232C input parameters are in the five items as shown in the display above.
- (3) Depress the CURSOR   keys to make the intended items on the display blink.
- (4) Depressing the  key changes the setting of the respective items one by one as shown below.
- (a) CHANNEL No. 1 or No. 2
 - (b) CONTROL CODE ON or OFF
 - (c) STOP BIT 1 or 2
 - (d) BAUD RATE 50, 100, 110, 150, 200, 300, 600, 1200, 2400, 4800, 9600
 - (e) PARITY ON or OFF

For setting the baud rate, digits may be directly input with keys such as     .

- (5) Set the RS-232C input parameters in conformance with the setting of the units to be connected to RS-232C.
- (6) Precautions

The No. 2 channels are displayed when the optional second RS-232C is connected. Without this optional unit, No. 1 only is displayed.

2.4.3.3 Setting RS-232C output parameters

Set the RS-232C output parameters as follows:

- (1) Call up the RS-232C output display by following the processes in Par. 2.4.3.1.
- (2) The RS-232C output parameters are in the 6 items as shown below:


PARAMETER	00000 N0000
RS232C OUTPUT	
CHANNEL	NO.1
ISO/EIA	ISO
CONTROL CODE	0 N
STOP BIT	2
BAUD RATE	4800
PARITY	0 N
MEMORY	LSK
EXIT	RDY
IN/OUT	

- (3) With these items, the following settings are possible, by the same setting method as for the RS-232C input parameters:

- (a) CHANNEL No. 1 or No. 2
- (b) ISO/EIA ISO or EIA
- (c) CONTROL CODE ON or OFF
- (d) STOP BIT 1 or 2
- (e) BAUD RATE 50, 100, 110, 150, 200, 300, 600, 1200, 2400, 4800, 9600
- (f) PARITY ON or OFF

(4) Set the RS-232C parameters in conformance with the setting of the unit to be connected to RS-232C.


(5) Cautions

- The set parameters become effective immediately upon keying the  key or the digit DATA keys.
- The No. 2 channel is displayed when an optional second RS-232C is connected. Without the optional RS-232C, No. 1 channel only is displayed.

2.4.4 Display by the use of FUNCTION Key

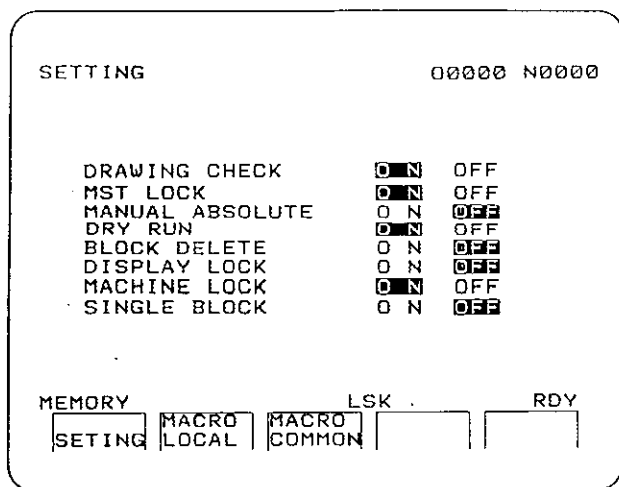
This unit has setting data stored in the internal memory, and the stored data are used for selectively turning various functions ON or OFF, and as the control constants for various functions.



For the details, refer to Appendix 1 "Setting No. list" of the standard YASNAC LX3 Manual.


- (1) Depressing the  FUNCTION key only displays the setting data.
- (2) For details of the display and writing of setting data, refer to Par. 4.3.6 of the standard YASNAC LX3 Manual.

2.4.4.1 Setting internal toggle switch

- (1) Even when the 9 basic function switches are eliminated from the operator's panel of the machine, the relevant functions can be turned ON and OFF simply by the setting on the NC operator's panel.
- (2) Depress the SETTING (setting) software key to display the internal toggle switch setting menu.



(3) Depress the CURSOR   keys to make the intended item blink.

(4) Depress the  key to set to "ON" or "OFF".

The set switch position becomes reverse displayed.

(5) When the "DRAWING CHECK" setting is changed, the settings shown below are changed automatically.

Use this "DRAWING CHECK" setting when checking the programs generated through the interactive function or manual function by the drawing check function.

(a) MST LOCK

(b) DRY RUN

(c) MACHINE LOCK

(6) Where the panel of the machine is provided with the switches for the above functions, the resulting ON/OFF settings of these functions are determined by the ORed results of the software setting and the hardware setting.

Setting DATA	Switch On Machine	Resultant ON/OFF
OFF	OFF	OFF
OFF	ON	ON
ON	OFF	ON
ON	ON	ON

(7) Precautions

- When the PAGE key is depressed, the normal setting display starting from #6001 is called up again.
- The display for the internal toggle switches is the #6000.

2.4.4.2 Setting of LOCAL macro variables

Depress the MACRO LOCAL key to call up the SETTING (MACRO) display starting from #0001. For the setting processes with this display, refer to Par. 2.8.23.8 of the standard YASNAC LX3 Manual.

SETTING(MACRO) 00000 N0000

LEVEL 0

#0001

#0002

#0003

#0004

#0005

#0006

#0007

#0008

#0009

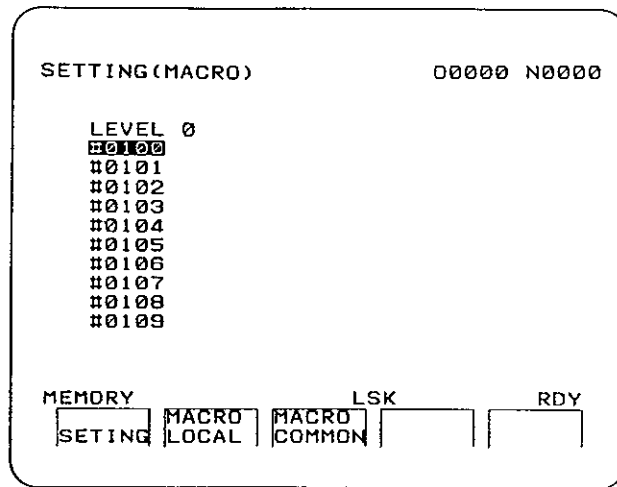
#0010

MEMORY LSK RDY


SETTING LOCAL COMMON


2.4.4.3 Setting of COMMON macro variables

Depress the MACRO COMMON key to call up the SETTING (MACRO) display starting from #0100. For the setting processes with this display, refer to Par. 2.8.23.8 of the standard YASNAC LX3 Manual.





2.4.5 Display with (COMMAND) FUNCTION Key

With the  FUNCTION key, command values are displayed by the following processes.





- (1) Depress the  key.

One of the following four displays will be called up.

- (a) Command value list
- (b) Sub-program execution state display
- (c) Tool life control state display
- (d) Drawing display

- (2) With the PAGE   keys, the above displays, except for the DRAWING display, are switched over one after another.


Depressing the following software function keys calls up the respective displays directly.

- (a) Depress  key (COMMAND VALUE) display
- (b) Depress  key (NESTING) display
- (c) Depress  key (TOOL LIFE CONTROL) display
- (d) Depress  key (DRAWING) display

(3) For a detailed description of these displays, refer to the following sections:

- (a) (COMMAND VALUE) Standard YASNAC LX3 Manual Par. 4.3.2.1
- (b) (NESTING) Standard YASNAC LX3 Manual Par. 4.3.2.2
- (c) (TOOL LIFE CONTROL) Standard YASNAC LX3 Manual Par, 4.3.2.3
- (d) (DRAWING) Par. 6 of this manual

2.4.6 Display with (PROGRAM) FUNCTION Key

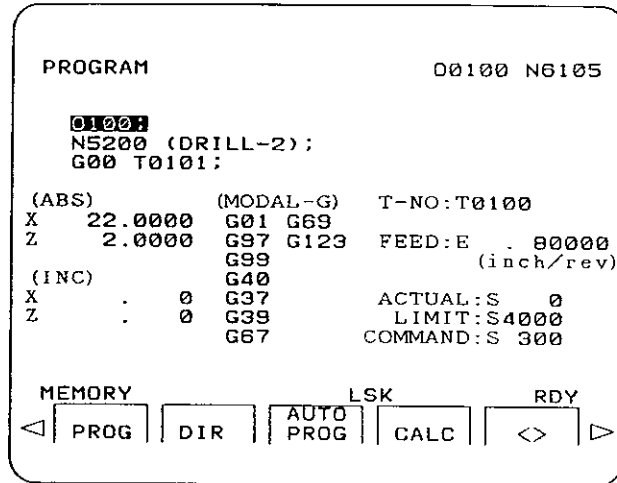
- (1) Depress the  FUNCTION key to call up the PROGRAM display.
- (2) The program functions are in the following 6 modes, each differing in function and operator manipulation.
 - (a) JOG mode
Mode for manual continuous feeding of the machine
 - (b) HANDLE/STEP mode
Mode for using manual pulse generator
 - (c) TAPE mode
Mode for NC tape operation
 - (d) MDI mode
Mode for writing command values with MDI (manual data input) and their execution
 - (e) MEMORY mode
Mode for automatic operation of stored programs
 - (f) EDIT mode
Mode for program storing, reading in and from the memory, and for editing
- (3) For the details of the above 6 modes, refer to Par. 4.3.3 of the Standard YASNAC LX3 Manual.

2.4.6.1 Common mode display

With the program function, there are displays which are common to all the modes.

(1) Program display

- (a) Depress the **PROG** key to call up the program display.
On the program display, NC programs and operation data are displayed, except that in the EDIT mode, no operation data is displayed.



- (b) The NC programs are displayed only in the MDI, MEMORY and EDIT modes.
- (c) Depressing the **< >** key switches the operation data display and cancels one after another.
- (d) The operation data includes the following displays:
- (i) POSITION (ABS), (INC)
 - (ii) MODAL G list
 - (iii) T-NO (tool No.)
 - (iv) FEED (feed rate)
 - (v) Spindle speed



(2) Directory display

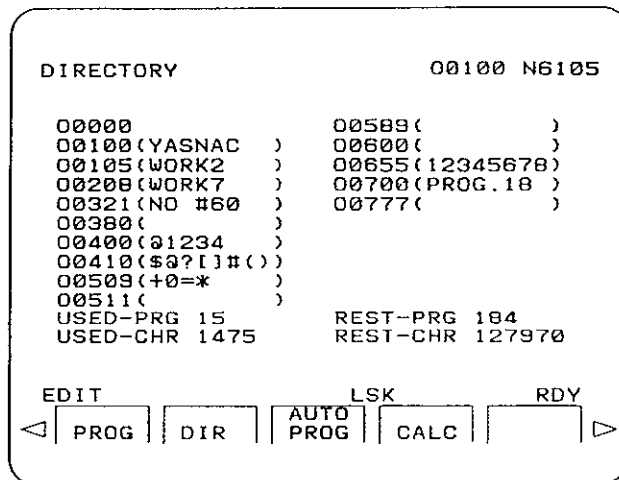
- (a) Depress the **DIR** key to call up the directory display.
Then, depressing the **PROG** FUNCTION key changes over the program display and the directory display in turn.
Depressing the PAGE keys does not change over the directory display into the program display.
- (b) One directory display displays up to 20 program Nos. When comments are attached to the programs, the comments are also displayed.
- (c) Number of registerable program Nos.

	Registerable Numbers
Basic	99 max.
Optional	199 max.

(d) On the directory display, the following are displayed:


- (i) Number of used programs
- (ii) Number of used characters
- (iii) Number of remaining programs
- (iv) Number of remaining characters

(e) When the number of registered program Nos. exceeds the maximum displayable limit in one display, succeeding pages may be called up with the PAGE   keys.

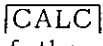


(f) O-number can be searched for in the directory display.

(3) Interactive automatic programming mode

Depress the  key to call up the interactive automatic programming mode. For the details of this mode, refer to Pars. 3.2 to 3.15.






(4) Calculation function

Depress the  key to call up the calculation function mode.

For details of the calculation function, refer to Par. 4.

When the calculation function has been executed, the calculation results can be written into the program as follows:



(i) Call up the EDIT mode.

(ii) When the keys  and  or keys   and  are

depressed, the X-axis which is the result of calculation is displayed.

(iii) When the keys  and  or keys   and  are

depressed, the Z-axis which is the result of calculation is displayed.

(iv) Depress the  or  key to write them into the program.

(5) Interactive parameter

When the ◀ or ▶ key is depressed, the and keys are displayed.

Depressing the key dalls up the interactive automatic programming parameter list.

Depressing the key calls up the interactive automatic programming parameter I/O setting is displayed.

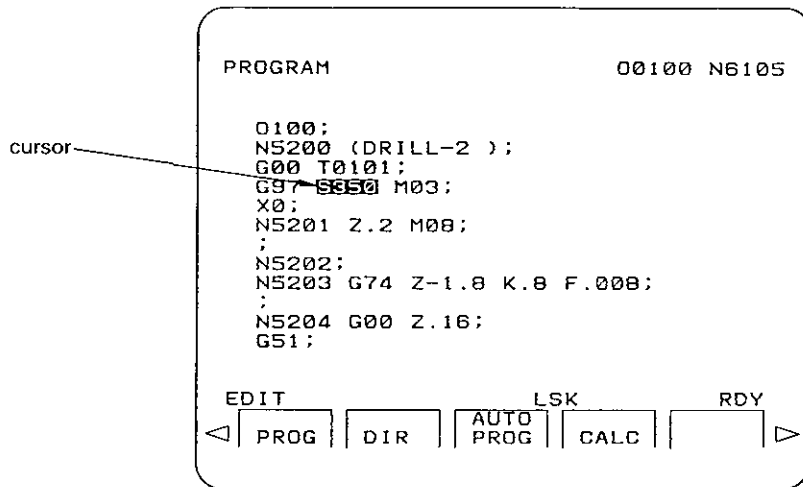
For details of the interactive automatic programming parameters, refer to Par. 8.

2.4.6.2 EDIT mode

In the EDIT mode, various functions for editing are used.

(1) Cursor type

The cursor displayed in the editor of this unit is in the form of the reverse displayed characters as shown below.



As an optional function, a cursor in the form of an underline can be selectively used, as with the standard YASNAC-LX3.

(2) Scrolling

The editor display of this unit is provided with a scrolling function.

(a) The display is moved by one line (block).

(i) Depressing the CURSOR key when the cursor is at the bottom of the display.

(ii) Depressing the CURSOR key when the cursor is at top of the display.

(b) Similar to the standard YASNAC-LX3, the function of display shifting by one page is available as an option.

(3) Program storage after editing

(a) After editing a program, the edited display can be stored in the memroy by the following keying:

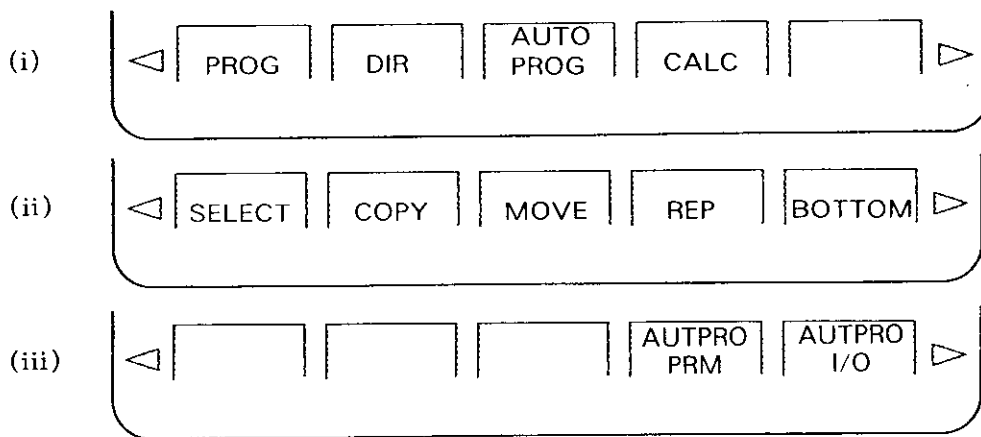
(i) Depress the key.

(ii) Depress a FUNCTION key other than .

(b) When the power is turned off after editing a program, without executing the above keying, the edited display is not stored, and the program returns to the unedited state.

(4) Display of software function keys

(a) In the EDIT mode, the following three software function key sets are used:



* The

AUTPRO I/O

 key is displayed only when the optional interactive automatic programming I/O function is incorporated.

(b) Depressing the MENU

▶

 key changes the software FUNCTION key display in the sequence (i) - (ii) - (iii) as shown above.

(c) Depressing the MENU

◀

 key changes the software FUNCTION key display in the sequence (i) - (iii) - (ii) as shown above.

* The ◀ ▶ marks on the display indicate the presence of latent function keys. When no ◀ ▶ marks are displayed, the MENU

◀

 AND

▶

 keys are disabled.

(5) COPY function

This function duplicates an existing character string to appear at a desired location.

(a) Bring the cursor to the leading end of the character string to be copied.

(b) Depress the

SELECT

 key.

The display SELECT is reverse displayed to indicate the calling up of the SELECT mode. Depressing the

SELECT

 key again clears the SELECT mode. When the cursor is at the leading end of the program, the SELECT mode can not be called up. To call up the SELECT mode, shift the cursor away from the leading end, and depress the

SELECT

 key again.

- (c) Move the cursor to the end of the character string to be copied.
The selected characters are all reverse displayed to indicate the selected range.

```

PROGRAM                                00100 N6105

0100:
N5200 (DRILL-2 ):
G00 T0101;
G97 S350 M03;
X0;
N5201 Z.2 M08;
;
N5202;
N5203 G74 Z-1.8 K.8 F.008;
;
N5204 G00 Z.16;
G51;

EDIT                                LSK                                RDY
< SELECT COPY MOVE REP BOTTOM >

```

- (d) Depressing the **COPY** key stores the selected character string, and a "*" mark appears on the software key display.
The selected character string is displayed normally.
- (e) Move the cursor to where the copy is to appear.
Not only the selected program Nos., but also others can be copied.
- (f) Depressing the **COPY** key displays the selected character string at the selected location.
- (g) While a "*" is displayed on the ***COPY** software key, the same character string can be copied as many times as the ***COPY** key is depressed.
- (h) By depressing the **ORG** key when a "*" is displayed on the ***COPY** software key, the data in the selected character string are cleared and the "*" disappears.

```

PROGRAM                                00100 N6105

0100:
N5200 (DRILL-2 ):
G00 T0101;
G97 S350 M03;
X0;
N5201 Z.2 M08;
;
N5202;
G97 S350 M03;
X0;
N5203 G74 Z-1.8 K.8 F.008;
;

EDIT                                LSK                                RDY
< SELECT *COPY MOVE REP BOTTOM >

```

Note: When the power supply is turned off, the selection of character string is cleared, and the "*" mark disappears.
When the MOVE function is used after the COPY function setting, the character string selection is also cleared.
When the cursor is moved to the leading end of the program in the SELECT mode, the SELECT mode is automatically cancelled.
The range of the character string to be selected is up to 1024 characters.
If the **COPY** key is depressed with the number of characters exceeding the range, warning message "AREA OVER!" is displayed.

- (6) MOVE function
This function is for displacing the existing character string to other locations in NC program editing.
- Specify a character string to be moved by using the **SELECT** key, as with the **COPY** function.
 - Depress the **MOVE** key to store the selected character string. A "*" mark appears on the **MOVE** key display. The reverse displayed character string is deleted.
 - Move the cursor to where the character string is to appear.
Not only the selected program Nos., but also others can be moved.
 - Depressing the ***MOVE** key displays the selected character string at the selected location.
 - While a "*" is displayed on the ***MOVE** software key, the same character string can be displayed as many times as the ***MOVE** key is depressed.
 - By depressing the **ORG** key when a "*" mark is displayed on the ***COPY** software key, the data in the selected character string are cleared and the "*" mark disappears.

```

PROGRAM                               00100 N6105

0100;
N5200 (DRILL-2 );
G00 T0101;
N5201 Z.2 M08;
;
N5202;
G97 S350 M03;
X0.
N5203 G74 Z-1.8 K.8 F.008;
;
N5204 G00 Z.16;
G51;

```

EDIT
LSK
RDY

< SELECT
COPY
*MOVE
REP
BOTTOM >

Note: When the power supply is turned OFF, the selection of character string is cleared, and the "*" mark disappears.
When the COPY function is used after the MOVE function setting, the character string selection is also cleared.
When the cursor is moved to the leading end of the program in the SELECT mode, the SELECT mode is automatically cancelled.
The range of the character string to be selected is up to 1024 characters.
If the **COPY** key is depressed with the number of characters exceeding the range, warning message "AREA OVER !" is displayed.

(7) REPLACE function

This function is for searching a specified character string in the displayed NC program and for changing it with another character string.

- (a) Depressing the **REP** key displays "OLD STRING:" at the lower left area of the display.

Key in the character string to be replaced.

For example, to change "G00", key **G** **Ø** **Ø** and **WR**.

```
PROGRAM                                00100 N6105

N5205 M01;
;
N1300 (FACE- FREE- ROUGH);
G50 S4000;
G00 T0202;
G96 S700 M03;
N1301 X4.2 Z.08;
;
N1302 G00 G41 X4.208 Z.004;
N1303 G01 X.728 F.01;
;
N1304 G51;

OLD STRING: G00
EDIT                                LSK                                RDY
◁ SELECT COPY *MOVE REP BOTTOM ▷
```

- (b) "NEW STRING:" is displayed at the lower left area of the display. Key the character string to replace the existing one.

For example, to write "G01," key **G** **Ø** **1** and **WR**.

```
PROGRAM                                00100 N6105

N5205 M01;
;
N1300 (FACE- FREE- ROUGH);
G50 S4000;
G00 T0202;
G96 S700 M03;
N1301 X4.2 Z.08;
;
N1302 G00 G41 X4.208 Z.004;
N1303 G01 X.728 F.01;
;
N1304 G51;

NEW STRING: G01
EDIT                                LSK                                RDY
◁ SELECT COPY *MOVE REP BOTTOM ▷
```

(c) In the lower left area of the display, "YES.NO.ALL" is displayed, and the cursor moves to the character string specified in (a).

(i) Depressing the **Y** key replaces the character string specified in (a) with the one specified in (b).

When the same character string as specified in (a) is present elsewhere, the cursor moves there, and "YES.NO.ALL" is displayed on the display. No more character string specified in (a) is found, the replacing function ends.

(ii) Depressing the **N** key causes no change in character strings.

The cursor moves to the next position of the same character string specified in (a), and "YES.NO.ALL" is displayed on the display.

If more character string specified in (a) is found, the replacing function ends.

(iii) Depressing the **A** key replaces all the character strings displayed on the display with the one specified in (b).

```
PROGRAM                                00100 N6105

N5205 M01:
;
N1300 (FACE- FREE- ROUGH);
G50 S4000;
G00 T0202;
G96 S700 M03;
N1301 X4.2 Z.00;
;
N1302 G00 G41 X4.200 Z.004;
N1303 G01 X.728 F.01;
;
N1304 G51;

YES.NO.ALL
EDIT                                LSK                                RDY
< SELECT COPY *MOVE REP BOTTOM >
```

(d) Precaution

The replacing is executed in units of words, and therefore is subject to the following restrictions:

(i) The character string to be keyed when "OLD STRING:" is displayed must be one word preceded by an alphabet character.

When characters other than an alphabet character are keyed for the leading character, a warning "INPUT ERROR" is displayed.

(ii) A character string containing two or more addresses (comment) can not be replaced at the same time.

For example, "O.D." can not be replaced by "I.D."

During the replacing process, the PAGE keys and the CURSOR keys are invalid.

(8) BOTTOM function

Depressing the **BOTTOM** key brings the cursor to the last address of the displayed programs.

(9) Search erase function

This function is for erasing the portion of display from the cursor to the character string which is keyed in.

- (a) Bring the cursor to the leading end of the character string to be erased.
- (b) Key in the character string to be erased.
- (c) Depress the **ERASE** key.
- (d) The portion from the cursor to the keyed in character string is erased.
- (e) The cursor moves to the address next to the erased block.
- (f) When the last block has been erased, the cursor moves to the address immediately before the erased address.
- (g) The address to be erased can be specified in any of the following three methods, as with the address search function:
 - (i) Key in the word (one address data) to be erased.
In this case, the leading zeros can be omitted.
 - (ii) Key in one character without data.
 - (iii) Key in the data to be erased (up to 32 characters), after depressing the **NEXT** key.

In this case, leading zeros can not be omitted. (erasing by means of pattern searching function) All the portion between the cursor position to the keyed in character string is erased, and if the keyed-in character string contains two or more words, only up to the first word of the keyed-in string is erased.

(h) An example of erasing is shown by the two diagrams below.

PROGRAM 00100 N6105

```

N5205 M01;
;
N1300 (FACE- FREE- ROUGH);
G50 S4000;
G00 T0202;
G96 S700 M03;
N1301 X4.2 Z.08;
;
N1302 G00 G41 X4.208 Z.004;
N1303 G01 X.728 F.01;
;
N1304 G51;

```

EDIT LSK RDY

◀ PROG DIR AUTO LSK RDY ▶

PROG DIR AUTO LSK RDY

↓ When **N** **1** **3** **0** **1** **ERASE** are depressed.

PROGRAM 00100 N6105

```

N5205 M01;
;
X4.2 Z.08;
;
N1302 G00 G41 X4.208 Z.004;
N1303 G01 X.728 F.01;
;
N1304 G51;
G40;
N1305 M01;
;
N2100 (00- CYCLE- ROUGH);

```

EDIT LSK RDY

◀ PROG DIR AUTO LSK RDY ▶

PROG DIR AUTO LSK RDY

(10) Line cursor function

This function is for moving the cursor by one line (block) at a time.

- (a) Depress the key.
- (b) Depressing the CURSOR keys moves the cursor by one line.
- (c) To return to the word (address) by work move function, clear the NEXT mode by one of the following methods:
 - (i) Depress the key again.
 - (ii) Depress the key.
 - (iii) Depress any FUNCTION key other than the PROG FUNCTION key.

(11) Automatic re-naming function of O No. input

- (a) When reading in programs from outside, if the O No. of the program and the keyed-in O No. are different, the keyed-in O No. is registered for that program.
- (b) The O No. of the input program is automatically re-named to the keyed O No.
- (c) When the input program has no O No., it is input as is, and no re-naming takes place.
- (d) For the details of part program inputting, refer to Par. 4.4 of the standard YASNAC-LX3 Manual.

(12) Feed eliminate function in program outputting.

When outputting part programs and internal data from the NC to outside units, feed is eliminated by this function.

- (a) Feed is eliminated from the output by one of the following two methods.
 - (i) Depress the key in the output procedure, and as outputting is started, depress the key. When the key is depressed, the outputting of the significant data of [%,...] starts immediately. The feed after the outputting of the significant data is also eliminated when the key is depressed.
 - (ii) Specifying with a parameter
 - #6008 D4 1 : No feed output
 - #6008 D4 0 : Feed output
- (b) For details of the outside I/O operator manipulations, refer to Par. 4.7 of the standard YASNAC-LX3 Manual.

(13) Reset function during outside I/O manipulation.

With this unit, for outside I/O manipulations, the key need not be depressed except in the following cases:

- (a) When ALARM occurs.
- (b) When WARNING occurs.


(14) Limitation at editing

- Any program exceeding 40m can be input from external devices but cannot be displayed or edited. If an attempt to display such a program is made, a warning message "EDIT MEMORY FULL !" is displayed and the part after 40m cannot be displayed.






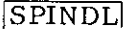




- Do not input any program with a block in which more than 28 characters of only numerals, ".", "+" or "-" continues.

2.4.7 Displays with FUNCTION Key






Various POSITION display screens are called up by the following keying:

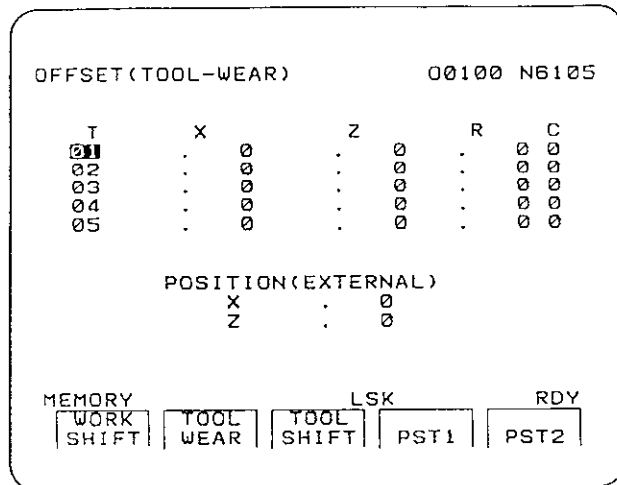
- (1) Depress the  FUNCTION key.
One of the following screens is displayed:
 - (a) POSITION external
"POSITION (EXTERNAL)"
 - (b) POSITION absolute
"POSITION (ABSOLUTE)"
 - (c) POSITION collective indication
"POSITION"
 - (d) Program restart information display
"PROGRAM RETURN"
 - (e) Stored stroke limit residual pulse count display
"STORED STROKE LIMIT"
 - (f) Main spindle PG pulse count display
"SPINDLE COUNTER"
 - (g) Servo position deviation pulse count display
"ERROR PULSE"
 - (h) Command pulse cumulative sum register display
"COMMAND PULSE"










Note: The display (h) is made only when the SYSTEM No. switch is 4.

- (2) Depressing the PAGE   keys switches the above display screens sequentially one after another.
- (3) For details of the above display screens, refer to Par. 4.3.4.1 through 4.3.4.9 of the standard YASNAC LX3 Manual.
- (4) With all the POSITION FUNCTION displays, the following software function keys are displayed. Depressing one of these software keys calls up the corresponding display screens directly as follows:
 - (a) Depressing  key... POSITION (EXTERNAL) is displayed
 - (b) Depressing  key... POSITION (ABSOLUTE) is displayed
 - (c) Depressing  key... POSITION collective is displayed
 - (d) Depressing  key... Spindle PG pulse count display
- (5) Depressing the  key also calls up these four displays sequentially, in turn.
- (6) With the position collective display screen, the following keying resets POSITION EXTERNAL alone to 0.
 - (a) Depress ADDRESS key  or  to select the axis to be reset.
 - (b) Depress the  key.
 - (c) The display for the selected axis becomes 0.
 - (d) This display resetting keying is always effective including the motion time in a part program automatic run.

2. 4. 8 Display with FUNCTION Key

- (1) Depress the  key to call up the OFFSET display screen.
- (2) For the display and writing-in manipulation, refer to Par. 4.3.5 in the standard YASNAC LX3 Manual.
- (3) With this unit, depressing the following software function keys calls up the respective display screens:
 - (a) Depress  key ... Work coordinate system shift amount display
 - (b) Depress  key ... Tool offset display
 - (c) Depress  key ... Tool coordinate data display
- (4) Depressing the  key changes the above displays in sequence one after another.

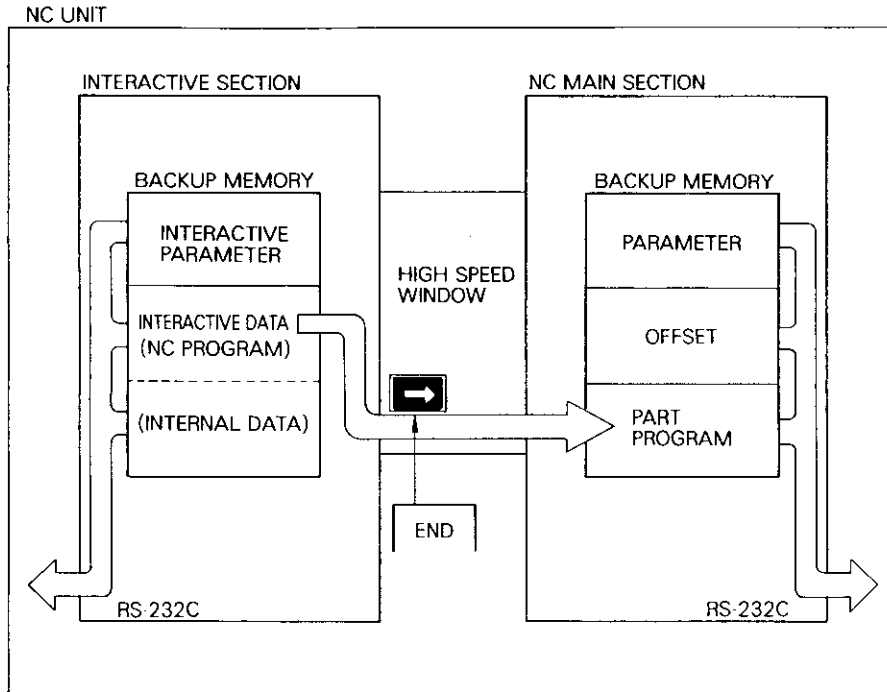


- (5) For the new tool setter function, the setting is made with the following software function keys:
 - (a) When the  key is depressed, the software key is reverse displayed, and tool coordinate memory writing is enabled. The offset display screen automatically changes to the one for the current turret tool No. and the LED of the  FUNCTION key blinks.
 - (b) Depressing the  key reverse displays the software key and work shift amount writing is enabled. The offset screen is automatically changed to the work shift amount screen. The LED of the  FUNCTION key blinks. During the  and  modes, the ,  and  keys are disabled.
 - (c) For details of the new tool setter function, refer to Sect. 2 of "YASNAC LX3 Upgrading Function Operator's Manual" (TOE-C843-9.23).

3. INTERACTIVE PROGRAMMING

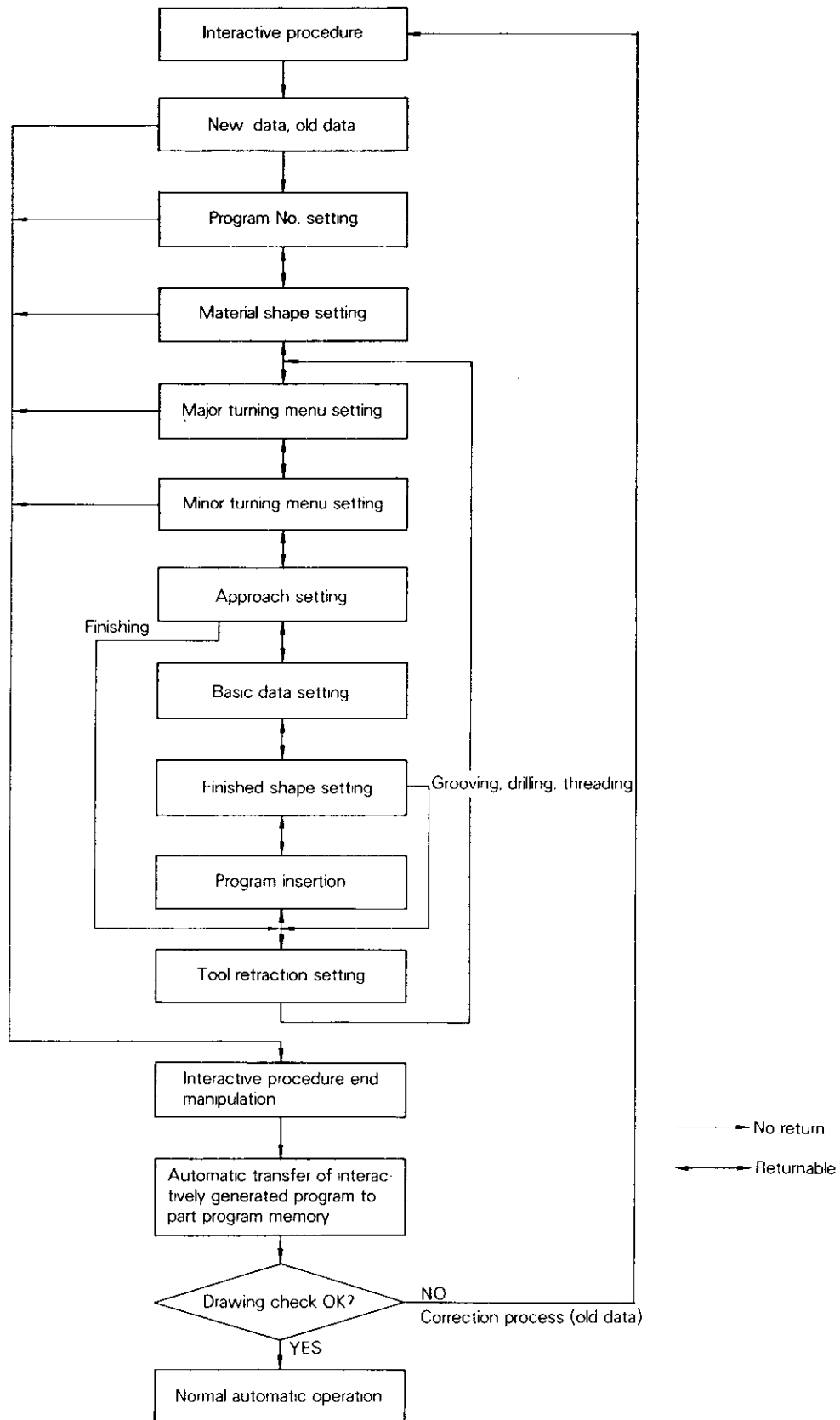
3.1 NC UNIT INTERNAL CONFIGURATION AND FLOW OF INTERACTIVE PROCESSES

(1) The NC internal memory configuration related to interactive processes is shown below.



As shown above, the NC unit is composed roughly of interactive and NC main sections. The interactive data (NC program) created in the interactive section is transferred automatically to the part program memory in the NC main section by the operation "END". Conversely, however, the part program in the NC main section cannot be read out to the interactive section. In other words, the data flows unidirectionally from the interactive to NC main section.


(2) The overall flow chart for the compact interactive automatic programming function is shown below.



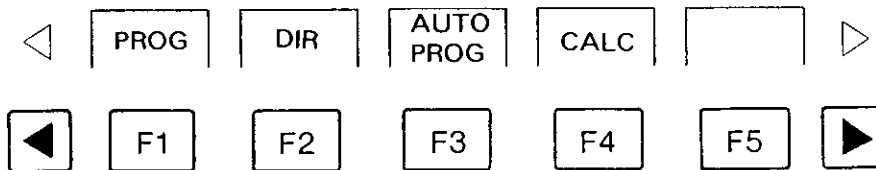
- (3) The interactive programming manipulation for various turning processes (such as outside rough turning) can all be executed in the unified flow consisting of approach - shape setting - tool retract.


3.2 CALL UP OF INTERACTIVE MODE

By the following manipulation, the interactive mode can be called up from the ordinary NC mode.

- (a) Depress the  key.

The program function display is called up and the following software function keys (F1 ~ F5) are displayed.



- (b) Depress the  key.

Now the interactive mode has been called up.

3.3 PROGRAM NO. SETTING (FOR NEW DATA)

- (1) In the interactive mode, the following screen is displayed:

** PROGRAM NUMBER ** 00000 N0000

1 Old Data
2 New Data



Program number = 0
Comment = ()


MEMORY LSK RDY

END ENTER





Initially, the cursor is located at "1 Old Data", and "1" blinks. At the bottom of the display, software function keys are displayed.

(2) The program No. of the program to be newly generated is set by the following manipulations.





(a) Depress the CURSOR   keys to bring the cursor to "2 New Data". Now, "2" blinks.

Depress the  key. Now, the cursor is at "0 number".




(Note: The treatment of "1 Old Data" will be described in Sect.5.)


(b) Any numbers between 1 and 9999 can be set as the program No. For example, to set "100", key    and , in this sequence. The displayed "Comment" now blinks.


(c) Up to 8 alphanumeric characters can be keyed as the comment.

To input "ABC", key    .

Comment may be omitted.

(d) Depressing the CURSOR   keys or the  key moves the cursor between "Program number" and "Comment". Use this feature to correct keying, if necessary.

(Note: Depressing the  key calls up the normal NC mode again, but usually, at this point, further manipulations are made without calling up the normal NC mode again.

(e) Depress the  key.

Now, the program No. and comment have been set.

(3) Precautions

If the same program No. keyed-in has been registered, the keying is invalid, and the message "O number already exist" is displayed. Key some other program No.

3.4 SETTING BLANK SHAPE

(1) When a program No. has been set, the following is displayed:

** BLANK SET **		00000 N0000
01000		
O. D.	=	0
I. D.	=	0
Length	=	0
Face removal	=	0
Chucking lgth	=	0
Center	=	0:No/1:Yes
MEMORY	LSK	RDY
END	MANUAL	ENTER

(2) The blank shape is set through the following keying:

(a) Input the O. D. For example, to input "4 inch", key and , in this sequence.

The "I.D." in the display starts to blink.

(b) Input the "I.D." To input "0.8 inch", key , and , in this sequence.

The keying of I.D. is required only for tubular blanks. For other blanks, no I.D. need be input.

Where bar material is drilled and bored, the drill diameter is input automatically as the I.D. upon completion of the drilling process to set a new blank.

The "Length" display starts to blink.

(c) Input the length. For "5.5 inch", key , , and , in this sequence.

The "Face removal" display starts to blink.

(d) Input the face machining allowance. Input the allowance from material face to program reference point. This defines the reference point "⊕" position.

The "Chucking leg" display starts to blink.




(e) Input the chucking length.

This is the length of the blank gripped by the chuck. With external jaws, the jaw length is to be input, and with the internal jaws, "0" is to be input.

The "Center" display starts to blink.

(f) Input the use or no use of the center.

Key , when no center is used, and key , when a center is used.

(g) If wrong data have been keyed-in, move the cursor to the item in question with the CURSOR   keys or the  key, and key the correct data.

(3) Precautions

(a) Turning of cast blanks

With cast blanks which are shaped similar to the finished shapes, the "roughing cycle" such as G71 and G72 involves much air cutting and wastes much time. For these blanks, manually input the G73 "closed loop turning cycle" in the course of the interactive programming, or manually input outside the interactive mode, on the programming display.




For the details of the closed loop turning cycle, refer to Par. 2.8.25.4 of "YASNAC LX3 Instruction Manual."

However, where the turning consists only of one roughing and one finishing cycle, any turning menu can be used.

For details, refer to Par. 3.6, "MINOR TURNING MENU SETTING."

In the above case, input the largest blank diameter and the longest blank length respectively as the "O.D." and the "Length".


(b) Data decimal point inputting method


To input "10", key    , in this sequence.



To input "10.1", key      , in this sequence.


To input "0.1", key     , or    , in this sequence.

(4)  key

The  key is a select key for the use of the CURSOR keys and DATA keys in the upper or lower part of the display. It is an alternate switch.

When the  key has been depressed, and the EDIT mode has been called up, the following edit functions are available.


(i) The CURSOR   keys have a scrolling function.

(ii) Depressing the  key displays "NEXT" in the upper part of the display.

In this state, the CURSOR   keys function as line cursor keys.

(iii) Search erase function

This function is for erasing the portion between the current cursor position and the to-be-searched position.

Depressing the keys for the to-be-searched string and the  key,

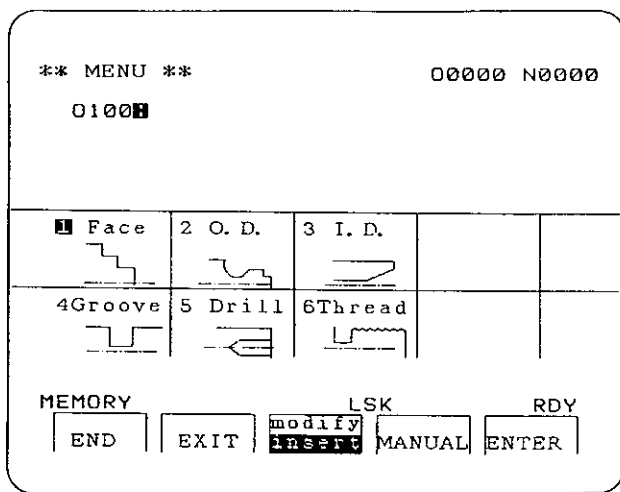
erases the portion between the initial cursor position and the searched characters.

(iv) The functions of the  ,  and  keys can be used.

For details, refer to "YASNAC LX3 Instruction Manual."

3.5 SETTING BY VARIABLE TURNING MENU

- (1) When the blank shape setting has been made, the following menu is displayed.



With this menu, the following processes are included:

"Face", "O.D.", "I.D.", "Groove", "Drill", "Thread"

Basically, other turning processes are not programmable in the interactive mode.

- (2) Setting is executed by the following keying:

- (a) To make a selection, move the cursor to the intended menu with the CURSOR

keys or the key.

The same selection can be effected when the menu No. is directly specified with the DATA to keys.

- (b) To return to the preceding display, that is, the blank shape setting display, depress the key. When editing in the upper part of the screen is desired, depress the key. Depressing it once

reverse displays it, and depressing again returns it to normal. The key is for selecting between the insertion of new NC programs generated

by interaction and the changing of the previously input processes. With the new data, the insert mode is set as the initial value, and with the old data, the change mode. Note that this mode is switched only in the variable turning process menu.

Depress the key to cancel the interactive mode.

Now the variable turning menu has been set.

- (c) Depress the key after setting with the menu.

- (3) Process list

The process list indicates all processes of a program currently edited for interaction. Each process is expressed with the turning menu numbers of the variable and detailed menu displays. Additionally, each process name at the current cursor position in each process list is displayed.

For example, a process with variable menu No. 4 and detailed menu No. 3 indicate rough O.D. drilling.

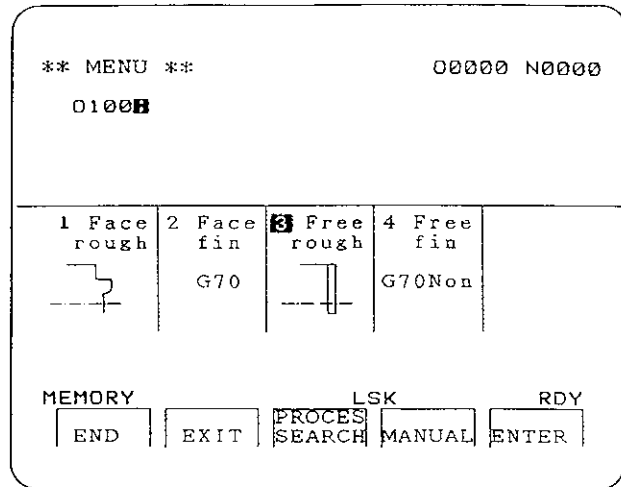
- (a) Up to 36 processes can be registered.
- (b) If the number of processes exceeds 12 or 24, they are displayed on the second and third pages and, at the same time, the number of pages is displayed on the screen.
- (c) If the number of processes exceeds 36, they are inserted into the program but are not reflected in the process list.
- (d) When process deletion or the like is performed by using the MANUAL key, it is not reflection in the process list.
- (e) The name of the process where the cursor is currently located is displayed in the process list.
- (f) If any of the following operations is performed, the process list cannot correspond to the programs.
 - More than 36 processes are created.
 - Several processes with the same menu are created and some of them are deleted.

3.6 SETTING WITH DETAILED TURNING MENU (ROUGHING, FINISHING)

When the setting is completed with the VARIABLE turning menu, the respective detailed turning menus are displayed.






3.6.1 When Facing is Set

- (1) The following display is called up.
 - (a) Initially, the cursor is located at "Free rough".
 - (b) With the Face menu, the following four menus are available:
 - (i) Face rough
This is a canned facing cycle using G72.
 - (ii) Face fin
This is the finishing cycle of the shape input for roughing by G70.



- (iii) Free rough
The NC program is generated with only G00 and G01. For the input finishing shape, one roughing cycle is executed on the input finishing shape with a specified finishing allowance. The free rough turning is mainly suited to face roughing with small turning allowance or for cast blanks. It is not suitable for blanks with heavy turning allowance. For these blanks, use face rough which generates canned cycle NC programs.
- (iv) Free fin
The finishing of the shape input by the free rough with only G00 and G01. It is not a canned cycle.

(2) Detailed turning menu is set with the following operation.

- (a) Select the desired menu with the CURSOR   keys, or the  key.
The same effect is obtained when the desired menu No. is directly keyed with the data keys  to .

- (b) To return to the previous display, (the variable turning menu), depress the [EXIT] key. Depress the [MANUAL] key when editing in the upper part of the display is desired. Depressing it reverse displays the key, and depressing it again returns it to normal. To cancel the interactive mode, depress the [END] key.

When the insert setting has been selected for the

modify
insert

 key in the variable turning menu, the F3 software key indicates

PROCES
SEARCH

.

Depressing the

PROCES
SEARCH

 key detects the leading ends of the processes one after another. After detecting the last program, depressing the key again detects the first program. This function is used when inserting a new process between two existing processes.

When the modify setting has been selected for the

modify
insert

 key in the variable turning menu, the F3 software key shows

modify
insert

, indicating the current mode. However, mode modification is disabled in the detailed turning menu, and accordingly, the F3 key is disabled.

- (c) After selecting the turning menu depress the [ENTER] key. Now, the detailed turning menu has been set.

(3) Precaution

When finishing is set with out a roughing setting, warning message "Rough cutting data does not exit" is displayed. Set a roughing process.

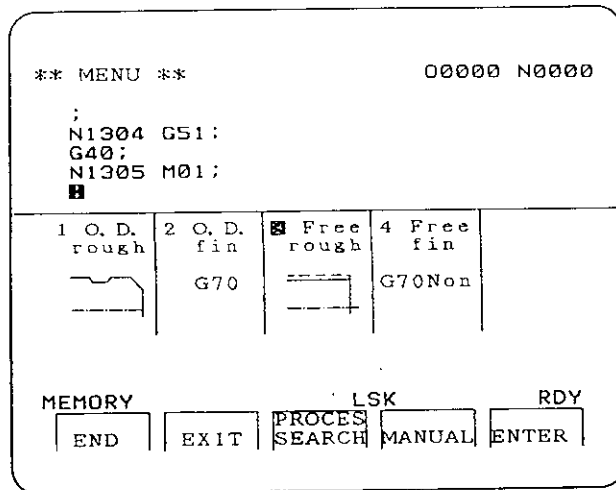
3.6.2 When O.D. Turning is Set

- (1) The following display is called up.

In this menu, the following four processes are available.

- (i) O.D. rough,
- (ii) O.D. fin,
- (iii) Free rough and
- (iv) Free fin.

For detailed descriptions refer to Par. 3.6.1, "When Facing has been Set."



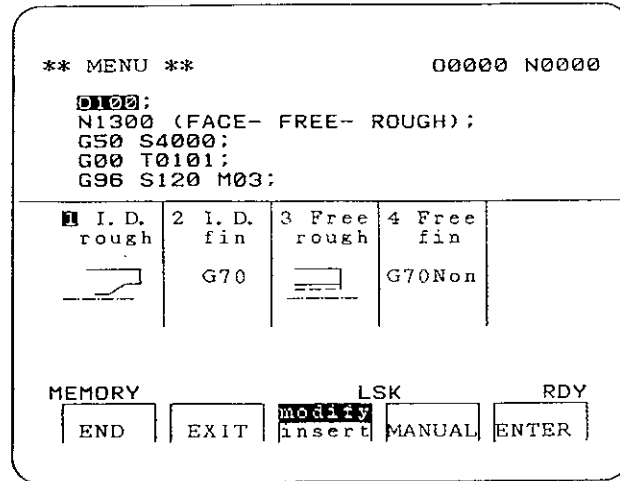
- (2) The setting of the menus is the same as in Par. 3.6.1, "When Facing has been Set". The functions of the software function keys are also the same as for facing.

(3) Precautions

Refer to Par. 3.6.1, "When Facing has been Set".

3. 6. 3 When I.D. Turning is Set

(1) The following display is called up.



In this menu, the following four processes are available:

- (i) I.D. rough, (ii) I.D. fin, (iii) Free rough, and (iv) Free fin.

For detailed descriptions refer to Par. 3.6.1 (1), (b), "Facing".

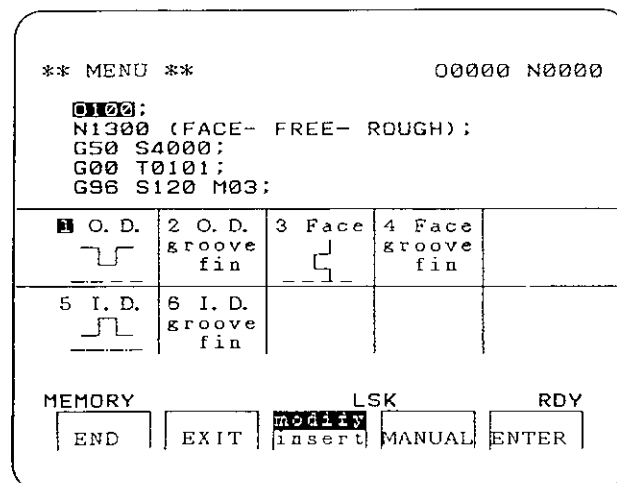
- (2) The setting of the menu is the same as in Par. 3.6.1, "When Facing has been Set". The functions of the software function keys are also the same as for facing.

- (3) Precautions

Refer to Par. 3.6.1, "When Facing has been Set".

3. 6. 4 When Grooving is Set

(1) The following display is called up.



In this menu, the following six processes are available:

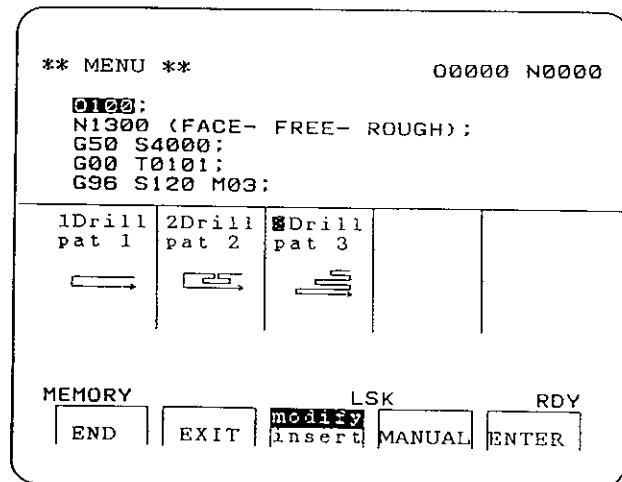
- (i) O.D.
O.D. grooving canned cycle using G75
 - (ii) O.D. groove fin
O.D. groove finishing with G00 and G01, of the shape input by O.D. cycle.
 - (iii) Face
Face groove canned cycle using G74
 - (iv) Face groove fin
Finishing cycle with G00, G01, of the shape input by face grooving cycle.
 - (v) I.D.
I.D. groove canned cycle using G75
 - (vi) I.D. groove fin
Finishing cycle with G00, G01, of the shape input by I.D. grooving cycle.
- (2) The setting of the menus is the same as in Par. 3.6.1, "When Facing has been Set". The functions of the software function keys are also the same as for facing.
- (3) Precautions
Refer to Par. 3.6.1, "When Facing has been Set."

3.6.5 When Drilling is Set

- (1) The display at right is called up.

In this menu, the following three processes are available.

- (i) Drill pat 1
Drilling with G01, and drilling through to the end.
No canned cycle is used.
- (ii) Drill pat 2
Using the G74 canned cycle, the drill is retracted through the preset distance during drilling.



- (iii) Drill pat 3
Using the G74 canned cycle, the retraction distance setting is neglected and each time, the drill is withdrawn to the approach point.
- (2) The setting of the menus is the same as in Par. 3.6.1, "When Facing has been Set". The functions of the software function keys are also the same as for facing.





3.6.6 When Threading is Set

(1) The following display is called up.

```

** MENU **                                00000 N0000
O100;
N1300 (FACE- FREE- ROUGH);
G50 S4000;
G00 T0101;
G96 S120 M03;

```

1 O. D. thread 	2 I. D. thread 	3 O. D. taper 	4 I. D. taper 
--	--	---	---

```

MEMORY          LSK          RDY
| END |         | modify |  | MANUAL | | ENTER |

```

In this menu, the following four processes are available.

(i) O.D. thread

Using G76, the program cuts external straight threads.

(ii) I.D. thread

Using G76, the program cuts internal straight threads.

(iii) O.D. taper

Using G76, the program cuts external taper threads.

(iv) I.D. taper

Using G76, the program cuts internal taper threads.

(2) The setting of the menus is the same as in Par. 3.6.1, "When Facing has been Set". The functions of the software function keys are also the same as for facing.

(3) Precautions

In cutting threads, the following turning processes cannot be programmed in the interactive mode:

(a) Variable pitch threads

(b) Multiple start threads

3.7 SETTING OF APPROACH

3.7.1 Setting Approach for Facing, O.D. and I.D. Turning

- (1) When the detailed menu setting is completed, the following display is called up.

```

**APPROACH** FACE FREE ROU 00000 N0000
0100#

Approach X= 4.2000 Gear=0:Off/1:High
              Z= .800 2:Low
Tool no = Turn=0:Normal
Surf speed= 1:Reverse
Spin speed= Oil =0:On/1:Off
Spin max = Work=0:F/1:L/2:Off

MEMORY          LSK          RDY
[ ] [EXIT] [modify] [MANUAL] [ENTER]
             [insert]

```

- (a) With this display, the tool approaches from the EXT origin or the machine origin, etc. to the turning start point. In addition, auxiliary function and manual input items are mixed.
- (b) In this display, both automatically determined items and manual input items are mixed.
- (c) For the facing, external and internal machining, the approach data is common.
 For example, approach data are set for a facing, these data set in the last procedure are also indicated when the external or internal turning display screen is called up.
 With these processes, once approach data are set, the same data are indicated in all other displays, and only different points need to be set.
- (d) The selected turning menu is displayed at the top center part of the screen.

(2) Set various items by the following keying:

- (a) The approach points X and Z are automatically determined on the basis of the blank shape and the clearance of the interactive parameter. They can also be manually modified.
 However, for face finishing, external finishing and internal finishing, the approach point is automatically set by the final block coordinate values for the respective roughing and finishing shapes.

(b) Inputting tool No.

For example, to use tool No. "01" and offset No. "02", depress 0

1 0 2 WR in this sequence.

The "Surf speed" display is now blinking.

(c) Inputting surface speed or spindle speed

Either surface speed or spindle speed can be input.

Inputting a surface speed value generates a surface speed constant control ON type NC program.

Inputting a spindle speed value generates a surface speed constant control OFF type NC program.

For example, to input "200 rpm",

depress in this sequence.

When a value is input for surface speed, no value can be input as spindle speeds. When a surface speed has been set, and a spindle speed is still desired to be input, depress the key after bringing the cursor to "Surface speed" to "dump" the surface speed data, and key the spindle speed value.

Conversely, where a spindle speed value has been set, and a surface speed is desired to be set, "dump" the spindle speed data by depressing the key with the cursor on the "Spin speed", and then, input a surface speed.

"Spin max" starts to blink.

(d) Inputting spindle maximum speed

Depress the maximum spindle speed DATA keys and the key.

For example, to input "3000 rpm",

depress in this sequence.

Then, a G50S**** spindle speed clamp NC program is output.

Although the maximum spindle speed need not be input, if it is not input, no G50S**** NC program is output.

Now, the "Gear" display in the screen starts to blink.

(e) Inputting gear

The initial setting for "Gear" is "0".

Depress the following DATA keys as required.

For "off": depress .

For "high speed": depress .

For "low speed": depress .

If no change from the initial setting is needed, move the cursor with the CURSOR key or the key.

Now, the "Turn" display on the screen starts to blink.

(f) Inputting turning direction

The initial setting for turning direction is "0".

Depress to select forward run, and depress to select reverse run.

Now, the "Oil" display on the screen starts to blink.

(g) Inputting cutting oil use selection

The initial setting for "Oil" is "0".

To use cutting oil, depress 0 , and to use no cutting oil, push 1 .

Now, the "Work" display on the display starts to blink.

(h) Inputting workpiece position

The workpiece position means that side of the advancing tool on which the workpiece is present. This setting is used as data in tool edge radius compensation.

The initial setting for workpiece position is automatically set by turning menus as follows:

- Facing: right
- External turning: left
- Internal turning: right

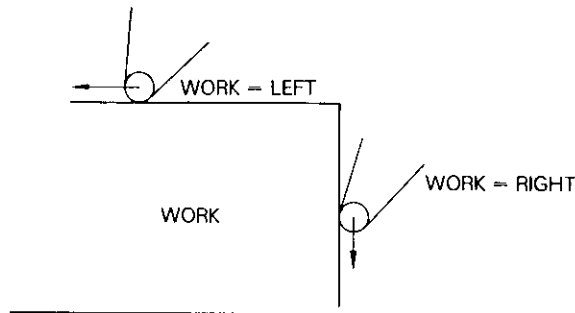
To change these setting,

Depress 0 for "right",

Depress 1 for "left"

and Depress 2 for

"none".



When "none" is selected, an NC program with tool edge radius compensation OFF is generated.

(i) To change the data for various items, move the cursor to the respective position with the CURSOR ^ v keys or the WR key.

Depressing the ORG key makes the items from Approach X to spindle maximum speed on the left half of the screen disappear.

(j) Depress the ENTER key.

Now, the approach data have been set, and a program is generated in the upper part of the display.

(3) Precautions

All the setting items, except for the spindle maximum speed and either of "Surf speed" or "Spin speed", must be input. If some items are not set, "Item data is missing" is displayed.

In this case, input the missing items, and depress the ENTER key again.

3.7.2 Setting Approach for Grooving

- (1) For grooving, after setting the detailed turning menus, the following display is called up. Initially, the cursor is found at "Approach X". In this case, since the approach point is not automatically set, a proper approach point must be input according to the drawing. This input approach X becomes the starting point for grooving.

```

**APPROACH** OD GROV ROUGH  00000 N0000
0100█

Approach X=          Gear=0:Off/1:High
Tool no  =          2:Low
Surf speed=          Turn=0:Normal
Spin speed=          1:Reverse
Spin max  =          Oil  =0:On/1:Off

MEMORY  LSK  RDY
[ ] [EXIT] [modify] [MANUAL] [ENTER]
           [insert]

```

- (2) For the setting methods for various items, refer to Par. 3.7.1, "Setting Approach for Facing, O.D. and I.D. Turning."
 (3) Precautions
 Refer to Par. 3.7.1 (3), "Precautions".

3.7.3 Setting Approach for Drilling

- (1) With the drilling screen, when the detailed turning menu has been set, the display shown below is called up automatically.
 In the case of drilling, since the approach point not automatically set, the grooving approach point must input in accordance with the drawing. This approach Z point becomes the starting point for drilling.
- (2) For the setting methods for the respective items, refer to Par. 3.7.1, "Setting Approach for Facing, O.D. and I.D. Turning". However, "Spin speed" is calculated by "Drill diam" and "Surf speed", and displayed.
- (3) Precautions

When the drill diameter and the surface speed are input, the spindle speed is automatically determined, and displayed.

When, the drill diameter and the spindle speed are input, the surface speed is automatically calculated, and displayed.

If some setting items are not set, "Item data is missing" is displayed.

```

**APPROACH** DRILL PAT 3  00000 N0000
0100█

Approach Z=          Gear=0:Off/1:High
Tool no  =          2:Low
Drill diam=          Turn=0:Normal
Surf speed=          1:Reverse
Spin speed=          Oil  =0:On/1:Off

MEMORY  LSK  RDY
[ ] [EXIT] [modify] [MANUAL] [ENTER]
           [insert]

```

3.7.4 Setting Approach for Threading

- (1) With the threading display, when the detailed turning menu has been set, the display shown below is called up automatically.

```

**APPROACH** OD THREAD      00000 N0000
0100█

Approach X=                Gear=0:Off/1:High
      Z=                    2:Low
Tool no  =                 Turn=0:Normal
Spin speed=                1:Reverse
                        Oil =0:On/1:Off
                        Chamfer=0:On/1:Off

MEMORY  LSK  RDY
[ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]
        EXIT modify insert MANUAL ENTER
    
```

In the case of threading, since the approach point is not automatically set, the grooving approach point must be input in accordance with the drawing. This approach point becomes the starting point for threading.

- (2) For the setting methods for the respective items, refer to Par. 3.7.1, "Setting Approach for Facing, O.D. and I.D. Turning".

- (3) Precautions

Refer to Par. 3.7.1 (3), "Precautions".

3.8 SETTING OF BASIC DATA

When the approach point has been set, a display for all the basic data values corresponding to the detailed turning menu is called up. Except for "threading" and "drilling" and for finishing commanded by the respective detailed turning menus, this display is available.

In this display, the finishing allowance, depth of cut, feedrate, etc. required for setting before the finish shape display are set. All the data values are automatically set on the basis of the interactive parameters, but can be modified when required.

3.8.1 When Face, O.D. and I.D. Roughing has been Set







- (1) The display shown at the right is called up.
The tool No. of the current tool is displayed at the upper right area of the display.

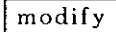
```

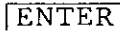
**B. DATA** FACE ROUGH  T01 00000 N0000
G50 S2000;
G00 T0101;
G96 S120 M03;
N1101 X100.2 Z.08 M08;
█

Fin allowance U = . 80
              W = . 40
Depth of cut  D = . 800
Feedrate      F = . 100

MEMORY  LSK  RDY
[ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]
        EXIT modify insert MANUAL ENTER
    
```

- (2) In this display, all the items have been automatically set.
- (a) To modify the values, move the cursor to the respective position with the CURSOR   keys or the  key.
- (b) To return to the previous display, that is, the approach setting display, depress the  key. Changing the approach data and depressing the  key sets a new approach point. Depress the  key for moving the cursor in the upper part of the display for editing.

The  key is displaying the current mode. Since mode changing is disabled on the basic data display, the F3 key is ineffective.

- (c) Depress the  key.
Now, the basic data values have been set.

3.8.2 When Face, O.D. and I.D. Free Roughing has been Set

The setting is the same as in Par. 3.8.1, except that no "Depth of cut" is displayed.

3.8.3 When Grooving Has Been Set







- (1) The display shown below is called up.

```

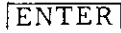
**B. DATA** OD GROV ROUGHT04 00000 N0000

N4100 (OD- GROOVE- ROUGH);
G50 S200;
G00 G40 T0404;
N4101 G96 S20 M03;
#

Fin allowance U = . 80
                W = . 40
Depth of cut  D = . 800
Retreat       = . 40
No. of steps  = . 1
Feedrate      F = . 32

MEMORY          LSK          RDY
     

```

The retreat distance displayed in this display is the one in the NC setting. If the retreat distance is modified in this display, the one in the NC setting is automatically modified. However, if the NC is running on memory when the  key is depressed on the basic data display, the setting is modified after the completion of the run.

- (2) For the basic data setting, refer to Par. 3.8.1.

3.9 SETTING FINISH SHAPE

When the setting of the basic data has been made, the finish shape display is called up according to the variable turning menu.

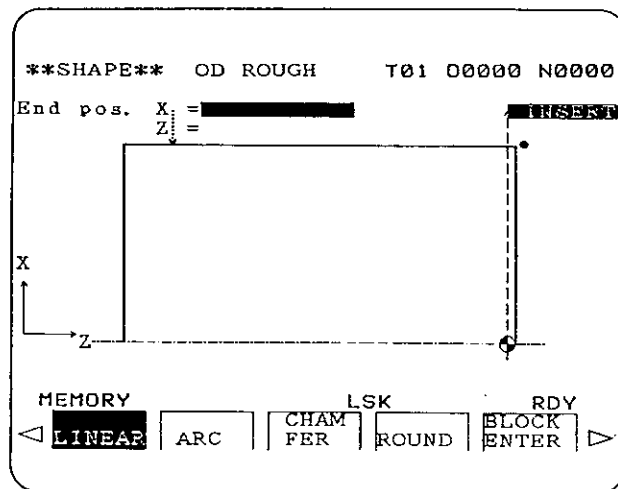
With facing, O.D. turning and I.D. turning, the workpiece shape is to be input with straight lines, circular arcs, chamfers and rounding.

As the input data is graphically displayed on the display, visual checking is possible. With grooving, drilling and threading, the finish shape is set while data values are input in response inquiries message.

3.9.1 When Face, O.D. and I.D. have been Set

(1) The display shown below is called up.

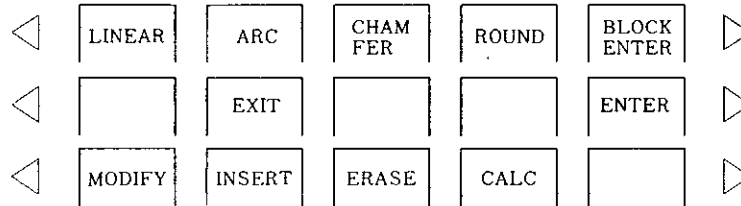
Initially, the software function **LINEAR** key is reverse displayed.



- The displayed point "." is the approach point. Program is to be written along the tool path starting from this point.
- The mark "●" indicates the program origin, which is (0, 0) in the absolute coordinate system. This position shifts with the face removal allowance data.
- The "|" line outside the workpiece confour indicates the chuck line. The chuck jaw comes to this line, and tool path must not be programmed beyond this line. This line shifts with the chucking allowance data.
- The current input mode is displayed in the upper right part of the display. The mode is either insert or modify. **INSERT** is reverse displayed and **MODIFY** is reverse displayed and blinks.
- As the finish shape data elements are input, each of them is represented by " — " straight line, " ⌒ " circular arc, " ○ " radius, or " □ " chamfer. Note however that " ○ " and " □ " are drawn in the same size regardless of the actual value.

The shape elements indicated by the graphic cursor change solid lines into dotted lines. The graphic cursor moves when the PAGE **▲** **▼** keys are depressed.

(f) On this display the following software function keys are displayed:



These are displayed, in turn, as the ◀ or ▶ key is depressed.

(2) Set "the first block of finish shape" through the following keying. Make sure the insert mode is ON.

(a) The first block must consist only of rapid linear feed. If other elements are selected, a warning "First block can set line data only" is displayed.

Therefore, input only the "End pos" coordinate.

Key in the X coordinate followed by **WR**.

For example, to input "2.4 inch".

Depress **2** **.** **4** **WR**, in this sequence.

With the **U** key, the end point coordinate can be input as the increment from the current position.

For example, to designate a point "1 inch" less than the current coordinate as the end point X coordinate, depress keys as follows:

U **-** **1** **WR**

Depressing only **U** and **WR** input the current X coordinate.

When the X coordinate has been input, the cursor moves over to "Z".

(b) Similar to the keying for X, depress the Z coordinate value keys followed by the **WR** key.

The **W** key represents the current Z coordinate, and with it, the end point coordinate can be input as an increment from the current coordinate similar to the case of X.

(c) To correct the existing value, bring the cursor to the items to be corrected with the CURSOR **▲** **▼** keys or the **WR** key.

Depressing the **ORG** key "dumps" the item indicated by the cursor.

(d) Depress the **BLOCK
ENTER** key.

Now, the rapid feed in the first block has been set.
The shape after the block setting is shown by dotted lines.

(e) To modify the finish shape, refer to Par. 3.9.1 (5), (6) and (7).

Note: The sign for the input coordinate system is the same as that for the lathe program coordinate system.



(3) Set "second and further finish shape blocks" by the following keying:
 For the second and subsequent blocks, [LINEAR] is originally selected, but other elements can be selected with the software function keys displayed in the bottom area of the display. When one of them is depressed, the corresponding software key is reverse displayed, and the [LINEAR] key is returned to normal.

(a) Using [LINEAR]

(i) The following are displayed in the upper left area of the display:

```
"End pos. X = 
"           Z = 
"Angle      = 
"Feed rate F = 
```

The angle can be specified between -360° and $+360^\circ$, as measured from the plus direction of the Z-axis.

- Note: 1 When both the X and Z coordinates of the end point are input, no angle need be input.
 2 When no angle is input, and only one of the end point coordinates is input, the unspecified coordinate is regarded as the same as the current coordinate.
 3 When angle is input, either the X or the Z coordinate of the end point must be input. If only the angle is input, a warning "Item data is missing" is displayed.
 4 The feedrate for the second block is automatically displayed. This is because of the F designation for finishing that will become effective for finishing.
 Even for the data inputting for the roughing menu, the feedrate displayed here is that for finishing. This feature must be given attention. For the roughing, the feedrate set as the basic data is effective.

The third and subsequent blocks are to be specified when the feedrate is to be changed sometime during the finishing process.

The input patterns are listed below. No other pattern is usable.

End Point X	End Point Z	Angle	Remarks
○			Parallel to X-axis from current point to end point X
	○		Parallel to Z-axis from current point to end point Z
○	○		
○		○	
	○	○	
○	○	○	Angle is disregarded.

○: Applicable

(ii) Depress the

BLOCK
ENTER

 key.

Now, the straight line block finish shape has been set.

(iii) To modify the finish shape:
Refer to Par. 3.9.1 (5), (6) and (7).

(iv) To use the CALCULATION function

Depress the

CALC

 key.

For the usage of the calculation function, refer to sect,4 "Calculation Function Usage".

The calculation results are displayed at the final coordinate X and Z

positions when

X

WR

 ,

Z

WR

 or

X

X

WR

 ,

Z

Z

WR

are depressed, after returning to the finish shape setting display.

(b) Using

ARC

(i) The followings are displayed in the upper left part of the display:

```
"Dir (0 = CW/1 = CCW)" = "
"End pos. X = "
"      Z = "
"Radius R = "
"Center Pos. X = "
"      Z = "
"Feedrate F = "
```

First, the turning direction of arc is to be input.

Depress

0

 for clockwise and

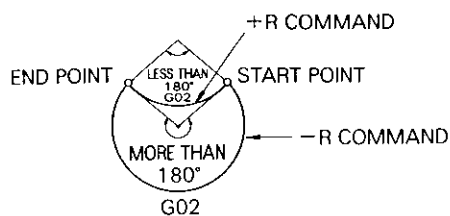
Depress

1

 for counterclockwise.

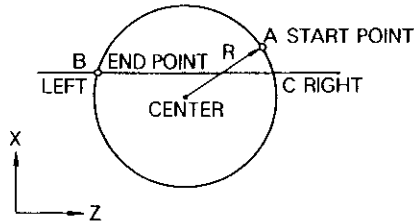
For other items, input data values in the same way as for (i) through (iii) of the first block (a).

Note: 1 When a minus value is input for "Radius R", an arc with a central angle larger than 180° is meant.



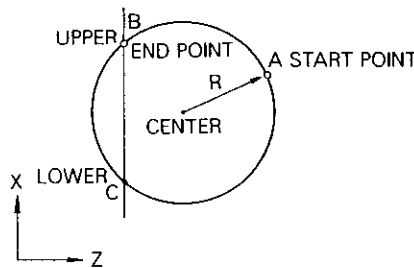
Note: 2 When the X and Z coordinates of the end point are input, either the coordinates of the center or the radius must be input.

Note: 3 When the X coordinate of the end point and the coordinates of the center are input, a message "End point (0:left/1:right) of center" is displayed.



Since a circle intersects a straight line BC at two points, the intended point must be keyed in.

Note: 4 When the Z coordinate of the end point and the coordinates of the center are input:



A message "End point (0:upper/1:lower) of center" is displayed. Since a circle intersects a straight line BC at two points, the intended point must be keyed in.

Note: 5 When both the X and Z coordinates of the end point are not input, the following message is displayed:
"Get end point by calculate function"

Note: 6 For the feedrate, refer to Note 4 for (a) Using straight line.

The input patterns are listed below:

End Point X	End Point Z	Center X	Center Z	Radius	Remarks
○	○			○	Center compensation
○	○	○	○		Center compensation
○		○	○	○	Radius compensation
	○	○	○	○	Radius compensation
○		○	○		
	○	○	○		
○	○	○	○	○	Center compensation

○: Applicable

(ii) Depress the

BLOCK
ENTER

 key.

Now, the finish shape of a circular arc block has been set.

(iii) To modify the finish shape, refer to Par. 3.9.1 (5), (6) and (7).

(c) Using

CHAM
FER

(i) The following displays appear in the upper left part of the display:

"Chamfer amount C =

0.0000

 "

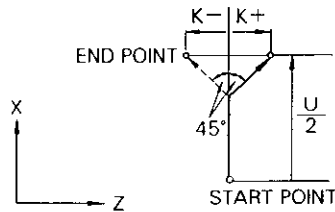
"Feedrate F =

0.0000

 "

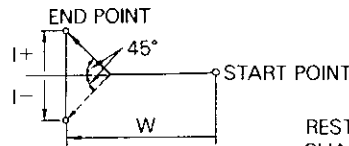
Key in chamfer size C. Input the feedrate when a different feedrate is desired for the chamfer amount:

Note: 1 The chamfer amount is under the following restriction:



RESTRICTION:
CHAMFER AMOUNT $|K| < \left| \frac{U}{2} \right|$

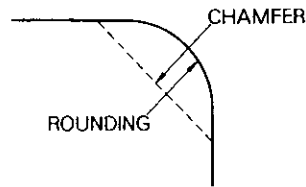
X-AXIS CHAMFER



RESTRICTION
CHAMFER AMOUNT $|I| < |W|$

Z-AXIS CHAMFER

2. After rounding a corner, the same corner cannot be chamfered.



3. For the feedrate, refer to Note 4 for (a) "Using straight line."

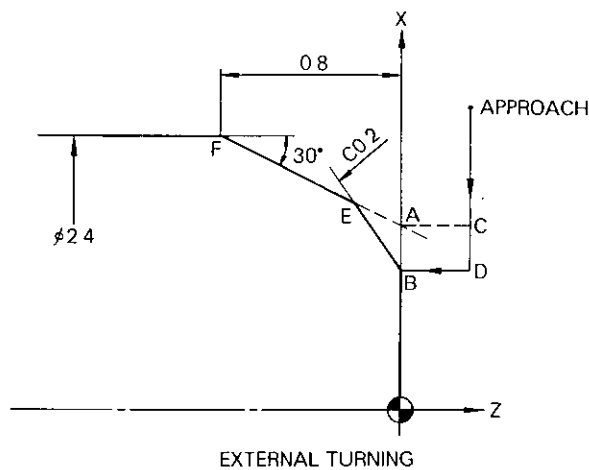
(ii) Depress the

BLOCK
ENTER

 key.

Now, the finish shape for the chamfer block has been set.

(iii) The chamfering function has the following convenient usage.



When machining the shape as shown above using the O.D. rough menu, the finish shape input must contain the coordinates of point B and point E. Using the chamfering function, the same shape can be more simply input as follows:

- Obtain the coordinates of point A with the "intersection of two lines" menu of the calculation function.
- Input "LINEAR" from the approach point to point C the X coordinate of which is the same as point A.
- Input "LINEAR" from point C to point A.
- With the "CHAMFER" menu selected, key in

X

.

2

WR

.
- Input "LINEAR" to point F.

As seen above, when

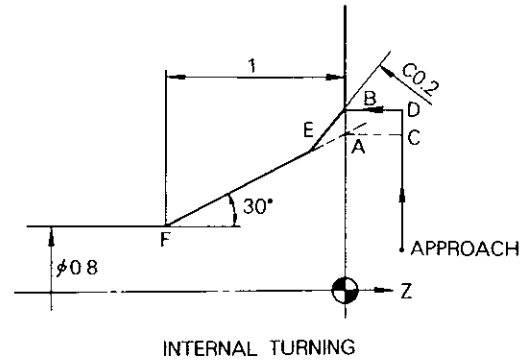
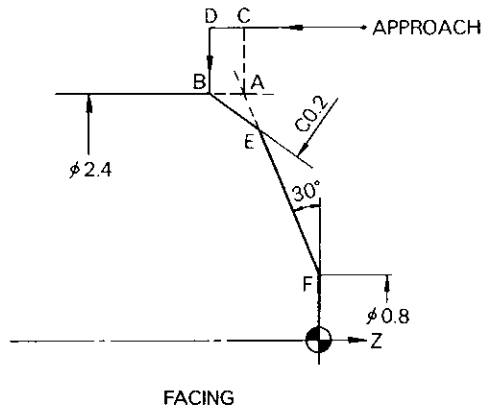
X

 [chamfer length]

WR

 are keyed for chamfering in external turning, the chamfer is made between the X-axis and the next block, instead of between the preceding block and the next block. Then, the coordinate values input in the preceding two blocks are automatically compensated. In this case, point C is compensated to point D, and point A to point B.

With facing and internal turning operations, the following examples correspond to the above case.



In a facing operation, since the chamfering takes place between the Z-axis and the next block, key `Z` `.` `2` `WR`.

In an internal turning operation, since the chamfering takes place between the X-axis and the next block, key `X` `.` `2` `WR`.

- Note: 1 All keyings are invalid except for these specified. For external turning, only `X`, for facing `Z`, and for internal turning, `X` are the valid keys.
- 2 This function is effective for roughing and free roughing of the outside, face and the inside.
- 3 This chamfering command should not be used except at the first position of the shape (third block from approach).

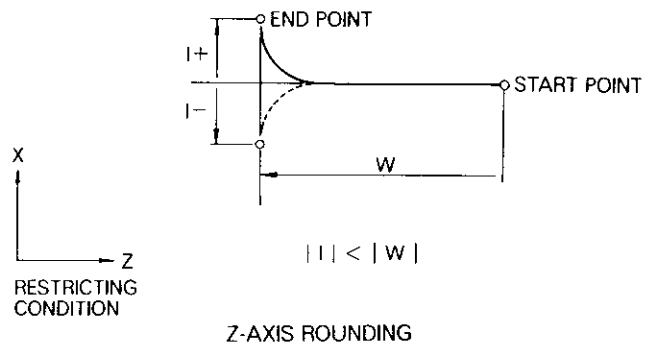
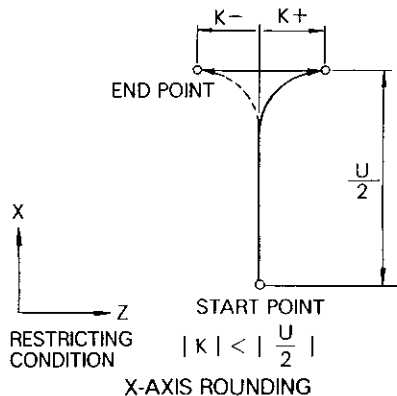
(iv) To modify finish shape
Refer to Par. 3.9.1 (5), (6) and (7).

(d) Using `ROUND`

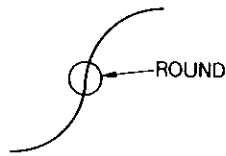
- (i) The following items are displayed in the upper left area of the display:
"Rounding amount R = `0.00000000`"
"Feedrate F = `0.0000`"

Key in the rounding amount R. Input a feedrate when a different feedrate is desired for the rounding.

Note: 1 The rounding amount has the following restriction:



2 Rounding is not possible for a shape as shown below:



3 For the feedrate, refer to Note 4 for (a) "Using straight line"

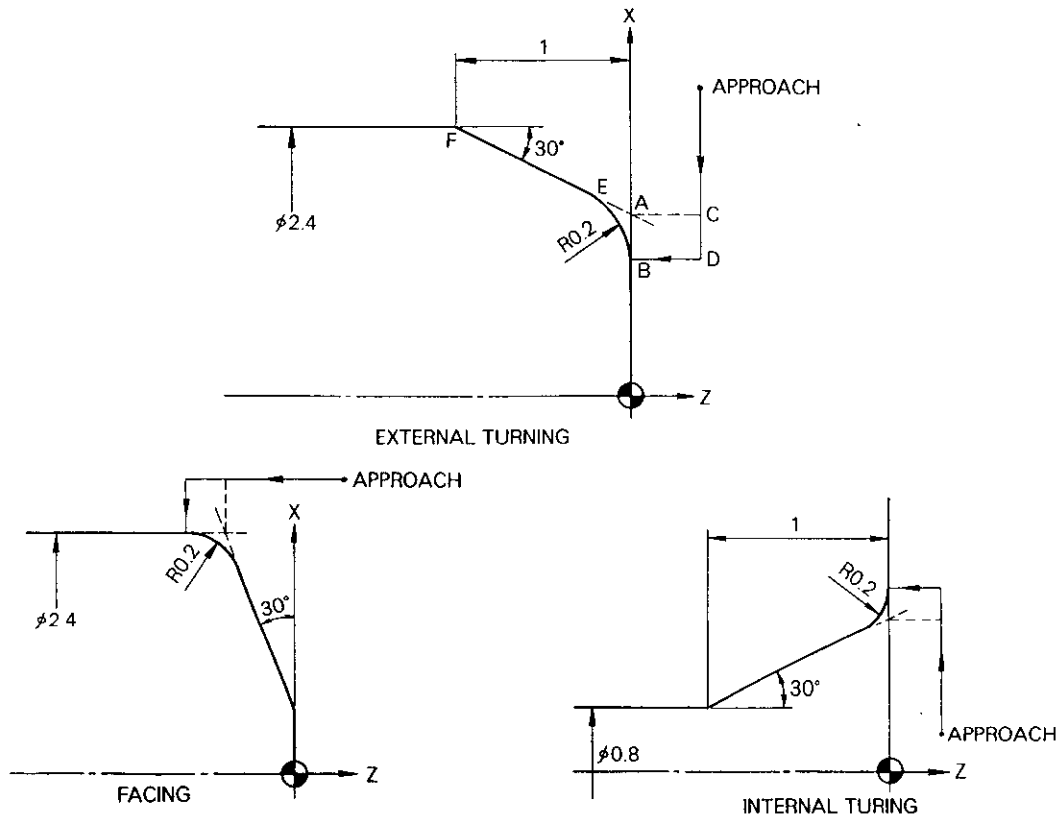
(ii) Depress the

BLOCK
ENTER

 key.

Now, the rounding block finish shape has been set.

(iii) The rounding function has the following convenient application. Similar to the chamfering function, the rounding function automatically compensates the intersection when the first portion of the shape is rounded.



For external turning, the shape can be simply input by the following keying:

1. Obtain the coordinate of point A by the calculation menu "Line/Line".
2. Input "LINEAR" from approach point to point A.
3. Input "LINEAR" from point C to point A.
4. Select "ROUND" menu, and key

X	.	2	WR
---	---	---	----



.
5. Input "LINEAR" to point F.

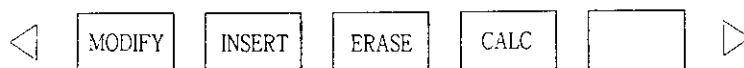
With this keying, point C is compensated to point D, and point A to point B.

Note: Refer to Note for Par. 3.9.1 (3) (c) (iii) "Chamfer".

- (iv) To modify the finish shape, refer to Par. 3.9.1 (5), (6) and (7).
- (4) Set the last block of the finish shape by the following keying:
It must be the linear instruction in the final block.
- (a) LINEAR has been selected and is reverse displayed.
- (b) Input values for the respective items in the same way as when LINEAR has been depressed in (3) After block 2.
- (c) Depress BLOCK
ENTER.
Now, the final block has been set.
- (d) With the menu for OD rough, and ID rough, the X coordinate value of the finish shape last block becomes the approach X coordinate value for OD finish and ID finish.



With the menu for Face rough, the Z coordinate value of the finish shape last block becomes the face finish approach Z coordinate value.

- (5) To modify (insert mode) the finish shape, proceed as follows:
- (a) Depress the  or  key to display the following software function keys:



- (b) When MODIFY is displayed in the upper right area of the display, depress the INSERT key.
The "MODIFY" display changes to "INSERT".

Note: When "INSERT" is displayed, the INSERT key need not be depressed.

- (c) Move the graphic cursor with the PAGE   keys to the block before the position for insertion.
The selected portion changes from a solid line to a dotted line.
- (d) The following software function keys are displayed:

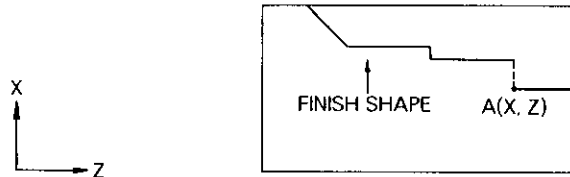


- (e) For the inputting and setting methods of the to-be-inserted shape, refer to Par. 3.9.1 (3), "After second block". Note that with this finish shape modification, when the values for all the items are keyed with [LINEAR] or [ARC], and the [BLOCK ENTER] key is depressed, the following message is displayed, unless the set block is the last block:

"Affect next block? (Yes:1/No:0)

The necessary response to this message is shown below:

- (i) Assumed finish shape



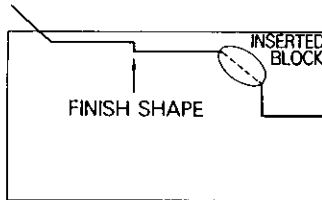
To insert a linear block after the block shown by dotted line.

- (ii) Depress the [LINEAR] key.
 (iii) To bring the start point at A (X, Z) and the end point at (X+1, Z-1), key [U] [1] [WR] and [W] [-] [1] [WR].
 (iv) Depress [BLOCK ENTER] key.
 (v) Message "Affect next block? (Yes:1/No:0) is displayed.

- ① When Change Occurs in Subsequent blocks:

Depress [1].

The finish shape after the block insertion is as shown below.

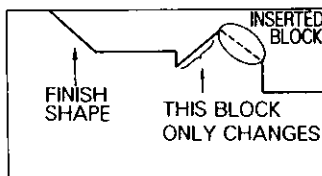


As the block shown by a dotted line is inserted, all the subsequent blocks change.

- ② When No Change Occurs In Subsequent blocks:



Depress [Ø].

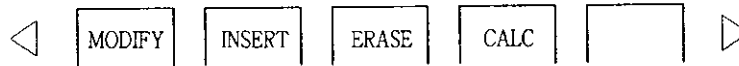
The finish shape after the block insertion is as shown below.




As the block shown by the dotted line is inserted, only the next one block changes.

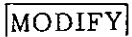
(6) To modify (insert mode) the finish shape, proceed as follows:



(a) Depress the  or  key to display the following software function keys:



(b) When "INSERT" is displayed in the upper right area of the display, depress the  key.

The "MODIFY" display changes to "MODIFY".

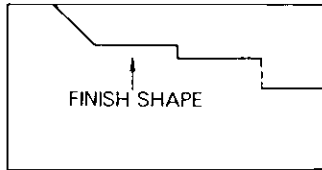
(Note: When "MODIFY" is displayed, the  key need not be depressed.)

(c) Move the graphic cursor with the PAGE   keys to the block before the position for insertion.


The selected portion changes from solid line to a dotted line.

(d) Set the changed block in the same way as for (5) changing (insertion mode) the finish shape.

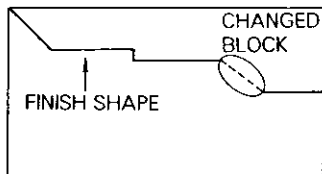
The same finish shape example is assumed.



① When Change Occurs in Subsequent Blocks:


Depress .

The finish shape after the block change is as shown below.

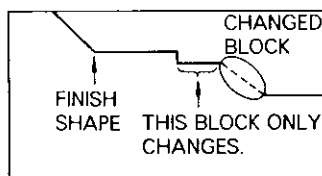


As the block is changed into a dotted line block, all the subsequent blocks change.

② When No Change Occurs in Subsequent Blocks:



Depress  key.

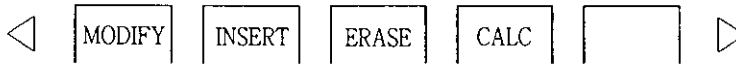
The finish shape after the block change is as shown below.





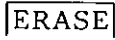
As the block shown by the dotted line is changed, only the next one block changes.

(7) To modify (erase mode) the finish shape, proceed as follows:

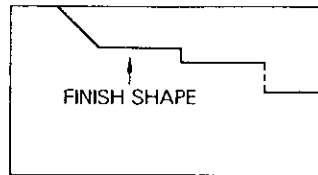
(a) Depress the  or  key to display the following software function keys:




(b) Move the graphic cursor with the PAGE   keys to the block to be erased. The selected portion changes from a solid line to a dotted line.

(c) Depress the  key.

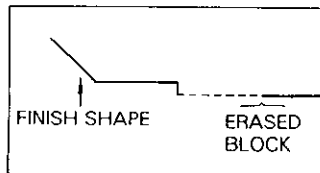
(d) Unless the erased block is the last block, "Affect next block? (Yes:1/No:0)" is displayed. The same finish shape example as for "(5) Finish shape modify (insertion mode) is assumed.



① When Change Occurs in Subsequent Blocks:


Depress .

The finish shape after the block erase is as shown below.

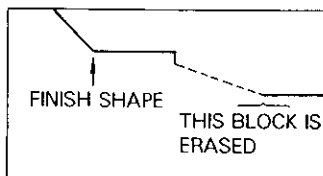


As the block in the dotted line is erased, all the subsequent blocks change.

② When No Change Occurs in Subsequent blocks:

Depress .

The finish shape after the block erase is as shown below.



As th block shown by the dotted line is erased, only the next one block change.

(8) Other software function keys on the finish shape display

When the **[EXIT]** key is depressed, the display returns to the previous display, that is, the basic data setting display.

The **[CALC]** key is for using the calculation function.

(9) Concavity and simplicity of the finish shape are automatically checked.

The output NC program differs according to this check result. For a simple shape, the rough turning leaves finishing allowance in both the X and Z directions. For a concave shape, the rough turning leaves finishing allowance only in the X or Z direction.

(10) Depress the **[ENTER]** key.

Now, intersection calculation is executed from the first input block, and "Now calculating..." is displayed at the lower center of the display during the operation.

If an intersecting point calculation error occurs, the graphic cursor stops at the block in which the error occurred, to indicate the location of the error.

When this happens, the input mode automatically changes to the modify mode, even when it has been in the insert mode. Change the finish shape data for the block element in which the error has occurred.

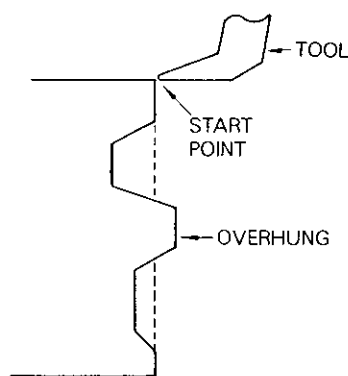
Then, depress the **[BLOCK]** key and depress the **[ENTER]** key again to execute the intersecting point calculation.

When no error is present, the finish shape is set.

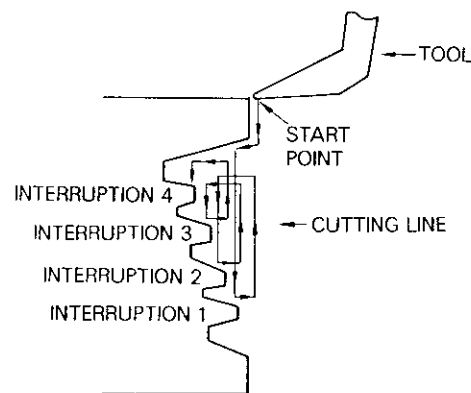
(11) Precautions

The following shapes cannot be machined in facing, O.D. turning or I.D. turning.

(a) Shape containing overhang as shown below.



(b) Concave shape containing 4 or more interruptions as shown below.



(c) Shape exceeding 39 blocks.

3.9.2 When Grooving has been Set

3.9.2.1 O.D. grooving

(1) The display shown below is called up.

```

**SHAPE** OD GROV ROUGH T06 00000 N0000

O100;
N4100 (OD- GROOVE- ROUGH);
G00 G40 T0606;
N4101 G96 S700 M03;
█

GroovWidth=          Right X =
Bottom X =           +C-R =
Left Z =             Left X =
EdgeWidth=           +C-R =
                    Edge R =

MEMORY                LSK                RDY
[ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]
[ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]
[ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]
[ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]

```

(2) Set the groove shape as follows:

(a) Input the Groove Width.

For example, to input "0.4 inch",

Depress in this sequence.

The cursor moves to "Bottom X".

(b) Input the X coordinate of the groove bottom.

Then, the cursor moves to "Left Z"

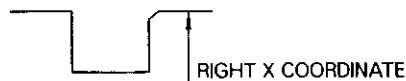
(c) Input the Z coordinate of the groove left flank.

Then, the cursor moves to "Edge Width".

(d) Input the tool edge width.

Then, the cursor moves to "Right X".

(e) Input the X coordinate of the right corner. However, this input is not required if the right corner has no chamfer or rounding.



Then, the cursor moves to "+C-R".

- (f) Input the right corner chamfer amount or rounding amount.
Here, "+" value is for chamfer, and "-" value is for rounding.

To input chamfer "0.1 inch",

Depress , in this sequence.

To input rounding "0.2 inch",

Depress , in this sequence.

Then, the cursor moves to "Left X".

- (g) Input the X coordinate of the left corner.

This input is not required when the left corner is not chamfered nor rounded.

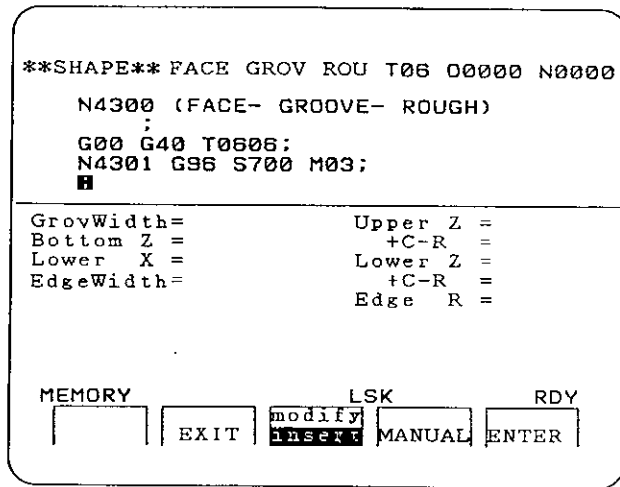


Then, the cursor moves to "+ C - R".

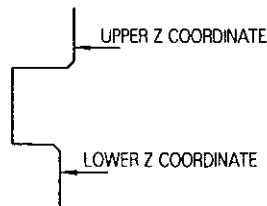
- (h) Input the left corner chamfer amount or rounding amount.
Input in the same way as for (f) right corner.
Then, the cursor moves to "Edge R".
- (i) Input the tool edge R.
Input the edge R of the grooving tool used. With this input, an NC statement taking the tool edge R at groove finishing is generated. Input the tool edge R when either corner is chamfered or rounded.
- (j) To modify some of the input data, move the cursor to the to-be-modified item with the cursor keys or the key.
- (k) Depress the key.
Now, the O.D. groove finish shape has been set.

3.9.2.2 Face Groove Turning

(1) The screen will show the following display (in face groove rough turning):



(2) Input and set as in Par. 3.9.2.1, "Outer diameter groove".



3.9.2.3 Inner Diameter (O.D.) Grooving

(1) The screen will show the same display as that shown when turning an O.D. groove.

(2) Set by the same method.

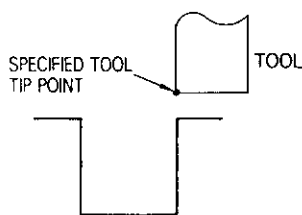
3.9.2.4 Precautions

(1) The tool tip position is specified as follows. Set the control points in the offset display also as follows.

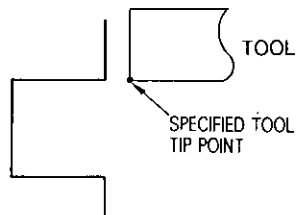
(i) O.D. groove

(ii) Face groove

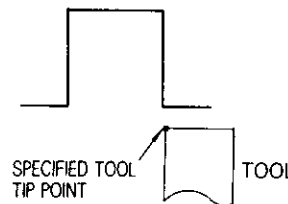
(iii) I.D. groove



Control Point 3



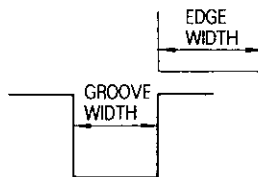
Control Point 3



Control Point 2

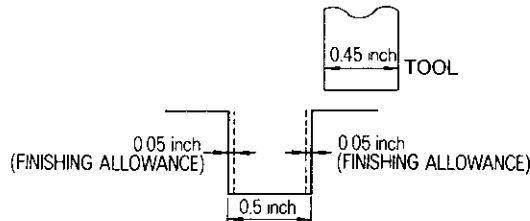
(2) The finish shape cannot be set in the following cases:

(i) If the edge width is wider than the groove width.

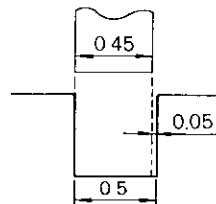


Depress the [ENTER] key and the message "Edge width is too wide" will be displayed.

(ii) If the length obtained by adding finishing allowances on both sides of the groove to the edge width is longer than the groove width.



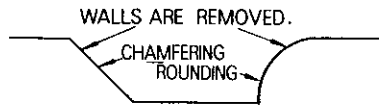
The relationship between the tool and workpiece will be as follows if the tool approaches in the example shown above.



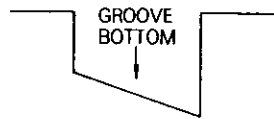
Therefore, in this case, finishing allowances cannot be obtained.

If the [ENTER] key is depressed after inputting the dimensions shown in this example, the message "Change value of finishing cut (w)." will be displayed. Change the finishing allowances from 0.05 to 0.025 or less and depress the [ENTER] key again in the SHAPE display.

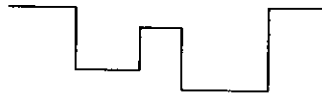
- (iii) Special turning such as turning V-belt grooves is not possible. Escape from the interaction mode and manually input.
- (iv) If walls are removed as a result by specifying chamfering and rounding on the groove entrance and bottom as shown below.



- (v) If the groove bottom is not flat as shown below.

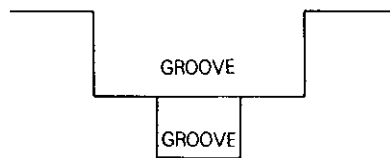


- (vi) Turning more than two grooves in one process as shown below.

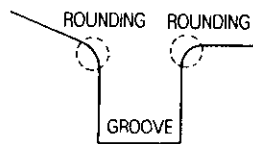


This workpiece can be turned by turning in different processes.

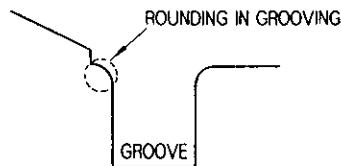
- (vii) Making a groove inside a groove as shown below.



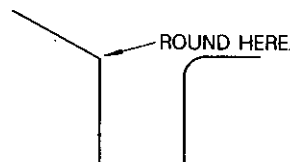
- (viii) Rounding the corners of a tapered block adjoining a groove as shown below.



Rounding in grooving makes the finish shape different, as shown below.



In this case round the workpiece by manual input after setting the finish shape as follows.



- (3) The groove is finished by G00 and G01 cycles rather than by fixed cycles. Dwell time is inserted to finish the groove bottom uniformly. The dwell time can be calculated automatically using the following expressions:

For G97:

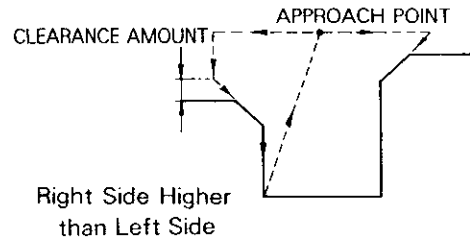
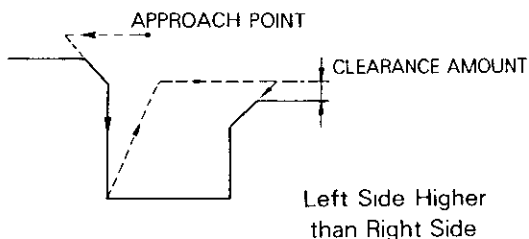
$$P = \frac{60 (\text{sec}) \times 2}{\text{Revolution Speed (rpm)}}$$

For G96:

$$P = \left| \frac{\pi \times \text{Groove Bottom X Coordinate (inch)}}{\text{Peripheral Speed (ft/min)}} \right| \times 0.01$$

- (4) Chamfering motion is automatically compensated in finishing chamfering of a corner of a groove with a step if the difference of X coordinates input at left and right in an O.D. or I.D. groove or of Z coordinates input vertically in an end groove is larger than the groove step clearance amount set by interactive parameters.

In the case of an O.D. groove, for example, chamfering on the lower side by the same turning method as that for the higher side, is wasteful. Chamfering is compensated to match that for the lower side as shown below.



- (5) The tool is changed between groove roughing and groove finishing. Thus, in groove finishing, the basic data display is skipped to show the finish shape display if the approach display is set. The cursor is set to the edge width. If the edge width or edge R amount in groove finishing differs from that in groove roughing, depress the [ENTER] key after inputting new data.

If the tools for groove roughing and finishing are the same, depress the [ENTER] key.

```

**SHAPE** OD GROV FIN T06 00000 N0000
;
N4200 (OD- GROOVE- FIN);
G00 G40 T0606;
N4201 G96 S700 M03;
#
EdgeWidth= .2000
Edge R = .160

```

MEMORY	LSK	RDY
EXIT	modify insert	MANUAL ENTER

- (6) The NC program output in groove finishing does not use edge R compensation by G40. Instead, NC programs of positions X__ and Z__, taking into consideration the edge R amount, are created by automatically calculating it based on the edge R amount set in the finish shape display.
- (7) Groove finishing is also performed in groove roughing only if the groove width and edge width are identical. Groove bottom and wall are finished roughly by setting finishing allowances U and W to 0 if the groove width and edge width are the same. If chamfering and rounding are required, an NC program to turn chamfering and rounding only after a fixed cycle of groove roughing is created.

3.9.3 Drilling Setting

(1) The screen will show the following display. (Drill pattern 2)

```

**SHAPE** DRILL PAT 2 T01 00000 N0000
G00 T0101;
G97 S350 M03;
X0;
N5201 Z.2;
█
End pos. Z =
Depth of cut = .8000
Retreat = . 40
Feedrate = . 80
MEMORY LSK RDY
[ ] [EXIT] [modify] [MANUAL] [ENTER]
[insert]
```

(2) Set the finish shape by operating as follows.

(a) Drill pattern 1

(i) Input End pos. Z.

For example, to input "-1.8 inch":

Depress keys and sequentially.

The cursor moves to the "Feedrate" position.

(ii) Input the feedrate.

The feedrate is automatically displayed. However, a change is possible.

(iii) Modification

Move the cursor by operating the cursor and keys or by the

key.

(iv) Depress the key when wishing to return to the previous display, or the approach display.

The key displays the present mode. The mode change is not allowed in the escape display and the F3 key cannot be used.

(v) Depress the key.

The finish shape of Drill pattern 1 is now set.

(b) Drill pattern 2

(i) Input End pos. Z.

After inputting, the cursor moves to the "Depth of cut."

- (ii) Input the depth of cut.

The depth of cut is automatically displayed. However, it can be changed.

The cursor moves to the "Retreat" position.

- (iii) Input the "Retreat."

This value displays the "Retreat" in the NC setting data. If the retreat is rewritten in this display, the NC setting retreat is automatically rewritten also.

Depress the WR key as it is. However, a change can also be made.

The cursor moves to the "Feedrate" position.

- (iv) Input the feedrate.

- (v) Depress the ENTER key.

The finish shape of Drill pattern 2 is now set.

(c) Drill pattern 3

- (i) Input End pos. Z.

After the input, the cursor moves to the "Depth of cut" position.

- (ii) Input the depth of cut.

After the input, the cursor moves to the "Feedrate" position.

- (iii) Input the feedrate.

- (iv) Depress the ENTER key.

The finish shape of Drill pattern 3 is now set.

3.9.4 Setting Threading

(1) The following will be displayed. (O.D. taper thread)

```

**SHAPE**  OD TAPER      T03 00000 N0000

G00 T0303;
G97 S20 M03;
M23;
N6301 X2.5 Z0;
█

Pitch      =              1st depth= . 140
End pos. Z=              Edge angle =  55
Base diam=             (29, 30, 55, 60, 80)
Base Z     =              Taper ratio=  16
Height    =
    
```

MEMORY LSK RDY

 EXIT modify MANUAL ENTER

(2) Set the finish shape as follows.

(a) Input the pitch.

To input "0.08 inch" for example:

Depress the . 0 8 and WR keys in succession.

The value obtained by multiplying the pitch by the coefficient to calculate the thread height set by the interactive parameter will be displayed in the "Height" column when input is performed. The cursor moves to "End pos. Z" coordinate position.

(b) Input the end pos. Z coordinates.

For example, when inputting "-1.6 inch", depress keys - 1 . 6 and WR, in succession. The cursor moves to the "Base diam" position.

(c) Input the base diam. For example, when inputting "3.6 inch", depress keys

3 . 6 and WR, in succession. The cursor moves to the "Base Z" coordinate position.

(d) Input the base Z coordinates.

The cursor moves to the "Height" position.

(e) Input the thread height.

The thread height is obtained by multiplying the value set by the parameter by the pitch value. Values will be displayed automatically when the pitch is input. However, changes can also be made. Depress the WR key. The cursor moves to the "1st depth" position.

- (f) Input the "1st depth". The value is automatically displayed. However, changes can also be made.

Depress the key. The cursor moves to the "Edge angle" position.

- (g) Input the edge angle.

"60°" or "55°" will be displayed automatically if the screw is cylindrical or tapered, respectively. As the comment in the display mentions, the value can be rewritten by selecting 29°, 30°, 55°, 60° or 80°. Depress the key.

The cursor moves to the "Taper ratio" position. Cylindrical threading requires no taper ratio.

- (h) Input the taper ratio. The radius difference of the tapered part can be expressed by the following expressions.

- (i) X-axis plus

Tapered part radius difference =

$$- \left| \frac{\text{Approach point Z - end pos. Z coordinate}}{\text{Taper ratio}} \right|$$

- (ii) X-axis minus

Tapered part radius difference =

$$+ \left| \frac{\text{Approach point Z - end pos. Z coordinate}}{\text{Taper ratio}} \right|$$

The taper ratio is the set value of interactive parameters.

Depress the key.

- (i) Modification

Move the cursor using and keys or key to make the modification.

- (j) Depress the key to return to the previous display, namely, the approach display.

- (k) Depress the key.

The thread finish shape has now been set.

3.9.5 Where Programming not Possible by Interaction

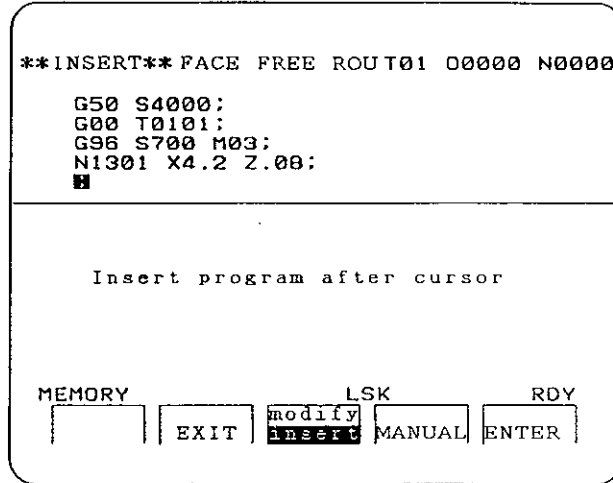
- (1) Cutting off (2) Closed loop cycle turning (3) Variable pitch thread turning (4) Threading of more than 2 screw rods (5) Turning more than twice by same menu

For example, if O.D. grooving is ordered again after instructing O.D. grooving, the previous interactive data are deleted and the new interactive data remain.

The first interactive data are deleted and modification of first grooving by interaction is not possible. No problem is caused if this modification is not tried.

3.10 PROGRAM INSERTION

- (1) After setting the finish shape, the display to insert a created program will appear as shown below. This display is not shown in finishing for face, O.D. and I.D. grooving, drilling, or threading. The set turning menu will be displayed on the display.



- (2) Insert the program as follows.
- (a) Insert the program in the block after the cursor.
When the cursor position is desired to be changed:
- Depress the **MANUAL** key and the key display will be reversed.
 - Depress the cursor keys **▲** and **▼** and move the cursor to the position previous to inserting the program.
- (b) Depress the **EXIT** key to return to the previous display, namely, the finish shape setting display.
- The **modify** / **insert** key displays the present mode. A mode change in the program insertion display is prohibited and the F3 key cannot be operated.
- (c) Depress the **ENTER** key. By this, the created program is inserted after the cursor.

3. 11 ESCAPE SETTING

- (1) The escape setting display as shown below will be displayed after program insertion is finished. This display is the end of one process and determines where tools finished cutting must escape to. It can also set the spindle stop and program end.

```
**ESCAPE**FACE FREE ROU T01 00000 N0000
N1301 X4.2 Z.08;
;
N1302 G00 G41 X4.208 Z.004;
N1303 G01 X.008 F.01;
■
```

Escape point= 0:Ext org/1:Machine org
2:Free point

Spindle stop= 0:No/1:Yes
Program end = 0:No/1:Yes

MEMORY		LSK	RDY
	EXIT	modify insert	MANUAL ENTER

- (2) Set escape as follows.

- (a) Input the escape point.

Depress 0 to select the external origin.

Depress 1 to select the machine origin.

Depress 2 to select a free escape point.

Time is lost in free escape if escape is made to the external origin or to the machine origin when continuously cutting in subsequent processes using one tool. Therefore, free cutting is performed when escaping a tool to a free point temporarily or when not wishing to escape from the present position. After making the selection, the cursor moves to the "spindle" position.

- (b) Input whether or not spindle stop is required.

Depress 0 to select no spindle stop.

Depress 1 to select spindle stop.




After the selection is made, the cursor moves to the "Program end" position.

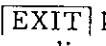
- (c) Input whether or not program end is required.


Depress 0 to select no program end.


Depress 1 to select program end.


(d) Modification

Depress the  and  cursor keys or the  key to move the cursor and make the modification.

(e) Depress the  key to return to the previous display, namely, the program insertion display.

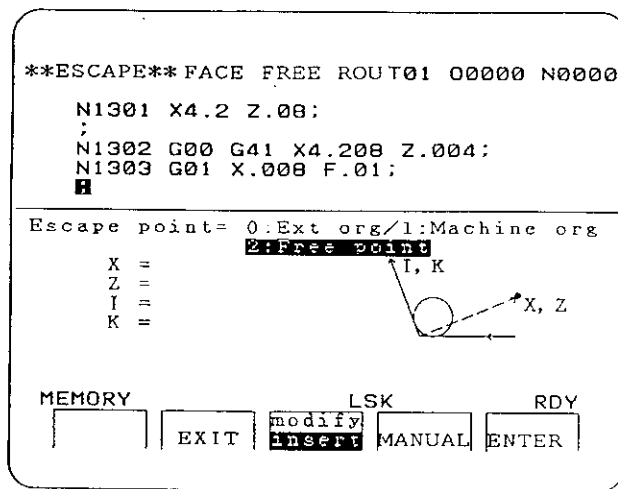
Depress the  key to use the cursor in the top part of the display.

The  key shows the present mode. Changes in the mode are not allowed in the escape display and the F3 key cannot be used.

(f) Depress the  key.




(i) Escape is set if the escape point is the EXT origin or machine origin.

(ii) If the escape point is a free escape point, the following display will be shown on the display.




① Escape in One Shaft Direction Only

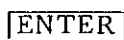
Input the coordinate of the shaft only. The input coordinate only is output to the NC program. For example, to escape to the position of "5 inch" parallel to axis X, input coordinate values in X coordinates only by depressing

keys  and , in succession. Depress the  key.


② Escaping in both Axes Directions

Input the X and Z coordinate values and depress the  key.

③ Stopping the Tool in Position Finished with Turning

No coordinate values are input. Depress the  key.

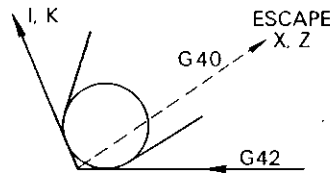
G00 X ___ Z ___ will not be output to the NC program. Depress the

 key to delete data in ① and ② if past data are contained.

④ Special Escaping

Use Command I or K if the direction of the move command instructed by the same block as that for edge R compensation cancel differs from the material shape direction.

Instruct "G00 G40 X ___ Z ___ K ___;" to escape the tool by cancelling edge R compensation in the X and Z directions at the end of first block cutting if the workpiece has the following shape.



To escape in such a special direction, using [ENTER] key, input the material shape directions of the next block in I and K incrementally. Return to the display of Par. 3.5, "Setting Variable Turning Menu" after setting.

3.12 ESCAPE FROM INTERACTIVE MODE

3.12.1 Turning Program Created

Depress the [END] key in the variable turning menu. Refer to Par. 3.13.1 for transfer of programs to the memories.

3.12.2 Escape from Interactive Mode during Program Creation

Escape from the interactive mode is not possible during program creation.

The [END] key is displayed only in the variable and detailed turning menu and in the material display only. Continue operating and proceed to these displays or return by depressing the [EXIT] key and [END] key.

The program returns to the display immediately before the interactive mode after escaping from the interactive mode.

3.13 PRECAUTIONS

3.13.1 Interactive Programming Data Transfer

Programs created or modified by interactive operation are sequentially transferred and stored in the normal part program memory.

(1) Other than in memory mode

Data are transferred when the [END] key is depressed.

(2) Memory mode

(a) New data

Data are transferred when the [END] key is depressed.

(b) Old data

Data are transferred to the memory with the label skip turned ON (refer to Par. 1.1.4 in the YASNAC LX3 Operator's Manual) after depressing the [END] Key.

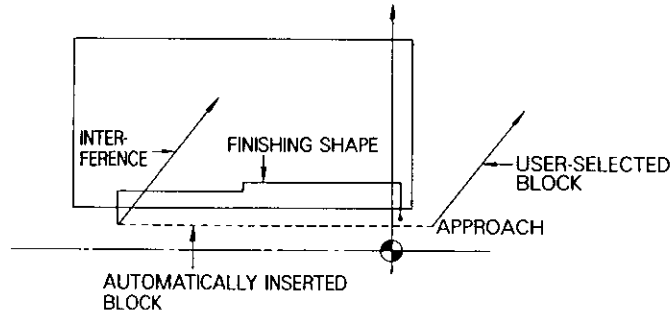
3.13.2 Interactive Data Search Timing

The interactive program number is searched for only in the EDIT mode. If the interaction ends in another mode, the interactive program number should be sought manually for operation.

3.13.3 Interference Check

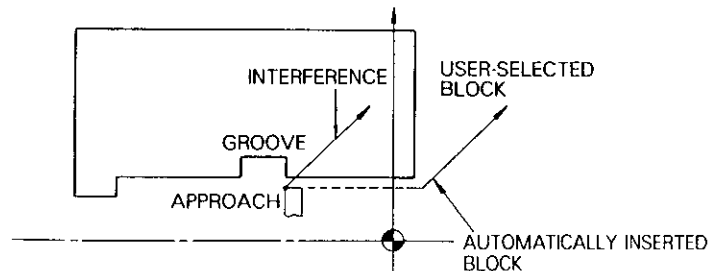
(1) Inner diameter (I.D.) turning

(a) I.D. free turning (rough turning or finish turning)



In the finishing shape shown above, a block escaping to "material right end Z coordinate + end clearance Z" is inserted automatically in the setting.

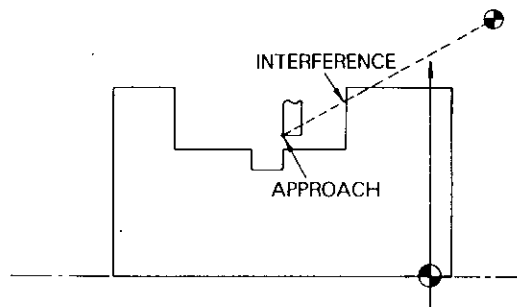
(b) I.D. grooving (rough turning or finish turning)



In the finishing shape shown above, a block escaping to "material right end Z coordinate + end clearance Z" is inserted automatically in the escape setting.

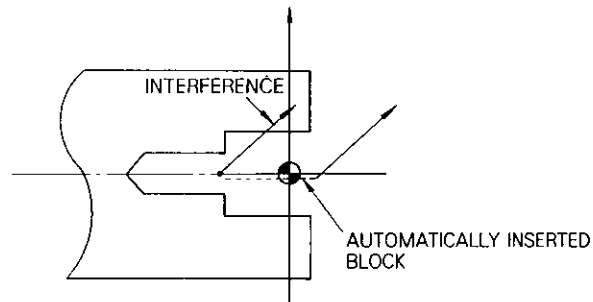
(c) For I.D. cylindrical screws and tapered screws, a block escapes similarly to the "material right end Z coordinate + end clearance Z".

(2) Outer diameter (O.D.) grooving (rough turning or finish turning)



An escape should be considered in the finishing shape shown above. In this case, an interference check is not performed automatically in the interaction.

(3) Drilling



In the finishing shape shown above, a block escaping to the "material right end Z coordinate + end clearance Z" is inserted automatically in the escape setting.

3.13.4 Notes on Editing Interactive Program Using the EDIT Key

- (a) Since all control is performed by the sequence number, do not change, delete, or add a sequence number manually.
- (b) Do not change, delete, or add control-in, control-out, or "()".

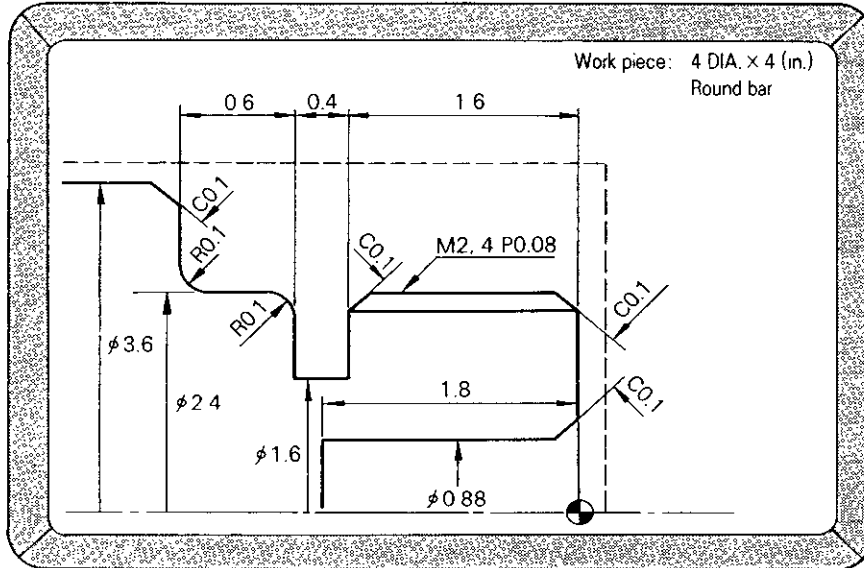
3.13.5 Generated NC Statements

The interactive section determines automatically the type of coordinate system used by the NC section, type of edge R compensation, setting of a coordinate system, and selection of the inch or millimeter unit for creation of an NC program. Accordingly, no switching parameters are provided in the interactive section and the user need not be concerned with these settings.

3. 14 MESSAGES IN INTERACTIVE MODE

Message	Action
O number already exist	Enter another O number.
O number is set wrong	Enter another O number.
O number does not exist	Set up a new O number and create a program interactively.
Item data is missing	Enter data into an available item.
Block to modify does not exist	Set the insert mode and specify a block.
Rough cutting data dose not exist	Set a rough turning menu, create a program, and set a finishing menu.
First block can set linear only	Depress the [LINEAR] key and enter linear data.
Get end point by calculating function	Depress the [CALC] key and find the end point (See Sect. 4)
End point (0: upper/1: lower) of center	Depress either [0] or [1] .
End point (0: left/1: right) of center	Depress either [0] or [1] .
Center is not set	Enter the coordinates of the center.
Affect next block ? (Yes: 1/No: 0)	See (5), (6), and (7) in Par 3 9.1.
Can't correct due to arc in next block	Delete the circular arc block and make a modification. Modify by selecting the "next block affected" option.
Edge width is too wide	Reenter the cutting edge width.
Change value of finishing cut (U) Change value of finishing cut (W)	Return to the basic data display and enter a finishing allowance.
Intersection point calc error	Modify the block in error.
Data to modify does not exist	Return to the variable turning menu display and select the insert with the modify key insert
Error in set item	Reenter correctly
Program block overflow	The number of blocks exceeded 39. No further entry is possible.
Chamfer or round are in succession	There are two consecutive chamfering or rounding blocks in the finishing shape. Reenter properly.
No linear command in last block	The last block in the finishing shape is not a linear. Instruct a linear.
Present data is not in memory	Data are written to memory after operation. Set new data after the write-in.
Block exceeds drawing area	The end point went out of the drawing range. Modify the data and respecify.
Please Input Z	Enter [Z] CHAMFER/ROUNDING AMOUNT.
Please input X	Enter [X] CHAMFER/ROUNDING AMOUNT.
Change last block to linear command	Change the last block to a linear and reenter

3. 15 FINISH TURNING EXECUTED WITH NC COMPACT PROGRAMMING FUNCTIONS



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* Nos in parentheses indicate the turning tool.

3.15.1 Initialization

- (1) Set program No.
- (a) Select "2 New Data" and depress **[ENTER]** key.
- (b) Input Program No. and Comment then depress **[ENTER]** key.
Program No.=4000

```

** PROGRAM NUMBER **           00000 N0000

1 Old Data
2 New Data

Program number = 0
Comment       = (      )

EDIT          LSK          RDY
END          [ ]          [ ]          ENTER
    
```

(2) Set material shape.

- Outer diameter (O.D.)=4
- Inner diameter (I.D.)=0
- Depress **[WR]** key.
- Length=4
- Face removal=0.08
- Chucking legh = 0.4
- Depress **[ENTER]** key.

```

** BLANK SET **               00000 N0000

04000

O. D.      = . 0
I. D.      = . 0
Length     = . 0
Face removal = . 0
Chucking legh = . 0
Center     = 0:No/1:Yes

EDIT          LSK          RDY
END          [ ]          [ ]          MANUAL          ENTER
    
```

3.15.2 Drilling

- (1) Variable turning menu
- Select "5 Drill"
- Depress **[ENTER]** key.

```

** MENU **                   00000 N0000

04000

1 Face
2 O. D.
3 I. D.
4 Groove
5 Drill
6 Thread

EDIT          LSK          RDY
END          EXIT          modify          insert          MANUAL          ENTER
    
```

(2) Detailed turning menu.

Select "2 Drill pat 2".

Depress **[ENTER]** key.

```

** MENU **                                00000 N0000
04000H

1Drill pat 1    2Drill pat 2    3Drill pat 3
  ────>         ────>         ────>

EDIT          LSK          RDY
┌──┐ ┌──┐ ┌──┐ ┌──┐ ┌──┐
│END│ │EXIT│ │PROCES│ │MANUAL│ │ENTER│
│   │ │   │ │SEARCH│ │   │ │   │
└──┘ └──┘ └──┘ └──┘ └──┘
  
```

(3) Set approach data.

Approach = 0.2
 Tool no. = 0101
 Drill diam = 0.8
 Surf speed = 70

Depress **[ENTER]** key.

```

**APPROACH** DRILL PAT 2  00000 N0000
04000H

Approach Z=          Gear=0:OFF/1:High
Tool no. =           2:Low
Drill diam=         Turn=0:Normal
Surf speed=         1:Reverse
Spin speed=         Oil =0:ON/1:Off

EDIT          LSK          RDY
┌──┐ ┌──┐ ┌──┐ ┌──┐ ┌──┐
│   │ │EXIT│ │modify│ │MANUAL│ │ENTER│
│   │ │   │ │insert│ │   │ │   │
└──┘ └──┘ └──┘ └──┘ └──┘
  
```

(4) Set finish shape.

End pos. Z = -1.8

Depress **[ENTER]** key.

```

**SHAPE** DRILL PAT 2  T01 00000 N0000
G00 T0101;
G97 S350 M03;
X0;
N5201 Z.2 M00;
H

End pos. Z =
Depth of cut= .8000
Retreat = .40
Feedrate = .80

EDIT          LSK          RDY
┌──┐ ┌──┐ ┌──┐ ┌──┐ ┌──┐
│   │ │EXIT│ │modify│ │MANUAL│ │ENTER│
│   │ │   │ │insert│ │   │ │   │
└──┘ └──┘ └──┘ └──┘ └──┘
  
```

(5) Set escape.

Depress **ENTER** key.

```

**ESCAPE** DRILL PAT 2 T01 00000 N0000
;
N5201 Z.2 M08;
;
N5202;
N5203 G74 Z-1.0 K.0 F.000;
█

```

Escape point= **0:0:0:0**/1:Machine org
2:Free point

Spindle stop= **0:No**/1:Yes
Program end = **0:No**/1:Yes

EDIT		LSK	RDY
	EXIT	modify insert	MANUAL ENTER

3.15.3 Face Rough Turning

(1) Variable turning menu.







Select "1 Face".

Depress **ENTER** key.

```

** MENU **                                00000 N0000
;
N5204 G00 Z.16;
G51;
N5205 M01;
█

```

1 Face 	2 O. D. 	3 I. D. 		
4 Groove 	█ Drill 	5 Thread 		

EDIT		LSK	RDY
END	EXIT	modify insert	MANUAL ENTER

(2) Detailed turning menu.





Select "3 Free rough".

Depress **ENTER** key.

```

** MENU **                                00000 N0000
;
N5204 G00 Z.16;
G51;
N5205 M01;
█

```

1 Face rough 	2 Face fin G70 	█ 3 Free rough 	4 Free fin G70Non 	
---	--	--	--	--

EDIT		LSK	RDY
END	EXIT	PROCES SEARCH	MANUAL ENTER

(3) Set approach data.

Tool no. = 0202
 Surf speed = 700
 Spin max = 4000
 Depress **ENTER**
 key.

```

**APPROACH** FACE FREE ROU 00000 N0000
;
N5204 G00 Z.16;
G51;
N5205 M01;
█

```

Approach X= 4.2000 Gear=**0:Low**/1:High
 Z= .800 2:Low
 Tool no = Turn=**0:Forward**
 Surf speed= 1:Reverse
 Spin speed= Oil =**0:On**/1:Off
 Spin max = Work=**0:1**/1:L/2:Off

EDIT LSK RDY
 EXIT **modify** MANUAL ENTER
 insert

(4) Set basic data.

Depress **ENTER**
 key.

```

**B. DATA** FACE FREE ROU T02 00000 N0000
G50 S4000;
G00 T0202;
G96 S700 M03;
N1301 X4.2 Z.08;
█

```

Fin allowance U = .80
 W = .40
 Feedrate F = .100

EDIT LSK RDY
 EXIT **modify** MANUAL ENTER
 insert

(5) Set finish shape.

(a) Z = 0

Depress **BLOCK**
ENTER
 key.

```

**SHAPE** FACE FREE ROU T02 00000 N0000
End pos. X; =  insert
Z; =  insert

```

EDIT LSK RDY
 LINEAR ARC CHAM BLOCK
 FER ROUND ENTER

(b) X = 0.7

Depress **BLOCK**
key. **ENTER**

```

**SHAPE** FACE FREE ROU T02 00000 N0000
End pos. X1 = ██████████ INSERT
          Z1 = ██████████
Angle
Feedrate F = . 40

```

EDIT LSK RDY
◀ **LINEAR** ARC CHAM FER ROUND **BLOCK** ENTER ▶

(c) Depress **▶** key,
then **ENTER** key.

```

**SHAPE** FACE FREE ROU T02 00000 N0000
End pos. X1 = ██████████ INSERT
          Z1 = ██████████
Angle
Feedrate F =

```

EDIT LSK RDY
◀ **LINEAR** ARC CHAM FER ROUND **BLOCK** ENTER ▶

(6) Program insertion.

Depress **ENTER**
key.

```

**INSERT** FACE FREE ROU T02 00000 N0000
G50 S4000;
G00 T0202;
G96 S700 M03;
N1301 X4.2 Z.00;
█

```

Insert program after cursor

EDIT LSK RDY
EXIT **modify** **insert** MANUAL ENTER

(7) Set escape.

(a) Select "2:Free point".

Depress **[ENTER]** key.

```

**ESCAPE** FACE FREE ROU T02 00000 N0000
N1301 X4.2 Z.08;
;
N1302 G00 G41 X4.208 Z.004;
N1303 G01 X.708 F.01;
█

```

Escape point= █/1:Machine org
2:Free point

Spindle stop= █/1:Yes
Program end = █/1:Yes

EDIT	EXIT	modify	LSK	RDY
		insert	MANUAL	ENTER

(b) Input Free point.

No other input is accepted because operation is stopped at turning end point.

Depress **[ENTER]** key.

```

**ESCAPE** FACE FREE ROU T02 00000 N0000
N1301 X4.2 Z.08;
;
N1302 G00 G41 X4.208 Z.004;
N1303 G01 X.708 F.01;
█

```

Escape point= 0:Ext org/1:Machine org
2:Free point

X =
Z =
I =
K =

EDIT	EXIT	modify	LSK	RDY
		insert	MANUAL	ENTER

3.15.4 Outer Diameter (O.D.) Rough Turning

(1) Variable turning menu Select "2 O.D."

Depress **[ENTER]** key.

```

** MENU **                                00000 N0000
N1303 G01 X.708 F.01;
;
N1304 G40;
N1305;
█

```

█ Face 	2 O. D. 	3 I. D. 		
4 Groove 	5 Drill 	6 Thread 		



EDIT	EXIT	modify	LSK	RDY
END		insert	MANUAL	ENTER

- (2) Detailed turning menu.
 Select "1 O.D. rough".
 Depress **ENTER** key.

```

** MENU **                                00000 N0000
N1303 G01 X.708 F.01;
;
N1304 G40;
N1305;
█

```

█ O. D. rough	2 O. D. fin	3 Free rough	4 Free fin
	G70		G70Non

```

EDIT                                LSK                                RDY
┌ END ─┐ ┌ EXIT ─┐ ┌ PROCES ─┐ ┌ LSK ─┐ ┌ RDY ─┐
└───┘ └───┘ └ SEARCH ─┘ └ MANUAL ─┘ └ ENTER ─┘

```

- (3) Set approach data.
 Depress **ENTER** key.

```

**APPROACH** OD ROUGH                00000 N0000
N1303 G01 X.708 F.01;
;
N1304 G40;
N1305;
█

```

```

Approach X=      4.0400 Gear=0:Low/1:High
              Z=      .800  2:Low
Tool no      =      0202 Turn=0:Normal
Surf speed=      700    1:Reverse
Spin speed=
Spin max    =      4000 Work=0:R/0:1/2:Off

```

```

EDIT                                LSK                                RDY
┌   ─┐ ┌ EXIT ─┐ ┌ modify ─┐ ┌ LSK ─┐ ┌ RDY ─┐
└───┘ └───┘ └ insert ─┘ └ MANUAL ─┘ └ ENTER ─┘

```

- (4) Set basic data.
 Depress **ENTER** key.

```

**B. DATA** OD ROUGH                T02 00000 N0000
N2100 (OD- CYCLE- ROUGH);
G00 T0202;
G96 S700 M03;
N2101 X4.04 Z.08;
█

```

```

Fin allowance U =      .80
              W =      .40
Depth of cut  D =     .1600
Feedrate     F =     .120

```

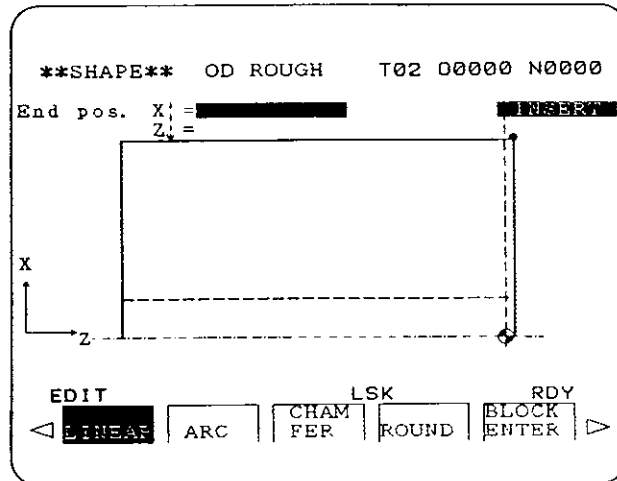
```

EDIT                                LSK                                RDY
┌   ─┐ ┌ EXIT ─┐ ┌ modify ─┐ ┌ LSK ─┐ ┌ RDY ─┐
└───┘ └───┘ └ insert ─┘ └ MANUAL ─┘ └ ENTER ─┘

```

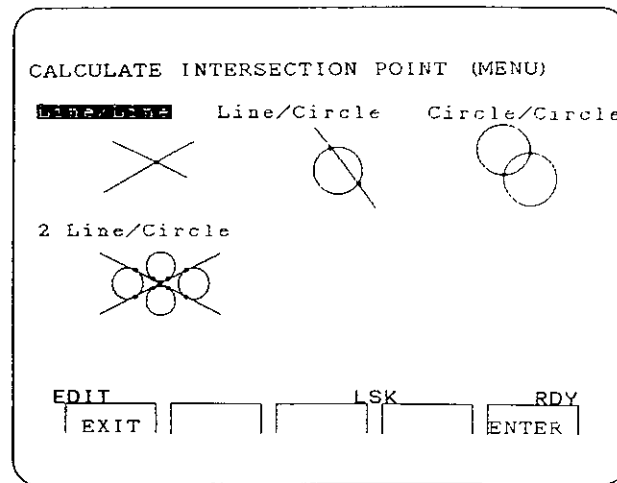
(5) Set finish shape.

(a) Depress \triangleleft key, then $\boxed{\text{CALC}}$ key.



(b) Select "Line/Line".

Depress $\boxed{\text{ENTER}}$ key.



(c) A-pos Z=0.08 or $\boxed{\text{W}}$

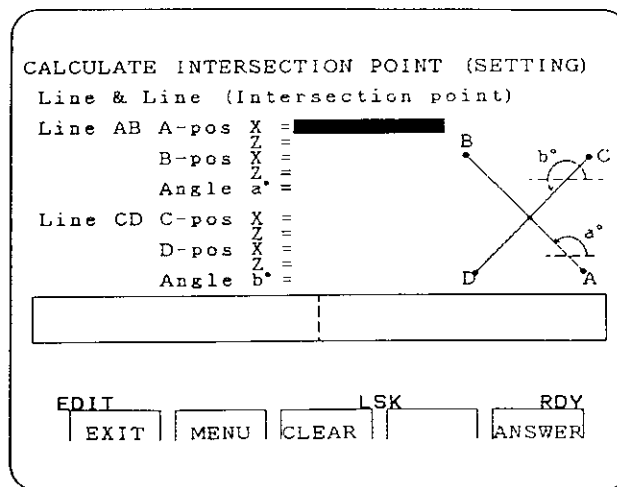
Angle $a^\circ = 90$

C-pos X = 2.4

C-pos Z = -0.1

Angle $b^\circ = -45$

Depress $\boxed{\text{ANSWER}}$ key.



(d) Depress **EXIT** key.

CALCULATE INTERSECTION POINT (SETTING)
Line & Line (Intersection point)

Line AB A-pos X = Z =
 B-pos X = .8000 Z =
 Angle a° = 90.

Line CD C-pos X = 2.4000 Z = .1000
 D-pos X = Z =
 Angle b° = -45.

POS X: 2.0400 Z: .8000

EDIT EXIT MENU CLEAR LSK ANSWER RDY

(e) Depress **▷** key then **X** and **WR** keys.

SHAPE OD ROUGH T02 00000 N0000

End pos. X: Z: **INSERT**

EDIT **LINEAR** ARC CHAM FER ROUND **BLOCK ENTER** LSK RDY

(f) Depress **BLOCK ENTER** key.

SHAPE OD ROUGH T02 00000 N0000

End pos. X: 2.0400 Z: **INSERT**

EDIT **LINEAR** ARC CHAM FER ROUND **BLOCK ENTER** LSK RDY

(g) $X = 2.4$
 $Z = -0.1$

Depress

BLOCK
ENTER

key.

****SHAPE**** OD ROUGH T02 00000 N0000

End pos. X_i = XXXXXXXXXX INSERT

Z_i = _____

Angle _____

Feedrate F = . 40

EDIT LSK RDY

LINEAR
ARC
CHAM
FER
ROUND
BLOCK
ENTER

(h) $Z = -2.6$

Depress

BLOCK
ENTER

key.

****SHAPE**** OD ROUGH T02 00000 N0000

End pos. X_i = XXXXXXXXXX INSERT

Z_i = _____

Angle _____

Feedrate F = _____

EDIT LSK RDY

LINEAR
ARC
CHAM
FER
ROUND
BLOCK
ENTER

(i) Depress

ROUND

key.

****SHAPE**** OD ROUGH T02 00000 N0000

End pos. X_i = XXXXXXXXXX INSERT

Z_i = _____

Angle _____

Feedrate F = _____

EDIT LSK RDY

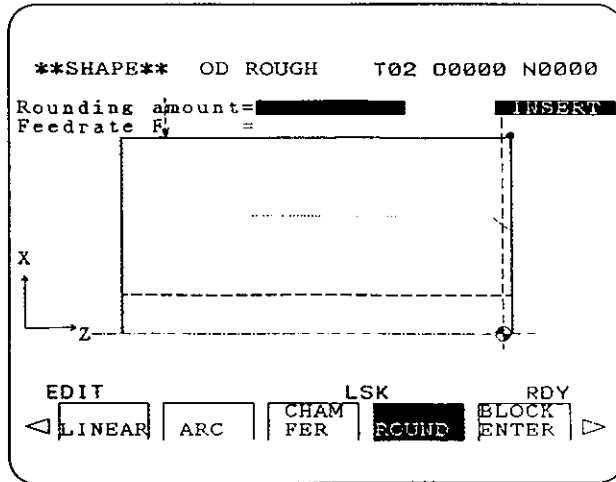
LINEAR
ARC
CHAM
FER
ROUND
BLOCK
ENTER

(j) $R = 0.1$

Depress

BLOCK
ENTER

 key.

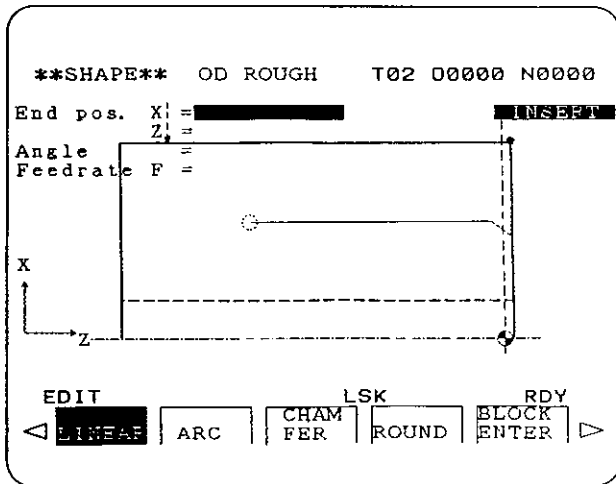


(k) $X = 3.6$

Depress

BLOCK
ENTER

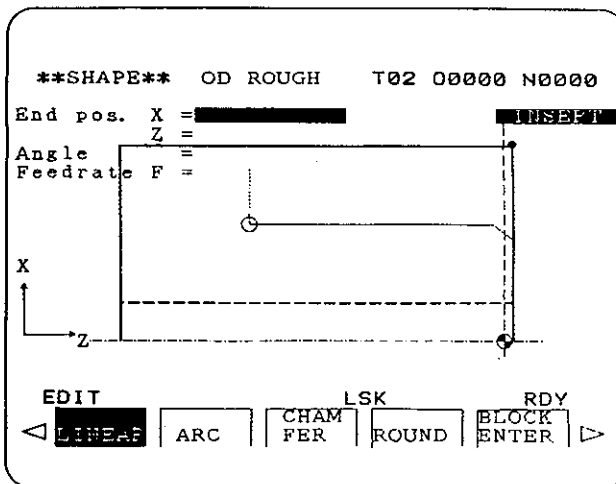
 key.



(l) Depress

C H A M
F E R

 key.

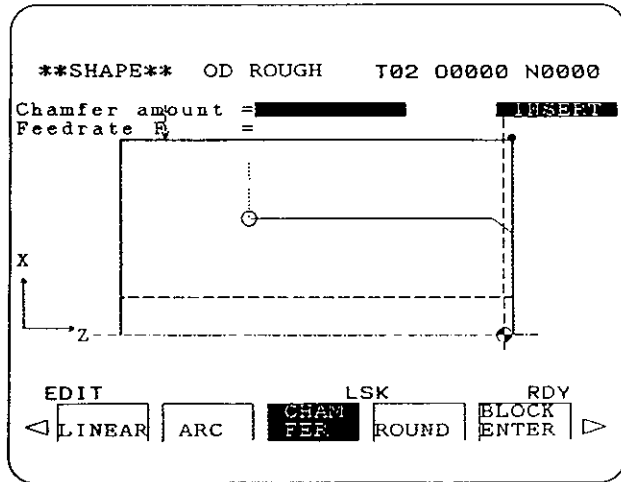


(m) Chamfer amount=0.1

Depress

BLOCK
ENTER

 key.

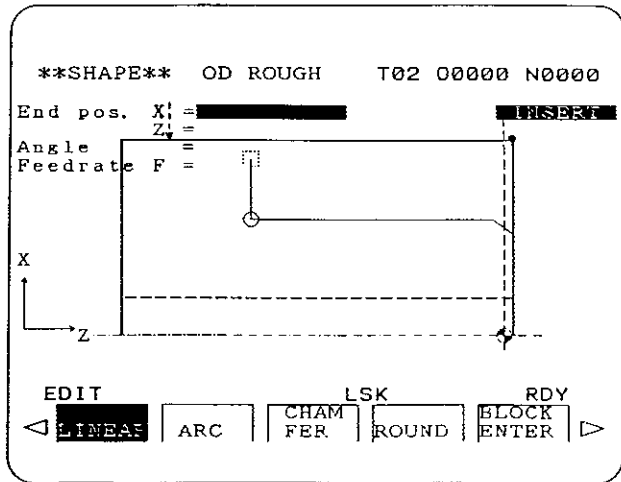


(n) Z = -3.4

Depress

BLOCK
ENTER

 key.

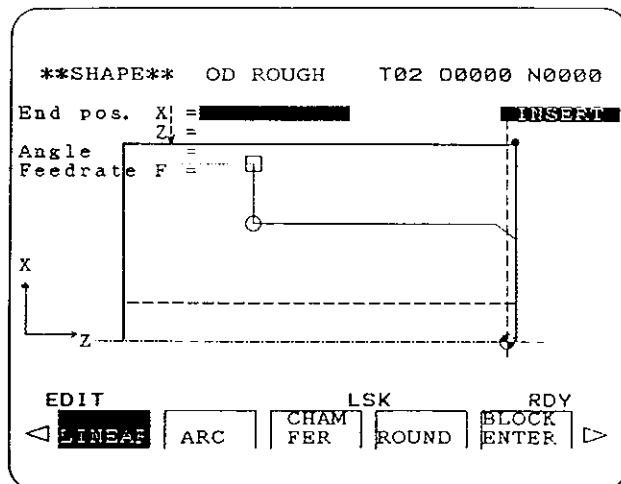


(o) X = 4.1

Depress

BLOCK
SET

 key.



(p) Depress \triangleright key,
then $\overline{\text{ENTER}}$ key.

```

**SHAPE** OD ROUGH T02 00000 N0000
End pos. X1 = ██████████ INSERT
          Z1 = ██████████
Angle    F = ██████████
Feedrate P = ██████████

```

```

EDIT          LSK          RDY
◀ LINEAR   ARC   CHAM   ROUND   BLOCK   ENTER ▶
                FER

```

(6) Program insertion
Depress $\overline{\text{ENTER}}$ key.

```

**INSERT** OD ROUGH T02 00000 N0000
N2100 (OD- CYCLE- ROUGH);
G00 T0202;
G96 S700 M03;
N2101 X4.04 Z.08;
█

```

Insert program after cursor

```

EDIT          LSK          RDY
  [ ]   EXIT   modify   MANUAL   ENTER
                insert

```

(7) Set escape.
Select "O: Ext org"
Depress $\overline{\text{ENTER}}$ key.

```

**ESCAPE** OD ROUGH T02 00000 N0000
G01 X3.4;
X3.6 Z-2.7;
Z-3.4;
N2104 X4.1;
█

```

Escape point= 0:Ext org/1:Machine org
█:Free point

Spindle stop= 0:No/1:Yes
Program end = 0:No/1:Yes

```

EDIT          LSK          RDY
  [ ]   EXIT   modify   MANUAL   ENTER
                insert

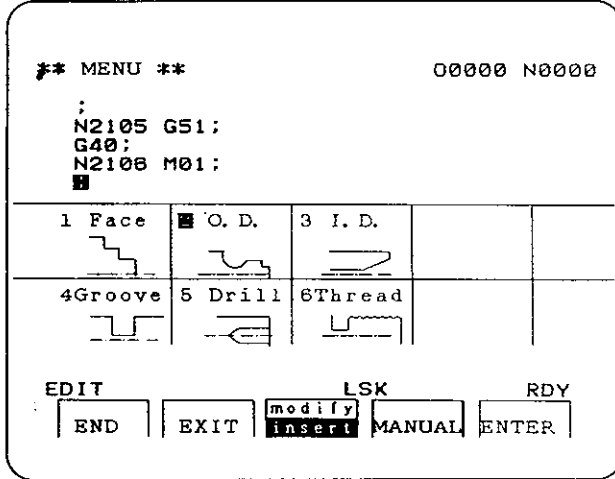
```

3. 15. 5 Inner Diameter (I.D.)
Rough Turning

(1) Variable turning menu.

Select "3 I.D."

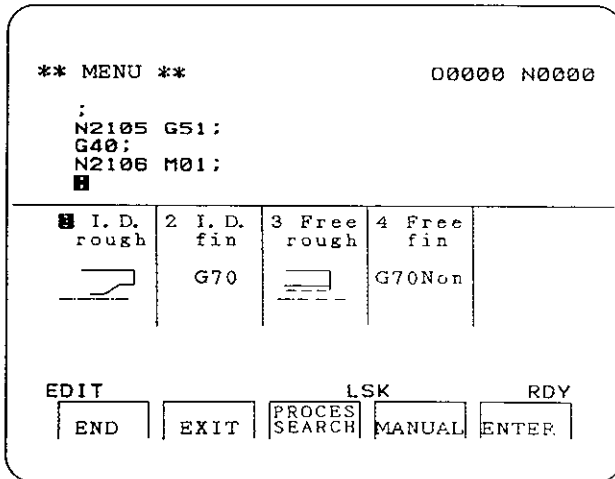
Depress [ENTER] key.



(2) Detailed turning menu.

Select "3 Free rough."

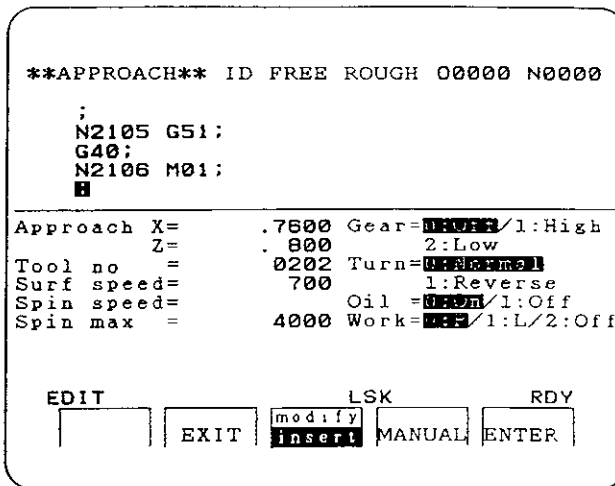
Depress [ENTER] key.



(3) Set approach data.

Tool no. = 0303

Depress [ENTER] key.



- (c) Depress **CLEAR** key.
 A-pos Z = 0.08 or **W**
 Angle $a^\circ = 90$
 C-pos X = 0.88
 C-pos Z = -0.1
 Angle $b^\circ = 45$
 Depress **ANSWER** key.

CALCULATE INTERSECTION POINT (SETTING)
 Line & Line (Intersection point)
 Line AB A-pos X = ██████████ Z = .800
 B-pos X = ██████████ Z =
 Angle $a^\circ = 90.$
 Line CD C-pos X = 2.4000 Z = .100
 D-pos X = ██████████ Z =
 Angle $b^\circ = -45.$

██████████

EDIT LSK RDY
 |EXIT| |MENU| |CLEAR| | | |ANSWER|

- (d) Depress **EXIT** key.

CALCULATE INTERSECTION POINT (SETTING)
 Line & Line (Intersection point)
 Line AB A-pos X = ██████████ Z = .800
 B-pos X = ██████████ Z =
 Angle $a^\circ = 90.$
 Line CD C-pos X = .8800 Z = .1000
 D-pos X = ██████████ Z =
 Angle $b^\circ = 45.$

POS X: 1.2400
 Z: .8000

EDIT LSK RDY
 |EXIT| |MENU| |CLEAR| | | |ANSWER|

- (e) Depress **▷** key,
 then **X**, **WR** key.

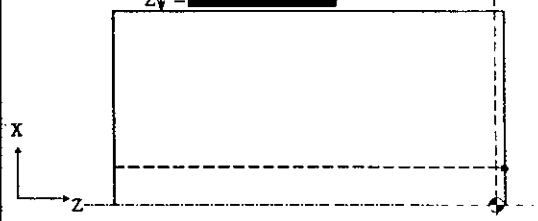
****SHAPE**** ID FREE ROUGH T03 00000 N0000
 End pos. X1 = ██████████ Z1 = ██████████ **INSEFT**

EDIT LSK RDY
 |LINEAR| |ARC| |CHAMFER| |ROUND| |BLOCKENTER|

(f) Depress key.

BLOCK
ENTER

```
**SHAPE** ID FREE ROUGH T03 00000 N0000
End pos. X = 1.2400
          Z =
          Y =
```



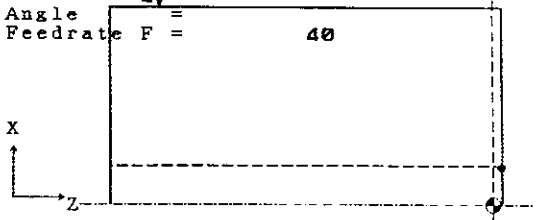
EDIT **LINEAR** **ARC** **CHAM** **LSK** **ROUND** **RDY**
FER **BLOCK**
ENTER

(g) $X = 0.88$
 $Z = -0.1$

Depress key.

BLOCK
ENTER

```
**SHAPE** ID FREE ROUGH T03 00000 N0000
End pos. X =
          Z =
          Y =
Angle
Feedrate F = 40
```



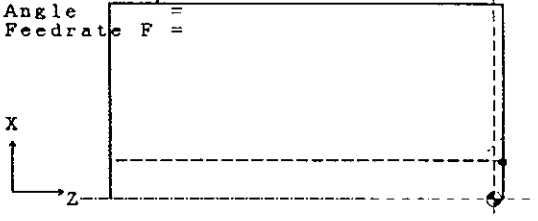
EDIT **LINEAR** **ARC** **CHAM** **LSK** **ROUND** **RDY**
FER **BLOCK**
ENTER

(h) $Z = -1.8$

Depress key.

BLOCK
ENTER

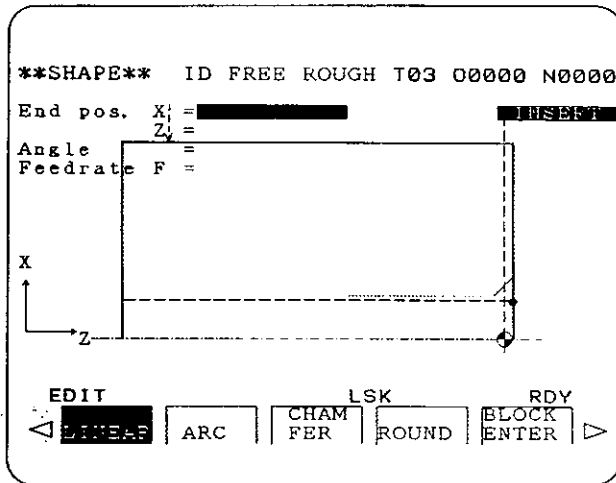
```
**SHAPE** ID FREE ROUGH T03 00000 N0000
End pos. X =
          Z =
          Y =
Angle
Feedrate F =
```



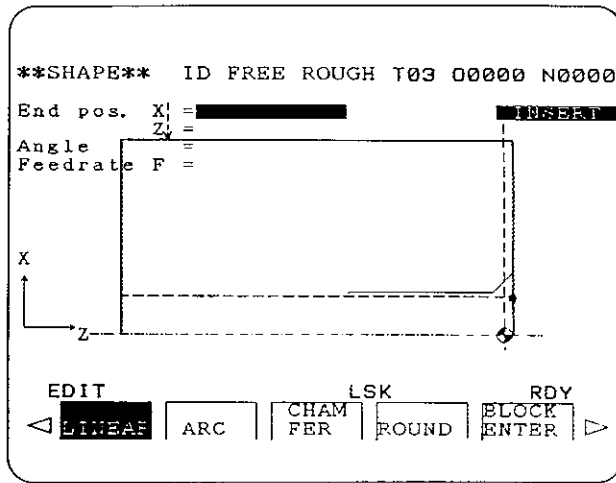
EDIT **LINEAR** **ARC** **CHAM** **LSK** **ROUND** **RDY**
FER **BLOCK**
ENTER

(i) X = 0.7

Depress **BLOCK**
key.

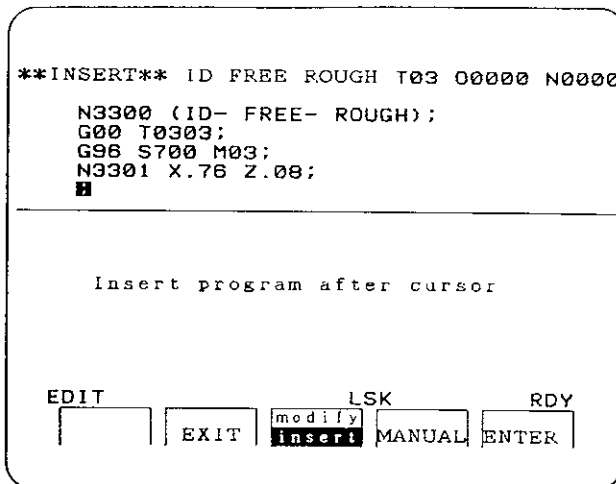


(j) Depress **>** key,
then **ENTER** key.



(6) Program insertion

Depress **ENTER**
key.



(7) Set escape.

Select "0: Ext org"

Depress key.

```

**ESCAPE** ID FREE ROUGH T03 00000 N0000
N3302 G00 G41 X1.232 Z.084;
G01 X.872 Z-.096 F.01;
Z-1.796;
N3303 X.692;
█
Escape point= /1:Machine org
                2:Free point
Spindle stop= /1:Yes
Program end = /1:Yes

EDIT          LSK          RDY
     

```







3.15.6 Face Finish Turning

(1) Variable turning menu.

Select "1 Face".

Depress key.

```

** MENU **                                00000 N0000
N3304 G00 Z.16;
G51;
G40;
N3305 M01;
█
1 Face      2 O. D.       I. D.
  
4Groove     5 Drill     6Thread
  

EDIT          LSK          RDY
     





```

(2) Detailed turning menu.

Select "4 Free fin".

Depress key.

```

** MENU **                                00000 N0000
N3304 G00 Z.16;
G51;
G40;
N3305 M01;
█
1 Face      2 Face       Free      4 Free
rough       fin         rough       fin
   
G70        G70Non
G70        G70Non

EDIT          LSK          RDY
    

```

(3) Set approach data.

Approach X = 2.4
 Tool no. = 0404

Depress **[ENTER]**
 key.

```

**APPROACH** FACE FREE FIN 00000 N0000
N3304 G00 Z.18;
G51;
G40;
N3305 M01;
█

```

Approach X= 4.2000 Gear=~~0:High~~/1:High
 Z= .800 2:Low
 Tool no = 0303 Turn=~~0:Normal~~
 Surf speed= 700 1:Reverse
 Spin speed= Oil = ~~0:On~~/1:Off
 Spin max = 4000 Work=~~0:1~~/1:L/2:Off

EDIT [] LSK [] RDY []
 [] EXIT [modify] [insert] MANUAL [ENTER]

(4) Set escape.

Select "2:Free point".

Depress **[ENTER]**
 key.

```

**ESCAPE** FACE FREE FIN T04 00000 N0000
N1401 X2.4 Z.08;
;
N1402 G00 G41 Z0;
N1403 G01 X.7 F.004;
█

```

Escape point= ~~0:Ext org~~/1:Machine org
 2:Free point
 Spindle stop= ~~0:On~~/1:Yes
 Program end = ~~0:No~~/1:Yes

EDIT [] LSK [] RDY []
 [] EXIT [modify] [insert] MANUAL [ENTER]

(5) Input Free point.

No other input is accepted because operation is stopped at turning end point.

Depress **[ENTER]**
 key.

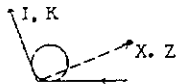
```

**ESCAPE** FACE FREE FIN T04 00000 N0000
N1401 X2.4 Z.08;
;
N1402 G00 G41 Z0;
N1403 G01 X.7 F.004;
█

```

Escape point= 0:Ext org/1:Machine org
 2:Free point

X =
 Z =
 I =
 K =



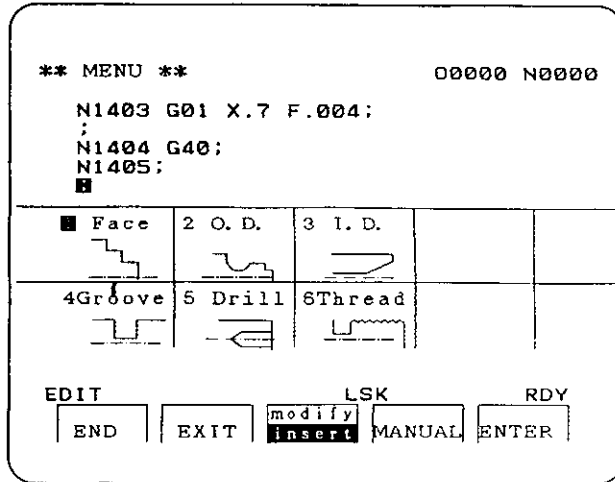
EDIT [] LSK [] RDY []
 [] EXIT [modify] [insert] MANUAL [ENTER]

3.15.7 Outer Diameter (O.D.)
Finish Turning

(1) Variable turning
menu.

Select "2 O.D.".

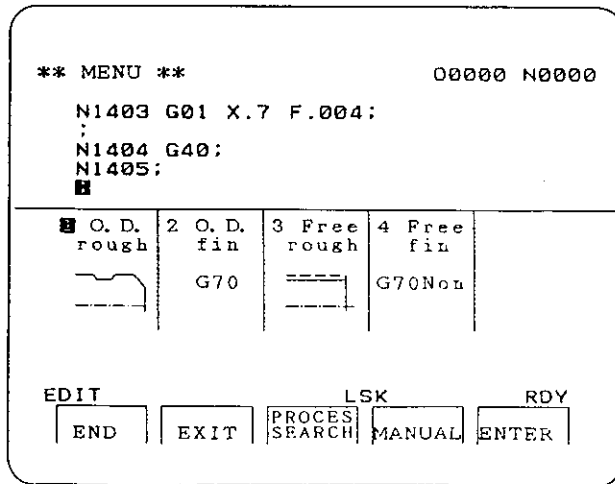
Depress **ENTER**
key.



(2) Detailed turning
menu.

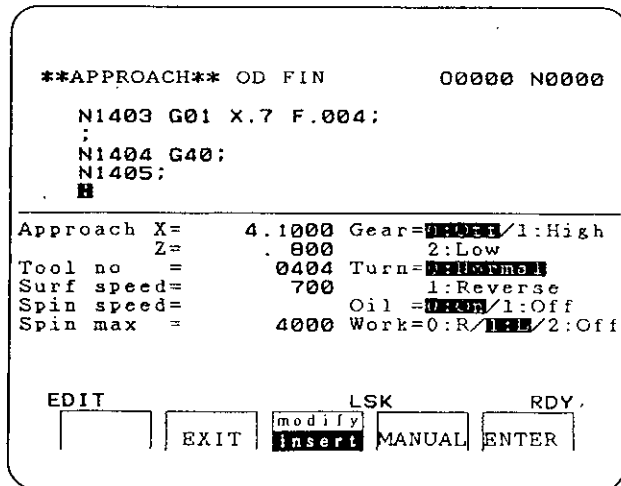
Select "2 O.D. fin".

Depress **ENTER**
key.



(3) Set approach data.

Depress **ENTER**
key.



(4) Set escape "0: Ext org".

Depress **ENTER** key.

```

**ESCAPE** OD FIN      T04 00000 N0000
;
N2201 X4.1 Z.08;
;
N2202;
N2203 G70 P2103 Q2104;
█

Escape point= 0:Ext org/1:Machine org
             0:0000/1:0000

Spindle stop= 0:No/1:Yes
Program end = 0:No/1:Yes

EDIT      LSK      RDY
[ ]       [EXIT]   [modify] [MANUAL] [ENTER]
                [insert]
  
```

3.15.8 Inner Diameter (I.D.) Finish Turning




(1) Variable turning menu.




Select "3 I.D."

Depress **ENTER** key.

```

** MENU **              00000 N0000
;
N2204 G51;
G40;
N2205 M01;
█

1 Face   O. D.  3 I. D.
  

4 Groove  5 Drill  6 Thread
  

EDIT      LSK      RDY
[END]     [EXIT]   [modify] [MANUAL] [ENTER]
                [insert]
  
```





(2) Detailed turning menu.

Select "4 Free fin"

Depress **ENTER** key.

```

** MENU **              00000 N0000
;
N2204 G51;
G40;
N2205 M01;
█

1 I. D.  2 I. D.  3 Free  4 Free
rough    fin     rough   fin
   
                G70                G70Non

EDIT      LSK      RDY
[END]     [EXIT]   [PROCES] [MANUAL] [ENTER]
                [SEARCH]
  
```

(3) Set approach data.

Tool no. = 0505

Depress **ENTER** key.

```

**APPROACH** ID FREE FIN 00000 N0000
;
N2204 G51:
G40:
N2205 M01:
█

```

Approach X= .7600 Gear=0:High/1:High
Z= .800 2:Low
Tool no = 0404 Turn=0:Clockwise
Surf speed= 700 1:Reverse
Spin speed= Oil =0:On/1:Off
Spin max = 4000 Work=0:1/1:L/2:Off

EDIT LSK RDY
 EXIT modify MANUAL ENTER
 insert

(4) Set escape.

Select "0: Ext org".

Depress **ENTER** key.

```

**ESCAPE** ID FREE FIN T05 00000 N0000
N3402 G00 G41 X1.24;
G01 X.88 Z-.1 F.004;
Z-1.8;
N3403 X.7;
█

```

Escape point= 0:Ext.org/1:Machine org
2:Free point
Spindle stop= 0:No/1:Yes
Program end = 0:No/1:Yes

EDIT LSK RDY
 EXIT modify MANUAL ENTER
 insert

3.15.9 Groove Rough Turning

(1) Variable turning menu.







Select "4 Groove".

Depress **ENTER** key.

```

** MENU ** 00000 N0000
N3404 G00 Z.16;
G51:
G40:
N3405 M01:
█

```

1 Face 	2 O. D. 	<input checked="" type="checkbox"/> I. D. 		
4Groove 	5 Drill 	6Thread 		

EDIT LSK RDY
 END EXIT modify MANUAL ENTER
 insert

(2) Detailed turning menu.


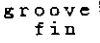



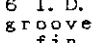
Select "1 O.D."

Depress **ENTER** key.

```

** MENU **                                00000 N0000
N3404 G00 Z.16;
G51;
G40;
N3405 M01;
█

```

1 O. D. 	2 O. D. groove fin 	3 Face 	4 Face groove fin 	
5 I. D. 	6 I. D. groove fin 			

```

EDIT      LSK      RDY
┌───┐    ┌───┐    ┌───┐
│   │    │   │    │   │
└───┘    └───┘    └───┘

```

(3) Set approach data.

Approach X = 2.6

Tool no. = 0606

Surf speed = 700

Depress **ENTER** key.

```

**APPROACH** OD GROV ROUGH  00000 N0000
N3404 G00 Z.16;
G51;
G40;
N3405 M01;
█

```

Approach X=	Gear= <u>0:000</u> /1:High
Tool no =	2:Low
Surf speed=	Turn= <u>0:Normal</u>
Spin speed=	1:Reverse
Spin max =	Oil = <u>0:On</u> /1:Off

```

EDIT      LSK      RDY
┌───┐    ┌───┐    ┌───┐
│   │    │   │    │   │
└───┘    └───┘    └───┘

```

(4) Set basic data.

Depress **ENTER** key.

```

**B. DATA** OD GROV ROUGH T06 00000 N0000
;
N4100 (OD- GROOVE- ROUGH);
G00 T0606;
N4101 G98 S700 M03;
█

```

Fin allowance U =	. 80
W =	. 40
Depth of cut D =	. 800
Retreat =	. 40
No. of steps =	1
Feedrate F =	. 32

```

EDIT      LSK      RDY
┌───┐    ┌───┐    ┌───┐
│   │    │   │    │   │
└───┘    └───┘    └───┘

```


(5) Set finish shape.

Grov Width = 0.4
Bottom X = 1.6
Left Z = -2
Edge width=0.2
Right X = 2.4
+C - R = 0.1
Left X = 2.4
+C - R = -0.1
Edge R = 0.01

Depress key.

```

**SHAPE** OD GROV ROUGH T06 00000 N0000
;
N4100 (OD- GROOVE- ROUGH);
G00 T0606;
N4101 G98 S700 M03;
█
GrovWidth=           Right X =
Bottom X =           +C-R =
Left Z =             Left X =
EdgeWidth=           +C-R =
                   Edge R =

```

EDIT LSK RDY

(6) Set escape.

Select "2: Free point".

Depress key.

```

**ESCAPE** OD GROV ROUGH T06 00000 N0000
;
N4102 X2.6 Z-1.804;
N4103 G75 X1.608 Z-1.996
      I.08 K.16 F.0032;
█
Escape point= /1:Machine org
              2:Free point
Spindle stop= /1:Yes
Program end = /1:Yes

```

EDIT LSK RDY

(7) Input "Free point".

No other input is accepted because operation is stopped at turning end point.

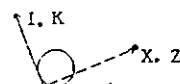
Depress key.

```

**ESCAPE** OD GROV ROUGH T06 00000 N0000
;
N4102 X2.6 Z-1.804;
N4103 G75 X1.608 Z-1.996
      I.08 K.16 F.0032;
█
Escape point= 0:Ext org/1:Machine org
              

```

X =
Z =
I =
K =



EDIT LSK RDY

3.15.10 Groove Finish Turning

(1) Variable turning menu







Select "4 Groove".

Depress **ENTER** key.

```

** MENU **                                00000 N0000

;
N4104:
N4105:
█
  
```

1 Face 	2 O. D. 	3 I. D. 		
█ Groove 	5 Drill 	6 Thread 		

```

EDIT          LSK          RDY
┌ END ─┬──┬──┐ ┌ modify ┬──┬──┐ ┌ MANUAL ┬──┬──┐ ┌ ENTER ┬──┬──┐
└──┘ └──┘ └──┘ └──┘ └──┘ └──┘ └──┘ └──┘ └──┘
  
```

(2) Detailed turning menu.







Select "2 O.D. groove fin".

Depress **ENTER** key.

```

** MENU **                                00000 N0000

;
N4104:
N4105:
█
  
```

█ O. D. 	2 O. D. groove fin 	3 Face 	4 Face groove fin 	
5 I. D. 	6 I. D. groove fin 			

```

EDIT          LSK          RDY
┌ END ─┬──┬──┐ ┌ PROCESS ┬──┬──┐ ┌ MANUAL ┬──┬──┐ ┌ ENTER ┬──┬──┐
└──┘ └──┘ └──┘ └── SEARCH ┬──┬──┐ └──┘ └──┘ └──┘ └──┘
  
```

(3) Set approach data.

Depress **ENTER** key.

```

**APPROACH** OD GROV FIN 00000 N0000

;
N4104:
N4105:
█
  
```

```

Approach X= 2.6000 Gear= 0:Normal /1:High
Tool no = 0606 2:Low
Surf speed= 700 Turn= 0:Normal
Spin speed= 1:Reverse
Spin max = Oil = 0:On /1:Off
  
```





```

EDIT          LSK          RDY
┌   ─┬──┬──┐ ┌ modify ┬──┬──┐ ┌ MANUAL ┬──┬──┐ ┌ ENTER ┬──┬──┐
└──┘ └──┘ └──┘ └──┘ └──┘ └──┘ └──┘ └──┘ └──┘
  
```


(2) Detailed turning menu.

Select "1 O.D. thread".

Depress **ENTER** key.

** MENU **		00000 N0000	
N4204 G00 X2.6 W0.05; ; N4205 G51; N4206 M01; H			
1 O. D. thread 	2 I. D. thread 	3 O. D. taper 	4 I. D. taper 
EDIT		LSK	
END	EXIT	PROCES SEARCH	RDY MANUAL ENTER

(3) Set approach data.

Approach X = 2.6

Approach Z = 0.1

Tool no. = 0707

Spin speed = 300

Depress **ENTER** key.

APPROACH OD THREAD		00000 N0000	
N4204 G00 X2.6 W0.05; ; N4205 G51; N4206 M01; H			
Approach X =	Z =	Gear = 0:Off / 1:High 2:Low	Turn = 0:Normal 1:Reverse
Tool no =	Spin speed =	Oil = 0:On / 1:Off	Chamfer = 0:On / 1:Off
EDIT		LSK	
[]	EXIT	modify insert	RDY MANUAL ENTER

(4) Set finish shape.

Pitch = 0.08

End pos. Z = -1.6

Diameter = 2.4

Depress **ENTER** key.

SHAPE OD THREAD		T07 00000 N0000	
G00 T0707; G97 S300 M03; M23; N6101 X2.6 Z.1; H			
Pitch =		1st depth =	. 140
End pos. Z =		Edge angle =	60
Diameter =		(29, 30, 55. 60, 80)	
Height =			
EDIT		LSK	
[]	EXIT	modify insert	RDY MANUAL ENTER

(5) Set escape.

Escape point =
0: Ext org.

Spindle stop = 1:Yes

Program end = 1:Yes

Depress **ENTER**
key.

```

**ESCAPE** OD THREAD ' T07 00000 N0000
;
N6102:
N6103 G76 X2.2960 Z-1.6
      K.0516 D.014 E.00 A60:
█

```

Escape point= **0:Ext**/1:Machine org
2:Free point

Spindle stop= **0:No**/1:Yes
Program end = **0:No**/1:Yes

EDIT LSK RDY
[] [EXIT] [modify
insert] [MANUAL] [ENTER]







(6) Depress **END** key.

```

** MENU **                               00000 N0000

```

N6104 G51:
M09;
T0100 M05:
N6105 M30:
█

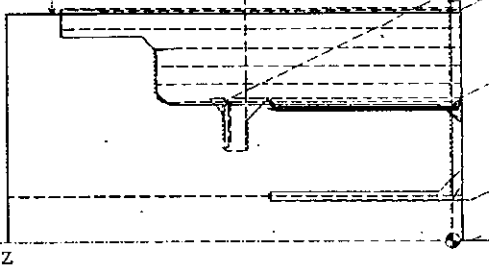
1 Face 	2 O. D. 	3 I. D. 		
4 Groove 	5 Drill 	<input checked="" type="checkbox"/> Thread 		

EDIT LSK RDY
[END] [EXIT] [modify
insert] [MANUAL] [ENTER]

3. 15. 12 Drawing

Draw finish shape
with drawing func-
tion.

DRAWING 04000 N6105



MEMORY LSK RDY
[BLANK
SET] [SCALE] [START] [BLANK
SHAPE] [CLEAR]

4. CALCULATION FUNCTION

Depress the **CALC** key displayed at the bottom of the normal PROG function screen and conversational mode finishing form screen, to display the following calculation function menu screen.

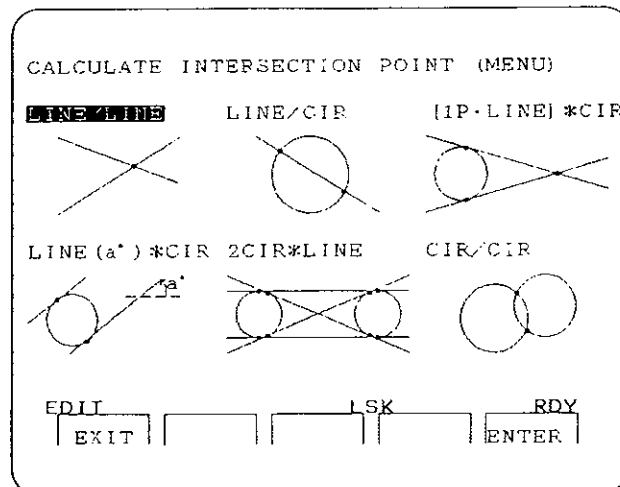
The following menu is prepared in the calculation function.

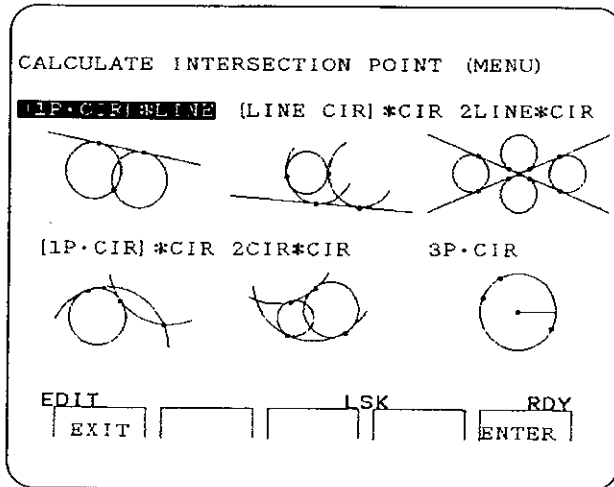
- (a) Line/Line ... Calculates the intersection point of line and line.
- (b) Line/Circle ... Calculates the intersection points of line and circle.
- (c) [1 Point·Line]* Circle ... Calculates the contact points of 2 lines that intersect one point and contact a circle.
- (d) Line (angle)* Circle ... Calculates the contact points of a line of specified angle and a circle.
- (e) 2 Circles* Line ... Calculates the contact points of a line that contacts two circles.
- (f) Circle/Circle ... Calculates the intersection points of two circles.
- (g) [1 Point.Circle]* Line ... calculates the contact points of a circle that intersects one point and contacts a line.
- (h) [LINE Circle]* Circle ... Calculates the contact points of a circle that contacts a line and circle.
- (i) 2 Lines* Circle ... Calculates the contacts of a circle that contacts two lines.
- (j) [1 Point·Circle]* Circle ... Calculates the contact points of a circle that intersects one point and contacts another circle.
- (k) Two circles* Circle ... Calculates the contact points of a circle that contacts two circles.
- (l) Three points.Circle ... Calculates the center and radius of a circle that intersects three points.

The "/" in the above menu represents "intersections", ".", "intersects" and "*" "contacts".

- (a) to (f) are displayed on the first page of the calculation function menu screen, and (g) to (l) on the second page. The pages can be changed by depressing the page key.

Depress the **RETURN** key to return to the previous screen; the program screen or interactive finishing form screen.

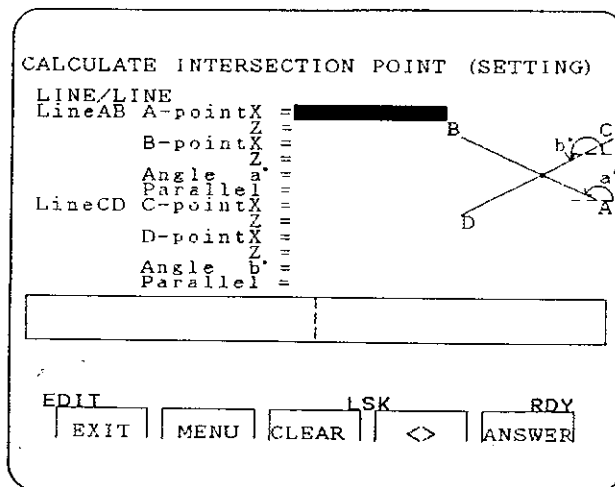




The calculation is made by the following operation.

4.1 INTERSECTION POINT OF LINE AND LINE

- (1) Depress the page keys, the cursor keys, or the key on the calculation function menu screen, to move the cursor to "line/line". Then, depress the key. The intersection point calculation (setting) screen as shown in the figure is displayed.



Enter the coordinates using the program coordinate system of the drawing. The answer is also calculated in the same program coordinate system.

- (2) Enter the data as follows.

Two coordinate points or one coordinate point plus angle must be entered to express a line.

- (a) Enter the X coordinate of point A.

For example, operate as follows, to enter "10.0".

Depress the $\boxed{1}$ $\boxed{\emptyset}$ \boxed{WR} keys in that order.

The \boxed{U} key can be used to enter the incremental amount from the current setting. For instance, depress the following keys to set "20 mm" smaller than the current value; \boxed{U} $\boxed{-}$ $\boxed{2}$ $\boxed{\emptyset}$ \boxed{WR} .

Depress \boxed{U} \boxed{WR} , to set the X coordinate of the current form, only when called up from the conversational finishing form screen. Depress \boxed{U} \boxed{WR} when called up from the program screen, to set 0.

The cursor moves to the "A point Z" position after input.

- (b) Enter the Z coordinate of the A point.

The \boxed{W} key is used to enter the incremental amount from the current setting.

Depress \boxed{W} \boxed{WR} to set the Z coordinate of the current form, only when called up from the interactive finishing formscreen.

The cursor moves to the "B point X" position after input.

- (c) Enter the X coordinate of the B point.

The cursor moves to the "B point Z" position after input.

- (d) Enter the Z coordinate of the B point.

The cursor moves to the "angle a°" position after input.

- (e) Enter the angle a°.

The clockwise direction toward the Z-axis is the positive direction of the angle. The range that can be input is -360° to 360°.

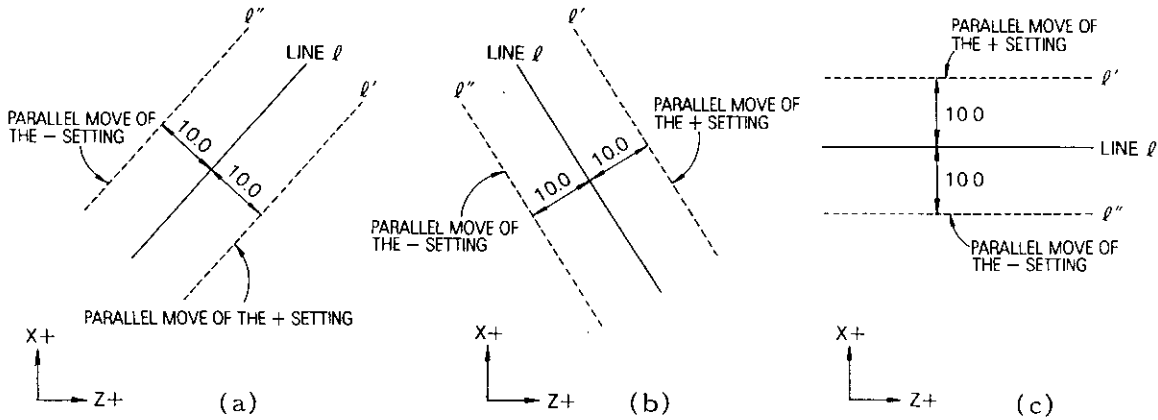
However, there is no need for input when two points passing line AB are input. Input the angle, only when either point A or point B is not input.

- (f) Input the parallel move amount.

Parallel move of the line for the preset value is performed, also considering the sign. If the setting value is positive, it moves to the Z-axis + direction, if it is negative, it moves to the Z-axis - direction.

For example, in the following (a), (b), set 10.0 for parallel movement of line l to l' . set -10.0 for parallel movement of line l to l'' . (The setting value is the move distance in the perpendicular direction of the line.)

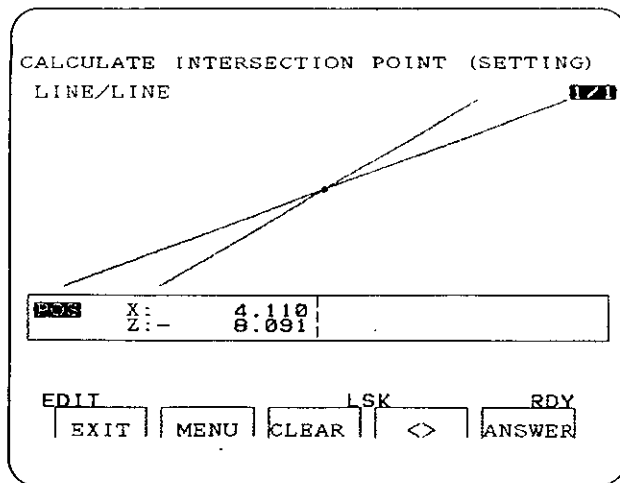
Note that lines parallel with the Z-axis are moved to the X-axis + direction when the setting value is positive, and to the X-axis - direction when the setting value is negative. (Example (c))



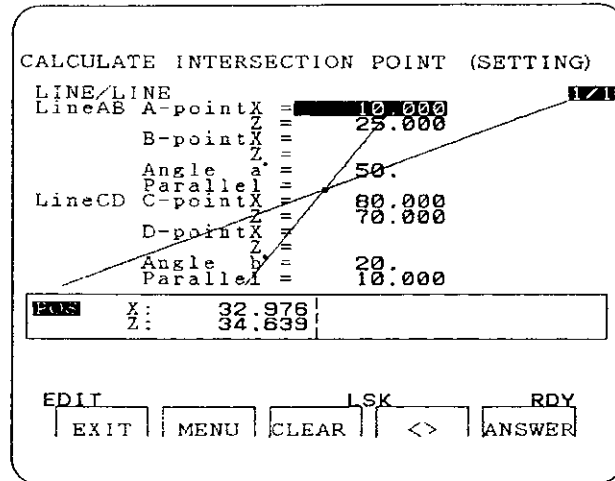
After the input, the cursor moves to the "line CD C point X" position.

- (g) Input the values for line CD, in the same manner as for line AB.
- (h) If correction is needed, use the cursor move keys \triangle ∇ or the $\boxed{\text{WR}}$ key to move the cursor.
- (i) Depress the $\boxed{\text{ORG}}$ key to clear the item at the cursor position.
- (j) Depress the $\boxed{\text{ANSWER}}$ key.

The answer as well as the input figure and the answer point "." are displayed. When the line was specified by coordinate input of two points, the angle is also calculated, to rewrite the correct value of angle a° .



- (k) Depress the $\boxed{\langle \rangle}$ keys to display the setting value again. The setting value can be corrected, if so desired. After correcting the setting value using the numeral keys plus $\boxed{\text{WR}}$, depress the $\boxed{\text{ANSWER}}$ key to display the result of calculation.



- (l) Depress the **MENU** key to return to the "calculation function (menu)" screen.
- (m) Depress the **CLEAR** key to clear the setting value, and to return to the display of 4.1 (1).
- (n) Depress the **RETURN** key.
 After returning, depress the following keys on the interactive finishing form screen, to display the following.

X **WR** in this order to display the X coordinate of the result of calculation.

Z **WR** in this order, to display the Z coordinate.

(3) Notes

- (a) When there are not enough items to calculate the intersection point. "Setting item insufficient" is displayed. Supply the missing items. Refer to the following table for details on the input pattern.

Point A X	Point A Z	Point B X	Point B Z	Angle	Remarks
○	○	○	○		
○	○			○	
		○	○	○	
○				○	180°, 0°, 360° -180°, -360° → Parallel with the Z-axis
		○		○	180°, 0°, 360° -180°, -360° → Parallel with the Z-axis
	○			○	90°, 270° -90°, -270° → Parallel with the X-axis
			○	○	90°, 270° -90°, -270° → Parallel with the X-axis
○	○	○	○	○	Angle offset

Input can be made by the pattern of the above table.

When the angles are specified in the Remarks column of the input pattern, the specified angles alone can be input.

- (b) If no intersection point exists as a result of calculation by the input value, "intersection operation error" will be displayed.
- (c) The answer calculated by the calculation function is effective until the calculation function [ANSWER] key is depressed next. The answer will otherwise be kept unless the power is turned off.
The previously calculated answer and angle of the line can be used in the calculation function as follows, as long as the [ANSWER] key is still not depressed.

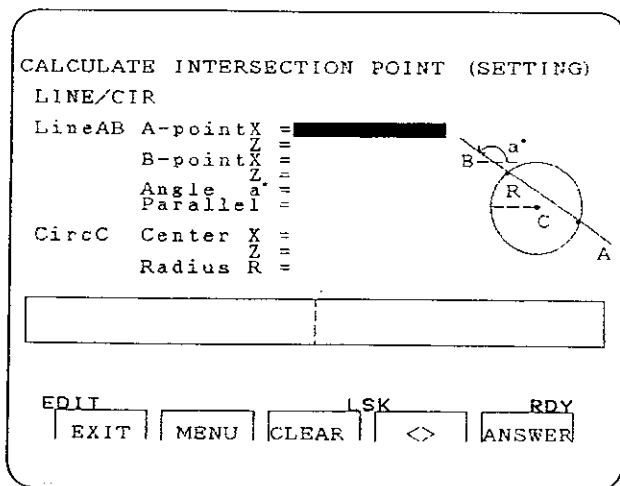


4.2 INTERSECTION POINTS OF LINE AND CIRCLE

- (1) Depress the page keys , the cursor keys , or the WR key in the "calculation function (menu)" screen to move the cursor to the "LINE/CIR" position.

Depress the [ENTER] key.

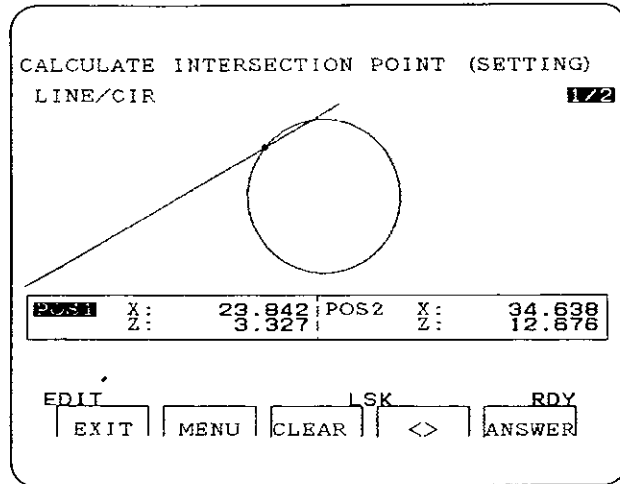
The following screen appears.



- (2) Enter each item in the same manner as Par. 4.1, "INTERSECTION POINT OF LINE AND LINE". Enter the center X, Z coordinates and radius R as the circle data.

Warning appears if any one of these three is missing, and no calculation can be made. when the radius R is displayed in capital letters in the input item display as in this menu, entering a negative value for the radius will cause a warning.

Depress the [ANSWER] key. If two intersection points are output, two answers, "POS1" and "POS2" are displayed. The page is displayed at the upper right position of the screen.



(a) The cursor appears first at the "POS1" position.

Depress the page keys \uparrow \downarrow to move the cursor between "POS1" and "POS2". The cursor position intersection point will be displayed on the screen by a ".".

Therefore, set the cursor at the intersection that is needed.

(b) Depress the RETURN key.

(c) Depress X WR or Z WR in this order in the returned screen, to display the coordinate of the intersection point selected in (a).

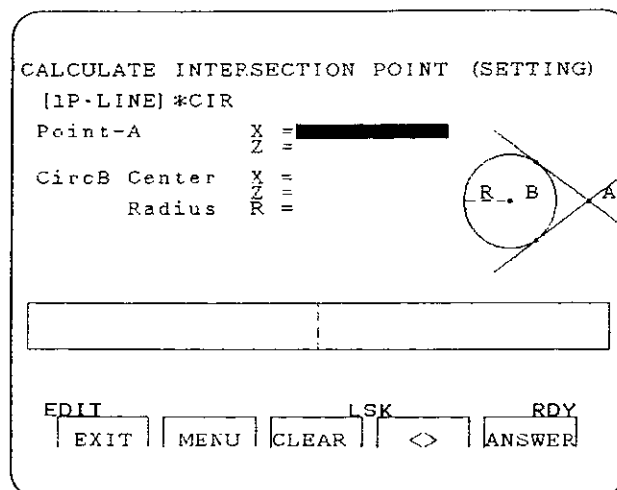
(3) Notes

Same as the notes for Par. 4.1.(3).

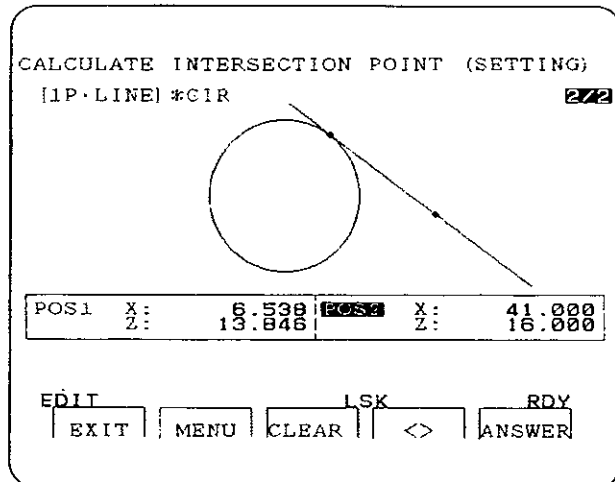
4.3 CONTACT POINTS OF LINE INTERSECTING ONE POINT AND A CIRCLE

(1) Depress the page keys \uparrow \downarrow , the cursor keys \uparrow \downarrow , or the WR key in the "calculation function (menu)" screen to move the cursor to the "[1P·LINE]* CIR" position.

Depress the ENTER key to display the following screen.



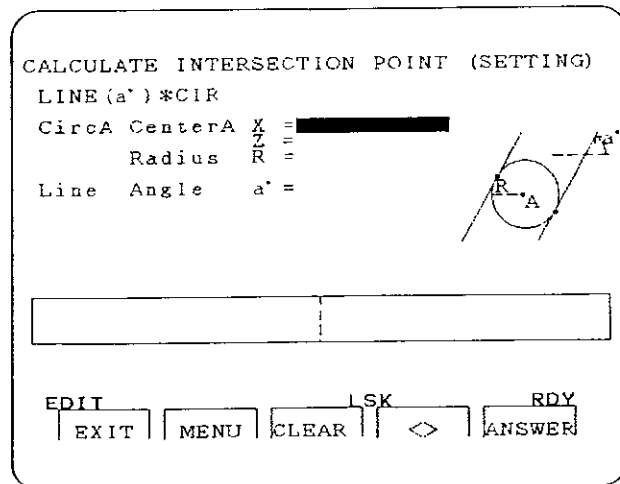
- (2) Enter the 1 point and circle, in the same manner as Par. 4.1, "INTERSECTION POINT OF LINE AND LINE" and Par. 4.2, "INTERSECTION POINTS OF LINE AND CIRCLE".
- (3) If two contacts are calculated by depressing the **ANSWER** key, two answers, "POS1" and "POS2" appear, and the page is displayed in the upper right corner of the screen.



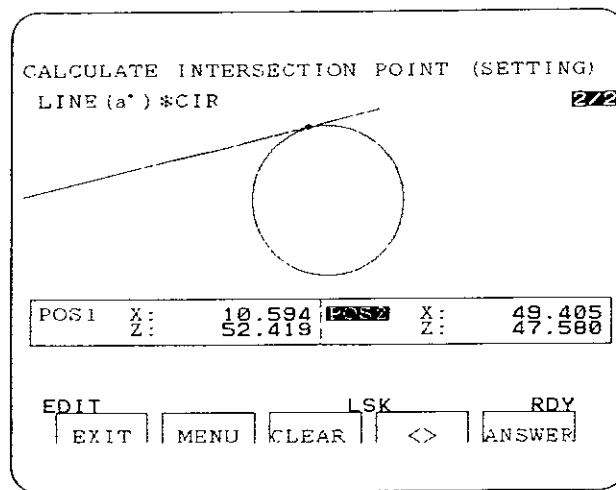
- (a) The cursor appears first at the "contact point 1" position.
 Depress the page keys **▲** **▼** to move the cursor between "POS1" and "POS2". The cursor position contact point will be graphically displayed on the screen.
 Therefore, set the cursor at the required contact.
- (b) Depress the **RETURN** key.
- (c) Depress **X** **WR** or **Z** **WR** in this order, in the returned screen, to display the coordinate of the intersection point selected in (a).
- (4) Notes
 Same as the notes for Par. 4.1 (3).

4.4 CONTACT POINTS OF LINE OF THE SPECIFIED ANGLE AND CIRCLE

- (1) Depress the page keys **▲** **▼**, the cursor keys **▲** **▼**, or the **WR** key in the "calculation function (menu)" screen to move the cursor to the "LINE (a°) * CIR" position.
 Depress the **ENTER** key. The following screen appears.



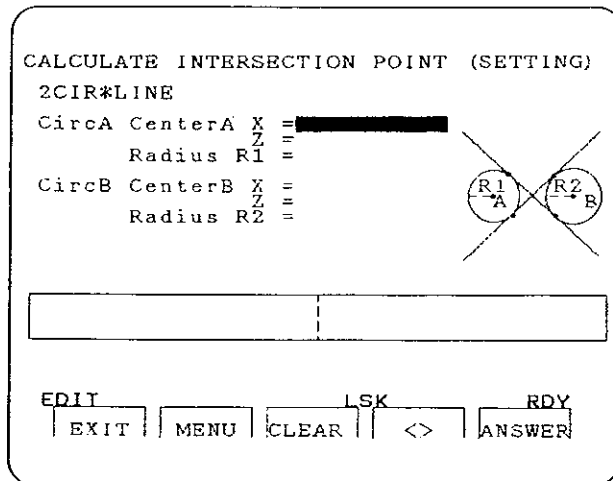
- (2) Enter the circle and angle of line, in the same manner as Par. 4.1, "INTERSECTION POINT OF LINE AND LINE" and Par. 4.2, "INTERSECTION POINTS OF LINE A AND CIRCLE".
- (3) Depress the [ANSWER] key. Select the result of the calculation in the same manner as Par. 4.3, "INTERSECTION POINTS OF LINE AND LINE", and refer to the answers.



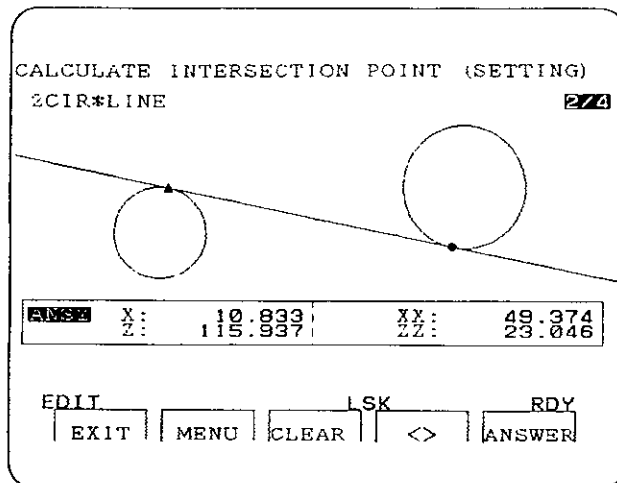
- (4) Notes
Same as the notes for Par. 4.1 (3).

4.5 CONTACT POINTS OF A LINE THAT CONTACTS TWO CIRCLES

- (1) Depress the \uparrow \downarrow page keys, the \downarrow \uparrow cursor keys, or the [WR] key on the "calculation function (menu)" screen, to move the cursor to "2CIR * LINE" position.
Then, depress the [ENTER] key. The intersection point calculation (setting) screen as shown in the figure is displayed.



- (2) Enter the two circles, in the same manner as Par. 4.1, "INTERSECTION POINT OF LINE AND LINE" and Par. 4.2, "INTERSECTION POINTS OF LINE AND CIRCLE".
- (3) Depress the **ANSWER** key.
- (a) The (two) contact points of one calculated line are numerically and graphically displayed.
- (b) Point (X, Z) on the left side of the answer field is displayed by ".", and point (XX, ZZ) on the right side is displayed by "▲".








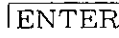
- (c) The answer is a maximum of four lines (with eight contact points). The number of answers is displayed as the number of pages in the upper right part of the screen.
- (d) When there are multiple answers, depress the **▲** **▼** page keys to switch the answers from "answer 1" to "answer 4". The necessary contacts are also displayed.
- (e) Depress the **RETURN** key.
- (f) Depress **X** **WR** or **Z** **WR** in this order in the returned screen, to display the left side coordinate of the contact pair displayed in (d).
Depress **X** **X** **WR** or **Z** **Z** **WR** in this order to display the right side coordinate.

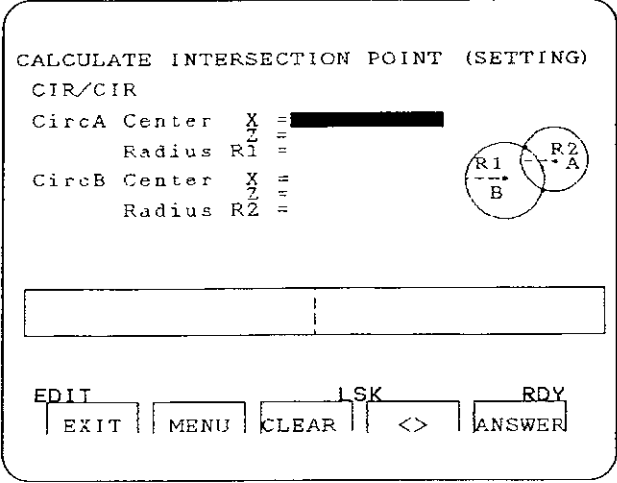
(4) Notes

- The two circles can be circumscribed, inscribed, intersected, or separated. However, "cross point error" occurs if one circle is included in the other.
- If two contacting circles are input, and a line that intersects the contact points is selected, (X, Z) and (XX, ZZ) become the same.
- See the notes for Par. 4.1. (3) for additional details.


4.6 INTERSECTION POINTS OF CIRCLE AND CIRCLE

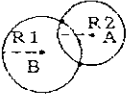
(1) Depress the page keys  , the cursor keys  , or the  key in the "calculation function (menu)" screen to move the cursor to the "CIR/CIR" position.


Depress the  key. The following screen appears.



CALCULATE INTERSECTION POINT (SETTING)
CIR/CIR

CircA Center $X \frac{Z}{2}$ = 
Radius R1 =
CircB Center $X \frac{Z}{2}$ =
Radius R2 =



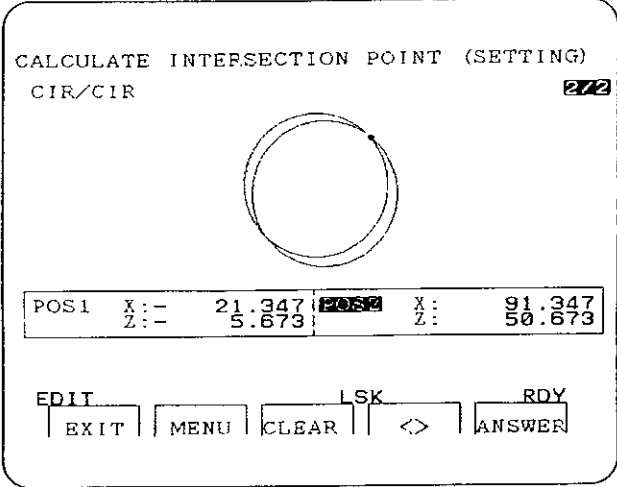



EDIT LSK RDY
EXIT MENU CLEAR <> ANSWER

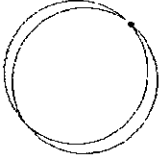
(2) Enter the two circles, in the same manner as Par. 4.1, "INTERSECTION POINT OF LINE AND LINE" and Par. 4.2, "INTERSECTION POINTS OF LINE AND CIRCLE".

(3) Depress the  key.

The resultant calculation is treated as described in Par. 4.2 "INTERSECTION POINTS OF LINE AND CIRCLE".



CALCULATE INTERSECTION POINT (SETTING)
CIR/CIR 



POS1 X:- 21.347 POS2 X:- 91.347
Z:- 5.673 Z:- 50.673

EDIT LSK RDY
EXIT MENU CLEAR <> ANSWER

(4) Notes

Same as the notes for Par. 4.1 (3).

4.7 CONTACT POINTS OF CIRCLE THAT INTERSECTS ONE POINT AND CONTACTS A LINE

(1) Depress the page keys \uparrow \downarrow , the cursor keys \uparrow \downarrow , or the $\boxed{\text{WR}}$ key in the "calculation function (menu)" screen to move the cursor to the "[IP·CIR] * LINE" position.

Depress the $\boxed{\text{ENTER}}$ key. The following screen appears.

(2) Enter the point, line, and the radius of the contacting circle, in the same manner as Par. 4.1, "INTERSECTION POINT OF LINE AND LINE". No negative value is accepted as the radius of the contacting circle.

(3) Depress the $\boxed{\text{ANSWER}}$ key. Select the result of calculation in the same manner as Par. 4.3, "CONTACT POINTS OF LINE INTERSECTION ONE POINT AND CIRCLE", and refer to the answers.

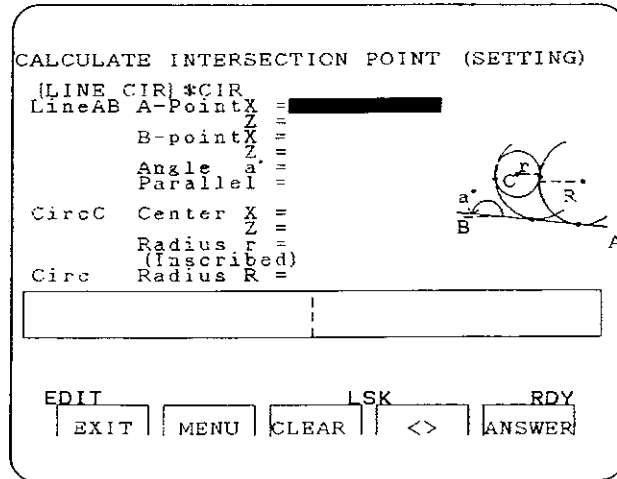
(4) Notes

Same as the notes for Par. 4.1 (3).

4.8 CONTACT POINTS OF CIRCLE CONTACTING A LINE AND CIRCLE

- (1) Depress the page keys $\boxed{\wedge} \boxed{\vee}$, the cursor keys $\boxed{\wedge} \boxed{\vee}$, or the \boxed{WR} key in the "calculation function (menu)" screen to move the cursor to the "[LINE CIR] * CIR" position.

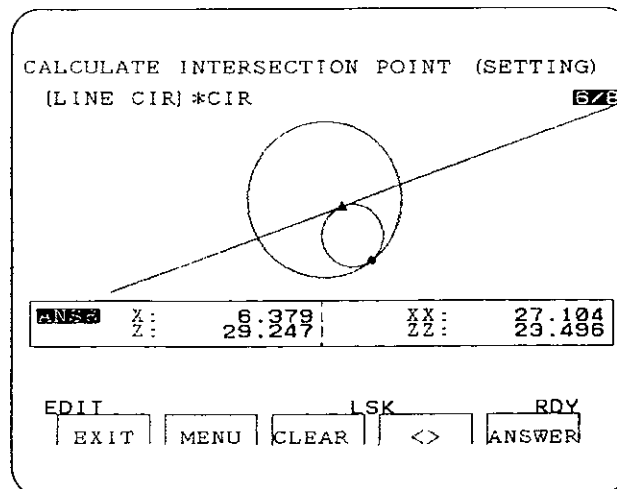
Depress the \boxed{ENTER} key. The following screen appears.



- (2) Enter the line, circle, and the radius of the contacting circle, in the same manner as Par. 4.1, "INTERSECTION POINT OF LINE AND LINE" and Par. 4. 2, "INTERSECTION POINTS OF LINE AND CIRCLE".

Note that a negative value is also accepted in this menu, as the radius r of circle C. When a negative value is input, the display of the inscribing circle has priority.

- (3) Depress the \boxed{ANSWER} key.
 (a) The value of the two contact points on the circumference of one of the answer circles as well as the inscribing points and the circle are displayed.



- (b) Point (X, Z) on the right side of the answer field is displayed by " \blacktriangle ", and point (XX,ZZ) on the left side is displayed by " \blacktriangle ".

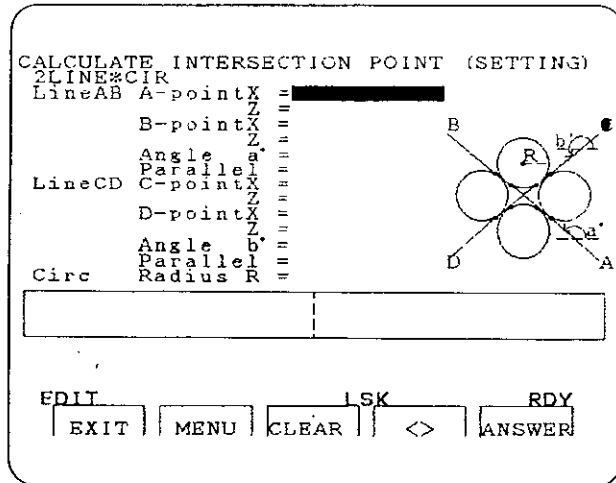
- (c) The answer is a maximum of eight circles (with sixteen contact points).
The number of answers is displayed as the number of pages in the upper right part of the screen.
- (d) When there are multiple answers, depress the $\boxed{\wedge}$ $\boxed{\vee}$ page keys to switch the answers from "answer 1" to "answer 8". The necessary contacts are also displayed.
- (e) Depress the $\boxed{\text{RETURN}}$ key.
- (f) Depress \boxed{X} $\boxed{\text{WR}}$ or \boxed{Z} $\boxed{\text{WR}}$ in this order in the returned screen, to display the left side coordinate of the contact pair displayed in (d).
Depress \boxed{X} \boxed{X} $\boxed{\text{WR}}$ or \boxed{Z} \boxed{Z} $\boxed{\text{WR}}$ in this order to display the right side coordinate.

(4) Notes

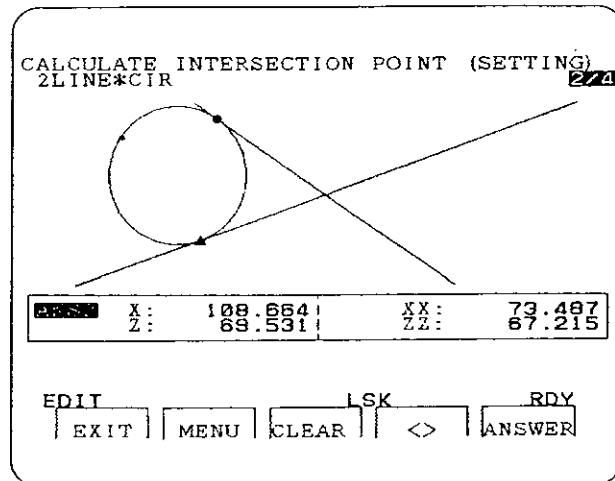
- When the input line and circle intersect, there are a maximum of eight answer circles, but if they do not, the number of the answer is a maximum of four.
- See the notes for Par. 4.1. (3) for additional details.

4.9 CONTACT POINTS OF CIRCLE CONTACTING TWO LINES

- (1) Depress the page keys $\boxed{\wedge}$ $\boxed{\vee}$, the cursor keys $\boxed{\wedge}$ $\boxed{\vee}$, or the $\boxed{\text{WR}}$ key in the "calculation function (menu)" screen to move the cursor to the "2 LINE * CIR" position.
Depress the $\boxed{\text{ENTER}}$ key. The following screen appears.



- (2) Enter the two lines and the radius of the contacting circle in the same manner as Par. 4.1, "INTERSECTION POINT LINE AND LINE".
- (3) Depress the $\boxed{\text{ANSWER}}$ key.
There are a maximum of four circles (with eight contact points). The answers are handled in the same way as Par. 4.8, "CONTACT POINTS OF CIRCLE CONTACTING A LINE AND CIRCLE".



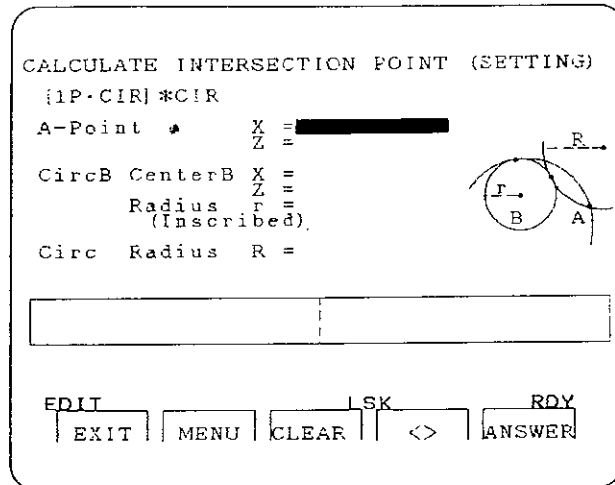
(4) Notes

See the notes for Par. 4.1.(3).

4.10 CONTACT POINTS OF CIRCLE THAT INTERSECTS ONE POINT AND CONTACTS CIRCLE

(1) Depress the page keys \uparrow \downarrow , the cursor keys \downarrow \uparrow , or the $\boxed{\text{WR}}$ key in the "calculation function (menu)" screen to move the cursor to the "[IP·CIR] * CIR" position.

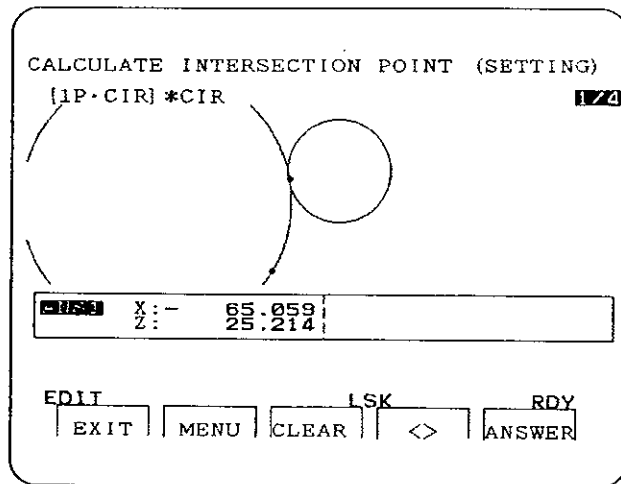
Depress the $\boxed{\text{ENTER}}$ key. The following screen appears.



(2) Enter the 1 point, circle, and radius of the contacting circle, in the same manner as Par. 4.1, "INTERSECTION POINT OF LINE AND LINE" and Par. 4.2, "INTERSECTION POINTS OF LINE AND CIRCLE".

Note that a negative value is also accepted in this menu, as the radius r of circle B. when a negative value is input, the display of the inscribing circle has priority.

- (3) Depress the **ANSWER** key.
- (a) The value of the one contact point on the circumference of one of the answer circles as well as the inscribing points and the circle are displayed. Point (X,Y) is displayed by ".".

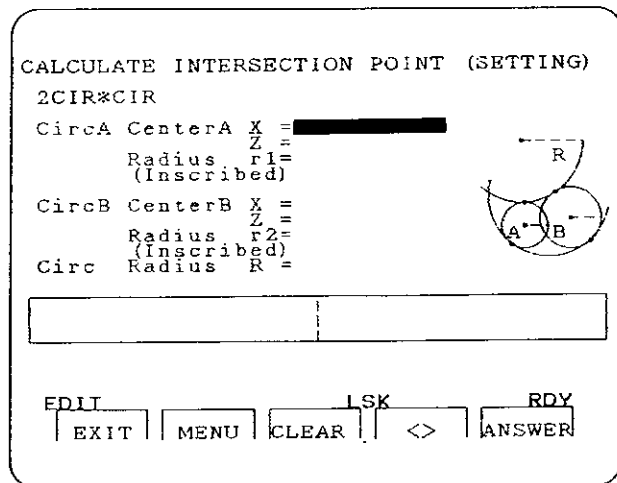


- (b) The answer is a maximum of four circles (with four contact points). The number of answers is displayed as the number of pages in the upper right part of the screen.
- (c) When there are multiple answers, depress the page keys **▲** **▼** to switch the answers from "answer 1" to "answer 4". The necessary contacts are also displayed.
- (d) Depress the **RETURN** key.
- (e) Depress **X** **WR** or **Z** **WR** in this order in the returned screen, to display the coordinate of the contact displayed in (c).
- (4) Notes
- The position of input point A is acceptable for either in or out of the input circle B.
 - See the notes for Par. 4.1.(3) for additional details.

4.11 CONTACT POINTS OF CIRCLE CONTACTING WITH TWO CIRCLES

- (1) Depress the page keys **▲** **▼**, the cursor keys **▲** **▼**, or the **WR** key in the "calculation function (menu)" screen to move the cursor to the "2CIR * CIR" position.

Depress the **ENTER** key. The following screen appears.

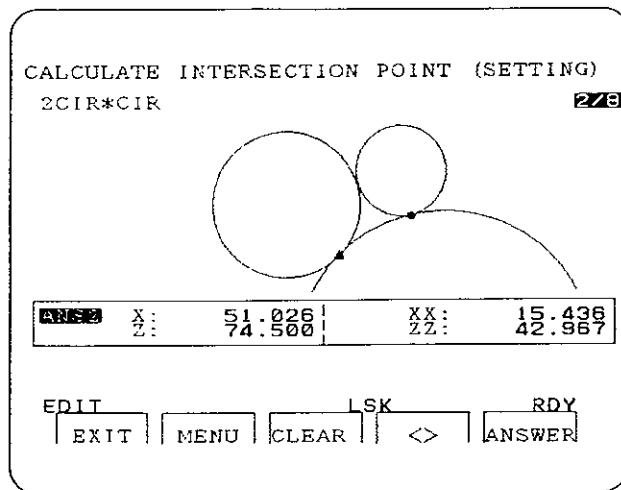


- (2) Enter the radius of the two circles and the contacting circle, in the same manner as Par. 4.1, "INTERSECTION POINT OF LINE AND LINE" and Par. 4.2, "INTERSECTIION POINTS OF LINE AND CIRCLE".

Note that a negative value is also accepted as the radius r of the two circles. When a negative value is input, the display of the inscribing circle has priority.

- (3) Depress the **ANSWER** key.

There are a maximum of eight circles (with sixteen contact points). The answers are handled in the same way as Par. 4.8, "CONTACT POINTS OF CIRCLE CONTACTING A LINE AND CIRCLE".



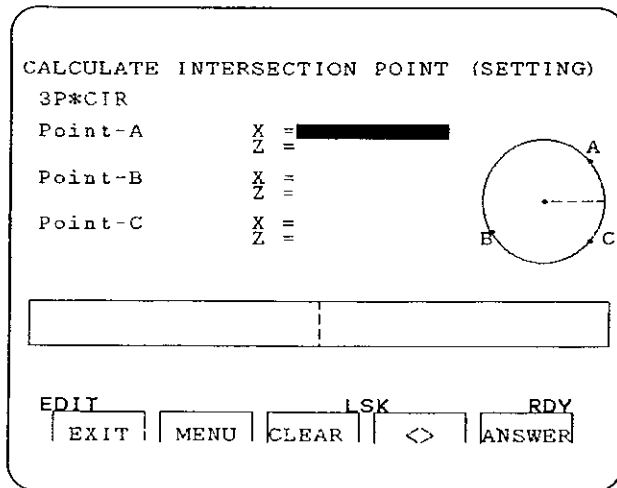
(4) Notes

- No warning will be given nor will the priority be assured when negative values are input as the radius of the input circles when such input should not be made (for example, when the two circles intersect, but one radius is input by negative value, while the other is input by positive value).
- See the notes for Par. 4.1.(3) for additional details.

4.12 CENTER POINT AND RADIUS OF A CIRCLE THAT INTERSECTS THREE POINTS

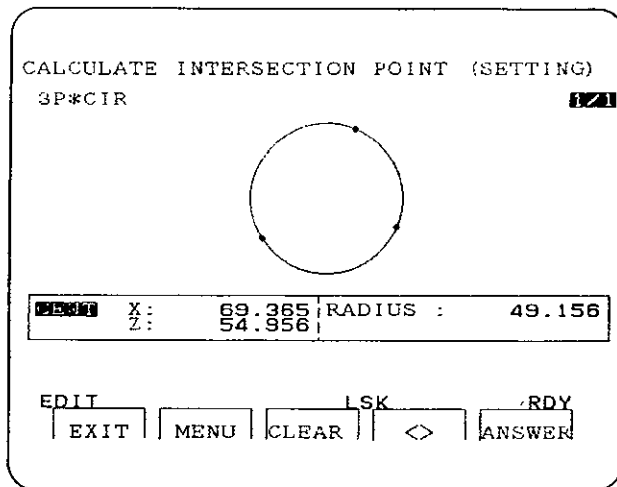
- (1) Depress the page keys $\boxed{\Delta}$ $\boxed{\nabla}$, the cursor keys $\boxed{\Delta}$ $\boxed{\nabla}$, or the \boxed{WR} key in the "calculation function (menu)" screen to move the cursor to the "3P·CIR" position.

Depress the \boxed{ENTER} key. The following screen appears.



- (2) Enter the three points in the same manner as Par. 4.1, "INTERSECTION POINT OF LINE AND LINE".
- (3) Depress the \boxed{ANSWER} key.

The circle that intersects three points is displayed. The center coordinate (X, Z) and the value of the radius are also displayed.



- (4) Depress the \boxed{RETURN} key.

Depress the \boxed{X} \boxed{WR} keys in this order in the returned screen, to display the X coordinate, and \boxed{Z} \boxed{WR} to display the Y coordinate of the center of the circle. Depress \boxed{R} \boxed{WR} in this order to display the radius of the circle.

- (5) Notes

See the notes for Par. 4.1.(3).

5. PROGRAM MODIFICATION

5.1 PREPARATIONS FOR MODIFICATION

- (1) Enter the interactive mode for program modification.
- (2) See par. 3.3.

In the interactive mode, the following display will appear.

If the program is found at the dialog, the program number is displayed in the position "Program number" and the program comment at the position "Comment" as shown on this display.

** PROGRAM NUMBER **		00000 N0000
<input checked="" type="checkbox"/> Old Data 2 New Data		
Program number = 1000		
Comment = (YASNAC)		
MEMORY		LSK
END		ENTER

- (3) Move the cursor to the "Old Data," and depress the key.
The program number will blink on the display.
- (4) If the program number and comment are changed, rewrite them and depress the key.

5.2 MODIFICATION PROCEDURE

The procedure for program modification is executed the same as the displays in Sect. 3. You can modify only the desired process without performing any unnecessary operation.

5.2.1 Modifying the Blank Data

- (1) Modifying
 - (a) Use the , or the key to position the cursor to the item to be modified and enter new data.
 - (b) Depress the key.
- (2) Not modifying
Depress the key.




5.2.2 Selecting the Variable Turning Menu (End Facing, O.D. Turning, etc.)



This display branches to modification of a previously input process and to insertion of a new process.

5.2.2.1 Modifying a Process (mode is used.)

- (1) In this procedure, an existing NC program is deleted in order to create a new NC program.




First select the variable turning menu to be modified.

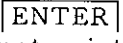
- (a) Use the  ,  , or the  key to position the cursor to the turning menu to be modified.

- (b) Depress the  key to set "Modify" and depress the  key.

The detailed turning menu will appear.

- (2) Selecting the detailed turning menu (rough turning, finishing, etc.)

- (a) Use the  ,  , or the  key to position the cursor to the turning menu to be modified.

- (b) Depress the  key. If the process is not found, a message "Data to modify does not exist" is displayed.




- (c) The system searches for the preset turning block automatically and displays the target program in the program area at the top of the display. The approach setting display appears.

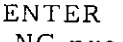
- (d) Notes

- (i) If the same process is used at more than one location, the process found by the search is the first process.
- (ii) All process range is identified by a sequence number.
If a sequence number has been entered manually during the process, the process modification may not be accomplished properly.
- (iii) If an interactive programming is manually edited by NC and then interactively edited for transfer, the transferred program will not reflect the manual editing.

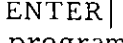
- (3) Modifying the approach

- (a) Modifying the data

- (i) Use the  ,  or the  key to position the cursor to the item to be modified and enter new data.

- (ii) Depress the  key. The previous NC program is deleted and a new approach NC program is created.

- (b) Not modifying the data

Depress the  key without changing the approach data. The same NC program as the previous one is created.

The basic data setting display will appear. When "threading" or "drilling" is instructed, the display changes to the finishing shape display. When "finishing" is instructed, the display changes to the escape setting display.

(4) Modifying the basic data

(a) Modifying the data

Enter new data and depress the `[ENTER]` key.

(b) Not modifying the data

Just depress the `[ENTER]` key. Then the display changes to the finishing shape display.

(5) Modifying the finishing shape

(a) Modifying the end facing, O.D./I.D. turning

The modify mode is initially set on this display. To modify the finishing shape, see (5), (6) and (7) in par. 3.9.1.

If no data is to be modified, depress the `[ENTER]` key. The display will change to the program insert display.

(b) Modifying the grooving, drilling, or threading

Modify by referring to par. 3.9.2, 3.9.3, or 3.9.4.

After the modification, depress the `[ENTER]` key.

If no data is to be modified, depress `[ENTER]` key. Then the display will change to the escape setting display.

(6) Inserting a program

Depress the `[ENTER]` key whether or not the modification has been completed. The display changes to the escape setting display.

(7) Modifying the escape

(a) Modifying the data

Enter new data and depress the `[ENTER]` key.

(b) Not modifying the data

Just depress the `[ENTER]` key. The system returns to the variable turning menu setting display.

(8) Precautions

- The cursor in the variable turning menu list is not displayed.
- If the `[ENTER]` key is depressed when there is no process, a message "Data to modify does not exist" is displayed.
- Any changes in a part exceeding 36 processes are not acceptable.
- If several processes with the same menu number in the process list exist, any process closed to the beginning of the program is deleted. After that, the process list may not be able to correspond to the programs.
- When a process which exists in the process list but not in the program is specified, the cursor at the upper part of the screen points to the beginning of the program at the time when the `[ENTER]` key is depressed.
- When any changes are made in this function, the detailed turning menu is not displayed. The screen is changed to the approach display.
- When the interactive mode is entered in new data editing and then the variable turning menu is returned, process insertion is always selected.

5.2.2.2 Inserting a Process (| | |--------| | modify | | insert | mode is used.)

- (1) A new NC program may be inserted at the cursor location.
For example, this procedure is used to insert grooving between O.D. and I.D. turning or to add threading to the end of the process.
- (a) Use the

▲

 ,

▼

 or the

WR

 key to position the cursor to the machining menu to be inserted.
- (b) Depress the

modify
insert

 key to set "Insert" and depress the

ENTER

 key.
The display will change to the detailed turning menu display.
- (2) Selecting the detailed turning menu (rough turning, finishing, etc.) and searching for the process
- (a) Use the

▲

 ,

▼

 or the

WR

 key to position the cursor to the turning menu to be inserted.
- (b) Search for the insert location.
Depressing the

PROCES
SEARCH

 key causes the system to search successively for the beginning of the processes.
Having searched to the end, the system starts searching again from the beginning of the program.
Depressing the

MANUAL

 key reverses the key indication, which makes available the cursor keys

▲

 and

▼

 at the top of the display.
Depressing the

MANUAL

 key again resets the indication.
Position the cursor to the insert location using these functions. The program will be inserted after the cursor.
- (c) Depress the

ENTER

 key.
The display will change to the approach setting display.
- (3) Inserting the approach
Input the necessary items and depress the

ENTER

 key.
The display will change to the basic data setting display.
If threading or drilling is instructed, the display changes to the finishing shape display. If finishing is instructed, the display changes to the escape setting display.
- (4) Inserting the basic data
Input the necessary items and depress the

ENTER

 key.
The display changes to the finishing shape display.

(5) Inserting the finishing shape

(a) Inserting the end face, O.D./I.D.turning

Set the finishing shape by referring to par. 3.9.1.
The display changes to the program insert display.

(b) Inserting grooving, drilling, or threading

Set by referring to par. 3.9.2, 3.9.3 or 3.9.4.
The display will change to the escape setting display.

(6) Inserting a program

Depress the [ENTER] key. Check the location where the program is to be inserted. The display will change to the escape setting display.

(7) Inserting the escape

Input the necessary items and depress [ENTER] key.
The system will return to the variable turning menu setting display.

(8) Precautions

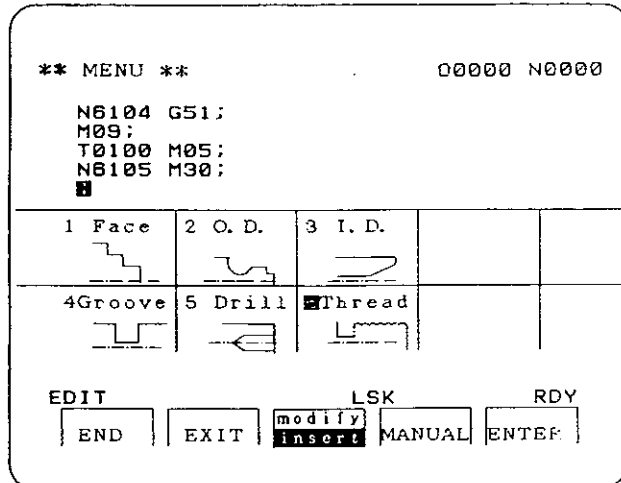
- When the variable turning menu is returned after inserting the process, the cursor always points to the one next to the process which has been currently created.
- For process insertion, even when the same menus exist in the process list, the process is inserted in front of the position indicated by the cursor.
- If the number of processes exceeds 36 after process insertion, they exist in the program but are not displayed in the process list.
- If the variable turning menu display is returned after insertion of the 12th or 24th process, the next page (the second page for 12th process and the third page for 24th process) is displayed in the process list.
- The cursor in the variable turning menu is moved by numerical keys 1 to 6 or the [WR]key. The cursor in the process list is moved by the cursor keys. Two cursors move independently.



5.2.2.3 Deleting a Process.

By specifying a process and performing deleting operation, the process part specified by the program under interactive editing can be deleted.

(1) Procedures

- (a) When the variable turning menu is displayed in the interactive mode, depress the [DELETE] key. Then the [DELETE] key is displayed in reverse and the cursor appears in the line of the variable turning menu in the process list. (Hereafter, this status is called process deletion mode.)
A message "move the cursor and push [ENTER] key" appears.



(b) Move the cursor to the process to be deleted by using the cursor key  or .

(c) Depress the **ENTER** key.

(i) When the rough turning process is specified, especially when its finishing process exists, a message "Finish process is deleted too, OK? (Y/N)" is displayed.

(ii) Other cases

A message "Are you sure? (Y/N)" is displayed. The beginning of the specified process displayed in the program display at the upper part of the screen.

(d) Depress the **Y** or **N** key.

When the **Y** key is depressed

The finishing process corresponding to the specified rough turning process in (i) above is deleted.

For example, in the status shown in the figure, move the cursor to 4.1 (O.D. groove rough turning) and depress the **ENTER** key and the **Y** key in that order. Then the process of 4.2 (O.D. groove finishing rough turning) is deleted at the same time. In the (ii) above, only the specified process is deleted.

After deletion, the process deletion mode is released automatically. That is, the cursor returns to the process menu list and the **DELETE** key returns to its former status.

If any key other than the **Y** key is depressed, the process deletion mode is released.

(2) Other operations

- To release the process deletion mode, depress the **DELETE** key.
- If the process list covers two pages, move the cursor in the process deletion mode to display the second page.

(3) Precautions

- All process ranges are identified by the sequence numbers. If a sequence number is input manually during the operation, the data may not be changed correctly.
- To delete the rough turning process and finishing turning process simultaneously [(1) (c) (i) above], any other process can exist between them and the finishing turning process corresponding to the rough process.
- By executing the process deletion, the form data on the process is also deleted in addition to the program.
- When several processes with the same menu number exist in the process list, the process closed to the beginning of the program is deleted. After that, the process list may not correspond to the programs.

5.3 ENDING THE PROGRAM MODIFICATION

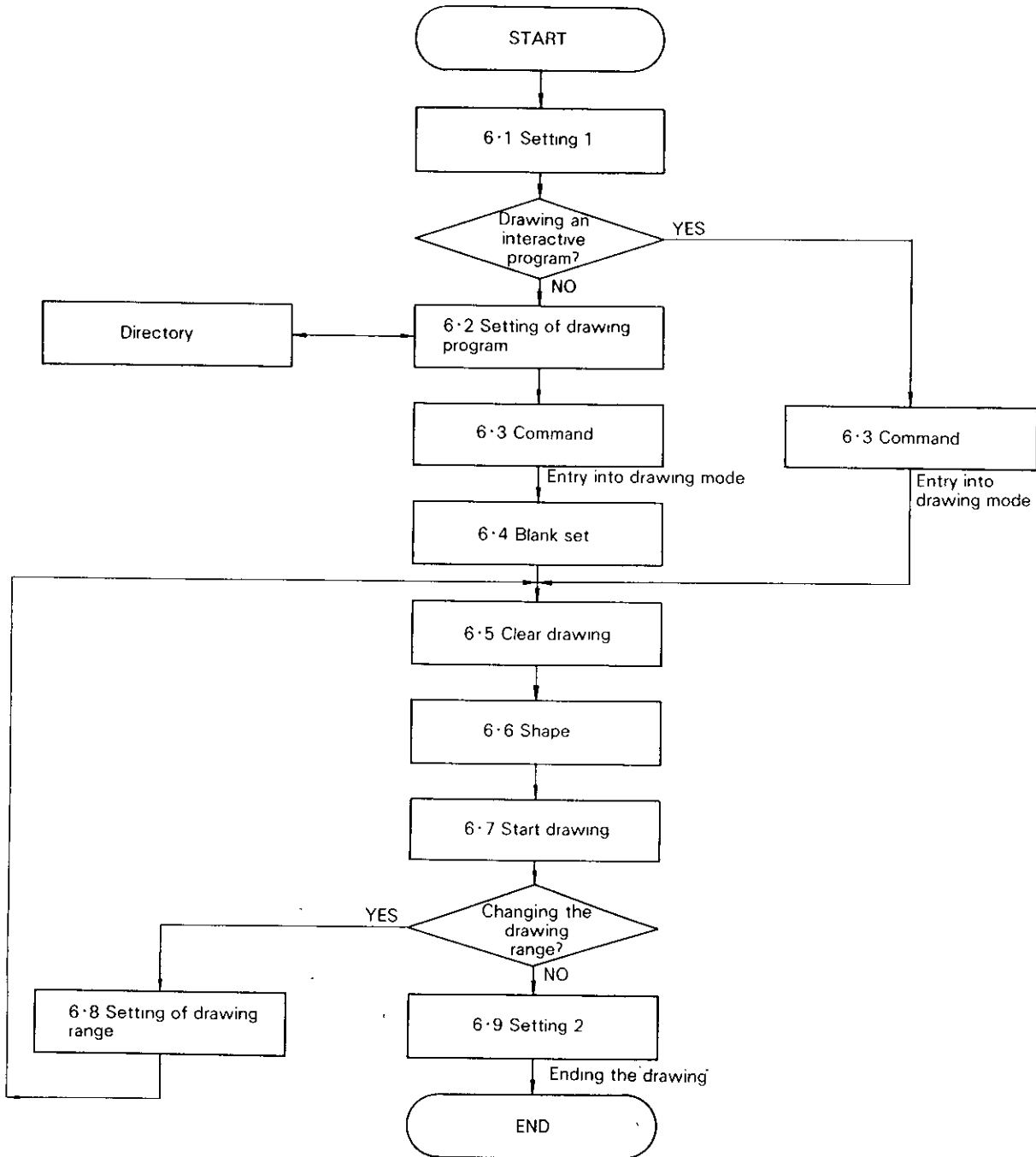
After the modification of the target process, depress the **END** key.
The system ends the program modification and exits from the interactive mode.

NOTE

- Suppose the system ended after modifying the old data during operation in the memory mode. The modified data are not written to memory at the time the system ended. The data will be written to memory at the end of operation.
- When any other function key is depressed to display the variable turning menu again in the process deletion mode, the process deletion mode is released.
- When a process which exists in the process list but not in the program is specified, the cursor at the upper part of the screen points to the beginning of the program at the time when the **ENTER** key is depressed.
- After creating more than 36 processes, the number of process is still 35 even by process deletion. The processes after the first 36 processes are not displayed in the process list.
- By depressing the **DELETE** key when there is no process, the process deletion mode is entered but a message "Data to modify dose not exist" is displayed at the time when the **ENTER** key is depressed.
In the following cases, the program at process deletion becomes faulty.
 - (i) When the sequence of the interactive program is changed
 - (ii) When the final block (M01; or M30;) of the process is changed

6. DRAWING OF PROGRAMMING

The drawing function checks on the display the tracks of a program created by the dialog function. The drawing operation normally runs as follows:




6.1 SETTING 1

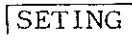
This drawing function is not enabled unless the program is executed in the NC memory mode.

If the interactive programming is checked by the drawing, all machine motion must be stopped first before running the program. Therefore, set the data as follows before entering the drawing mode.



The drawing can also be accomplished during actual cutting. In this case, the machine need not be stopped. Therefore, skip this section.


- (1) Depress the  key.

The system enters the setting function mode.

(If not on the "setting" display, depress the  key.)

- (2) If the "DRAWING CHECK" is OFF:

Use the cursor key ,  to position the cursor to the position "DRAWING CHECK". The "DRAWING CHECK" will blink.


- (3) Depress the  key.


For items the drawing check, auxiliary function lock, dry run, and machine lock, are turned "ON".

6.2 SETTING OF DRAWING PROGRAM

The operation in this section is not necessary for drawing an interactive programming.

- (1) Set the mode select switch to "MEM (memory)".

- (2) Depress the  key.

The system enters the program function mode. If not on the "program" display depress the  key.

The display shown at right will appear.

Two types of program displays are available in the MEM (memory) mode.

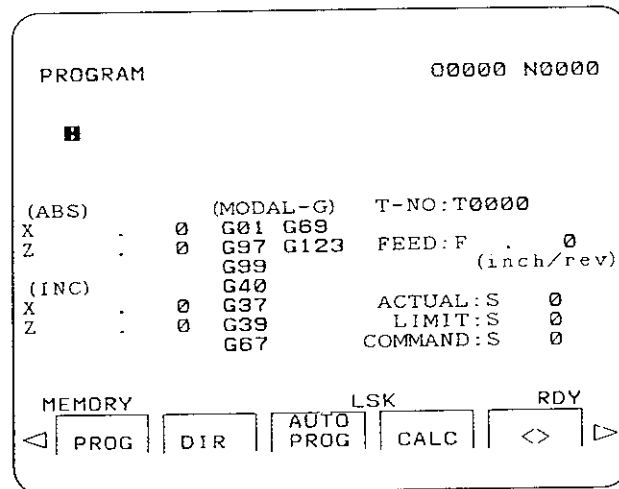


Fig. 6.1

- Display showing the NC program and operation information (Fig. 6.1)
 - Display showing only the NC program (Fig. 6.2)
- These displays can be switched from one to the other by depressing the $\langle \rangle$ key. A drawing program can be established on either of these displays.

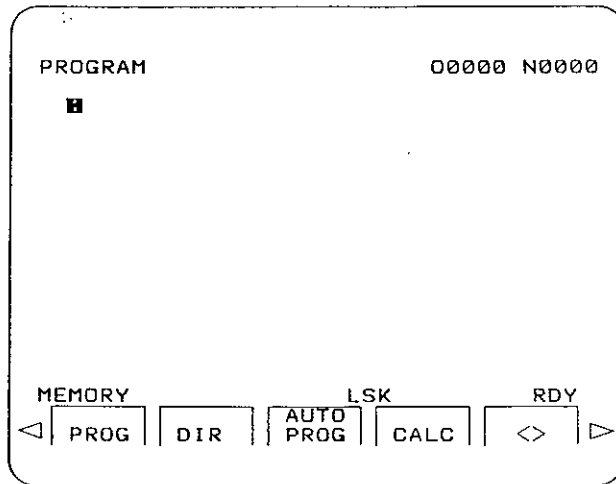


Fig. 6.2

(3) Enter the program number of the program to be drawn and depress the cursor key ∇ . The desired program will be searched.

e.g If the program number is "100," depress keys

$\boxed{0}$ $\boxed{1}$ $\boxed{0}$ $\boxed{0}$ and ∇ in this order.

To check the program number, depress the \boxed{DIR} key and check on the directory display. The display will appear as follows. This effectively calls up the program to be drawn.

•When the program is searched by the display of Fig. 6.1:

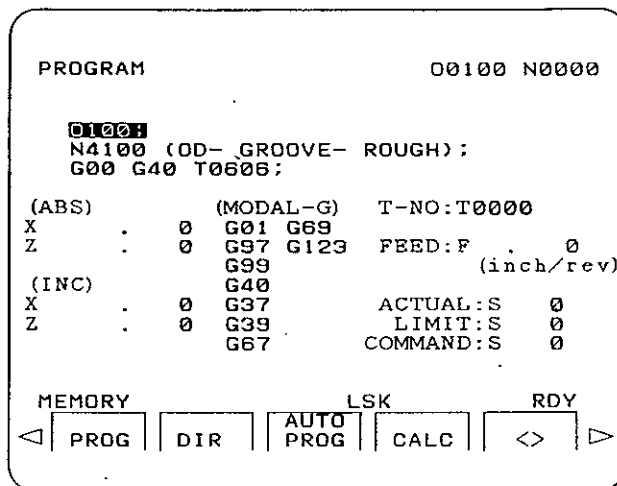
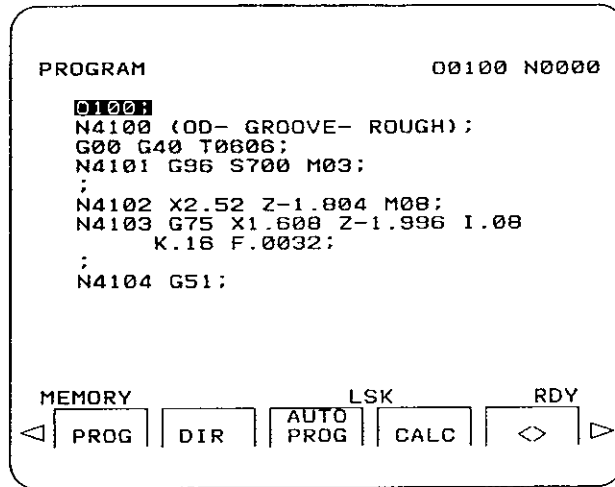



Fig. 6.3

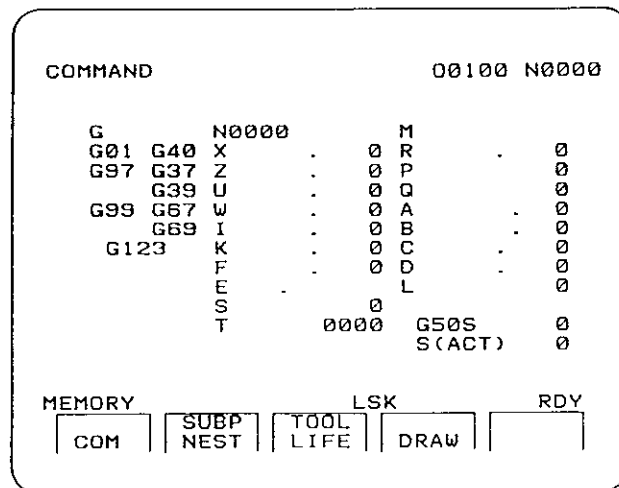
When the program is searched by the display of Fig. 6.2:



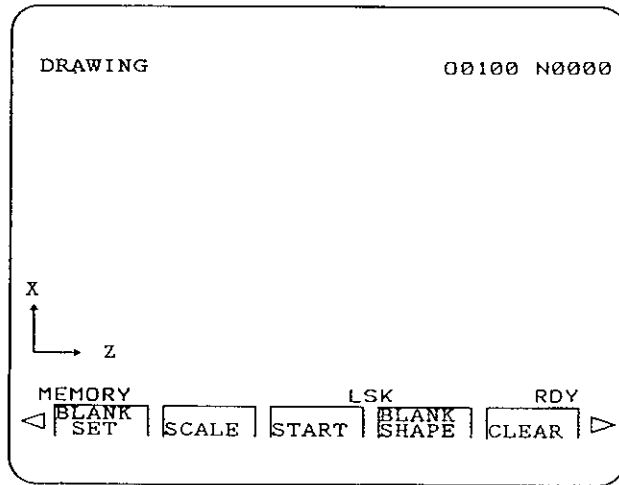
6.3 HOW TO ENTER THE DRAWING MODE

(1) Depress the  key.

The system will enter the command function mode.
The display below will appear.



- (2) Depress the **[DRAW]** key.
 The system enters the drawing mode.
 The display appears as follows:



[◀] (LEFT MENU) and **[▶]** (RIGHT MENU) become valid only when **◀▶** are displayed on the CRT display, respectively.

Depressing **[◀]** or **[▶]** displays the reverse of the function.

On this display, two indications shown below are switched.

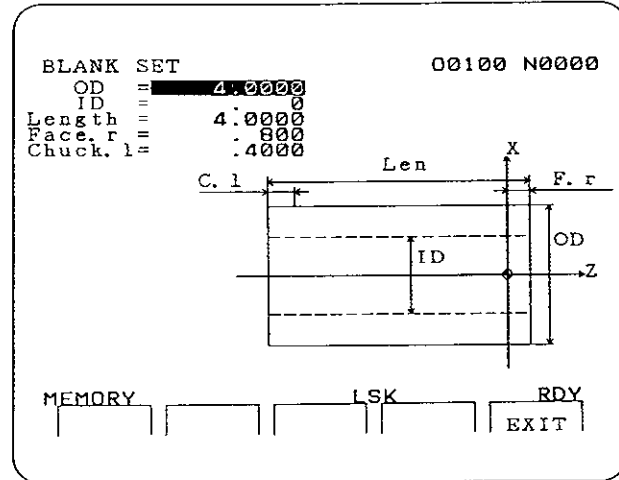


If material data has been input normally, the drawing display appears.
 If material data are either all 0 or not properly input, the display switches automatically to the "BLANK SET" display.

6.4 MATERIAL SETTING

(1) Depress the BLANK key.

The following display will be shown:



The displayed material data are transferred automatically from the dialog section during interactive operation and material setting need not be done at this time. If not in the interactive operation, the material data for the previous drawing will be stored. The data should be rewritten by material data of the O number to be drawn.

The material shape can be set by the following operation:

(a) Enter "O.D."

To enter "100 mm" for example, depress in sequence the , , , and keys.

The "I.D." starts blinking on the display.
See Notes in (2) for cast material.

(b) Next, enter "I.D."

To enter "10 mm" for example, depress in sequence the , , and keys.

The "Length" starts blinking on the display.

(c) Enter "Length."

To enter "150 mm", for example, depress in sequence the , , , and keys.

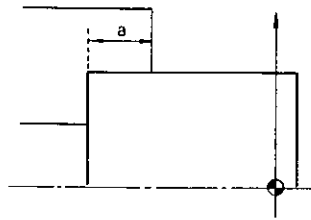
The "Face removal" starts blinking on the display.

(d) Enter the "Face removal" in the same way.

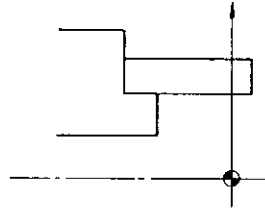
This value determines the reference point and the reference point mark moves on the drawing display.

The "chucking lgth" starts blinking on the display.

- (e) Enter "chucking lgth" in the same way.
The chucking lgth is the length of the section where the chuck grasps the material.






For external claw



For internal claw

- For an external claw, enter the value of (a) without a sign.
 - For an internal claw, enter 0.
- This value is used to check claw interference (for the external claw). The chuck line is indicated by a ↓ mark on the top left of the material on the display. This position is moved.

- (f) If wrong data has been entered:

Use the cursor  or  or the  key to position the cursor to the item in error and enter correct data. The value entered last becomes valid.

- (g) Ending the "BLANK SET"

Depress the  key.

(2) Notes

- (a) For a work piece such as a casting which has a material shape similar to a finishing shape, the "rough cycle" with G71 or G72 will have excessive air cut, which is a waste of time.
In such a case, instruct manually G73 or a "closed loop cutting cycle".
For details of the closed loop cutting cycle, refer to Par.1.8.25.4 in the Instruction Manual for YASNAC LX3
In the material shape input, enter the material maximum diameter and length as the "diameter" and "length".
- (b) The "I.D." may be input only for pipes.
Enter "0" for other materials.
- (c) To cut the inside diameter by drilling a bar:
When drilling is set in the interactive operation, the drill diameter is input automatically as an inside diameter and defined as a new material shape.

(d) How to enter decimal points of data:

To enter "10": Depress successively and .

To enter "10.1": Depress successively , and .

To enter "0.1": Depress successively or .

(e) If the following material shape setting is preformed, a warning is produced with a message "DATA SET ERROR":

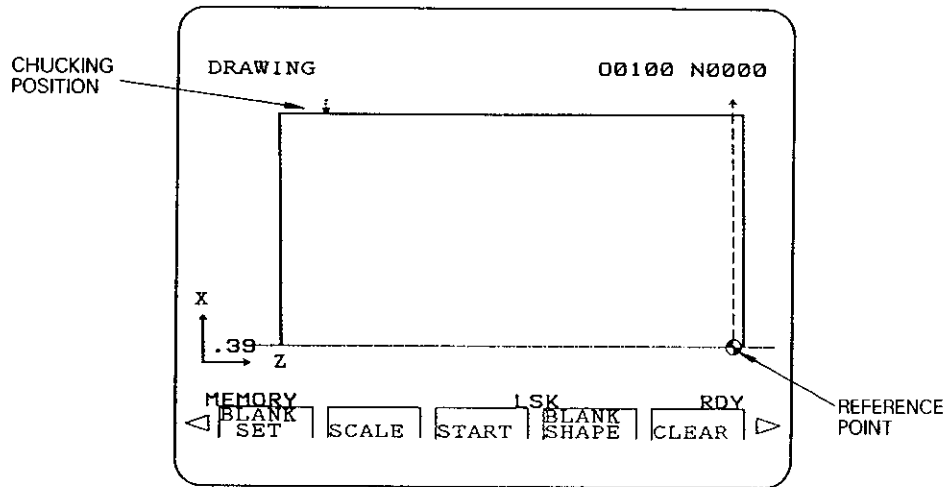
- I.D. > O.D.
- Chucking lgth > Material Length
- Face removal > Material Length

6.5 CLEARING THE DRAWING

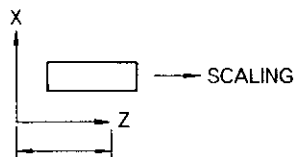
If the previous drawing remains displayed, depress the key.

6.6 SHAPE

- (1) Depress the **BLANK SET** key.
The display is as follows:



The material shape and the reference point and chuck positions are displayed.
The material shape of case material is displayed as a rectangle.



By setting the material and drawing range, the length shown by the arrow on the Z-axis is calculated automatically and displayed.
(Unit: mm or in.)

This length is displayed.

- (2) Setting the drawing area

Normally, the standard drawing area is used.

The standard area is set at power-on.

To change the drawing area, use the operation described in Par. 6.8.

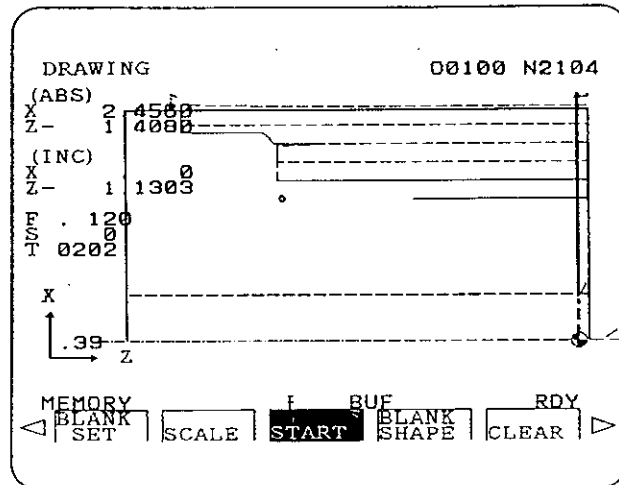
6.7 START OF DRAWING

- (1) Depress the **START** key.

The indication **START** on the display is reverse displayed. At the same time, the position absolute, position increment, feed rate, the running spindle speed, and tool number are displayed at the top left of the display.

The drawing may also be started by the next operation (2) without performing (1).

- (2) Turn ON the "cycle start switch" on the machine control panel. The following display shows where the program tracks are drawn. When the cycle start switch is turned on without the operation (1) above, the display "START" is reverse displayed.



(3) Explanation of the display

(ABS) Position absolute X: The position along the X-axis from the reference point.
Z: The position along the Z-axis from the reference point.

(INC) Position increment X: The displacement along the X-axis.
Z: The displacement along the Z-axis.

(F): Feed rate

(S): Spindle speed in operation.

(T): Tool number

○ : Lool-ahead indicator to show the end point of a block. You can check where the current block being executed will go.

⊙ : Reference point; Its position is decided by the value of the "face removal".

————: Cutting feed

.....: Fast feed

-----: Center of the workpiece

"Drawing exceeds the drawing range:" Displayed when the current value is found at a location that cannot be displayed.

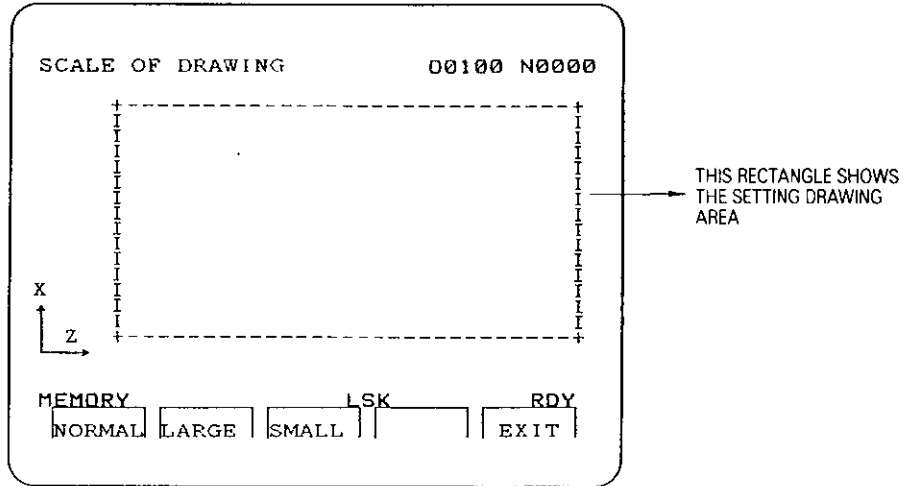
"Claw interference:" Displayed when the cutting edge is hitting the claw. The interference check is performed only on the external claw.

(4) End of drawing

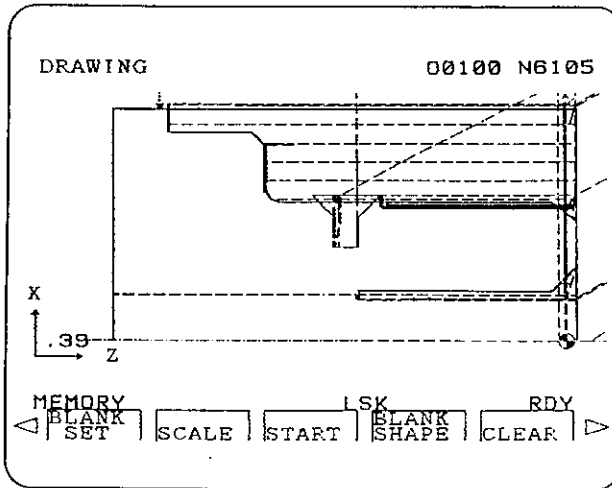
When the program execution ends, the indication "START" changes automatically to the normal indication and simultaneously all data indications (position absolute, position increment, feed rate, spindle running speed, and tool number) at the top left of the display disappear.

6.8 SETTING THE DRAWING AREA

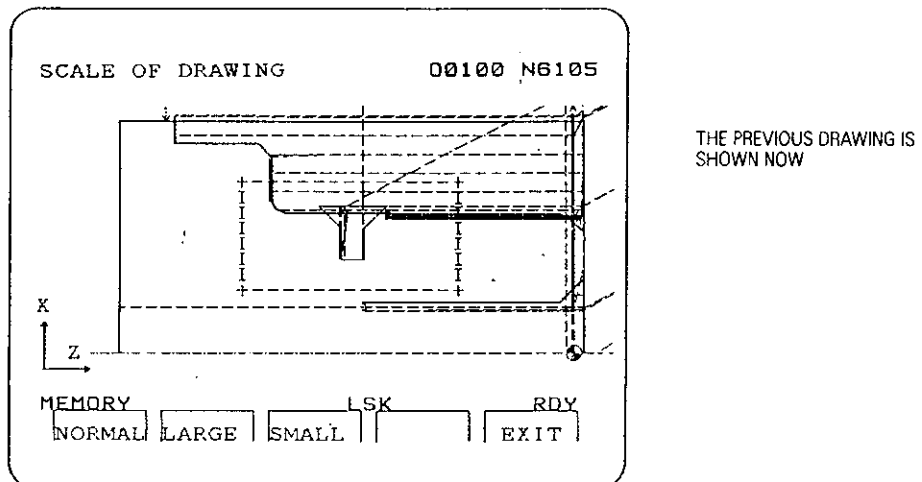
- (1) Depress the [SCALE] key. Normally depress the [NORMAL] key since drawing occurs in the standard area. The displays are as follows:




When the drawing is done in the normal area, the following is displayed:





- (2) When the [SMALL] is depressed to narrow the drawing scale:




The following keys may be used to position the drawing scale to a part of the work piece to be enlarged as in the figure on the previous page.

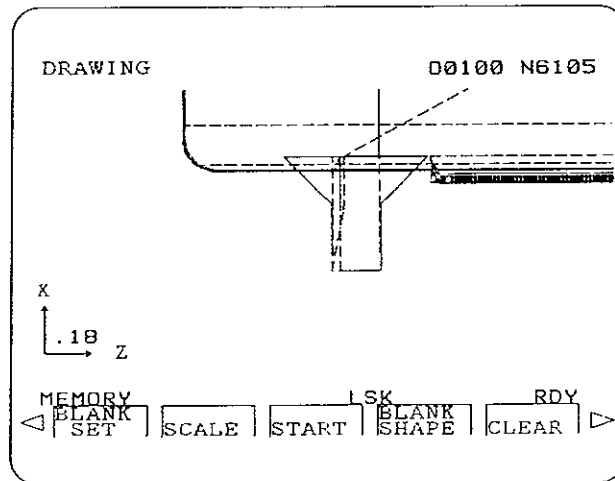
Upward: Page key 

Downward: Page key 

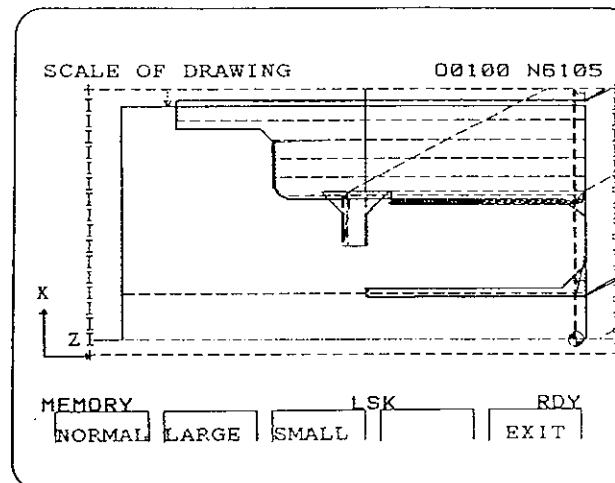
Left: Cursor key 

Right: Cursor key 

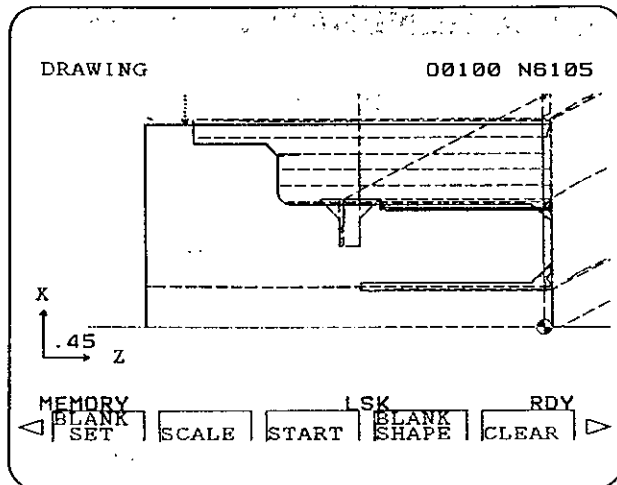
Drawing in this area displays the following:



(3) When the LARGE key is depressed to widen the drawing scale:



Drawing in the above scale displays the following:



6.9 SETTING 2 (DRAWING END OPERATION)

- (1) Depress the or key.

The soft key indication on the display changes.

- (2) Depress the key.

The system exits from the drawing mode.

- (3) When drawing is performed with the machine stopped, reset the setting data specified before entry into the drawing mode.

Depress the key.

The system enters the setting function mode.

(If not on the "setting" display, depress the key.)

- (4) Use the cursor key or to position the cursor to the item "drawing check".

The "drawing check" indication will blink.

- (5) Depress the key.

The four items (i.e. DRAWING CHECK, MST LOCK, DRY RUN, MACHINE LOCK) are turned OFF.

This ends the drawing operation.

7. OPERATION OF A GENERATED PROGRAM

An interactively generated NC program is the same as a manually created NC program.

- (1) Depress the reset key .




This moves the cursor to the beginning of the program.

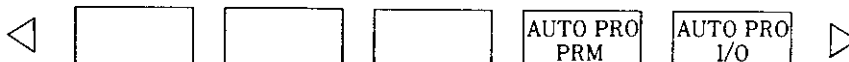
- (2) Before starting operation, be sure to check the interactively generated program using the drawing function (See Section 6).
This is an automatic programming function. If modification or insertion of a machining process is performed erroneously (e.g. the correction of old data), the incorrect machining program will be created automatically. The drawing check is necessary to prevent such erroneous machining.
- (3) After the drawing check, run the program by the conventional procedure.
(Refer to Section 5 in the YASNAC LX3 Instruction Manual.)


8. OPERATION OF INTERACTIVE PARAMETERS

The interactive parameters are used to set up beforehand items (finishing allowance, feed rate, etc.) necessary for creating a program interactively. For details, see Section 9.

8.1 HOW TO ENTER THE INTERACTIVE PARAMETER DISPLAY



- (1) Depress the  key to enter the program function mode.
- (2) Depress the key  or  to display the contents of the soft function keys shown below.





- (3) Depress the  key.
The system enters the interactive parameter display.

8.2 SETTING THE INTERACTIVE PARAMETERS

The interactive parameters are numbered 00 to 99. Parameter numbers 20 to 62 are used to set up items required for program generation. These parameter numbers are displayed ten at a time on the display.

Depressing page key  or  changes the display in the parameter number sequence.

8.2.1 Interactive Parameters #20 to #29

- (1) Depress page key  or  to display the following:

AUTPRO PARAMETER 04000 N0000

#20	80	Fin Allowance	U
#21	40		W
#22	2000	Face Clearance	X
#23	800		Z
#24	400	OD Clearance	X
#25	800		Z
#26	400	ID Clearance	X
#27	800		Z
#28	0		
#29	0		

MEMORY
LSK
RDY

EXIT

(2) Set the interactive parameters by the following procedure:

- (a) Use the or or the key to position the cursor to the item to be set.
- (b) Depress the data keys to set the data in the interactive parameter.
For example, to enter "0.5 mm" in the total finishing allowance U", depress successively the , , , and keys.
- (c) For the item set in the interactive parameter by the above, its data will be displayed automatically on the item setting display (approach or basic data setting display, etc.) in the interactive mode.
(See pars. 3.7 and 3.8.)

The following display is produced for #30 through #62.
Set the interactive parameters in the same way as in #20 to #29.

8.2.2 Display for Interactive Parameters #30 to #39

AUTPRO PARAMETER		04000 N0000	
#30	800	FaceRouDepthCut	D
#31	100	Feed	F
#32	1500	OD Rou DepthCut	D
#33	120	Feed	F
#34	1200	ID Rou DepthCut	D
#35	100	Feed	F
#36	100	FaceFreeRouFeed	F
#37	120	OD Free RouFeed	F
#38	100	ID Free RouFeed	F
#39	0		

MEMORY		LSK		RDY
				EXIT

8.2.3 Display for Interactive Parameters #40 to #49

AUTPRO PARAMETER		04000 N0000	
#40	40	Face Fin Feed	F
#41	40	OD Fin Feed	F
#42	40	ID Fin Feed	F
#43	40	FaceGroVFinFeed	F
#44	40	OD GroV FinFeed	F
#45	40	ID GroV FinFeed	F
#46	0		
#47	0		
#48	0		
#49	0		

MEMORY		LSK		RDY
				EXIT

8.2.4 Display for Interactive Parameters # 50 d to # 59

AUTPRO PARAMETER		04000 N0000	
#50	800	GrovRouDepthCut	D
#51	32	Feed	F
#52	1	Cut of Step	A
#53	80	Edge Overlap %	
#54	400	Step Clearance	
#55	0		
#56	8000	Drill Depth Cut	D
#57	80	Feed	F
#58	0		
#59	0		
MEMORY		LSK	RDY
			EXIT

8.2.5 Display for Interactive Parameters # 60 to # 69

AUTPRO PARAMETER		04000 N0000	
#60	140	Thread DepthCut	D
#61	645	Height Coef	
#62	18	Taperratio 1:A	
#63	0		
#64	0		
#65	0		
#66	0		
#67	0		
#68	0		
#69	0		
MEMORY		LSK	RDY
			EXIT

9. INTERACTIVE PARAMETER LIST

Number	Control manipulations
#20	Finishing allowance setting in all machining operations
#21	#20 is for X- axis incremental value (U) setting, and #21 is for Z-axis incremental value (W) setting. Setting range: 0 – 99999999 Unit: $1 = \frac{1}{10000}$ inch (0.001 mm)
#22	Clearance setting in face turning
#23	#22 and #23 set for the X and Z axes respectively. Setting range: 0 – 99999999 Unit: $1 = \frac{1}{10000}$ inch (0.001 mm)
#24	Clearance setting in O.D. turning.
#25	#24 and #25 set for the X and Z axes respectively. Setting range: 0 – 99999999 Unit: $1 = \frac{1}{10000}$ inch (0.001 mm)
#26	Clearance setting in I.D. turning
#27	#26 and #27 set for the X and Z axes respectively. Setting range : 0 – 99999999 Unit: $1 = \frac{1}{10000}$ inch (0.001 mm)
#30	Depth of cut setting in face rough turning Setting range : 0 – 99999999 Unit: $1 = \frac{1}{10000}$ inch (0.001 mm)
#31	Feedrate setting in face rough turning Setting range : 0 – 99999999 Unit: $1 = \frac{1}{10000}$ inch/rev (0.01 mm/rev.)
#32	Depth of cut setting in O.D. rough turning Setting range : 0 – 99999999 Unit: $1 = \frac{1}{10000}$ inch (0.001 mm)
#33	Feedrate setting in O. D. rough turning Setting range : 0 – 99999999 Unit: $1 = \frac{1}{10000}$ inch/rev (0.01 mm/rev.)
#34	Depth of cut setting in I. D. rough turning Setting range : 0 – 99999999 Unit: $1 = \frac{1}{10000}$ inch (0.001 mm)

Number

#35

Feedrate setting in I. D. rough turning
Setting range : 0 - 99999999
Unit : 1 = $\frac{1}{10000}$ inch/rev (0.01 mm/rev.)

#36

Feedrate setting in face free rough turning
Setting range : 0 - 99999999
Unit : 1 = $\frac{1}{10000}$ inch/rev (0.01 mm/rev.)

#37

Feedrate setting in O. D. free rough turning
Setting range : 0 - 99999999
Unit : 1 = $\frac{1}{10000}$ inch/rev (0.01 mm/rev.)

#38

Feedrate setting in I. D. free rough turning
Setting range : 0 - 99999999
Unit : 1 = $\frac{1}{10000}$ inch/rev (0.01 mm/rev.)

#40

Feedrate setting in face finish turning
Setting range : 0 - 99999999
Unit : 1 = $\frac{1}{10000}$ inch/rev (0.01 mm/rev.)

#41

Feedrate setting in O. D. finish turning
Setting range : 0 - 99999999
Unit : 1 = $\frac{1}{10000}$ inch/rev (0.01 mm/rev.)

#42

Feedrate setting in I. D. finish turning
Setting range : 0 - 99999999
Unit : 1 = $\frac{1}{10000}$ inch/rev (0.01 mm/rev.)

#43

Feedrate setting in face groove finish turning
Setting range : 0 - 99999999
Unit : 1 = $\frac{1}{10000}$ inch/rev (0.01 mm/rev.)

#44

Feedrate setting in O. D. groove finish turning
Setting range : 0 - 99999999
Unit : 1 = $\frac{1}{10000}$ inch/rev (0.01 mm/rev.)

#45

Feedrate setting in I. D. groove finish turning
Setting range : 0 - 99999999
Unit : 1 = $\frac{1}{10000}$ inch/rev (0.01 mm/rev.)

#50

Depth of one - cut setting in groove rough turning
Setting range : 0 - 99999999
Unit : 1 = $\frac{1}{10000}$ inch (0.001 mm)

Number

#51

Feedrate setting in groove rough turning

Setting range : 0 - 99999999

Unit : $1 = \frac{1}{10000}$ inch/rev (0.01 mm/rev.)

#52

Number of cut setting in groove turning

Setting range : 0 - 99999999

Unit: 1=1 cut

Note: Make sure that a value within the setting range is set. If "0" is set, operation may not be possible.

#53

Grooving tool shift overlap ratio setting in groove rough turning

Setting range: 0 - 100

Unit: 1 = 1%

Note: Make sure that a value within the setting range is set. If a value of "101" or larger is set, operation may not be possible.

#54

At finishing turning with groove having a offset to the right and left or top and bottom, when the following conditions are satisfied, chamfering movement is automatically compensated for.

Clearance at groove offset $\langle \left| \frac{\text{Right X coordinate} - \text{Left X coordinate}}{2} \right|$

Clearance at groove offset $\langle \left| \text{Top Z coordinate} - \text{Bottom Z coordinate} \right|$

Setting range: 0 to 99999999

Unit : 0.001 mm (1/10000 in)

Note : Clearance at groove offset is used in common for X and Z directions. |

X coordinate is set in units of the value.

#56

Setting of depth of bore in one boring in drilling

Setting range : 0 - 99999999

Unit : $1 = \frac{1}{10000}$ inch (0.001 mm.)

#57

Feedrate setting in drilling

Setting range : 0 - 99999999

Unit : $1 = \frac{1}{10000}$ inch/rev. (0.01 mm/rev.)

#60

Setting of depth of cut in one cut in threading

Setting range : 0 - 99999999

Unit : $1 = \frac{1}{10000}$ inch/rev (0.001 mm.)

Number

#61

Setting of thread height factor in threading

Setting range : 1 to 99999999

Unit : 1 = 0.001

Note: Make sure that a value within the setting range is set. If "0" is set, operation may not be possible.

Normally set this factor to 645 as specified by JIS*.

#62

Setting of radius ratio (taper ratio) in taper threading

Setting range : 0 - 99999999

Unit : 1 = 1

Note: Radius ratio is the ratio of length along the X-axis to the length along the Z-axis, with the former taken as 1. Normally set the taper threading radius ratio to 16 as specified by JIS*.

*: Japanese Industrial Standard

YASNAC LX3

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