# PROGRAMMING MANUAL

-FOR

# Mazak MAZATROL CAM T-2

(PRIMER)

SERIAL NUMBER

66079



# CONTENTS

			Page
1.	INTR	ODUCTION	1-1E
2.	A SM	ALL NUMBER OF KEYS ARE USED TO PREPARE A PROGRAM	2-1
3.	PREP	ARING A SIMPLE PROGRAM	3-1
	3-1	Rules of Preparing a Program	3-1
		Outside Diameter Cutting (BAR-OUT)	3-2
	3-3	Inside Diameter Cutting (BAR-IN)	3-14
	3-4	Edge Cutting (EDG)	3-20
		Grooving (GRV-OUT)	3-23
	3-6	Threading (THR-OUT)	3-27

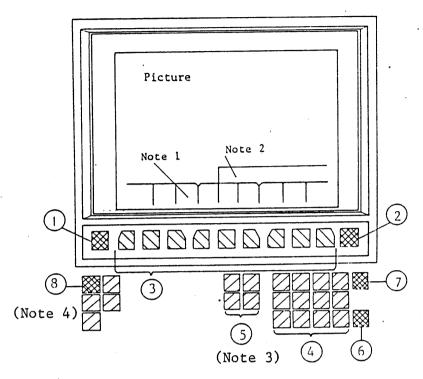


### 1. INTRODUCTION

The MAZATROL CAM T-2 is discussed.

The MAZATROL T-1 has been enjoying a good reputation as a computer numerical control (CNC) device which allows programming while communicating with the machine in human language without special knowledge and without complex calculations with a desk-top electric calculator. With these features of MAZATROL T-1 remaining a, wide diversity of new functions have been added to make MAZATROL CAM T-2 a CNC device with remarkably improved operational convenience. How to prepare a program is described below.

2. A SMALL NUMBER OF KEYS ARE USED TO PREPARE A PROGRAM.



- (1) Picture Select Key Press this key to select a picture. Press this key and the picture select menu (POSITION, COMMAND, TOOL SET, etc.) will be displayed. Press the menu key (3) to display desired picture.
- (2) Menu Select Key Press this key to change the information displayed in the menu blocks. (See Note 1.)
- (3) Menu Keys

  Nine yellow keys are provided to select a menu just above the key pressed.
- (4) Numerical Keys

  Numerical keys include 0 thru 9, decimal point, negative sign,

  etc. The numerical value pressed is displayed in the message

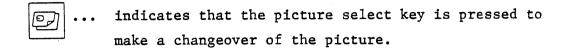
  column. (See Note 2.)
- (5) Cursor Keys (+) (+) (+) (1)

  Press these keys to move the cursor. (See Note 3.)

- (6) INPUT Key Press this key to input a numerical value in the message column to where the cursor is flashing.
- (7) CLEAR Key Press this key to erase a numerical value in the message column. This key is also pressed to erase a blue alarm indication (warning).
- (8) RESET Key //
  Press this key to erase a red alarm indication (warning). (See Note 4.)
- Note 1: The term "menu" means the information displayed in nine blocks along the lower part of the screen.
- Note 2: The term "message" means a question or inquiry. An operation should be advanced while keying in to answer the question displayed in this column.
- Note 3: The term "cursor" means a blinking mark which moves across the screen.
- Note 4: The RESET key has various other functions.

### 3. PREPARING A SIMPLE PROGRAM

3-1 Rules of Preparing a Program

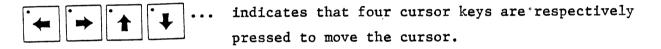


... indicates that the menu select key is pressed to alter the menu displayed.

PROGRAM ... indicates that the menu key is pressed to select the menu "program". (See Note 1.)

3 5 . 6 . indicates that numerical keys have been pressed.

These numerals "35. 6" will appear in the message column.



... indicates that the INPUT key is pressed to input numerals in the message column into a program.

"STARTING ... indicates the information displayed in the message POINT-X?" column.

indicates that the CLEAR key has been pressed.

... indicates that the RESET key has been pressed.

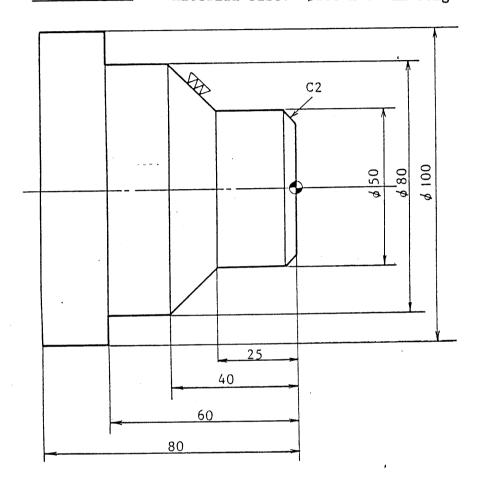
- indicates the "cursor".

Note 1: Some menus, which are available as option, may not be displayed though they are described in this manual. In such a case, proceed to the next line and continue inputting.

### 3-2 Outside Diameter Cutting (BAR-OUT)

Material: Carbon steel

6-S ( <del>VVV</del> ) Material size: \$100 x 80 mm long



Programming the above drawing.

Switch on the MAZATROL.

(Unlock the program data lock key (PROGRAM). Tilt the notch to the right (ENABLE) side.)

The programming steps are described below according to the particulars. Enter data one step at a time.

PROGRAM WORK NO.	
"WORKPIECE NO.?"	1 2 3 4 🕏

Enter the program number.

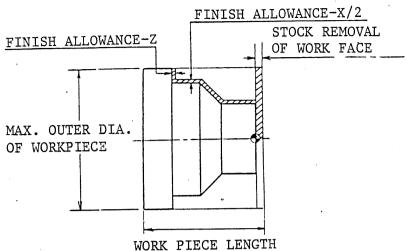
Sixteen types of programs can be recorded. Programs may be numbered from 1 to 9999. Initially, any number may be selected, because no program has yet been entered.

"NEW PROGRAM (PROGRAM)?"	PROGRAM
"MAZATROL OR EIA/ISO (MENU)?"	MAZATROL PROGRAM
"WORKPIECE MATERIAL (MENU)?"	CBN STL
"MAX. OUTER DIA. OF WORKPIECE?"	1 0 0 ⊕
"MIN. INNER DIA. OF WORKPIECE?"	0 ҈€
"WORKPIECE LENGTH?"	8 0 🖘

Enter the dimensions of a material before machining in accordance with messages "MAX. OUTER DIA. OF WORKPIECE?", "MIN. INNER DIA. OF WORKPIECE?" and "WORKPIECE LENGTH?".

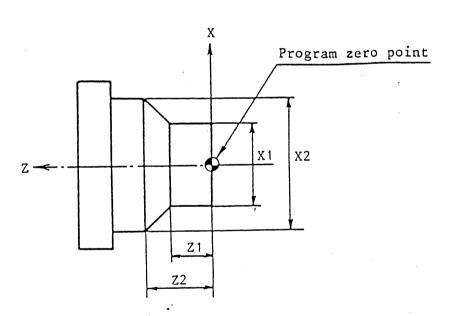
"MAX SPINDLE RPM LIMIT?"	•••••	2 0 0 0 🕏
"FINISH ALLOWANCE-X?"	• • •, • • •	0 . 2 °€
"FINISH ALLOWANCE-Z?"		0.1
"STOCK REMOVAL OF WORK FACE?"	• • • • • • •	0 🕏

For MAX SPINDLE RPM LIMIT, enter the upper spindle speed limit adopted in the program. If the spindle is to turn at a speed up to the maximum available in the machine, enter 0. For FINISH ALLOWANCE-X and FINISH ALLOWANCE-Z, enter the stroke of cutting by means of finishing tools. For FINISH ALLOWANCE-X, enter twice the cutting allowance at one side, that is, the value of the diameter. For STOCK REMOVAL OF WORK FACE enter an end cutting allowance, if any.



One line of data has now been prepared.

The MAZATROL coordinate systems will now be described.



### 1) X and Z:

X is defined as the diameter dimension of a workpiece and Z as the longitudinal dimension of a workpiece.

### 2) Program zero point:

The program zero point is the point at which the turning center of a workpiece (X-axis) intersects with the right end of a finished workpiece (Z-axis). ( $\bigoplus$  in the Figure)

3) To give a dimension command:

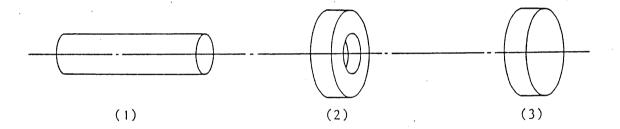
X-axial ... In any case, give the diameter of a workpiece as a command without change.

Z-axial ... Give a size from the zero in Z (right end of a workpiece) as a command.

Continue entering.

"MODE (MENU)?"	•••••	BAR
"MACHINING PART (MENU)?"	• • • • • •	OUT

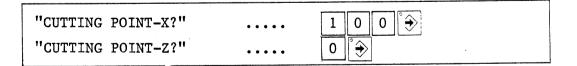
For all cylindrical materials, select the BAR menu.



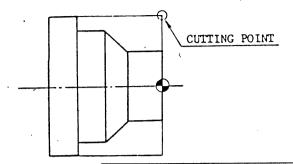
(1), (2) and (3) all belong to BAR.

Use the OUT menu to machine starting from a midway point of the material.

For outside diameter cutting, select the OUT menu.



CUTTING POINT-X and CUTTING POINT-Z are the point where machining be started as illustrated below.



(Note)

How to take CUTTING POINT in a variety of shapes to be machined is described in the Application Version of the Programming Manual.

"SURFACE SPEED FOR ROUGH CU	т?''	AUTO
"SURFACE SPEED FOR FINISH C	UT?"	*
"FEEDRATE (/REV) FOR ROUGH	CUT?"	*
"DEPTH OF CUT?"	• • • •	*
* → may be also used. key, such as → , will cau		y pressing a cursor sor to continue to move.

Pressing the AUTO menu key will automatically determine as follows:

Roughing/finishing tool	• • • • • • •	<pre>surface speed (m/min)</pre>
Roughing tool	• • • • • • •	stroke of feed per turn of
		spindle (mm/rev.)
Roughing tool		depth of cut per cycle (mm)

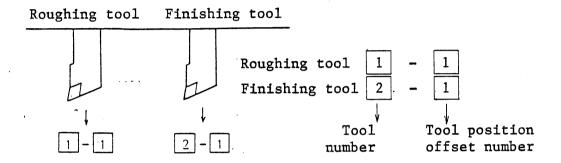
The values automatically determined vary with machine specifications.

These numerical values can be changed freely.

"GEAR NO.?'	·····
"ROUGHING TOOL NO"	1
"OFFSET NO.?"	1 °÷
"FINISHING TOOL NO.?"	···· 2 ÷
"OFFSET NO.?"	1 ÷

Spindle gear will be determined automatically. (Its number can be remaining "0".)

When numerical values are inputted for GEAR NO., the gear for rough machining can be selected and determined automatically. For number of gear stages, refer to the machine specifications.



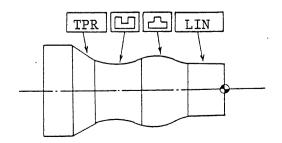
For OFFSET NO., two tool offset positions are available per tool. Enter "1" or "2" to select the tool position. With "0" selected, no position will be offset.

"SHAPE PATTERN	(MENU)?"	LIN

"SHAPE PATTERN" will be described below.

For outside diameter cutting, inside diameter cutting and facing, shapes could be classified as:

LIN	Linear	• • • • • •	a straight line without
,		•	inclination
TPR	Taper	• • • • • •	an inclined straight line
	Convex arc	• • • • • •	a convex arc for a workpiece
	Concave arc	• • • • • •	a concave arc for a workpiece

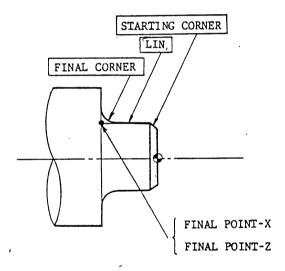


"STARTING CORNER?"	• • • • • •	2 🕏
"FINAL POINT-X?"	• • • • • •	5 0 €
"FINAL POINT-Z?"	• • • • • •	2 5 🕏
"FINAL CORNER?"	• • • • • •	<u></u>

Some additional explanations will be given.

In turning, corners are often chamfered circumferentially or radially. This can be most easily programmed by the use of starting and final corner.

Starting and final corner cover circumferentially or radially chamfering. To chamber radially, press the CORNER R menu key and then enter a radius.



FINAL POINT-X represents the finish diameter of the machined portion.

FINAL POINT-Z represents the longitudinal end point of the machined portion.

"FIN SURFACE ROUGHNESS (MENU)?"	4 🕏
"NECKING OR FR/MIN (MENU)?"	····· [**)
"M CODE (MENU)?"	•••••



FIN SURFACE ROUGHNESS is determined by selecting a drawing finish code from the menus. The feedrate of a finishing tool is calculated automatically to execute the program so that a specified surface roughness will be attained.

Drawing finish codes and surface roughness menus are related as shown below.

100-S ▽	50-S ▽	25-S ∇∇	12-S	6-S	3−S . ▽▽▽	1.5-S	0.8-S	0.4-S
▽ 1	∇ 2	3	<b>▽▽</b> 4	<b>▽</b> ▼▼ 5	6	7	8	9

To enter for "NECKING OR FR/MIN (MENU)?" and "M CODE (MENU)?", press the INPUT key only.

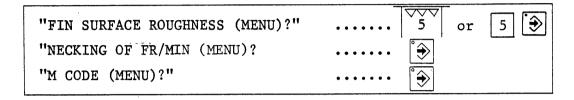
Details are described in the Application Version.

"SHAPE PATTERN (MENU)?"	• • • • • •	TPR
"STARTING CORNER?"	• • • • • •	0 ♣
"STARTING POINT-X?"	• • • • • •	CONTINUE
"FINAL POINT-X?"	• • • • • •	8 0 🖘
"FINAL POINT-Z?"	• • • • • •	4 0 °÷
"FINAL CORNER?"	• • • • • •	<b>→</b>
* If 0 is to be set wit	h 0 displ	ayed in advance, press
°→ only.		



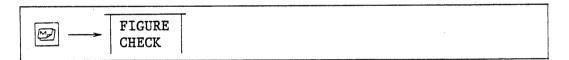
For LIN, specify FINAL POINT only. For TPR, "\_" and "" (arcs), it is necessary to specify both STARTING POINT and FINAL POINT.

If the final point of the preceding line is identical with the starting point of a line being currently prepared, pressing the CONTINUE menu key will cause the same numerical value to be entered.

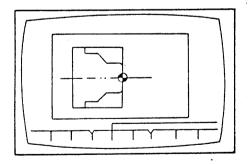


Enter in the same manner as that for the preceding line.

While programming, check the program to make certain that it is correct by letting the program draw a graph.



This operation will cause the programmed graph to be displayed immediately on the picture.



A shape to the stage programmed is displayed correctly.

Continue programming.

PROGRAM	·
"SHAPE PATTERN (MENU)?"	LINEAR
"STARTING CORNER?"	·····- [€]
"FINAL POINT-X?"	8 0 🕏
"FINAL POINT-Z?"	····· 6 0 <del>3</del>
"FINAL CORNER?"	[€]
"FIN SURFACE ROUGHNESS (MENU)?	" \\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\
"NECKING OR FR/MIN (MENU)?"	••••
"M CODE (MENU)?"	····· 🗟

That is all to entering for outside diameter cutting (BAR-OUT).

To end the program, stop with the END line.

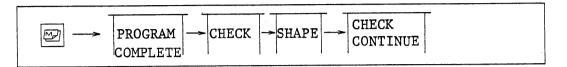
•	
"MODE (MENU)?"	SHAPE END , END
"PARTS COUNT YES (1), NO (0)?" [	→
"RET POSITION(2), ZERO(1), NO(0)?	•
"NEXT WORKPIECE NO.?"	•
"CONTINUE YES (1), NO (0)?"	•
"REPEAT TIMES OF SAME PROGRAM?"	•
"Z-AXIS SHIFT AMOUT?"	•
\ \ \ \ \	

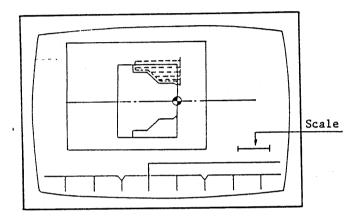
The END line may be set to "0". For details, see the Application Version.

### Check

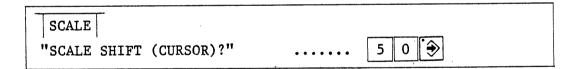
Check the program.

This function permits a material shape, a program shape and a tool path to be drawn.

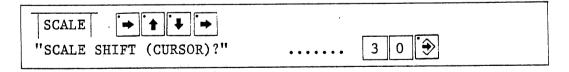




The size of a displayed graph can easily be changed as follows:



A graph sized to a scale length of 50 mm is displayed. Next, zoom a desired part of graph to display enlarged one.



Press the SCALE menu key and the cursor will appear at the center of the picture. After moving the cursor by the cursor keys, draw the graph sized to a scale length of 30. It will be displayed with the cursor position at the center of the picture.

Thus, a program shape can be partially expanded. If the scale length is changed, drawn graph shape is deleted. Practice again, therefore, operation for drawing a graph.

The program is displayed on the screen as follows:

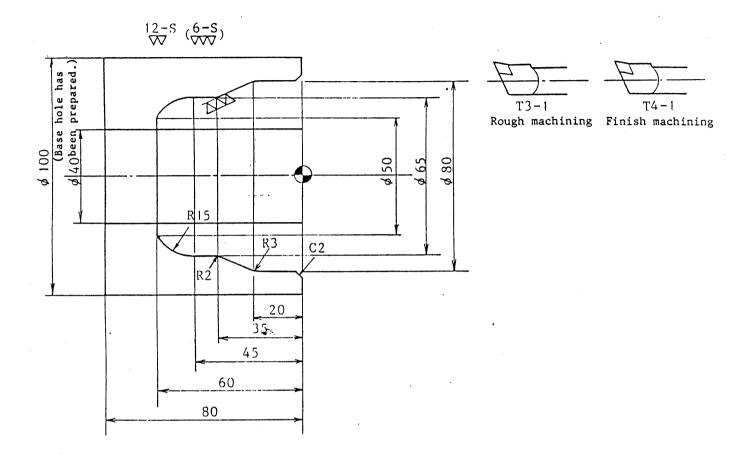
PNO	MAT	OD-MAX	ID-M	EN I	ENGTH	RPM	FIN	<b>-</b> X	FIN-	Z W	ORK I	FACE
0 (	CBST	100	0		80	2000	0.	2	0.1		0	
PNO	MODE	PART	CPT-X	ζ (	CPT-Z	RV	FV F	EED	DEPTH	GR	RT	FT
. 1	BAR	OUT	100		0	130 2	00 0	• 4	5	0	1-1	. 2-1
SEQ	SHP	S-CNR	SPT-X	SPT-Z	FPT-X	FP	T-Z	F-CN	R RAI	oius	SRF	\$ M
1	LIN	C2			50	2	5	CO			4	
2	TPR	Ċ0	50	25	80	4	0	.C0			5	
3	LIN	CO			80	6	0	C0			4	
PNO	MODE	CQUNTER	RETU	RN	WK.NO	CON	TINUE	. NU	MBER	SFT	AMT	
2	END	0	: 0		0		0		0		0	

PNO 0 is displayed at the left end, representing process No. 0, the first process of this program.

PNO 1 and PNO 2 represent process No. 1 and process No. 2, respectively.

The figures, 1, 2 and 3, shown under SEQ represent sequence Nos. 1, 2 and 3, respectively, indicating the order of shapes to be machined.

### 3-3 Inside Diameter Cutting (BAR-IN)

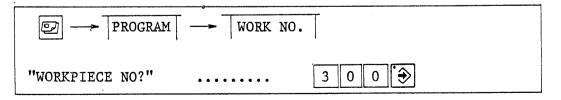


Material: Carbon steel

Max. 0.D.: 100
Max. I.D.: 40

Material Length: 80

Prepare the program using the same procedure as for programming the bar outside diameter cutting.



A work program number has been selected using the same procedure as for programming the outside diameter cutting. Subsequently, follow messages and proceed with inputting.

"NEW PROGRAM (PROGRAM)?"	PROGRAM
"MAZATROL OR EIA/ISO (MENU)?"	MAZATROL PROGRAM
"WORKPIECE MATERIAL (MENU)?"	CBN STL
"MAX. OUTER DIA. OF WORKPIECE?"	1 0 0 🕏
"MIN. INNER DIA. OF WORKPIECE?"	4 0 🕏
"WORKPIECE LENGTH?"	8 0 🕏
"MAX. SPINDLE RPM LIMIT?"	2 0 0 0 🕏
"FINISH ALLOWANCE-X?"	0 . 2 🕏
"FINISH ALLOWANCE-Z?"	0 . 1 🕏
"STOCK REMOVAL OF WORK FACE?"	0 🖘

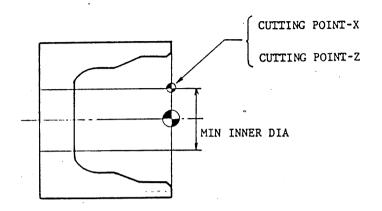
Process No. 0 has now been entered.

"MODE (MENU)?"	BAR
"MACHINING PART (MENU)?"	IN

For inside diameter cutting, select the IN menu.

"CUTTING POINT-X?"	4 0 <del>*</del>
"CUTTING POINT-Z?"	0 🕏

In this case, the "CUTTING POINT" is located as illustrated below.



Enter the sequence.

	SEQ 1	SEQ 2	SEQ 3	SEQ 4
"SHAPE PATTERN (MENU)?"	LINEAR	TAPAR	LINEAR	
"STARTING CORNER?"	2 🕏	CORNER 3	•	•
"STARTING POINT-X?"		CONTINUE		CONTINUE
"STARTING POINT-Z?"	,	CONTINUE		CONTINUE
"FINAL POINT-X?"	80 🕏	6 5 🕏	6 5 🕏	5 0 🕏
"FINAL POINT-Z?"	2 0 🕏	3 5 🕏	4 5 🕏	6 0 🕏
"FINAL CORNER?"	· •	CORNER 2	•	•
"RADIUS?"			·	1 5
"FIN SURFACE ROUGHNESS (MENU)?"	4	5	4	74
"NECKING OR FR/MIN (MENU)?"	° <b>→</b>	•	•	•
"M CODE (MENU)?"	<b>○</b>	•	•	•

Four sequences, linear, taper, linear and concave arc have been entered.

No message appears and the cursor does not stop at the blank

Finally, enter END.

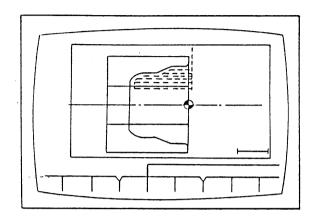
columns

"MODE (MENU)?"	SHAPE END END
"PARTS COUNT YES (1), NO (0)?"	•
"RET POSITION(2), ZERO(1), NO(0)?"	•
"NEXT WORKPIECE NO.?"	•
"CONTINUE YES (1), NO (0)?"	•
"REPEAT TIMES OF SAME PROGRAM?"	•
"X-AXIS SHIFT AMOUT?"	<b>+</b>

That is all for programming the bar inside diameter cutting.



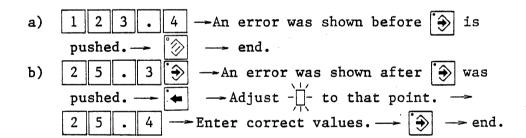
Follow the CHECK procedure referred to in the preceding page to verify both the program shape and tool path.



The action to correct a program has been entered is described below.

### EDIT function

1) To change the program by word



2) To change a menu:

OUT menu has been pressed incorrectly.

Display the menu to be inputted. — Press the correct menu IN . — end.

3) To erase data on a line basis:

Move - to the line to be erased. ERASE FRASE That line will disappear. — end.

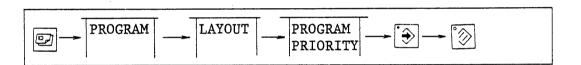
4) To add a new line:

Move - - to where the line is to be added.

INSERT • one line will appear just above - end.

- 5) To erase data on a process basis:

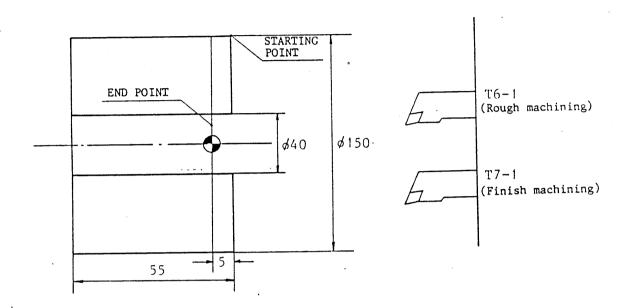
  Move to PNO desired to be erased. ERASE The PNO will disappear. end.
- Note 1) Where a program is erased completely is described in the Operating Manual.
- Note 2) After changing the program, use the CHECK function and an alarm message "LAYOUT NOT COMPLETE" may appear.

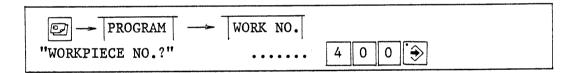


Then, perform the above-mentioned operation. The layout function is detailed in the Operating Manual.

### 3-4 Edge Cutting (EDG)

Material: Cast iron  $\phi 150 \times \phi 40 \times 55$  long



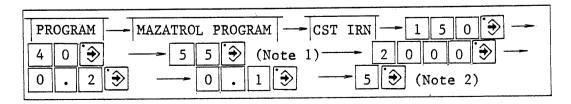


First, determine the work program number and enter it. If a recorded work program has been selected,

"WORKPIECE NO.?"	1 2 3 4 ÷	
	<u> </u>	

that program will be called and displayed.

Use No. 400 to prepare a new program.



Process No. 0 is entered in the program. The contents are the same as those of the BAR-OUT or BAR-IN program.

- Note 1) For WORKPIECE LENGTH, enter the length including the edge cutting allowance.
- Note 2) Enter the estimated size of the edge cutting allowance.

See the drawing.

Edge cutting (EDG) cuts the portion to the right of ZO straight. If is not possible to machine the left side of ZO.

"MODE (MENU)?"	• • • • • •	EDG
"SURFACE SPEED FOR ROUGH CUT?	",	AUTO
"SURFACE SPEED FOR FINISH CUT	?"	•
"FEEDRATE (/REV) FOR ROUGH CU	T3"	•
"DEPTH OF CUT?"	• • • • • •	•
"GEAR NO.?"	• • • • • •	•
"ROUGHING TOOL NR.?"	• • • • • •	6
"OFFSET NO.?"	•••••	1 🕏
"FINISHING TOOL NO?"	• • • • • •	7 🕏
"OFFSET NO.?"	• • • • • •	

Enter data using the same procedure as for bar inside or outside diameter cutting.

"STARTING POINT-X?"	1 5 0 <del>*</del>
"STARTING POINT-Z?"	5 🕏
"FINAL POINT-X?"	3 6 →
"FINAL POINT-Z?"	0 ⊕
"FIN SURFACE ROUGHNESS (MENU)	?" 4
"NECKING OR FR/MIN (MENU)?"	•••••
"M CODE (MENU)?"	•••••

For STARTING POINT-X, enter the same value as for workpiece maximum outer diameter (OD-MAX). For STARTING POINT-Z, enter the same value as for workpiece end face (WORK FACE). (See Note.) For FINAL POINT-X, enter a little smaller value than the workpiece minimum inside diameter (ID-MIN). To carry out edge-machining up to center "XO", enter "XO". For FINAL POINT-Z, enter "O".

Note: A numerical value larger than that of OD-MAX or WORK FACE will result in an error.

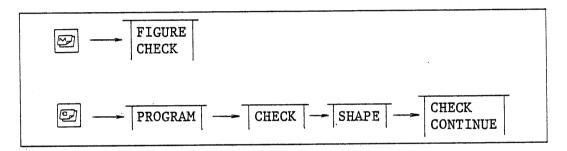
The EDG cutting is accomplished in one sequence (line) only.

Finally, enter END.

END

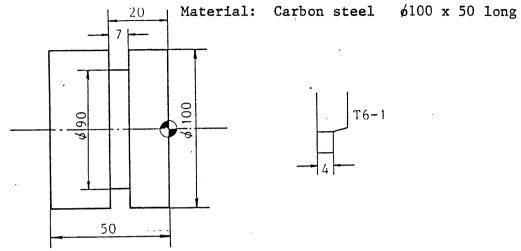
Input END mode as described above.

Use the FIGURE CHECK and CHECK functions to check the program.

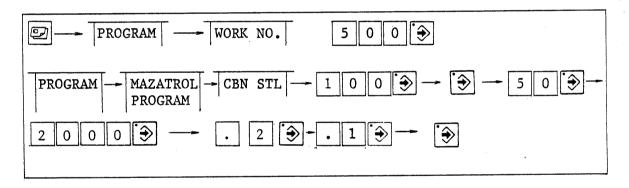


If an error is found in the program or a numerical value is to be replaced, use the EDIT function.

# 3-5 Grooving (GRV-OUT)



Note: Tool width (4 mm) should be entered separately. (See the Application Version.) A tool width lager than the groove width 7 mm will be result in an error.



Under work program No. 500, process Nr. 0 has been entered.

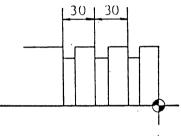
"MODE (MENU)?"	• • • • • •	GRV
"MACHINING PART (MENU)?"	• • • • • •	OUT
"GRV: TRAPEZOID(1), STRAIGHT(0)?"	• • • • • •	#0

The grooving (GRV) includes inside diameter grooving (IN) and face grooving (FCE) in addition to outside diameter grooving (OUT).

The grooving is available in two other types; #0 and #1. For details, see the Application Version.

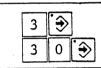
"NUMBER OF GROOVES?"	• • • • • •	1 🕏
"GROOVE PITCH?"	• • • • • •	
"WIDTH OF GROOVE?"	• • • • • •	7
"FINISH ALLOWANCE?"		
"SURFACE SPEED FOR ROUGH CU	JT?"	AUTO
"SURFACE SPEED FOR FINISH O	CUT?"	•
"FEEDRATE (/REV) FOR ROUGH	CUT?"	<b>□</b>
"DEPTH OF CUT?"	• • • • • •	<b>□</b>
"GEAR NO.?"	• • • • • •	<b>○</b>
"FINISHING TOOL NO.?"	• • • • • •	6
"OFFSET NO.?"	• • • • • •	1 🕏
	~~~~	~~~~

NUMBER OF GROOVES and GROOVE PITCH are to be used when a number of identical grooves are to be machined.



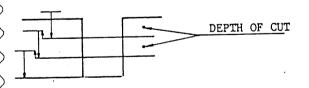
In the illustration given to the left, enter:

"NUMBER OF GROOVES?"
"GROOVE PITCH?"



For WIDTH OF GROOVE, enter the groove width of a workpiece. FINISH ALLOWANCE is valid with groove type #1.

The term "DEPTH OF CUT" means the pecking interval.



	"STARTING CORNER?"	• • • • • •	•
	"STARTING POINT-X?"	•••••	1 0 0 🕏
	"STARTING POINT-Z?"	• • • • • •	2 0 🕏
	"FINAL POINT-X?"	• • • • • •	9 0 🕏
	"FINAL POINT-Z?"		2 0 🕏
	"FINAL CORNER?"		•
	"FIN SURFACE ROUGHNESS (MENU)?	?"	
	"NECKING OR FR/MIN (MENU)?"		
	"M CODE (MENU)?"		•
- 1			

Enter numerical values from "STARTING POINT-X" to "FINAL POINT-Z". The grooving GRV is also accomplished in one sequence (line) only.

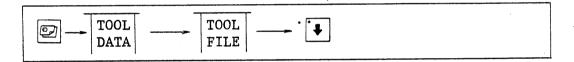
Finally enter END.

•

Make preparations to use the CHECK function. Performing checking without tooling information will result in an error: to machine a 7-mm groove, the machine will not operate without being given tool width.

To cope with this, tooling information such as tool width should be entered elsewhere than in the program.

First, select the TOOL FILE picture.



Lower -  $\frac{1}{1}$  to FN06.

Enter the information in TOOL FILE No. 6.

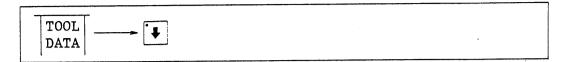
T	TURNING	GRV	<del></del>	OUT	

Outside Diameter Grooving in turning has been entered.

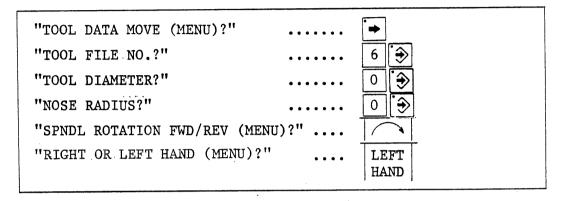
"TOOL HOLDER TYPE?"	1
"TOOL NOMINAL DIAMETER?"	
"CUTTING ANGLE (DEPTH)?"	1 0 →
"CUTTING ANGLE (WIDTH): '	4 →
"WIDTH/DIA. OF TOOL SHANK?"	2 5 ♣
"PITCH?"	□ 🕞
"TOOL LENGTH?"	0 €
"NUMBER OF TEETH?"	

TOOL FILE No. 6 is now completely entered.

Subsequently, enter tool data.



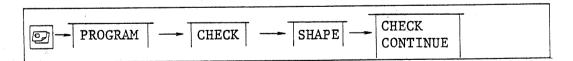
Switch to the TOOL DATA picture, lower - to TN06.



TOOL DATA No. 6 is now completely entered.

- Note 1. A description of details involved is omitted. To use CHECK function, enter as illustrated. Tool file and tool data are detailed in the Operating Manual.
- Note 2. Grooving includes I.D. and face grooving in addition to O.D. grooving. Besides, it is available in another two types; #0 and #1.

They are also detailed in the Application Version.

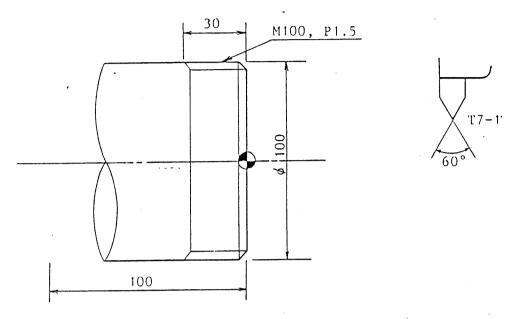


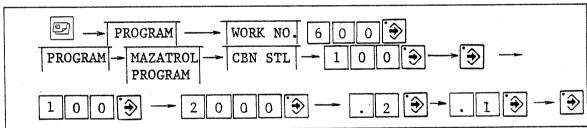
The menus SHAPE and CHECK CONTINUE will, respectively, cause a machining shape and a tool path to be drawn.

3-26

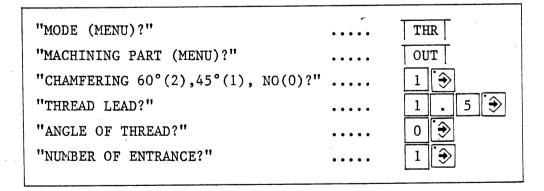
### 3-6 Threading (THR-OUT)

Material: Carbon steel \$100 x 100 long

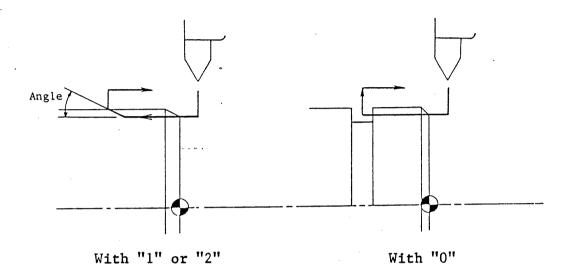




Under work program No. 600, prepare a program.



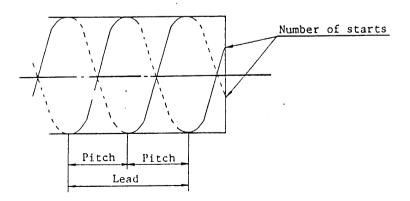
The term "chamfering" means the angle at which chamfering performed after threading.



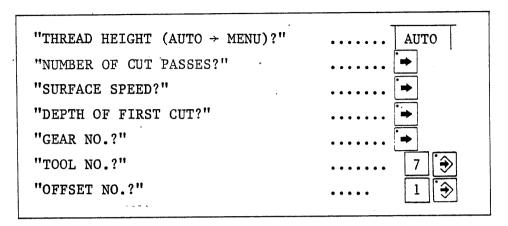
Generally, "0" should be selected if there is a "threading relief groove" and "1" or "2" if not.

THREAD LEAD and NUMBER OF ENTRANCE will be described. Thread is expressed as LEAD = PITCH x NUMBER OF STARTS. Generally, LEAD = PITCH may be reckoned for a "single start thread". It should be remembered that LEAD be entered for such a "multiple-start thread" as two-start or three-start threads.

### (Example) 2-start thread

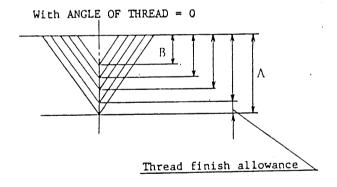


For ANGLE OF THREAD enter "0".
For dateils, see the Application Version.



THREAD HEIGHT represents "A" in the illustration above. DEPTH OF FIRST CUT represents "B".

Note: The thread finish allowance has been entered independently of the program.



"STARTING POINT-X?"	1 0 0 🕏
"STARTING POINT-Z?"	[0] →
"FINAL POINT-X?"	1 0 0 →
"FINAL POINT-Z?"	3 0 €

Enter STARTING POINT and FINAL POINT of threading.

Once one line has been entered, a message will ask "FINAL POINT-X?".

This function permits continuous machining of threads. One line handles machining of an ordinary thread. Press the SHAPE END menu key.

SI	APE	
E	db/	
•		

Finally enter END and the operation will end.

END			
1	•		

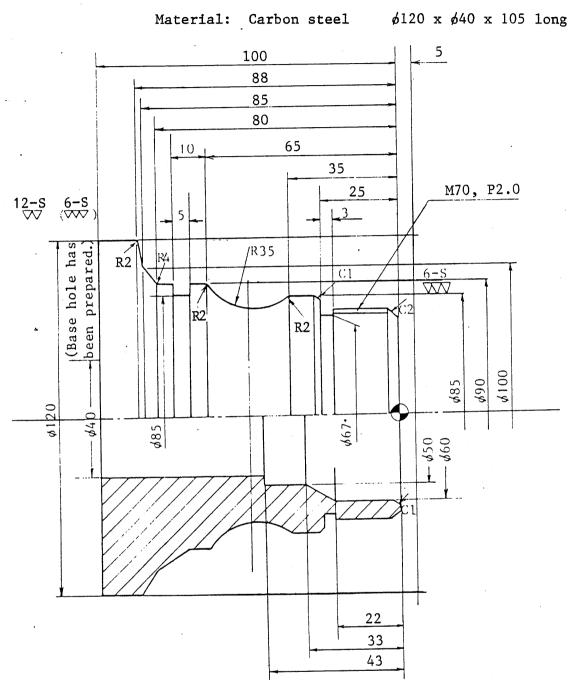
Note: Threading (THR) includes I.D. and FACE in addition to O.D. Tapered and left-hand screws can also be made. For details, see the Application Version.

### (Exercises)

The description given so far relates to cutting a bar material to an outside diameter (BAR-OUT), to an inside diameter (BAR-IN), edging (EDG), grooving to an outside diameter (GRV-OUT) and threading to an outside diameter (THR-OUT). In addition, a variety of machining modes are available, which are described in the Application Version.

Practice programming using the machining modes described so far.

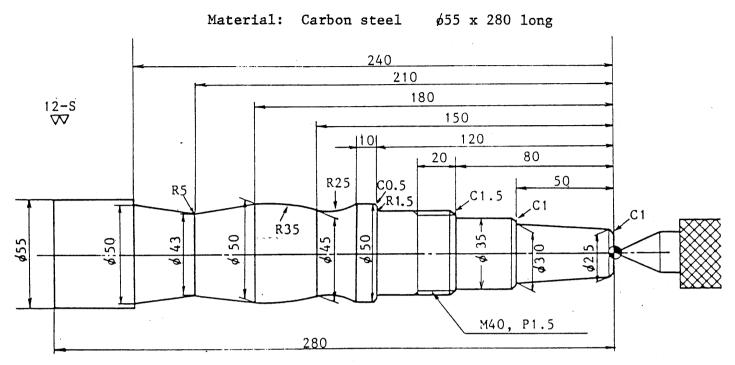
Exercise 1



# Answer of Excercise 1

PNO	MAT	OD-MAX	ID-	MIN	LENGTH	RPM	FIN	–X F	IN-Z	WORK	FACE
0	CB ST	120	4	0	105	1000	0.	2	0.1	5	•
PNO	MODE				RV	FV	FEED	DEPTH	GR	RT	FT
1	EDG				100	120	0.3	3	0	1-0	1-0
SEQ		SPT-X	SPT	'-Z	FPT-X		FPT-Z	•	SRF	\$	М
1		120		5	35		0		4		
PNO	MODE	PART	CPT-X	CPT-X	K RV		FV FE	ED DEP	TH GR	RT	FT
2	BAR	OUT	120	0	130	1.	50 0	.5 5	0	1-0	1-0
SEQ	SHP	S-CNR	SPT-X	SPT-Z	Z FPT-X	FPT	-Z F-	CNR R	ADIUS	SRF	\$ M
1	LIN	C2			70	2	5 C	0		4	
2	LIN	C1			85	3	5 C	0		6	
3	ப	R2	85	35	90	6	5 R	2	35	4	•
4	LIN	CO			· 90	8	0 C	0		4	. •
5	TPR	CO	90	80	100	8	5 R	4		4	
6	TPR	CO	100	85	120	8	8 R	2		4	
PNO	MODE	PART #	NO. P	ITCH	GRV WID	FIN	ISH RV	FV FE	ED DEP	TH GR	RT FT
3	GRV	OUT O	1	0	3	0	100	120 0	.3 3	0	2-0
SEQ	S-CNR	SPT-	X SPT	-Z FI	PT-X FF	T-Z	F-CNR	RADI	US S	RF \$	M
1	CO	85	2	25	67 2	.5	C0	•		4	
PNO	MODE	PART #	NO. F	PITCH	GRV WID	FIN	ISH RV	FV FE	ED DEP	TH GR	RT FT
4	GRV	O TUO	1	0	5		0 100	120 0	.3 3	0	2-0
SEQ	S-CNR	SPT-	X SPI	-Z FI	PT-X FF	T-Z	F-CNR	RADI	US S	RF \$	S M
1	CO	90	7	75	85	75	CO			4	
PNO	MODE	PART CHA	AMF LE	EAD A	ANG MUI	TI H	GT NU	MBER	V DE	PTH GF	T
5	THR	OUT	0	2	0 1	. 1	.3	10 1	00 0	.3 0	3-0
SEQ		SPT	<b>-</b> X	SPT-	Z	FPT-X		FPT-Z			
1		7	0	0		70		23			
PNO	MODE	PART C	PT-X (	CPT-Z	RV	FV	FEED	DEPT	H GR	RT	FT
6	BAR	IN	40	0	120	150	0.5	3	0	4-0	4-0
SEQ	SHP	S-CNR	SPT-X	SPT-Z	FPT-X	K FPT	-Z F-	CNR R	ADIUS	SRF	\$ M
1	LÍN	C1			60	22	C	0		4	
2	TPR	CO	60	- 22	50	33	C	0		4	
3	LIN	CO			50	43	C	0		4	
PNO	MODE	COUNT	ER RI	ETURN	WK NO.	, c	ONTINU	E NU	MBER	SFT A	TMA
7	END	0		0	0		0		0	0	

Exercise 2





# Answer of Exercise 2

PNO.	MAT	OD-MAX	ID-MIN	I LENG	TH RP	M FIN-X	FIN-Z	WORK F	ACE
0	CB ST	55	. 0	280	200	0 0.2	0.1	0	
PNO	MODE	PART	CPT-X	CPT-Z	RV	FV	FEED DE	PTH G	R RT FT
1	BAR	OUT	55	0	130	150	0.35 3	.5	0 1-0 1-0
SEQ	SHP	S-CNR	SPT-X	SPT-Z	FPT-X	FPT-Z	F-CNR	RADIUS	SRF \$ M
1	TPR	C1	25	0	30	50	CO		4
2	LIN	C1			35	80	CO		4
3	LIN	C1.5			40	120	R1.5		4
4	LIN	CO.5			50	130	C0		4
5	Ľ	C0	50	130	45	150	CO	25	4
6		CO	45	150	50	180	CO	35	4
7	TPR	CO	50	180	43	210	R5		4
8	TPR	CO	43	210	50	240	C0		4
PNO	MODE 1	PART CI	HAMF LI	EAD AN	G MUL	TI HGT	NUMBER	V DEP	TH GR T
2	THR [	TUC	1 1	.5 0	1	0.975	8	100 0.	275 O 3 <b>-</b> 0
SEQ		SPT-	X SP	r–z f	PT-X	FPT-Z			
1		40	8	30	40	100			
PNO	MODE	COUNT	ER RET	TURN	WK NO.	CONTINUE	NUMBER	SFT.	AMT
3	END	0	(	)	0	0 .	0	0	