

CNC SYSTEMS

OSP5020M OSP500M-G

SPECIAL FUNCTION MANUAL
(No.1) (4th Edition)

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TO ENSURE SAFE OPERATIONS

The machine is equipped with a variety of safety devices designed to prevent accidents and injuries from occurring. Still, operators must use the machine carefully and learn not to rely on these safety devices.

This section describes the general safety precautions required for machine operation. Every operator must read this section carefully and observe the guidelines it describes.

1. Precautions When Installing the Machine

- (1) To hoist the machine, only use wires of the dimensions specified in the manual. They must be strong enough to support the weight of the machine.
- (2) To maintain the static machine accuracy within the guaranteed values, the following conditions must be satisfied:
 - Ambient temperature : 17 to 25°C (63 to 77°F)
 - Humidity : 75% HR or less (without condensation)
 - The machine and the NC unit must not be subject to direct sunlight.
 - The machine and the NC unit must not be subject to any excessive vibrations.
 - The installation site must be free of dust and corrosives.
- (3) Make sure that the floor is strong enough to support the machine.
- (4) Allow space so that the machine table can be moved without interference.
- (5) If rust prevention coating is applied to the slideway surfaces, it must be removed completely.
- (6) The machine must be leveled carefully during initial installation; leveling greatly affects the machining accuracy and the service life of the machine.
- (7) Transit clamps are used for machine transportation. These clamps must be removed before turning ON the power.
- (8) Electrical wiring should only be carried out by Okuma's service technician or authorized electrical technician.
- (9) Do not connect the machine power cable to the same power board as noise generating equipment, such as an electric welder and electric discharge machine. Doing this will cause the NC to malfunction.
- (10) The machine should be grounded independently of other machines. If the machine must be grounded with other machines, do not connect the ground cable to the same ground terminal as noise generating equipment, such as an electric welder or an electric discharge machine.

2. Precautions Before Starting Machine Operation

- (1) Use the specified lubricating and hydraulic oil or an equivalent.
- (2) Do not set a large value for the lubricating oil supply interval. If this interval is too long, a sufficient amount of lubricating oil will not be supplied to the lubricating points, causing faulty machine operation.
- (3) Do not apply mechanical shocks to the NC, operation panel, or electrical control cabinet. Shocks applied to this equipment will malfunction or fail.
- (4) Close all the doors to the NC, operation panel, and electrical control cabinet to prevent entry of moisture, chips, and other foreign matter.
- (5) Check the cables and wiring for damages. Damaged cables or wiring may cause leakage or an electric shock.
- (6) Always be sure that there are no obstacles or people near the machine's movable parts before operating the machine.
- (7) It is recommended to use a water-soluble coolant to prevent fire. Do not attempt unmanned operation if a non-soluble coolant is used.

3. Precautions During Machine Operation

- (1) Perform daily inspection on the machine immediately after turning on the power.
- (2) The automatic lubricating unit supplies the lubricating oil to the lubricating points when the power supply is turned ON. However, when starting the machine after a long stop or during cold weather, the lubricating oil may not be supplied to all lubricating points. In such cases, supply lubricating oil manually by pressing the manual lubrication switch on the pendant operation panel.
- (3) Use the cutting tools which meet the machine specification. Do not use heavily worn tools.
- (4) Never try to touch the spindle or the tool in the spindle during spindle orientation. The spindle may rotate, causing serious accidents.
- (5) Never apply torque to the spindle after the completion of spindle indexing operation, for example by tightening the milling chuck. The spindle may rotate, causing serious accidents.
- (6) Make sure that the tools and workpieces are tightened securely.
- (7) Never touch the workpieces or the tools by bare hand.
- (8) Never try to remove chips entangled in cutting tools by hand while the spindle is rotating.
To remove chips, make sure that the spindle has come to a complete stop, and use a brush or broom.
- (9) Never approach the cutting point during cutting. Coolant, chips, and/or broken tools splash.
- (10) Never start machine operation without the safety devices in place. Never remove the covers unless absolutely necessary.
- (11) Before loading or unloading a workpiece or tool, make sure that the spindle has come to a complete stop.
- (12) Never touch movable parts or stand near the machine during operation.

- (13) Use extra care to machine motion when entering the inside of the enclosure shield. Never enter the inside of the enclosure shield during automatic operation.
- (14) Never touch any switch with wet hands.
- (15) Visually check the switches on the operation panel before operating them.

4. Precautions on Maintenance and Inspection

- (1) Always turn OFF the power supply before performing maintenance and inspection.
- (2) Never attempt maintenance work while the power supply is ON. Always turn OFF the power supply before beginning maintenance.
- (3) Never change the parameter settings without consulting your Okuma representative.

5. Precautions on Operating the ATC and APC

- (1) Never stand close to the ATC and APC while they are operating.
- (2) The tool clamp mechanism in the magazine, tool change arm, and spindle are constructed to hold the tool securely. However, do not touch or stand near the ATC units while the ATC is operating because the tools in these units might drop due to unexpected causes.
- (3) When checking or replacing the tools in the ATC magazine, always select the step mode.
- (4) Because chips adhering to the magazine or tool change arm will cause faulty operation of the ATC, always remove them. However, never use compressed air to remove chips; compressed air will cause chips to enter the ATC units.
- (5) If the ATC or APC has stopped due to unknown reason and if it is necessary to check the ATC or APC while the power is ON, never touch the units because they might begin moving suddenly.

6. Other General Precautions

- (1) Keep the area around the machine clean and organized.
- (2) Wear clothes which are appropriate to safe operations. Follow the instructions of trained machine operators.
- (3) Cover your hair and do not wear loose clothing to avoid becoming tangled or caught in the machine. Always wear proper shoes and protective glasses when operating the machine.
- (4) All operators must read the operation and instruction manuals carefully in order to fully understand the machine.
- (5) All operators must know the positions of the emergency stop buttons so that they can use them when necessary.
- (6) Do not touch the terminals of the electrical control panel, transformer, and motors because high voltage is applied to some of the terminals.
- (7) If more than one person is operating the machine, all involved operators must cooperate and be able to communicate.

7. Symbols

This manual uses the following symbols to emphasize the items which must be strictly observed:



REMARKS : Precaution in machine operations.

Default of this item affects the machining accuracy and smooth operation.



CAUTION : Default of this item causes faulty machine operation, machine damage, or possible operator injury.

More care must be exercised to this item than the items indicated under "REMARKS".



WARNING : Default of this item causes not only machine damage but also a serious accident may result including loss of life.

Sufficient care must be paid to this item.

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SECTION 1 PROGRAM INPUT/OUTPUT FUNCTIONS BY FLOPPY DISKS (OSP FORMAT)

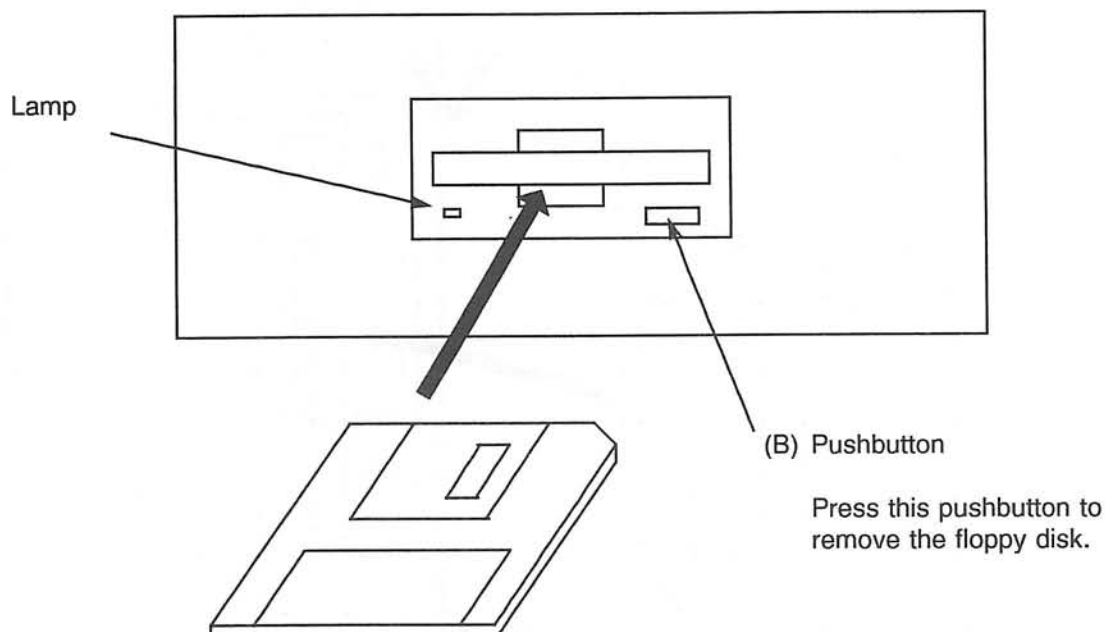
1. Overview

Ordinarily, paper tape is used as the storage medium for NC machining programs. This function allows the use of floppy disks instead of paper tape. Both 3.5" and 8" floppy disks can be used in OSP format.

Note: For physical format and logic format, refer to 3-3.

2. Floppy Disk Handling

2-1. 3.5" Built-in Floppy Disk Drive



Sector device name, FDD: or FDI:, is indicated in the floppy interface. Follow this instruction.

(1) Floppy Disk Setting

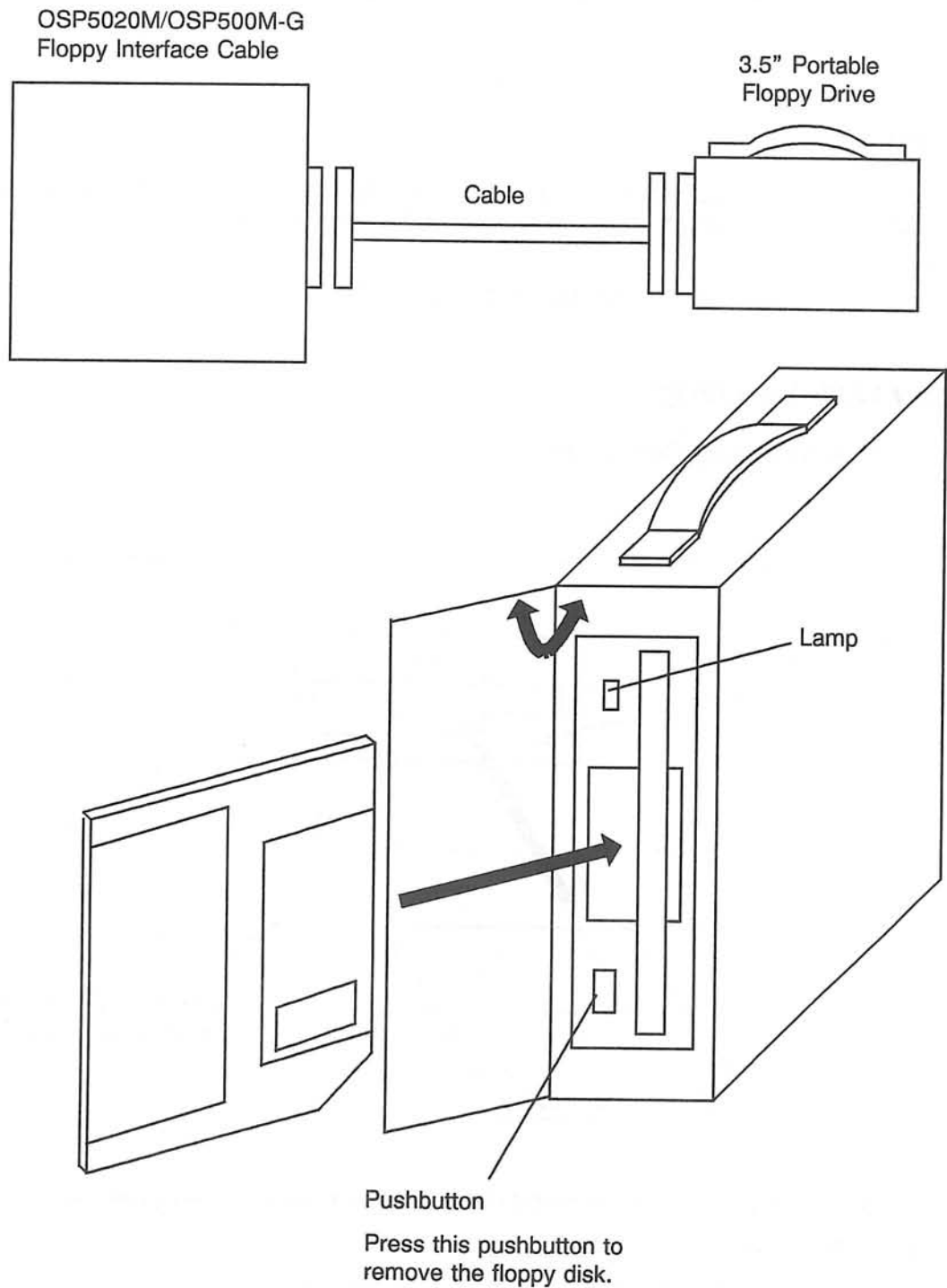
Insert a floppy disk to the slot until a floppy disk is firmly set.

(2) Floppy Disk Removal

Press (B).

Note: The lamp lights while floppy disk read/write operation is being executed. It does not light when a floppy disk is inserted.

2-2. 3.5" Portable Floppy Disk Drive



The sector device name, FD0: or FD1:, is indicated on the floppy interface. Follow this indication.

SECTION 1 PROGRAM INPUT/OUTPUT FUNCTIONS BY FLOPPY DISKS (OSP FORMAT)

(1) Floppy Disk Setting

Push the floppy disk as indicated on the previous page till it is inserted completely.

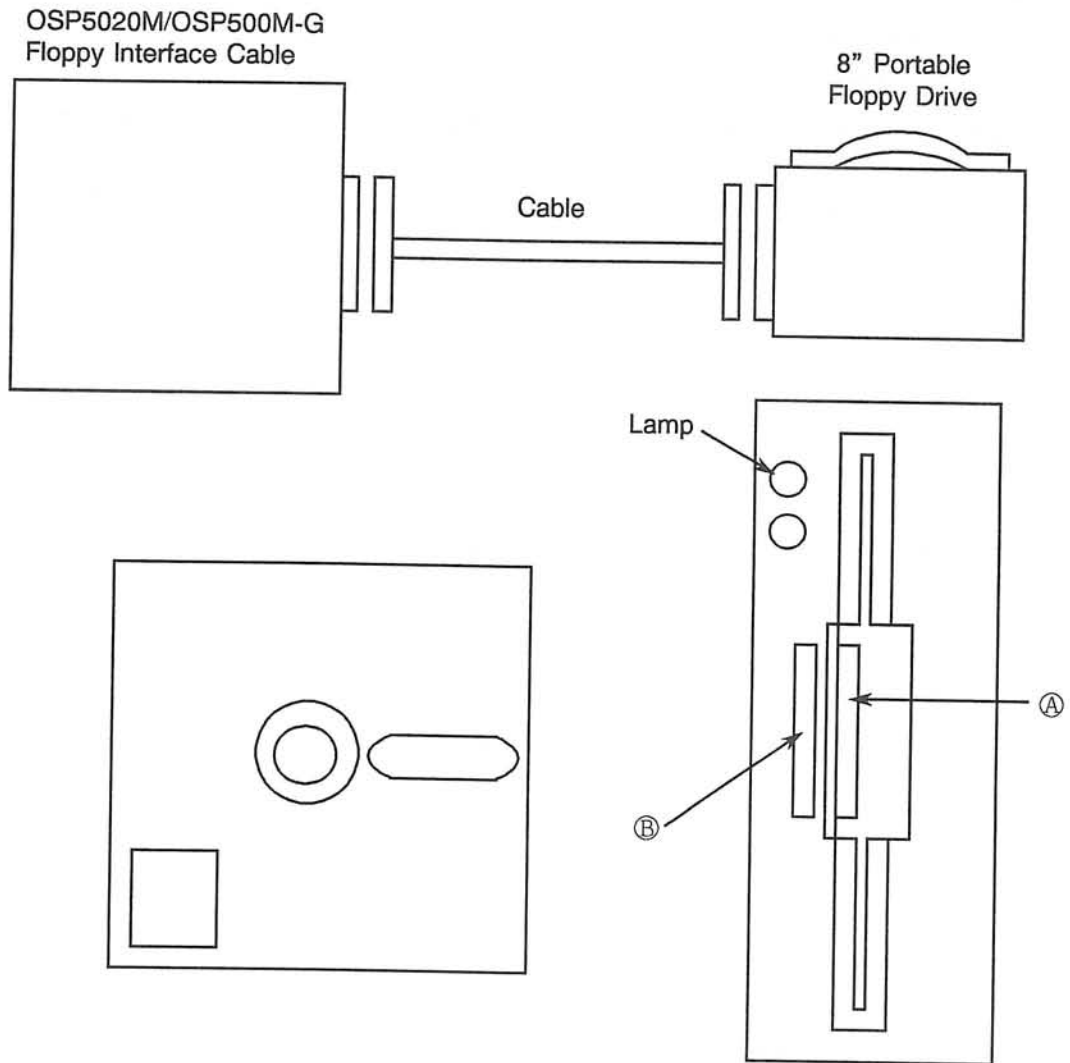
(2) Floppy Disk Removal

Press the pushbutton.

Note 1: Before connecting/disconnecting the cable to/from the floppy disk interface of OSP5020M/OSP500M-G, turn off the power.

Note 2: The lamp lights while floppy disk read/write operation is being executed. It does not light when a floppy disk is inserted.

2-3. 8" Portable Floppy Disk Drive



Sector device name, FD0: or FD1:, is indicated in the floppy interface. Follow this instruction.

(1) Floppy Disk Setting

Press **B** on the drawing above and insert and set a floppy disk.

Press **A** to the left and close the cover.

(2) Floppy Disk Removal

Press **B**.

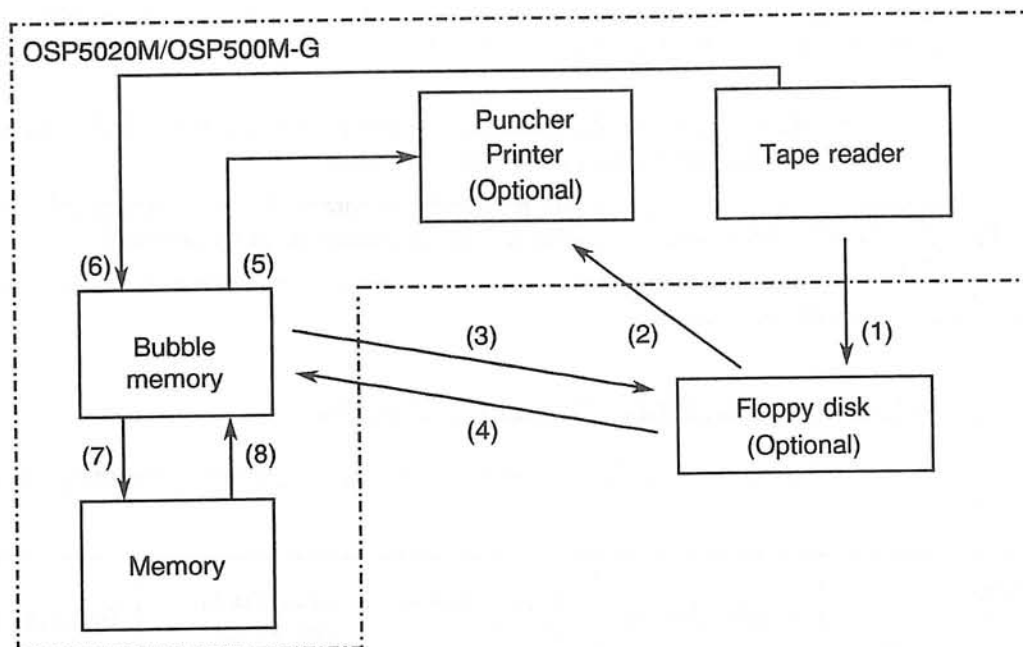
Note 1: Before connecting/disconnecting the cable to/from the floppy disk interface of OSP5020M/OSP500M-G, turn off the power.

Note 2: The lamp lights when the floppy disk is correctly set.

3. Floppy Disk Input/output Function

3-1. Outline of Operation

The data input/output operations using the floppy disk are represented by (1) through (4) in the following diagram. (2) and (6) are for tape puncher specifications (optional), and (6) through (8) are standard specifications for the OSP5020M/OSP500M-G.



- (1) In the program operation mode, the NC machining program stored on the paper tape is written directly onto the floppy disk from the tape reader by the read command in the PIP mode.
- (2) In the program operation mode, the NC machining program stored in the floppy disk is directly output to the puncher to create a punched tape for the NC machining program by the punch command in the PIP mode.

Similarly, the NC machining program stored in the floppy disk is directly output to the printer to create a process sheet by the list command.

Similarly, the names of the NC machining program files stored in the floppy disk are directly output to the printer to create a file name list by the directory command.

- (3) In the program operation mode, the NC machining program stored in the bubble memory of the NC unit is copied onto the floppy disk by the copy command in the PIP mode.
- (4) In the program operation mode, the NC machining program stored in the floppy disk is copied into the bubble memory of the NC unit by the copy command in the PIP mode..

- (5) In the program operation mode, the NC machining program stored in the bubble memory of the NC unit is output to the puncher to create a punched tape of the NC machining program by the punch command in the PIP mode.

Similarly, the NC machining program stored in the bubble memory is directly output to the printer to create a process sheet by the list command.

Also in the same way, the names of the NC machining program files stored in the bubble memory are directly output to the printer to create a file name list by the directory command.

- (6) In the program operation mode, the NC machining program punched onto the paper tape is read into the bubble memory of the NC unit from the tape reader by the read command in the PIP mode.
- (7) In the program operation mode, the NC machining program stored in the bubble memory of the NC unit is transferred to the edit buffer by the edit command.

In the automatic operation mode, the NC machining program stored in the bubble memory is transferred to the operation execution buffer by the program selection command.

- (8) In the program operation mode, the NC machining program in the edit buffer is returned to the bubble memory by the edit command.

3-2. Operation Command and Input/Output Relationship

- (1) The data stored in the input device is transferred to the output device by inputting the operation command.

External Device Command		Sector Device	Tape Reading Device	Tape Punching Device	Printout Device
F2	DIR	Input			Output
F3	PIP				
	F1 READ	Output	Input		
	F2 PUNCH	Input		Output	
	F3 VERIFY	Input/Output	Input		
	F4 COPY	Input/Output			
F5	FREE	Input			Output
F6	LIST	Input			Output
F2	INIT	Output			
F3	DELETE	Output			
F4	RENAME	Output			
F1	PROTECT	Output			

SECTION 1 PROGRAM INPUT/OUTPUT FUNCTIONS BY FLOPPY DISKS (OSP FORMAT)

(2) Connectable External Devices and Their Symbolic Designations:

Sector device	[	BB1:	User bubble memory
		FD0:	3.5" or 8" floppy disk
		FD1:	3.5" or 8" floppy disk
Tape reader	[	TR:	Standard tape reader provided
		CN0:	For RS232C Channel 0 tape reader*
		CN1:	For RS232C Channel 1 tape reader*
		CN2:	For RS232C Channel 2 tape reader*
		CN3:	For RS232C Channel 3 tape reader*
Tape punch	[	CN4:	For RS232C Channel 4 tape reader*
		CN0:	For RS232C Channel 0 tape punch*
		CN1:	For RS232C Channel 1 tape punch*
		CN2:	For RS232C Channel 2 tape punch*
		CN3:	For RS232C Channel 3 tape punch*
Printer	[	CN4:	For RS232C Channel 4 tape punch*
		CN:	Console
		PN:	Operation panel CRT
		CN0:	For RS232C Channel 0 printer*
		CN1:	For RS232C Channel 1 printer*
		CN2:	For RS232C Channel 2 printer*
		CN3:	For RS232C Channel 3 printer*
		CN4:	For RS232C Channel 4 printer*

Devices marked by an asterisk (*) are options.

(3) When the name of a connectable device is not designated, the respective default device name is assumed.

BB1: for sector device
 TR: for tape reader (selectable by NC optional parameter (word) No.57)
 CN0: for tape punch (selectable by NC optional parameter (word) No.45)
 PN: for printer

- Default device for the tape reader and tape punch can be changed as required by parameter settings.
- When the output NC machining program name is omitted, the same name as the input NC machining program is used.
- When the input NC machining program name is omitted, the name of the input NC machining program becomes "A.MIN". However, if the NC machining program name is punched on the paper tape, then that will be used as the name of the input NC machining program.

3-3. Types of Floppy Disks

(1) 3.5" Floppy Disk

Type	Recommended Manufacturers	OSP Format
2DD 80 Track 135TPI	TDK SUMITOMO 3M Hitachi Maxell	9 sector/track 512 byte/sector
2HD 80 Track 135TPI		18 sector/track 512 byte/sector

(2) 8" Floppy Disk

IBM P/N 2305830 (Hitachi Maxell FD1-128) (IBM DISKETTE 1)	Single-sided single-density: 77 cylinders/disk 1 track/cylinder 26 sectors/track 128 bytes/sector
IBM P/N 2736700 (Hitachi Maxell FD2-256) (IBM DISKETTE 2)	Double-sided single-density: 77 cylinders/disk 2 track/cylinder 15 sectors/track 256 bytes/sector
IBM P/N 1766872 (Hitachi Maxell FD2-256D) (IBM DISKETTE 2D)	Double-sided double-density: 77 cylinders/disk 2 track/cylinder 26 sectors/track 256 bytes/sector

(3) Supplement

- (a) As files are generated according to the OSP format (a file control system exclusive to the OSP5020M/OSP500M-G), floppy disks containing IBM format files generated on other computers cannot be read or written.
- (b) New floppy disks must be initialized before they can be used.
- (c) When reading floppy disks generated by IBM format (logic format) into the OSP, specially select floppy disk input/output function (optional) for IBM formatted disk.

Multi-volume specification which allows storing of a single program to be stored in more than one floppy disk is optionally available in the IBM format. (only for 8" floppy disk)

SECTION 1 PROGRAM INPUT/OUTPUT FUNCTIONS BY FLOPPY DISKS (OSP FORMAT)

(d) The following table shows the capacity of the floppy disks in terms of tape length.







Type of Floppy Disk	3.5"		8"		
	2DD	2HD/2HC	FD1-128	FD2-256	FD2-256D
Tape Storage Capacity [Tape Length]	1,840 m (6,037 ft)	3,770 m (12,369 ft)	650 m (2,133 ft)	1,470 m (4,823 ft)	2,550 m (8,367 ft)

(4) Cautions for Handling Floppy Disks:

- (a) Do not directly touch or wipe the area of the disk that is exposed.
- (b) Keep floppy disks away from magnets.
- (c) Do not use ball point pens or pencils to write onto the floppy disk covers. Use a soft felt tip pen to write on them.
- (d) Do not use clips to fasten floppy disks.
- (e) Keep floppy disk in their protective envelopes during storage.
- (f) Keep floppy disks out of the direct sunlight or hot places.

3-4. Sector Device

The following table indicates the available sector device according to the combination of specification.

Combination of Specification Sector Device	Only 3.5" floppy disk is selected	Only 8" floppy disk is selected	Both 3.5" and 8" floppy disks are selected
FD0:			 3.5" floppy disk
FD1:			 8" floppy disk

FD0: and or FD1: is indicated on the floppy unit for built-in type floppy disk drive, and on the floppy interface for the portable floppy disk drive.

4. Operations

The explanation that follows is made under the following assumption:

3.5" floppy disk is used Sector device FD0:

8" floppy disk is used Sector device FD1:

Whether 3.5" floppy is used or 8" floppy disk is used dese not any difference
 Sector device FD0:

The sector device of the floppy disk being used is indicated either on the floppy disk unit or floppy disk interface.

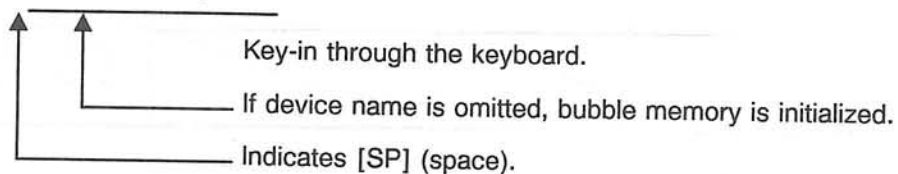
4-1. INIT: Initialize

New floppy disks which have not been formatted to the OSP format must be initialized before use. Initializing the OSP format for the floppy disk delete all the data stored on the disk.

4-1-1. 3.5" Floppy Disk

- (1) Select the PROG OPERATION mode by pressing the **EDIT AUX** key.
 "=" is displayed on the screen.
- (2) Press the function key [F8] (EXTEND).
 "=EX" is then displayed.
- (3) Press the function key [F2] (INIT).
 This changes the display to "=IN".
- (4) Then input "FD0:" after "=IN" and press the **WRITE** key.

=IN_FD0: [WRITE]



- (5) In response to the input above, the system prompt
initialize OK! (Y/N)!
 appears on the screen.
 Press "Y" and then **WRITE** key.
- (6) The prompt
formatting OK (Y/N)!
 appears on the screen.
 Press "Y" and then **WRITE** key.

- (7) The prompt

format (2DD-720K = 0, 2HD-1.44M = 1)!

is displayed on the screen.

Key in the type of floppy disk, "0" for 2DD and "1" for 2HD/2HC, through the key board, and press the **WRITE** key.

This completes the floppy disk initialization.

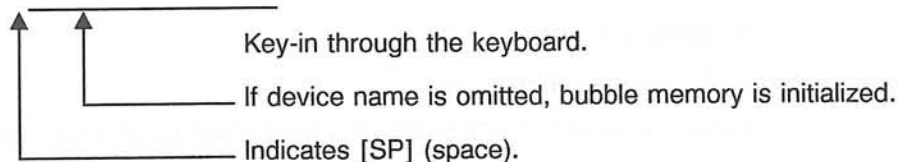
When the floppy disk is already formatted to the OSP format, key in "N" in step (6). The following message will be displayed and the floppy disk initialization will be completed.

FD0: OSP format (2HD-1.44M) (in the case of 2HD)

4-1-2. 8" Floppy Disk

- (1) Select the PROG OPERATION mode by pressing the **EDIT AUX** key.
" = " is displayed on the screen.
- (2) Press the function key [F8] (EXTEND).
" = EX" is then displayed.
- (3) Press the function key [F2] (INIT).
This changes the display to " = IN".
- (4) Then input "FD1:" after " = IN" and press the **WRITE** key.

= IN_ FD1: [WRITE]



- (5) In response to the input above, the system prompt

FD1: OSP format (FD2-256D)

initialize OK! (Y/N)!

appears on the screen.

Press "Y" and then **WRITE** key.

Note 1: When a new floppy disk which has not been initialized by the OSP is to be initialized, the floppy disk is usually written in the IBM format and therefore the system prompt in step (5) will be as indicated below:

FD0: IBM format (FD2-256D)

initialize OK (Y/N)!

Keying "Y" and press the **WRITE** key in response to the prompt above initializes the floppy disk to the OSP format.

Note 2: If the optional floppy I/O function in the IBM format is selected, keying "Y" and pressing the **WRITE** key in response to the prompt displayed on the screen in step (5) above, will display the prompt below.

type (OSP = O, IBM = I)!

In this case, press "O" and then **WRITE** key, and the floppy disk is initialized to the OSP format.

Note 3: When initializing the floppy disk, the OSP automatically reads and judges which type of floppy disk is being used; FD1-128, FD2-256 or FD2-256D.

However, if the data for floppy disk type identification has been destroyed, the system prompt displayed in stop (5) will be as follows:

FD1: ??? format (FD?-???)

2162 floppy disc initialize ERROR

And thus the initialization of the floppy disk will be impossible.

For the floppy disks written in the format other than the IBM format or the OSP format the same message will be displayed.

In such a case, initialize the floppy disk using the option code ";F", which allows the designation of the floppy disk type.

Example:

For designating the double-sided double-density floppy disk type

= IN FD1.;F [WRITE]

initialize OK (Y/N)!

Press "Y" and then **WRITE** key.

formatting (Y/N)!

Press "N" and then **WRITE** key.

format (FD2-128 = 0, FD2-256 = 1, FD2-256D = 2, FD1-128 = 3)!

Press "2" and the **WRITE** key.

(Do not use FD2-128 since it has a special formatting system).

Note 4: If the formatting data (data in the index field) of the floppy disk has been destroyed, the following error message is displayed and initialization will be impossible.

2014 floppy disk read/write ERROR

This occurs if the floppy disk has been placed near magnet, the floppy disk has been scratched, or the floppy disk has been used in the device which employs different formatting system.

In this case use the option code ";F" also.

Press "Y" and **WRITE** key following the system prompt appearing on the screen.

formatting (Y/N)!

Note that floppy disks are consumables and if a problem is with the floppy disk itself, then the initialization of such floppy disk is impossible.

Note that for the floppy disk having been formatted, read/write operations is possible only in the floppy disk drive used for formatting and these operations using other devices is not guaranteed. Therefore, formatting should be avoided unless otherwise absolutely necessary.

4-2. DEL: Delete

By designating the name of the file stored in the floppy disk, the file can be deleted.

- (1) Select the PROG OPERATION mode by pressing the **EDIT AUX** key.
"=" is displayed on the screen.
- (2) Press the function key [F8] (EXTEND).
"=EX" is then displayed on the screen.
- (3) Press the function key [F3] (DELETE).
This changes the display to "=DEL".
- (4) Key in "FD0:ABC.MIN" after "=DEL" and press **WRITE** key.
"**FD0:ABC.MIN deleted**" appears on the screen showing that deletion is completed. By this operation, the file "ABC.MIN" was deleted.

4-3. RENAME: Name Change

This command permits the change of a file name.

Procedure:

- (1) Select the PROG OPERATION mode by pressing the **EDIT AUX** key.
"=" is displayed on the screen.
- (2) Press the function key [F8] (EXTEND).
"=EX" is then displayed on the screen.
- (3) Press the function key [F4] (RENAME).
This changes the display to "=R".
- (4) Key in "FD0:ABC.MIN,DEF.MIN" after "=R" and press the **WRITE** key.
By the above operation, the file name "ABC.MIN" is renamed "DEF.MIN".
The contents of the file are not effected by changing of the file name.

4-4. DIR: Directory

This command displays all file names stored in the floppy disk, and prints out a list of file names on the printing device.

- (1) Select the PROG OPERATION mode by pressing the **EDIT AUX** key.
"=" is displayed on the screen.
- (2) Press the function key [F2] (DIR).
"=DI" is then displayed on the screen.
- (3) Key in "FD0:,CN0:" after "=DI" and press the **WRITE** key.
Default of output device name is PN: (CRT on operation panel).

By the above operation, a list of all the files stored in the floppy disk is output to the printer (optional) connected to the NC unit (CN0:).

Option codes can also be used with this command. Input of ";P" displays file protected conditions.

4-5. FREE: Remaining Floppy Disk Area

By this command, the remaining size of area on the floppy disk and the maximum size of the contiguous vacant area can be displayed.

- (1) Select the PROG OPERATION mode by pressing the **EDIT AUX** key.

"=" is displayed on the screen.

- (2) Press the function key [F5] (FREE).

"=FR" is then displayed on the screen.

- (3) Key in "FD0:;CN0:" after "=FR" and press the **WRITE** key.

Default of output device name is PN: (CRT on operation panel).

The remaining writing space is output to the printer (optional).

Option codes can be used with this command. Input of ";C" displays the maximum size of the contiguous vacant area. Therefore, in order to display the capacity in the contiguous vacant area key in "FD0:;CN0;;C" after "=FR" and press the **WRITE** key.

4-6. LIST: List of Files

By this command, a designated list of files stored on the floppy disk can be displayed on the operation panel CRT or output to the printer.

- (1) Select the PROG OPERATION mode by pressing the **EDIT AUX** key.

"=" is displayed on the screen.

- (2) Press the function key [F6] (LIST).

"=L" is then displayed on the screen.

- (3) Key in "FD0:ABC.MIN,PN:" after "=L" and press the **WRITE** key.

Default of the output device name is PN: (CRT on operation panel).

By the above operation, the list of file "ABC.MIN" is printed out by the printer (optional).

4-7. READ: Reading from Tape Reader

By this command, the NC machining program stored in the punched tape is read onto the floppy disk.

- (1) Select the PROG OPERATION mode by pressing the **EDIT AUX** key.

"=" is displayed on the screen.

- (2) Place the punched NC machining program tape into the tape reader.

- (3) Press the function key [F3] (PIP) for input/output operations between the OSP and peripheral equipment.

"=PIP >" is then displayed on the screen.

- (4) Press the function key [F1] (READ).

This changes the display to ">R".

SECTION 1 PROGRAM INPUT/OUTPUT FUNCTIONS BY FLOPPY DISKS (OSP FORMAT)

(5) Key in "FD0:ABC.MIN" after ">R" and press the **WRITE** key.

By the above operation, the NC machining program on the punch tape is read from the tape reader under the name of "ABC.MIN".

The following option codes can be used with this command.

Option Code	Meaning
;E	EIA code designation
;I	ISO code designation
;V	Verify designation
;A	File designation (used when designating the destination file to which the program is stored)
;C	When read error has occurred, continuous reading can be carried out. Symbol "I" is displayed or punched for character which causes an error.

4-8. Output of Files to the Tape Punch

By specifying the file name, the data stored in the floppy disk is punched out onto the paper tape.

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

"=" is displayed on the screen.

(2) Press the function key [F3] (PIP) for input/output operations between the OSP and peripheral equipment.

"= PIP >" is then displayed on the screen.

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

This changes the display to ">P".

(4) Key in "FD0:ABC.MIN,PP:" after ">P" and press the **WRITE** key.

If an output device name is not designated, the device assigned by the parameter setting is selected.

By the above operation, all data stored in the file "ABC.MIN" is output to an optional tape punch.

The following option codes can be used with this command.

Option Code	Meaning
;E	EIA code designation
;I	ISO code designation

4-9. Verify

By this command, the NC machining program punched out onto the paper tape is checked with the program stored in the floppy disk to see that the file name, program data etc. are matching.

- (1) Select the PROG OPERATION mode by pressing the **EDIT AUX** key.
" = " is displayed on the screen.
- (2) Place the punched NC machining program tape into the tape reader.
- (3) Press the function key [F3] (PIP) for input/output operations between the OSP and peripheral equipment.
" = PIP > " is then displayed on the screen.
- (4) Press the function key [F3] (VERIFY).
This changes the display to ">V".
- (5) Key in "FD0:ABC.MIN" after ">V" and press the **WRITE** key.

By the above operation, the system checks whether the data of file "ABC.MIN" punched onto the paper tape matches that of the stored in the floppy disk. The device name for reading the tape, such as tape reader (TR:), may be omitted.

When verification is completed, the following is displayed:

end of tape
end of file
all same data

When the data does not match, data causing mismatch flashes on the CRT and verification stops temporarily.

The following option codes can be used with this command:

Option Code	Meaning
;E	EIA code designation
;I	ISO code designation

4-10. Read from Bubble Memory

By designating the file stored in the bubble memory, the NC program of that file name is read onto the floppy disk.

- (1) Select the PROG OPERATION mode by pressing the **EDIT AUX** key.
" = " is displayed on the screen.
- (2) Press the function key [F3] (PIP) for input/output operations between the OSP and peripheral equipment.
" = PIP > " is then displayed on the screen.
- (3) Press the function key [F4] (COPY).
This changes the display to ">CO".

SECTION 1 PROGRAM INPUT/OUTPUT FUNCTIONS BY FLOPPY DISKS (OSP FORMAT)

- (4) Key in "ABC.MIN,FD0:" after ">CO" and press the **WRITE** key.

By this operation, the data of file "ABC.MIN" stored in the bubble memory is transferred to the floppy disk under the same file name.

The following option codes can be used with this command.

Option Code	Meaning
;E	EIA code designation
;I	ISO code designation
;A	File designation (used when designating the destination file to which the program is stored)
;V	VERIFY (The prompt "Y/N" will appear on the screen.)

4-11. Data Transmission to Bubble Memory

By designating the file stored in the floppy disk, the NC program of that file name is read into the bubble memory.

- (1) Select the PROG OPERATION mode by pressing the **EDIT AUX** key.

"=" is displayed on the screen.

- (2) Press the function key [F3] (PIP) for input/output operations between the OSP and peripheral equipment.

"= PIP >" is then displayed on the screen.

- (3) Press the function key [F4] (COPY).

This changes the display to ">CO".

- (4) Key in "FD0:ABC.MIN" after ">CO" and press the **WRITE** key.

By this operation, the data of file "ABC.MIN" stored in the floppy disk is transferred to the bubble memory under the same file name.

The following option codes can be used with this command.

Option Code	Meaning
;E	EIA code designation
;I	ISO code designation
;A	File designation (used when designating the destination file to which the program is stored)
;V	VERIFY (The prompt "Y/N" will appear on the screen.)

4-12. Floppy Disk File Protection

By this command, files stored in the floppy disk are protected so that they cannot be written over, edited or deleted.

- (1) Select the PROG OPERATION mode by pressing the **EDIT AUX** key.

"=" is displayed on the screen.

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

- (3) Press the function key [F5] (PROTECT).

This changes the display to "= PROT".

- (4) Key in "FD0:A.MIN" after "= PROT" and press the **WRITE** key.

When this operation is completed, the display "**A.MIN file protection end**" appears on the screen, denoting that the NC machining program "A.MIN" stored on the floppy disk has a protection label written for it.

In the following cases, the files are protected and the display "**A.MIN file write protection**" appears on the screen.

In the case of output file name is "FD0:A.MIN" in the following operations:

```
F1  ....  READ
F4  ....  COPY
F4  ....  EDIT
F3  ....  DELETE
F4  ....  RENAME
```

The following option codes can be used with this command.

Option Code	Meaning
;C	Release of the protection label for a designated file
;V	VERIFY (The prompt Y/N will appear on the screen.)

SECTION 2 PROGRAM INPUT/OUTPUT FUNCTIONS BY FLOPPY DISKS (IBM FORMAT)

1. Overview

- (1) The following are typical methods for loading an NC program created, for example, by an off-line automatic programming system to the NC system. (See Fig. 2-1)

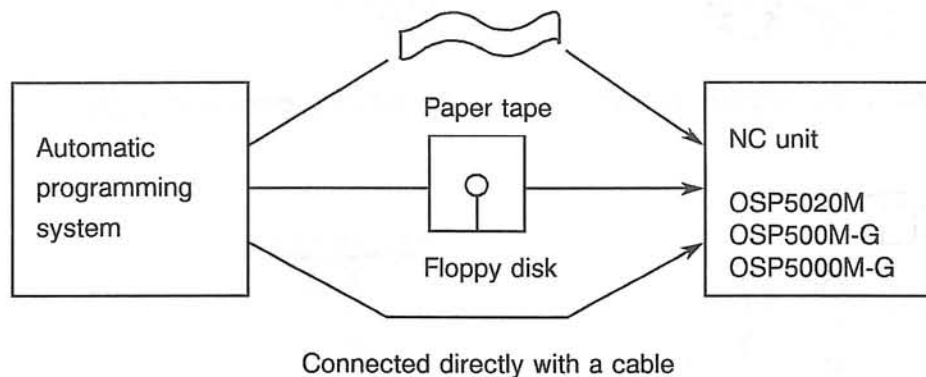


Fig. 2-1 NC Program I/O Method

- (2) In the past, a paper tape was normally used for this purpose; however, with the increase in program capacity, various problems have arisen for loading of NC programs; for example, the application of NC program to the punch and NC unit is too time-consuming, and a single program must be divided into several tapes, thus making it hard to handle.

In order to solve these problems, it becomes necessary to provide NC tape input/output means by a floppy disk. In this case, since the floppy disk format differs with the system, it should be converted by some method to an applicable form so that the respective systems are easy to handle.

- (3) With the OSP500M-G, OSP5000M-G and OSP5020M, a unique OSP format is employed for use in the data floppy disk; however, when inputting a floppy disk generated by other devices as illustrated above, the system should conform basically to IBM format now commonly in use. By explicating the items the OSP500M-G, OSP5000M-G and OSP5020M actually uses among these IBM formats, the floppy disk format with which the OSP can input and output is to be defined.
- (4) Floppy disks made in conformity with this standard can be used as input/output means for the OSP500M-G, OSP5000M-G, and OSP5020M. (See Fig. 2-2)

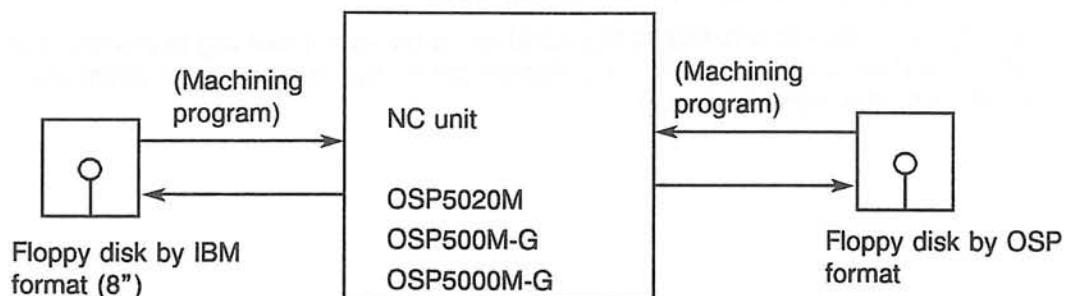
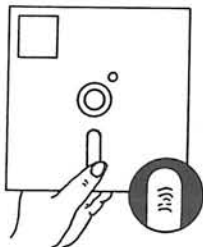


Fig. 2-2 Machining Program Input/Output in OSP Series

2. Floppy Disk Handling

2-1. Cautions On Handling Floppy Disks

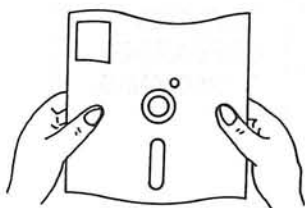


Never touch the magnetic surface.

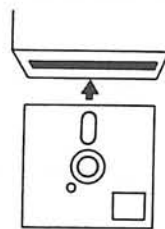


Write protect notch
(Some floppy disks
do not have it.)

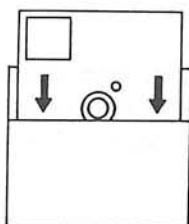
Do not bring close to magnets.



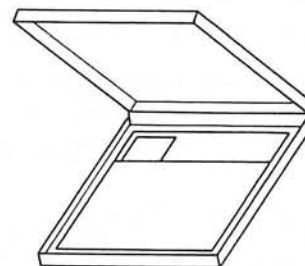
Do not twist or fold.



Always insert accurately.



Always store in the envelope.



Place in floppy disk storage box.

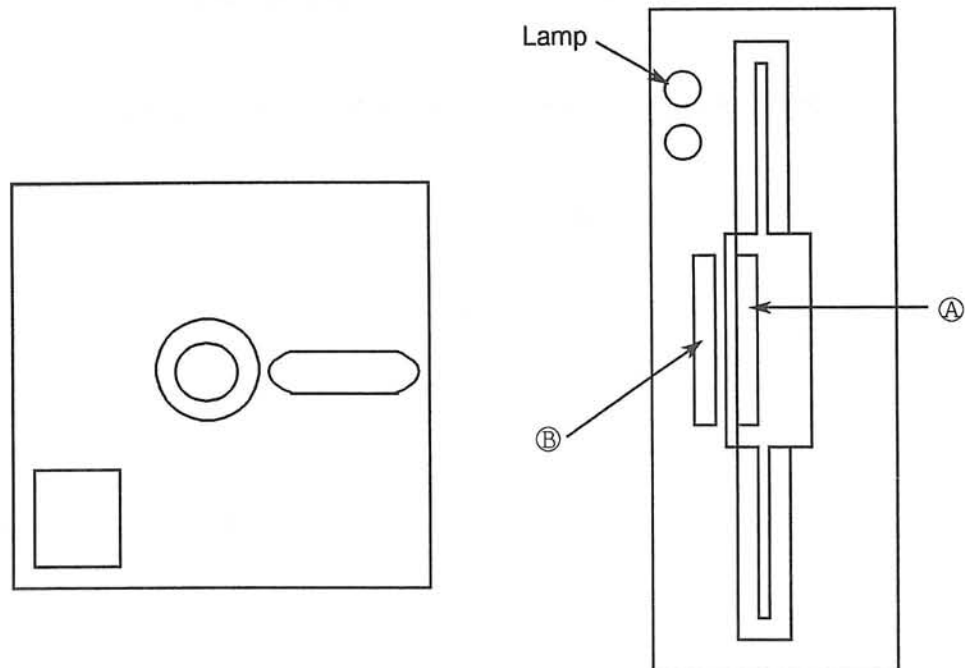
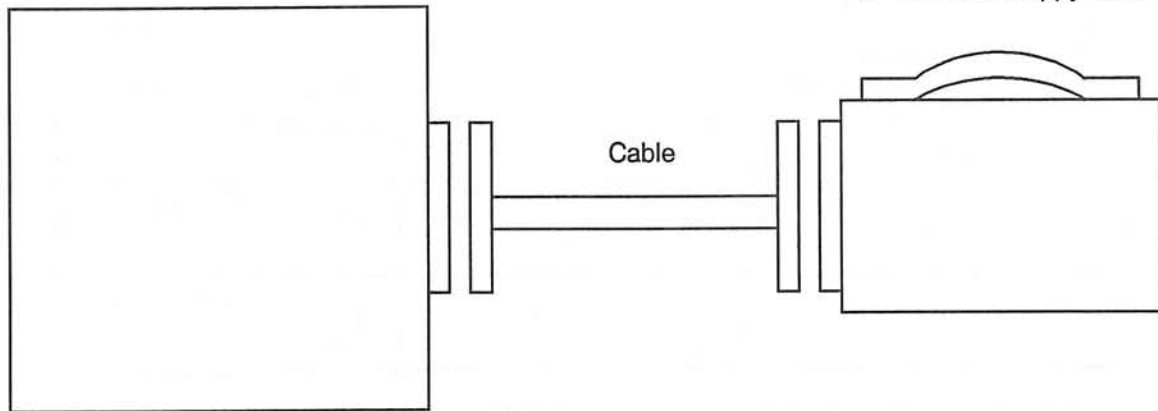
When not using the floppy disk:

- (1) Insert the floppy disk into the envelope
- (2) Place the floppy disk in the floppy disk storage box.
- (3) The floppy disk storage box should be placed into a moisture proof bag or box made of plastic or vinyl. In addition avoid storing it in high temperature, high humidity, or in direct sunlight. Never leave it lying around the machinery.

2-2. Floppy Disk Operation

OSP5020M/OSP500M-G
Floppy Interface Cable

8" Portable Floppy Disk



Sector device name, FD0: or FD1:, is indicated in the floppy interface. Follow this instruction.

Input/output function is available only for the 8" floppy disk if it is formatted in IBM system. The following instruction is for the disk with "FD1" device name.

(1) Floppy disk setting

Press on the drawing above and insert and set a floppy disk.
Press A to the left to close the cover.

(2) Floppy disk removal

Press B.

Note: Before connecting the cable to the floppy interface of OSP5020M/OSP500M-G, turn off the power. When a floppy disk is inserted correctly, the lamp lights.

2-3. Sector Device Name

Sector device name varies depending on the combination of the selected specifications.

Table 2-1

Combination of Specification Sector Device	Only 8" floppy disk is selected	Both 3.5" and 8" floppy disks are selected
FD0:	○	○ 3.5" floppy disk
FD1:	/	○ 8" floppy disk

FD0: and/or FD1: is indicated on the floppy unit for built-in type floppy disk drive, and on the floppy interface for the portable floppy disk drive.

Only 8" floppy disks can be used as IBM formatted floppy disks.

3. Floppy Disk Format

3-1. Applicable Floppy Disks

Available for this system are the following floppy disks which conform to 8" IBM sift sector format.

- (1) Floppy disk FDI-128 (IBM P/N 2305830)
Single-sided single-density 128 bytes/sector (26 sectors/track)
- (2) Floppy disk FD2-256 (IBM P/N 2736700)
Double-sided single-density 256 bytes/sector (15 sectors/track)
- (3) Floppy disk FD2-256D (IBM P/N 1766872)
Double-sided double-density 256 bytes/sector (26 sectors/track)

Side 0 of each floppy disk cylinder 0 is used at 128 bytes/sector (26 sectors/track) regardless of single or double density. (See Table 2-2)

Table 2-2 Type of Floppy Disk

Type of Floppy Disk	IBM P/N	Side 0 of Cylinder 0			Side 1 of Cylinder 0 Cylinders 1 to 76		
		Sector Track	Byte Sector	System	Sector Track	Byte Sector	System
FD-128	2305830	26	128	FM	— 26	— 128	— FM
FD2-256	2736700	26	128	FM	26 15	128 256	FM FM
FD2-256D	1766872	26	128	FM	26 26	256 256	MFM MFM

FM: Frequency Modulation

MFM: Modified FM

Note: Amount of data (in tape length) that can be written into a floppy disk is indicated below.

FD1-128 (single-sided single-density) Approx. 610 m (2,000 ft.)

FD2-256 (double-sided single-density) Approx. 1400 m (4,593 ft.)

FD2-256D (double-sided double-density) Approx. 2500 m (8,202 ft.)

3-2. Floppy Disk Layout

- (1) The floppy disk is divided into a cylinder, side and sector as shown in Fig. 3-1 below.

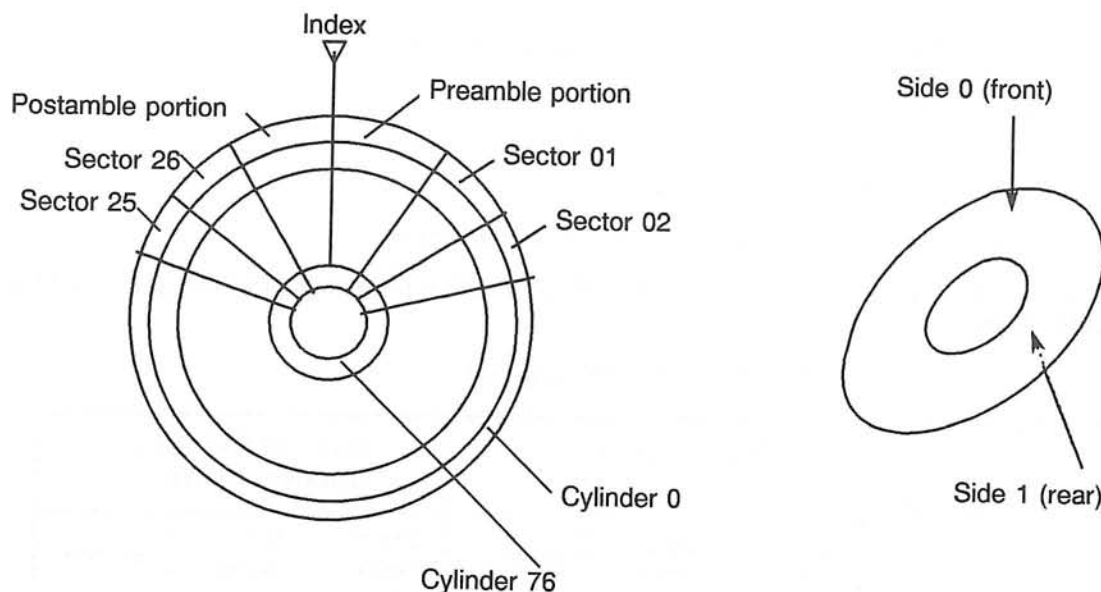


Fig. 2-3 Floppy Disk Layout

- (2) The floppy disk is divided into 77 cylinders, i.e. 0 to 76 in sequence from the outside. The single-sided cylinder has only side 0, and the double-sided cylinder has its track divided into side 0 and side 1.
- (3) Each track is divided into the preamble portion, sector portion and postamble portion with the index position as a reference.

Usage of each cylinder:

Cylinder 0	.....	Index cylinder
Cylinder 1-74	.....	Cylinder for NC machining data
Cylinder 75, 76	.....	Replacement of faulty cylinders

3-3. Number of Files

The maximum number of files a floppy disk is indicated below:

FD1-128 (single-sided single-density)	.....	19 files
FD2-256 (double-sided single-density)	.....	45 files
FD2-256D (double-sided double-density)	.....	Max. 71 files

Note: For details of floppy disk format, refer to 8, "Floppy Disk Format (IBM Format)".

4. Operations

The explanation is given assuming that the sector drive name is FDI:

Designate the sector device name correctly by referring to 2-3. "Sector Device Name"

4-1. Directory

This is the function for making a list of files stored in the floppy disk. The list may be displayed on the CRT and it may also be given as a hard copy.

Procedures:

- (1) Select the PROG OPERATION mode by pressing the **EDIT AUX** key.

The CRT will change as shown right.



PROG OPERATION							
DATE	DIR	PIP	EDIT	FREE	LIST	CONDENS	(EXTEND)
F 1	F 2	F 3	F 4	F 5	F 6	F 7	F 8

- (2) Press the function key [F2] (DIR).

The CRT displays the prompt "**= DI**" on its console line.

PROG OPERATION							
= DI							
DATE	DIR	PIP	EDIT	FREE	LIST	CONDENS	(EXTEND)
F 1	F 2	F 3	F 4	F 5	F 6	F 7	F 8

- (3) Enter the device name, FD1:.

- (4) Press the **WRITE** key.



Note 1: Up to 12 file names are displayed on the screen.

When all the file names are not indicated on one display page, the CRT does not display the prompt "=" and the cursor remains as it was. In this case:

- a) Press the **BS** key, and the display page advances one page.
- b) Press the **WRITE** key, and the display page will advance continuously. To stop the advancement of pages, press the **BS** key.
- c) Press the **CANCEL** key, and the command will be aborted with the display unchanged.

Example: In the case there are many files;

- 1) **[F2] (DIR) and WRITE** Display of the 1st page
- 2) **BS** Keep pressing until the required page is displayed.
- 3) **CANCEL** Abort the directory mode.
- 4) **EDIT** Designate the file on the CRT.

Note 2: When there are no files, the message "**file not found**" is given.

Note 3: Key in a file name following the prompt "=DI", and you can check if that file exists or not.

In this file name entry step, the use of symbols "*" and "?" is permitted.

The symbol "*" indicates a string of character while the symbol "?" represents a character. "*" may be used only once in both a file name and an extension.

Therefore, by specifying "*" and "?" in a file name, all the file names corresponding to the entered file name are given.

Example 1: =DI—FD1:*.MI **[WRITE]**

All the file names assigned with the extension MI
Refer to Section 5, 2 for file name in IBM format.

Example 2: =DI—FD1:BOX.MI **[WRITE]**

All the file names assigned with the extension MI and the main file name beginning with BOX

Example 3: =DI—FD1:*.? **[WRITE]**

All the file names (same as no data entry)

Example 4: =DI—FD1:???.SU **[WRITE]**

All the file names assigned with the extension SU, and those whose main file name consists of up to three characters

SECTION 2 PROGRAM INPUT/OUTPUT FUNCTIONS BY FLOPPY DISKS (IBM FORMAT)

Note 4: Output device name can be entered following the file name. Enter it following a comma.

Example: =DI—FD1:*.*,TT: [WRITE]

With the data entered as above, all the file names are output to the printer connected to RS232C interface channel 0.

As an output device name, PR: (printer) is also used.

Note 5: Option setting indicated below is possible following the file name.

;P (file protected state is displayed following the date)

00: Not protected

01: User-protected

02: Maker-protected

0F: Maker-protected

Note 6: To display files not assigned with an extension, key-in as follows:

=DIR—FD1:<main-file-name> [WRITE]

Omission of a main file name displays all files which have no extension.

4-2. Copy

Copying a file between the bubble memory and floppy disk is possible according to the following steps.

- (1) Copying a file in the bubble memory to the floppy disk:

Procedure:

- ① Select the PROG OPERATION mode by pressing the **EDIT AUX** key.



The CRT will change as shown right.

P R O G O P E R A T I O N

DATE	DIR	PIP	EDIT	FREE	LIST	CONDENS	[EXTEND]
------	-----	-----	------	------	------	---------	----------

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

- ② Press the function key [F3] (PIP).

The CRT displays the prompt "CO" on its console line.

P R O G O P E R A T I O N T R A N S F E R

•PIP
>CO
>

READ	PUNCH	VERIFY	COPY	FAST FORWARD	FAST REWIND	PIP QUIT	[EXTEND]
------	-------	--------	------	-----------------	----------------	-------------	----------

F 1

F 2

F 3

F 4

F 5

F 6

F 7

F 8

- ③ Press the function key [F4] (COPY).
- ④ Key in the file name of the program to be copied, comma (,) and device name (FD1:).
- ⑤ Press the **WRITE** key.



This copies the designated file in the bubble memory to the floppy disk.

P R O G O P E R A T I O N T R A N S F E R C O P Y C100.MIN

•PIP
>CO
>

READ	PUNCH	VERIFY	COPY	FAST FORWARD	FAST REWIND	PIP QUIT	[EXTEND]
------	-------	--------	------	-----------------	----------------	-------------	----------

F 1

F 2

F 3

F 4

F 5

F 6

F 7

F 8

- This completes the program copying operation and the CRT returns the display mode in step ①.

Example: > CO—BOX.MIN,FD1:BOX.MI [WRITE]

The program with the file name of BOX.MIN in the bubble memory is copied in the floppy disk with the file name of BOX.MI.

- ### Procedures:

- ① Select the PROG OPERATION mode by pressing the **EDIT AUX** key.



The CRT will change as shown below.

PROG OPERATION

- ② Press the function key [F3] (PIP).

The CRT displays the prompt “CO” on its console line.

P R O G O P E R A T I O N T R A N S F E R

*PIP
 >CO
 >

READ	PUNCH	VERIFY	COPY	FAST FORWARD	FAST REWIND	PIP QUIT	[EXTEND]
------	-------	--------	------	-----------------	----------------	-------------	----------

F 1

F 2

F 3

F 4

F 5

F 6

F 7

F 8

- ③ Press the function key [F4] (COPY).
- ④ Key in the device name (FD1:), file name of the program to be copied and comma (,).
- ⑤ Press the **WRITE** key.



This copies the designated file in the floppy disk to the bubble memory.

P R O G O P E R A T I O N T R A N S F E R C O P Y C100.M111

*PIP
 >CO
 >

READ	PUNCH	VERIFY	COPY	FAST FORWARD	FAST REWIND	PIP QUIT	[EXTEND]
------	-------	--------	------	-----------------	----------------	-------------	----------

F 1

F 2

F 3

F 4

F 5

F 6

F 7

F 8

SECTION 2 PROGRAM INPUT/OUTPUT FUNCTIONS BY FLOPPY DISKS (IBM FORMAT)

- ⑥ Press the function key [F7] (PIP QUIT).

This completes the program copying operation and the CRT returns the display mode in step ①.

Example: > CO—FD1:BOX.MI,BOX.MIN [WRITE]

The program with the file name of BOX.MI is copied in the bubble memory with the file name of BOX.MIN.

Note 1: When the specified file name is not found, the message "file not found" is given on the console line.

Note 2: When the file name specified as the output file name already exists, the following messages appear.

file exist overwrite (Y/N)!

Key in "Y" and press the WRITE key. This erases the presently stored program in the file and stores the copied program.

Keying in "N" followed by pressing the WRITE key ends the operation.

Note 3: Symbols "" and "?" can be used in an input file name. For details, refer to Note 3 of "4-1. Directory" of this section.*

(3) Option Function:

- (a) ;V . . . Specifying ";V" at the end of the copy command displays the message asking an operator if the commanded copy operation is to be carried out or not.

copy OK (Y/N)!

Before the entered copy operation begins, the CRT displays the message above.

[Y] and [WRITE] begins copying.

[N] and [WRITE] ends processing without copying.

Example: > CO—BOX. MIN, FD1: BOX. MI; V [WRITE]

> CO—FD1:BOX. MI, BOX. MIN; V [WRITE]

(b) Other option codes

- ;I . . . Designates ISO code.
- ;B . . . Designates EBCDIC code.
- ;S . . . Designates ASCII code.
- ;N . . . Designates NUL as the end of data code.
- ;F . . . Designates "%" as the end of data code.

4-3. Free (Remaining Floppy Disk Capacity)

This is the function to display the size of available area of the floppy disk.

The display is made both in the number of sectors and bytes.

1 sector = 256 bytes

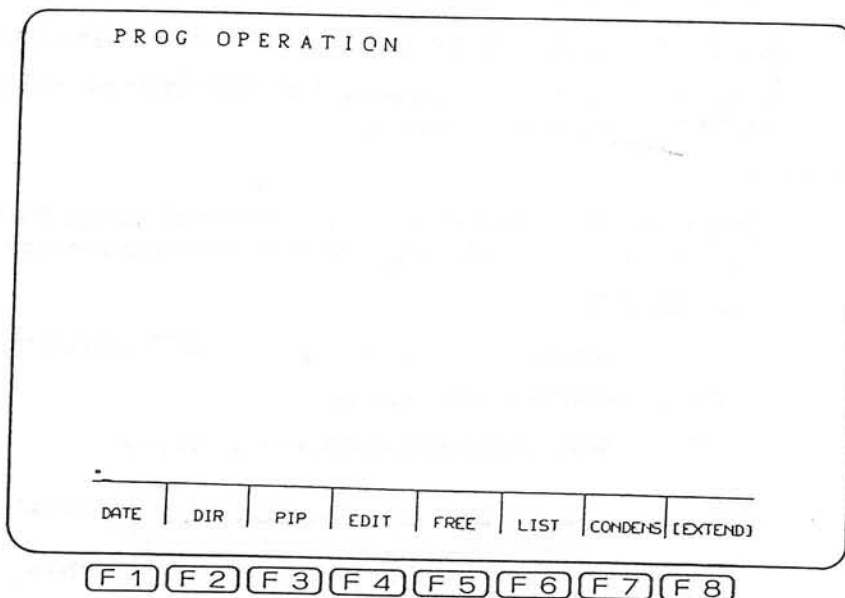
When making a file, all the remaining area cannot be used for storing the program data since a file name, the number of sectors to be used and other data are stored with the program data. One byte corresponds to one character.

Procedures:

- (1) Select the PROG OPERATION mode by pressing the **EDIT AUX** key.



The CRT will change as shown below.



- (2) Press the function key [F5] (FREE).
- (3) Key in the device name (FD1:).
- (4) Press the **WRITE** key.

Example: =FR-FD1: **[WRITE]**



PR OG O P E R A T I O N F R E E							
-FR .							
DATE	DIR	PIP	EDIT	FREE	LIST	CONDENS	[EXTEND]

Option Function:

;C Specifying “;C” at the end of the free command displays the size of the contiguous vacant area of the floppy disk.

Example:

= FR—FD1;;C

[WRITE]

4-4. Initializing

This is the function for initializing the floppy disk.

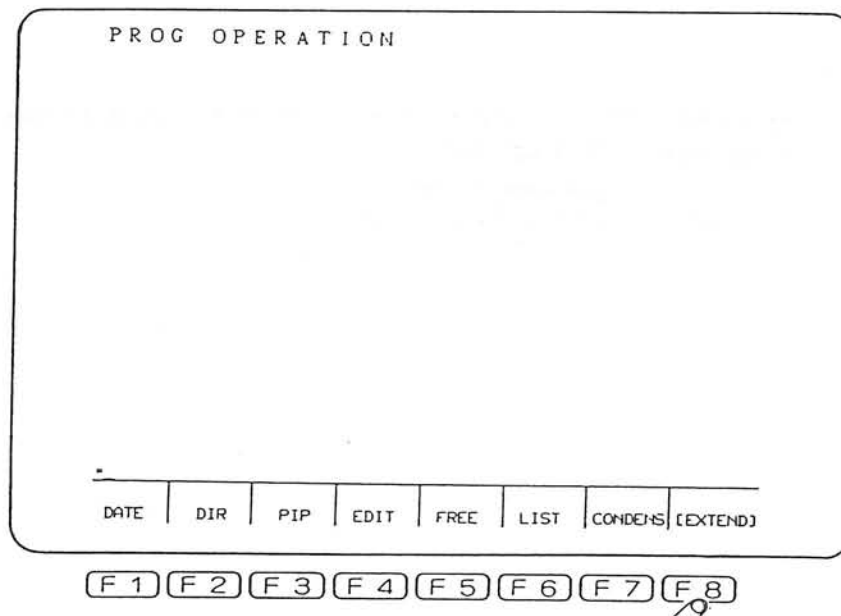


CAUTION

All the data in the floppy disk is cleared when this operation is performed.

Procedures:

- (1) Select the PROG OPERATION mode by pressing the **EDIT AUX** key.



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

SECTION 2 PROGRAM INPUT/OUTPUT FUNCTIONS BY FLOPPY DISKS (IBM FORMAT)

PROG OPERATION INIT

•EX
•IN
initialize OK (Y/N)

TIME	INIT	DELETE	RENAME				[EXTEND]
------	------	--------	--------	--	--	--	----------

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

9

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

(4) Key in the device name (FD1:).

(5) Press the **WRITE** key.

The following message is displayed on the console line, requiring the operator to key in the appropriate data.

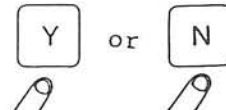
initialize OK (Y/N)!



(6) Press the **WRITE** key after keying in "Y" or "N" depending on whether floppy disk initialization is required or not.

[Y] and [WRITE] initializing the bubble memory
or the floppy disk

[N] and [WRITE] canceling



(7) Press the **WRITE** key.

type (OSP = O, IBM = I)!



(8) Key in "I".

Example: =IN-FD1: [WRITE]

Note 1: When a floppy disk is initialized, the type of the floppy disk (FD1-128, FD2-256, FD2-256D) is automatically recognized by the data written on it. However, if the floppy type indication data has been destroyed, initialization of the floppy disk cannot be accomplished correctly.

In this case, specify the floppy disk type following the option code “;F”.

Example: For specifying the IBM format for 2DD (FD2-256D) floppy disks

= IN—FD1;;F [WRITE]

initialize OK (Y/N) ! Y [WRITE]

formatting (Y/N) ! N [WRITE]

format (FD2-128=0, FD2-256=1, FD2-256D=2,

FD1-128=3) ! 2 [WRITE]

type (OSP=0, IBM=1) ! 1 [WRITE]

Note 2: If a floppy disk read/write error has occurred during floppy disk initialization, specify an option code “;F” to format the floppy disk.

TIME	INIT	DELETE	RENAME				[EXTEND]
------	------	--------	--------	--	--	--	----------

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

P R O G O P E R A T I O N

-EX
-DEL

T I M E	I N I T	D E L E T E	R E N A M E				(E X T E N D)
---------	---------	-------------	-------------	--	--	--	-----------------

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

- (4) Enter the device name, FD1: and the name of file to be deleted.
- (5) Press the **WRITE** key.



- Note 1:** When the specified file name does not exist in the floppy disk, the message "file not found" is given on the console line.
- Note 2:** Symbols "?" and "*" can be used for specifying a file name. For details, refer to Note 3 of "4-1. Directory" of this section.

Example 1: =DEL—FD1:BOX.MI [WRITE]

The file whose file name is BOX.MI is deleted.

Example 2: =DEL—FD1:*.SU [WRITE]

All the files whose extension is SU are deleted.

Option Function:

;V Specify ";V" at the end of the delete command displays the message asking an operator if the commanded delete operation is to be carried out or not.

delete OK (Y/N)!

Before the entered delete operation begins, the CRT displays the message above,

[Y] and [WRITE] . . begins deletion.

[N] and [WRITE] . . ends processing without deletion.

Example : =DEL—FD1:*.*,V [WRITE]

The message asking whether the file is to be deleted or not is displayed for each file.

4-6. Rename

This is the function for changing the name of the file stored in the floppy disk.

Procedures:

- (1) Select the PROG OPERATION mode by pressing the **EDIT AUX** key.



The CRT will change as shown below.

PROG OPERATION							
DATE	DIR	PIP	EDIT	FREE	LIST	CONDENS	[EXTEND]
[F 1]	[F 2]	[F 3]	[F 4]	[F 5]	[F 6]	[F 7]	[F 8]

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

- (3) Press the function key [F4] (RENAME).

TIME	INIT	DELETE	RENAME				[EXTEND]
[F 1]	[F 2]	[F 3]	[F 4]	[F 5]	[F 6]	[F 7]	[F 8]

Prompt "= R" appears on the console line.

P R O G O P E R A T I O N

-EX
 -R

TIME

INIT

DELETE

RENAME

[EXTEND]

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

- (4) Key in the device name (FD1:), file name presently registered and then the new file name it is to be changed to with a comma ",", placed between them.
- (5) Press the **WRITE** key.



This changes the file name.

Example: = R—FD1:SHIL1.MI,SHIL2.MI **[WRITE]**

The file name SHIL1.MI is changed to SHIL2.MI.

- Note 1:** In case the specified file name is not found, the message "**file not found**" is displayed on the console line and the renaming processing ends.
- Note 2:** When the file assigned the file name designated in the copy operation already exists in the floppy disk, the message "**file exists**" is displayed on the console line and the renaming processing ends.
- Note 3:** Symbols "*" and "?" cannot be used for specifying a file name. If specified, the error message "**file name error**" appears on the console line.

4-7. Protect

This is the function for protecting the specified file among the files in the floppy disk.

Access to the protected file, including editing, deleting and renaming is impossible until file protection is released.

(1) Protect a File

Procedures:

- ① Select the PROG OPERATION mode by pressing the **EDIT AUX** key.



The CRT will change as shown below.

PROG OPERATION							
DATE	DIR	PIP	EDIT	FREE	LIST	CONDENS	[EXTEND]
[F 1]	[F 2]	[F 3]	[F 4]	[F 5]	[F 6]	[F 7]	[F 8]

9

- ② Press the function key [F8] (EXTEND) two times.
- ③ Press the function key [F1] (PROTECT).

PRO-TECT			DNC			[EXTEND]
[F 1]	[F 2]	[F 3]	[F 4]	[F 5]	[F 6]	[F 7]

9

Prompt "= PROT" appears on the console line.

P R O G O P E R A T I O N

=EX
=EX
=PROT

PRO-
TECT
DNC
[EXTEND]

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

- ④ Enter the device name (FD1:) and name of the file to be protected.
- ⑤ Press the **WRITE** key.



This ends file protection.

Example: = PROT—FD1:BOX.MI **[WRITE]**

(2) Release File Protection

Procedures:

- ① Select the PROG OPERATION mode by pressing the **EDIT AUX** key.



The CRT will change as shown on the following page.

SECTION 2 PROGRAM INPUT/OUTPUT FUNCTIONS BY FLOPPY DISKS (IBM FORMAT)

PROG OPERATION							
<div style="display: flex; justify-content: space-between;"> *DI </div>							
DATE	DIR	PIP	EDIT	FREE	LIST	CONDENS	[EXTEND]
[F1]	[F2]	[F3]	[F4]	[F5]	[F6]	[F7]	[F8]

② Press the function key [F8] (EXTEND) two times.

③ Press the function key [F1] (PROTECT).

Prompt "= PROT" appears on the console line.

PROG OPERATION							
<div style="display: flex; justify-content: space-between;"> =EX </div>							
<div style="display: flex; justify-content: space-between;"> =EX </div>							
<div style="display: flex; justify-content: space-between;"> =PROT </div>							
PRO-TECT			DNC				[EXTEND]
[F1]	[F2]	[F3]	[F4]	[F5]	[F6]	[F7]	[F8]

④ Enter the device name (FD1:), name of the file for which protection is released and option specification (;C).

⑤ Press the **WRITE** key.



This ends releasing of file protection.

Example: = PROT—FD1:BOX.MI;C [WRITE]

Note 1: When the specified file name is not found in the floppy disk, the message **"file not found"** is displayed on the console line.

Note 2: Symbols "?" and "*" can be used for specifying a file name.
 "*" indicates an arbitrary character-string (can be used only one time in the file name and extension).
 "?" indicates an arbitrary character.
 For details, refer to Note 3 in Section 5, "2-1. Directory" of the Special Functions Manual (No. 1).

(3) Option Function:

(a) ;V Specifying ";V" at the end of the protect command displays the message asking an operator if the commanded protect operation is to be carried out or not.

file protection OK (Y/N)!

Before the entered protect operation begins, the CRT displays the message above.

[Y] and [WRITE] . . . executes protect command.
 [N] and [WRITE] . . . ends processing without executing protect command.

Example: = PROT—FD1:BOX.MI;V [WRITE]

(b) ;CV Specifying ";CV" at the end of the protect cancel command displays the message asking an operator if the commanded protect cancel operation is to be carried out or not.

file protection cancel OK (Y/N)!

Before the entered protect cancel operation begins, the CRT displays the message above.

[Y] and [WRITE] . . . executes protect cancel command.
 [N] and [WRITE] . . . ends processing without executing protect cancel command.

Example: = PROT—FD1:BOX.MI;CV [WRITE]

5 Precautions on I/O Functions Using Floppy Disks

NC machining program floppy disk in IBM format is converted to OSP format file type, which is in turn stored in the OSP500M-G/OSP5000M-G/OSP5020M data bubble memory. After that, it is possible to edit it in quite the same manner as with other OSP format machining programs.

The OSP format file is converted to IBM format file and then output to the floppy disk.

Follow the procedure below for inputting programs.

5-1. Parameter Setting

Default value for option specification, data code and end of data code are specified by NC optional parameter (bit) No. 10.

NC Optional Parameter (Bit) No. 10

Bit No.	Description	Contents
0	Data code	00 ISO
		01 EBCDIC
		10 ASCII
		11 EBCDIC
1		
2	End code	0 NUL
		1 %

Note 1: I/O file name is specified assuming OSP format. When disk drive is used for the input or output of files, be sure to prefix a device name. (Add FD0:.)

Note 2: The following processing is performed according to I/O file format.

<u>Input</u>	<u>Output</u>	<u>Processing</u>
1) OSP → OSP	No code check (no conversion)
2) OSP → IBM	Specified code from ASCII
3) IBM → OSP	ASCII from the specified code
4) IBM → IBM	No code check (no conversion)

For 2) and 3) above, if the corresponding code is not present when the code is converted, all such codes should be converted to "?". (When EBCDIC is converted to ASCII, CR (\$0D), BS (\$16), and LF(\$25) of EBCDIC should be disregarded codes.)

Note 3: The optional codes are indicated below .

;I Designates ISO code.

;B ... Designates EBCDIC code.

;S ... Designates ASCII code.

;N ... Designates NUL as the end of data code.

;F Designates "%" as the end of data code.

For IBM format files, option A (Supplement) is not allowed.

Example: >CO FD1:ABCD,BB1;;B

IBM format ABCD file (EBCDIC code) is converted to OSP format, which is in turn entered into bubble memory in the file name of ABCD.MIN.

When the file having the same file name as the output file name of floppy disk input in the copy operation has already existed in the data floppy disk, the following inquiry message is displayed on the CRT console line.

file exist overwrite (Y/N)!

[Y] and [WRITE] former file is deleted and new file is generated.

[N] and [WRITE] copy is invalid and former file remains as it is.

All information at the index cylinder section of floppy disk should be of EBCDIC codes, but for the data section (NC machining program section), select either one of ISO, EBCDIC and ASCII. (Information, if not specified, is stored in the code specified by the optional parameter.)

This data format should be quite the same as with the paper tape. However, it is impossible to specify the file name with the symbol "\$" at the top of data. Information to the first EOB (LF) is unconditionally skipped.

Data Section (ISO, EBCDIC, ASCII code)

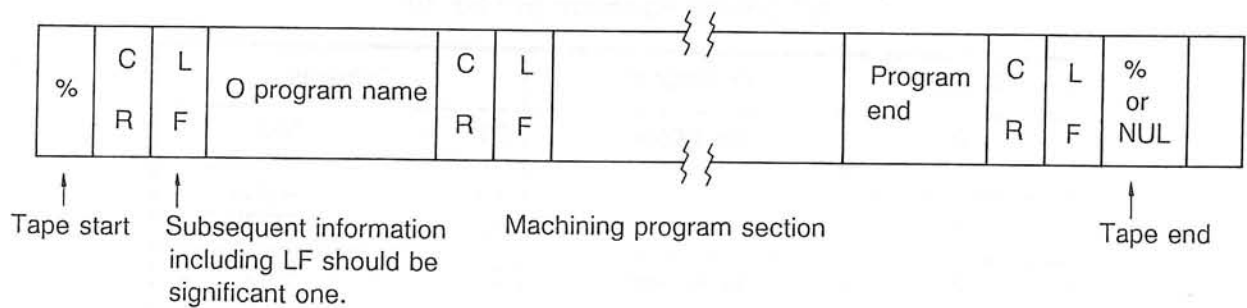


Fig. 2-4 Configuration of Data Section

Note: When end code designation and data code designation do not coincide with floppy disk data, no output result is guaranteed.

5-2. Parameter Setting for File Name

Whether an extension is used for the file name or not can be selected by the setting of the parameter.

NC optional parameter (bit) No. 10, bit 6:

- 0 Extension can be used
- 1 Extension can not be used

5-2-1. When an Extension is Used

- (1) The area of 8-digit file name in the file directory is divided into two parts: 6-character main file name and 2-character extension as follows.

Example:

File name							
A	B	C	D	E	F		
A	B	C	D	E	F	M	I
W	O	R	K	1		M	I
W	O	R	K	S		S	U
Main file name						Extension	

ABCDEF.
 ABCDEF.MI
 WORK1.MI
 WORKS.SU

- (2) NC machining program input according to IBM format is converted to OSP format within the OSP500M-G/OSP5000M-G/OSP5020M, and then it is handled in quite the same manner as with OSP format file already input.
- (3) Therefore, the mentioned file names, when converted to OSP format files, are also to be converted as follows.

(a) Main file name

This name is suffixed with blank, which is extended to 16 characters.

(b) Extension

IBM format extension blank and OSP format extension MIN are mutually converted when a file is transferred.

Others are suffixed with blank so that they are of two or three characters.

Extension in IBM Format	Extension in OSP Format	Meaning of Extension
Blank	MIN	Main program (normal program)
SU	SU—	Subprogram
SS	SS—	System subprogram
SD	SD—	Schedule program

Note 1

- (c) When the main file name area is blank, the file thereof is considered being non-existent. When the extension is blank, MIN is adopted as default.

Example:

File Name in IBM Format		File Name in OSP Format
ABCDEF.MI	→	ABCDEF .MI
WORK1— .MI	→	WORK1 .MI
WORKA— .SS	→	WORKA .SS
O1234—	→	O1234 .MIN
<div style="display: flex; align-items: center;"> } <div> Main file name (6 characters) </div> </div>		<div style="display: flex; align-items: center;"> } <div> Extended to 16 characters (suffixed with blanks to be 16 characters) </div> </div>

Note 1: The following are the output file names given when no output name is specified during the transfer of IBM format floppy disk to OSP format file.

Output file name:

Main file name	Same as main file name of input file
Extension	Same as the extension of input file Blank is converted to MIN.

In this transfer operation, output file name including only two character extension, such as ABC.SU, will be assigned depending on the original file name. This, however, is not recognized as a subprogram, requiring subprogram name to be specified or the file to be renamed.

Example 1: Designate output file name.

>COPY FD1:ABC. SU, ABC. SUB

If the function key (COPY) is pressed, the display will be ">CO", which has the same meaning as ">COPY"

Example 2: Rename the file.

>RENAME ABC. SU, ABC. SUB

If the function key (RENAME) is pressed, the display will be ">R", which has the same meaning as ">RENAME"

(d) During writing to IBM format, the extension, .MIN becomes blank.

Example:

File Name in OSP Format		File Name in IBM Format
O1234.MIN	→	O1234

- (e) An error will take place if it is specified that main file name exceeds 6 characters and the extension exceeds 2 characters for IBM format floppy disks.
- (f) The following are the output file names given when no output file name is specified during writing to IBM format.

Main file name	Same as main file name of input file
Extension	This name should be of 2 characters, omitting the third character of the extension of input file. It can also be converted to blank according to the setting of a parameter. MIN is converted to blank.

SECTION 2 PROGRAM INPUT/OUTPUT FUNCTIONS BY FLOPPY DISKS (IBM FORMAT)

Example 1: >COPY WORK1. MIN, FD1:

At this time, the file name in IBM format is WORK1.

>COPY WORKA. SSB, FD1:

At this time, the file name in IBM format is WORKA.SS.

>COPY ABCDEFG. MIN, FD1:

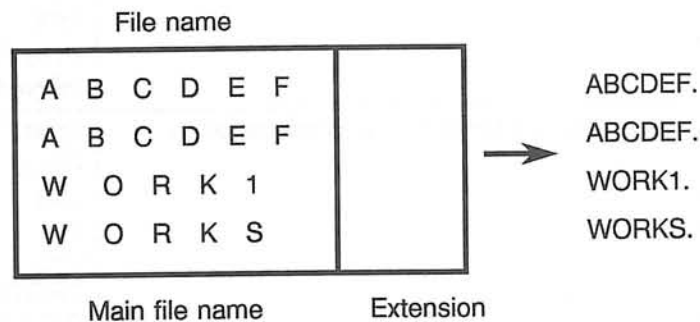
At this time, since main file name exceeds 6 characters, an error occurs; therefore, the output file name should not be omitted: the file name should be as follows.

>COPY ABCDEFG. MIN, FD1: ABC

If the function key (COPY) is pressed, the display will be ">CO", which has the same meaning as ">COPY".

5-2-2. When an Extension is Not Used

The area of 8-digit file name in the file directory is divided into two parts: 6-character main file name and 2-character extension as follows. Extension is displayed by space.



5-3. Parameter Setting for Number of Files

Number of files which can be stored in a floppy disk varies depending on the usage of the index cylinder of the floppy disk in IBM format (FD2256D).

NC optional parameter (bit) No. 10, bit 5

Setting = 1

Cylinder 0	Side 0: 1 file/physical record	19 files
	Side 1: 1 file/physical record	26 files
		Total 45 files

Setting = 0

Cylinder 0	Side 0: 1 file/physical record	19 files
	Side 1: 1 file/physical record	52 files
		Total 71 files

6. Error List

Error name	Message	Contents	Command
File name error	2152 file name	File name and extension exceeding 6 characters and 2 characters, respectively, are designated.	RENAME COPY DIR DEL PROTECT
No directory sector	2158 file label area over flow	No vacant sector in the directory area	COPY
No data vacant sector	2154 SAT full	No vacant sector in the data area	COPY
Error map faulty	2159 error-map information	Error map information is off specification.	COPY FREE DIR INIT DEL PROTECT RENAME
Format attribute faulty	2160 volume-label information	Volume label information is off specification.	COPY FREE DIR INIT DEL PROTECT RENAME
No significant data	2524 no file data	No significant data is found. Data code is misdesignated.	COPY
Floppy disk is not ready	2148 floppy ready	A floppy disk is not set in the floppy disk drive. Floppy disk is set in the floppy disk drive in the reverse direction.	COPY FREE DIR INIT DEL PROTECT RENAME
Unavailable device name is designated	2105 device name	Device name other than BB0:, BB1:, FD0:, FD1:, FD2:, and FD3: has been specified.	COPY FREE DIR INIT DEL PROTECT RENAME
Designated file name is not correct	1255 command syntax	The file name or its extension does not begin with an alphabetical character. The number of characters in the main file name and its extension exceeds 19.	COPY DIR DEL PROTECT RENAME

SECTION 2 PROGRAM INPUT/OUTPUT FUNCTIONS BY FLOPPY DISKS (IBM FORMAT)

Error name	Message	Contents	Command
Wrong attribute is specified	2556 file attribute	For copy operation, option function";A" (file merge) has been specified using the IBM-format floppy disk.	COPY
Improper I/O file name	2508 Input/output file name not same	Improper I/O designation of the main file name and extension has been made for copy operation.	COPY
Faulty floppy disk	2113 floppy disc read/write	Read/write operation for the floppy disk is impossible	COPY FREE DIR INIT DEL PROTECT RENAME

7. Examples

(1) INIT (Initialize)

= INIT FD0: ←
 FD0: IBM format (FD1-123)
 initialize OK (Y/N) ! Y←
 type (OSP = 0, IBM = 1) ! I _←

(2) DIR (Directory)

= DIR FD0: ←
 =

DIR				
(IBM format) PAGE 1				
FILENAME	SEC	BYTE	CHARACTER	DATE
BN.	0001	000100	256	1984.4.1
BF.	0001	000100	256	1984.4.1
SN.	0001	000100	256	1984.4.1
SF.	0001	000100	256	1984.4.1
P1001.	0014	001400	5120	1984.4.1
P2001.	0014	001400	5120	1984.4.1
p3001.	0014	001400	5120	1984.4.1
P4001.	0014	001400	5120	1984.4.1

Plural volume
indicator
Plural volume
sequence No.
C1

= DIR FD0: ;P←
 =

DIR				
(IBM format) PAGE 1				
FILENAME	SEC	BYTE	CHARACTER	DATE
BN.	0001	000100	256	1984.4.1
BF.	0001	000100	256	1984.4.1
SN.	0001	000100	256	1984.4.1
SF.	0001	000100	256	1984.4.1
P1001.	0014	001400	5120	1984.4.1
P2001.	0014	001400	5120	1984.4.1
P3001.	0014	001400	5120	1984.4.1
P4001.	0014	001400	5120	1984.4.1

Protect level
C1

SECTION 2 PROGRAM INPUT/OUTPUT FUNCTIONS BY FLOPPY DISKS (IBM FORMAT)

(3) FREE (Remaining Capacity)

= FREE FD0:←

=

FREE

FREE FD0:

PAGE 1

878/\$036E

221256

561 m

TOTAL SECTORS AVAILABLE

TOTAL BYTES

TAPE STORE LENGTH

= FREE FD0: ;C←

=

FREE

FREE FD0:

PAGE 1

878/\$036E

221256

561 m

TOTAL SECTORS AVAILABLE

TOTAL BYTES

TAPE STORE LENGTH

876/\$036C

220752

560 m

CONTIGUOUS SECTORS AVAILABLE

CONTIGUOUS BYTES

CONTIGUOUS TAPE STORE LENGTH

(4) DEL (Delete)

= DEL P1001←

P1001.

DELETE

DIR FD0: *.*

(IBM format)

PAGE 1

FILENAME	SEC	BYTE	CHARACTER	DATE
BN.	0001	000100	256	1984.4.1
BF.	0001	000100	256	1984.4.1
SN.	0001	000100	256	1984.4.1
SF.	0001	000100	256	1984.4.1
P2001.	0014	001400	5120	1984.4.1
P3001.	0014	001400	5120	1984.4.1
P4001.	0014	001400	5120	1984.4.1

C1

(5) PROTECT (Write Protection)

= PROT FD0:P2001←
P2001 file protect finished

DIR

DIR FD0: *.* (IBM format) PAGE 1

FILENAME	SEC	BYTE	CHARACTER	DATE	
BN.	0001	000100	256	1984.4.1	00
BF.	0001	000100	256	1984.4.1	00
SN.	0001	000100	256	1984.4.1	00
SF.	0001	000100	256	1984.4.1	00
P2001.	0014	001400	5120	1984.4.1	01
P3001.	0014	001400	5120	1984.4.1	00
P4001.	0014	001400	5120	1984.4.1	01 C1

= PROT FD0:P2001 ;C←
P2001. file protect cancel finished

DIR

DIR FD0: *.* (IBM format) PAGE 1

FILENAME	SEC	BYTE	CHARACTER	DATE	
BN.	0001	000100	256	1984.4.1	00
BF.	0001	000100	256	1984.4.1	00
SN.	0001	000100	256	1984.4.1	00
SF.	0001	000100	256	1984.4.1	00
P2001.	0014	001400	5120	1984.4.1	01
P3001.	0014	001400	5120	1984.4.1	00
P4001.	0014	001400	5120	1984.4.1	01 C1

(6) RENAME (Name Change)

= RENAME FD0:P2001, P2002←
=

DIR

DIR FD0: *.* (IBM format) PAGE 1

FILENAME	SEC	BYTE	CHARACTER	DATE	
BN.	0001	000100	256	1984.4.1	
BF.	0001	000100	256	1984.4.1	
SN.	0001	000100	256	1984.4.1	
SF.	0001	000100	256	1984.4.1	
P2002.	0014	001400	5120	1984.4.1	
P3001.	0014	001400	5120	1984.4.1	
P4001.	0014	001400	5120	1984.4.1	C1

(7) COPY (Copy)

(a)

EDIT AUX

(b) PIP

F3

= PIP >

(c) COPY

F4

> CO

(d)

- ① Transfer IBM format file A in FD0: to bubble memory.

> CO FD1:A, ;B [↵] Input data code EBCDIC
 > CO FD1:A, ;S [↵] Input data code ASCII
 > CO FD1:A, ;I [↵] Input data code ISO
 > CO FD1:A, [↵] Input data code Optional parameter setting code
 > CO FD1:A, ;F [↵] End code %

(Input data code ISO)

> CO FD1:A, ;N [↵] End code NUL
 > CO FD1:A, [↵] End code Optional parameter setting code

Note: At this time, OSP format file name is A, and the extension is MIN.

- ② Transfer file A.MIN in bubble memory file to IBM format floppy disk.

> CO A.MIN, FD1: ;B [↵] Output data code EBCDIC
 > CO A.MIN, FD1: ;S [↵] Output data code ASCII
 > CO A.MIN, FD1: ;I [↵] Output data code ISO
 > CO A.MIN, FD1: [↵] Output data code Optional parameter setting code
 > CO A.MIN, FD1: ;F [↵] End code %

(Output data code ISO)

> CO A.MIN, FD1: ;N [↵] End code NUL
 > CO A.MIN, FD1: [↵] End code Optional parameter setting code

Note: At this time, IBM format file name is A., and the extension is blank.

- ③ Transfer all files named A. in IBM format to bubble memory.

> CO FD1:A.*, ;B [↵]
 > CO FD1:A.*, ;BFV [↵] V option is also available.

8. Floppy Disk Format (IBM Format)

Floppy disk layout:

- (1) The floppy disk is divided into a cylinder, side and sector as shown in Fig. 2-5 below.

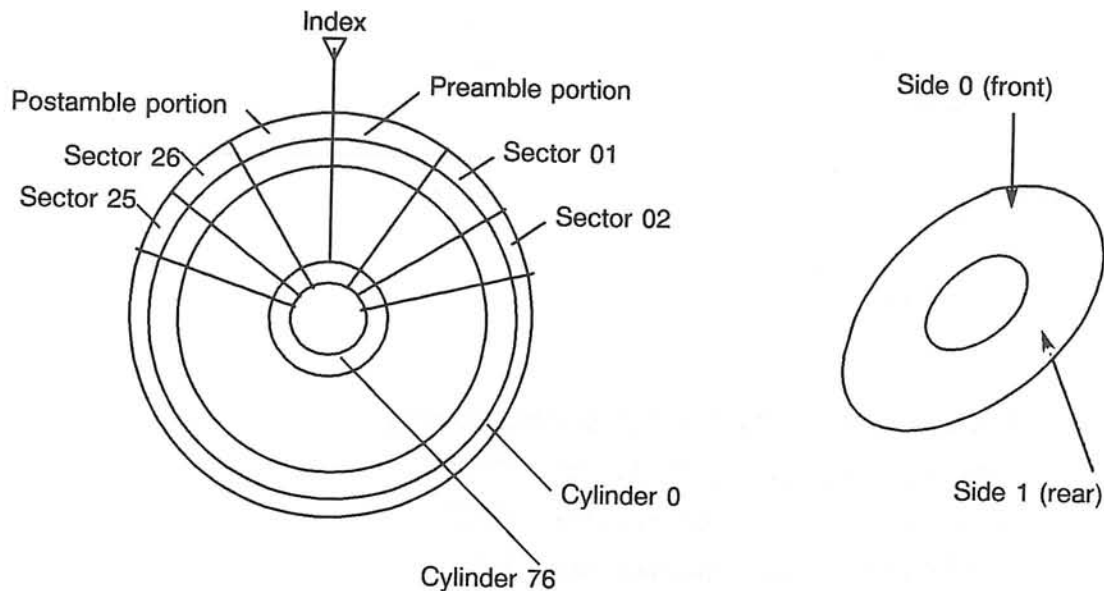


Fig. 2-5 Floppy Disk Layout

- (2) The floppy disk is divided into 77 cylinders, i.e. 0 to 76 in sequence from the outside. The single-sided cylinder has only side 0, and the double-sided cylinder has its track divided into side 0 and side 1.
- (3) Each track is divided into the preamble portion, sector portion and postamble portion with the index position as a reference.

SECTION 2 PROGRAM INPUT/OUTPUT FUNCTIONS BY FLOPPY DISKS (IBM FORMAT)

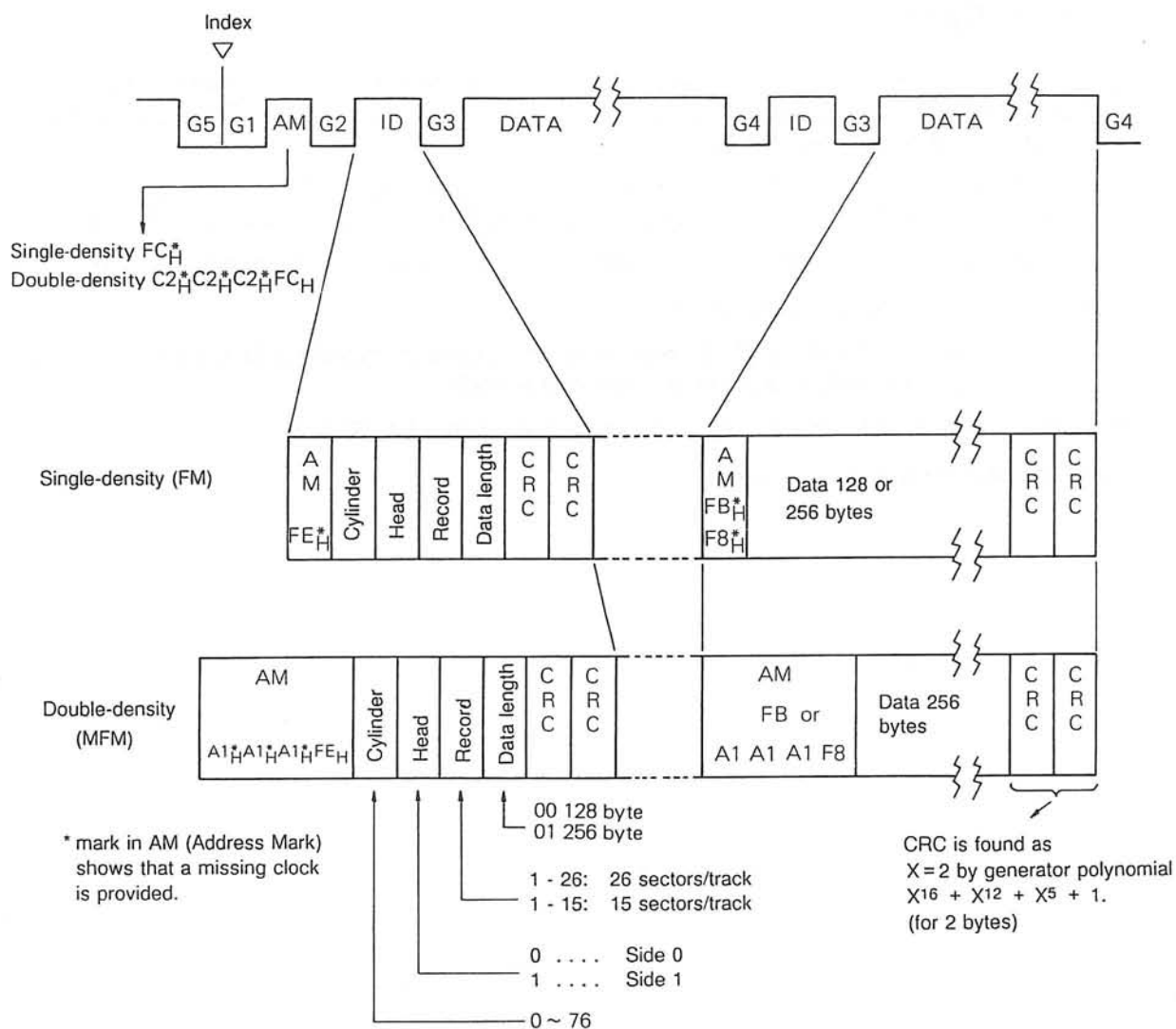


Fig. 2-6 Track Format

Table 2-3 Gap Format

System	Sector/Track	G1	G2	G3	G4	G5
Single-density (FM)	26 sectors/track (Figures in parentheses show 15 sectors/track.)	FF_H 40 bytes 00 6 bytes	FF_H 26 bytes 00 6 bytes	FF_H 11 bytes 00 6 bytes	FF_H 27(42) bytes 00 6 bytes	FF_H 247(170) bytes
Double-density (MFM)	26 sectors/track	$4E_H$ 80 bytes 00_H 12 bytes	$4E_H$ 50 bytes 00_H 12 bytes	$4E_H$ 22 bytes 00_H 12 bytes	$4E_H$ 54 bytes 00_H 12 bytes	$4E_H$ 598 bytes

8-1. Index Cylinder

Cylinder address 00, which is different from other cylinders (01 to 76), records information on attributes the floppy disk has and attributes of file recorded in the floppy disk. Therefore, cylinder 00 is specifically called "Index Cylinder". (See Fig. 2-7.)

In the index cylinder, only the first 80 bytes among the data records of 128 bytes are used, and the remainder should be 00H for single-density and blank (40H) for double-density. (See Note 1.)

The first 80 bytes of index cylinder sector addresses 01 to 04 and 06 all contain blank (40H).

Note 1: Following codes are EBCDIC.

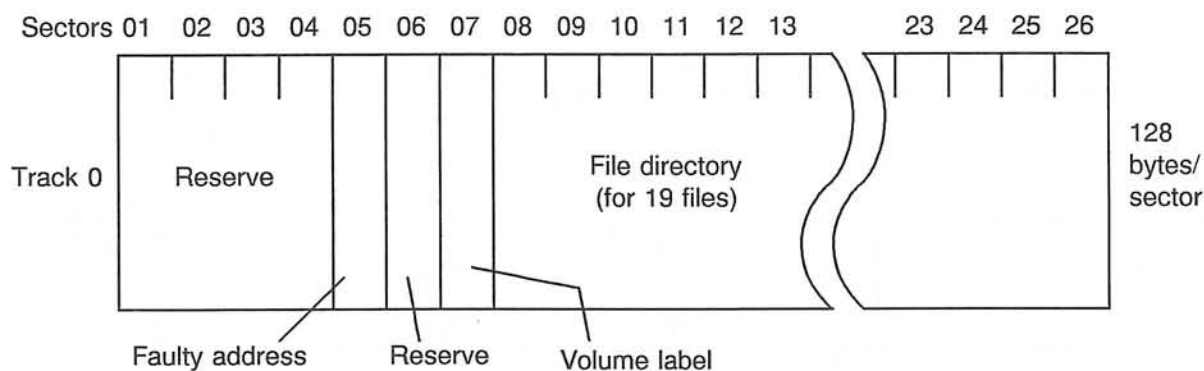
Sector addresses 05, 07 and 08 to 26 store faulty cylinder address information, volume label information and file directory respectively.

Note 2: For double side, the file directory is also entered into Side 1.

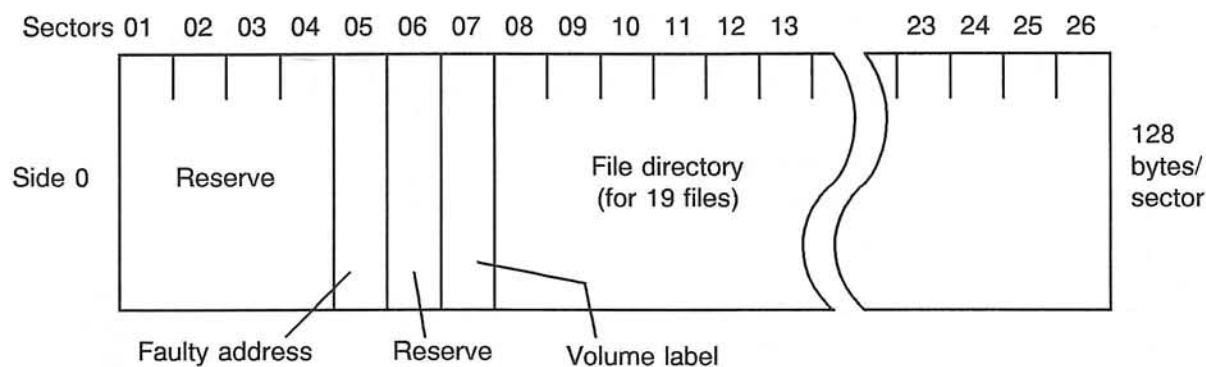
These information is described later.

SECTION 2 PROGRAM INPUT/OUTPUT FUNCTIONS BY FLOPPY DISKS (IBM FORMAT)

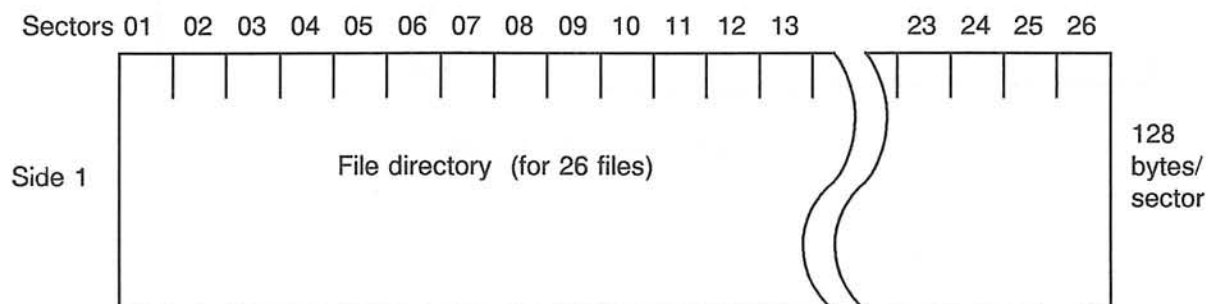
(1) For single-sided single-density: 19 file directories (MAX)



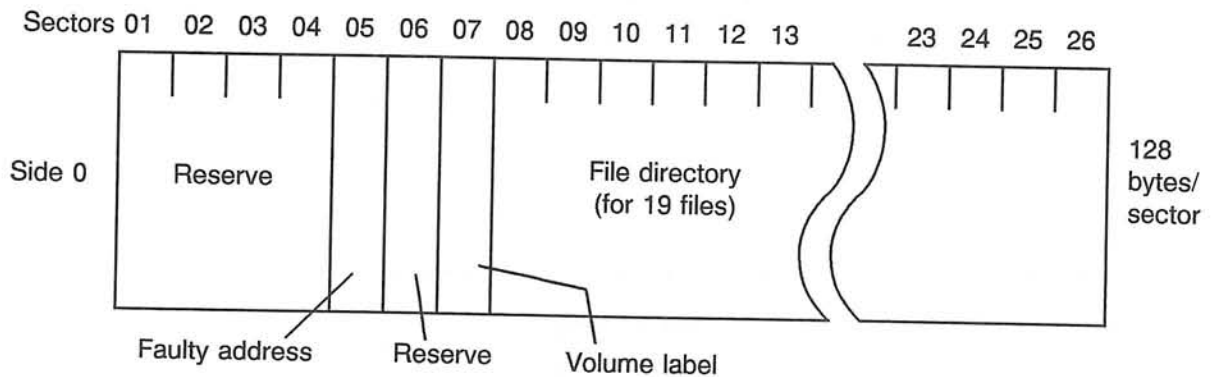
(2) For double-sided single-density: 45 file directories (MAX) (19 + 26)



Cylinder 0



- (3) For double-sided double-density: When NC optional parameter (bit) No.10, bit 5 is 0, the maximum file directory is 71 (19 + 52).



Cylinder 0

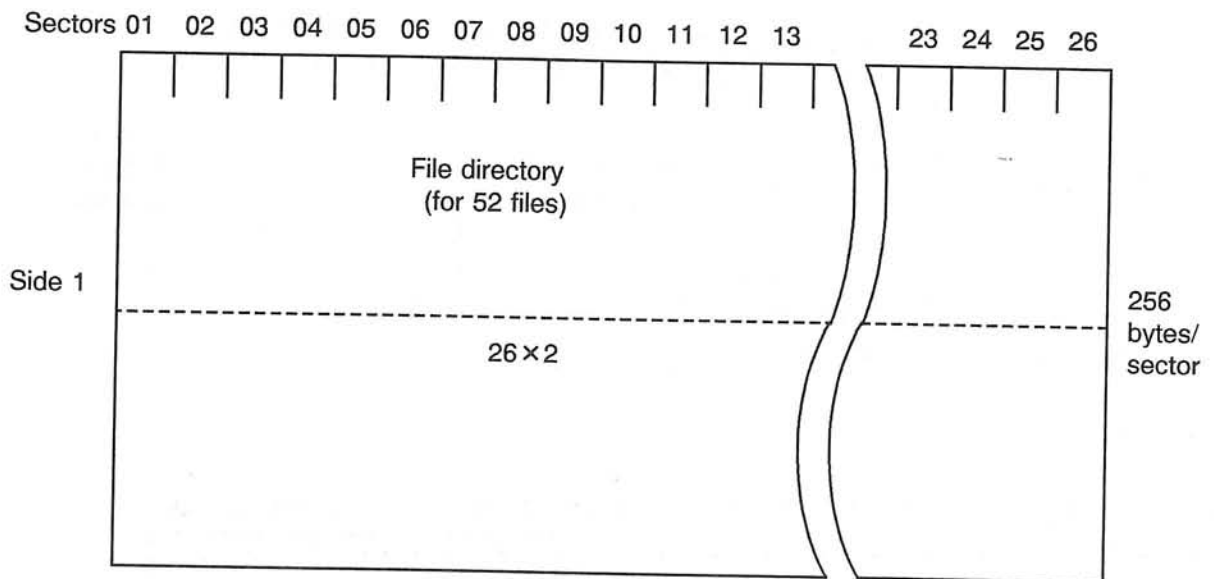


Fig. 2-7 Index Cylinder Configuration

SECTION 2 PROGRAM INPUT/OUTPUT FUNCTIONS BY FLOPPY DISKS (IBM FORMAT)

- (4) For double-sided double-density: When NC optional parameter (bit) No.10, bit 5 is 1, the maximum file directory is 45 (19 + 26)

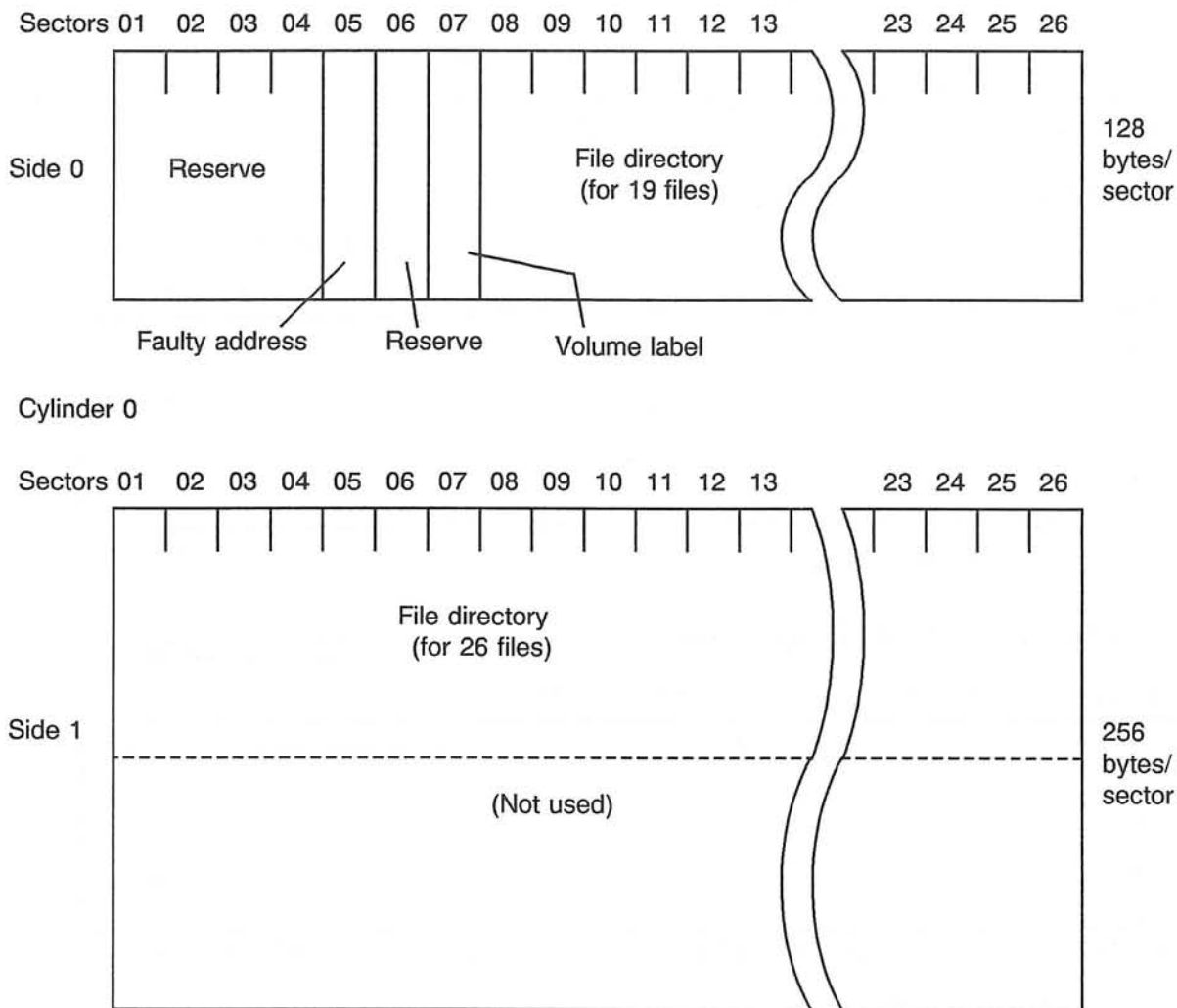


Fig. 2-8 Index Cylinder Configuration

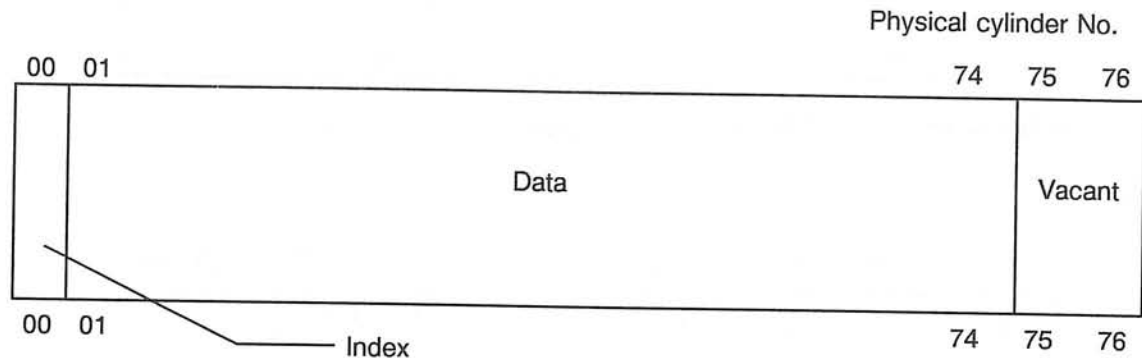
8-2. Faulty Cylinder Information

NC machining data can be normally stored in cylinders 1 to 74 in EBCDIC code. (Cylinders 75, 76 are used for replacement of faulty cylinders.)

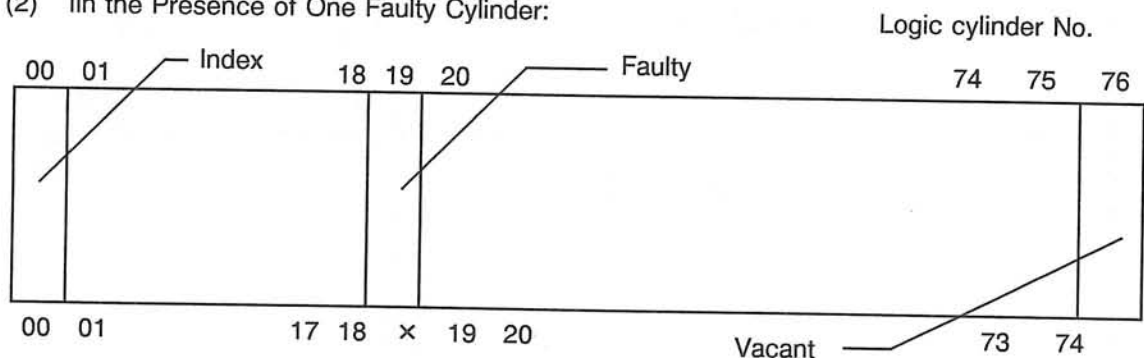
If a cylinder fails for some causes, the floppy disk can be used by re-initializing it.

At this time, the faulty cylinder thus found is loaded with FFH in the ID field for its clear identification, and the subsequent cylinders are shifted sequentially for use.

- (1) In the Absence of Faulty Cylinders:



- (2) In the Presence of One Faulty Cylinder:



- (3) In the Presence of Two Faulty Cylinders:

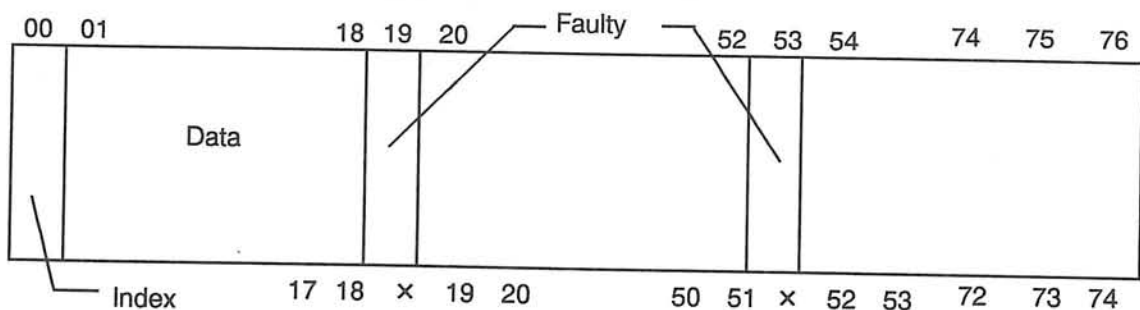


Fig. 2-9 Usage of Alternative Cylinder

In this way, up to two faulty cylinders are allowed for use.

This faulty cylinder information is stored in sector address 05 of the index cylinder. (See Fig. 2-10.)

Columns 1 to 5 are "ERMAP" (" " denote EBCDIC character code).

When column 9 is 00H or F0H, the first faulty cylinder address is entered into columns 7 and 8, and when column 13 is 00H or F0H, the second faulty cylinder is entered into columns 11 and 12 with decimal EBCDIC code respectively. When no faulty cylinder is present, these columns become blank (40H).

In the OSP series, the floppy disk in which column 9 or column 13 is not blank (40H) is considered to include a faulty cylinder, and when the faulty cylinder address does not fall within 1 to 76, it is judged as being erroneous. Also, an error takes place if column 1 to 5 identifier is not "ERMAP" (EBCDIC code).

8-3. Volume Label Information

Sector address 07 of the index cylinder contains volume label information which indicates floppy disk identification No. and attribute. (See Fig. 2-11.)

Column	Description
1 to 4	"VOL 1"
5 to 10	Floppy disk identification No. This is not referenced in OSP500M-G/OSP5000M-G/OSP5020M.
11	Secrecy protecting byte Accessing is possible in a normal method only when the byte is blank (40H). → This is not referenced in OSP500M-G/OSP5000M-G/OSP5020M. (It is considered as being 40H.)
72	Recording flag " " (40H) Single-sided "2" (F2H) Double-sided single-density "M" (D4H) Double-sided double-density
76	Record length of cylinders 1 to 76 " " (40H) 128 bytes "1" (F1H) 256 bytes
77/78	Sector access sequence codes The sectors within the track can be arranged by skipping 0 to 13 sectors according to the data reading speed. → This is not referenced in OSP500M-G/OSP5000M-G/OSP5020M. (It is considered as 0.)
80	Character "W" showing the volume label is entered.

All other column information is not referenced by the OSP500M-G/OSP5000M-G/OSP5020M.

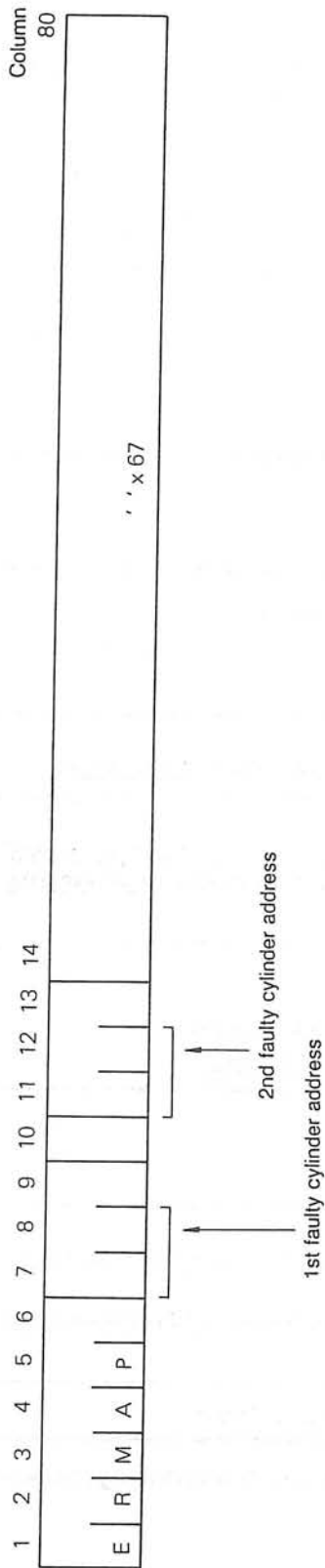


Fig. 2-10 Faulty Cylinder Information

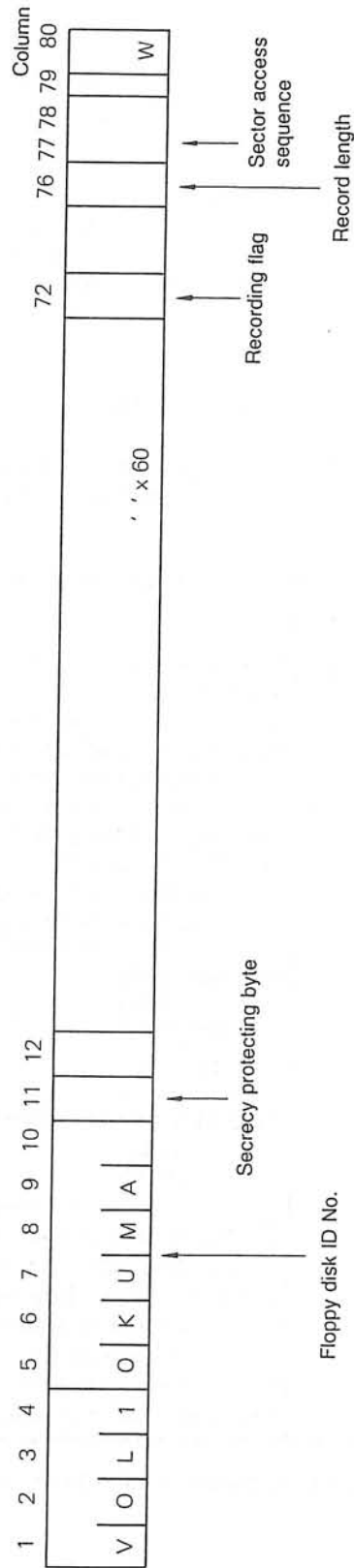


Fig. 2-11 Volume Label Information

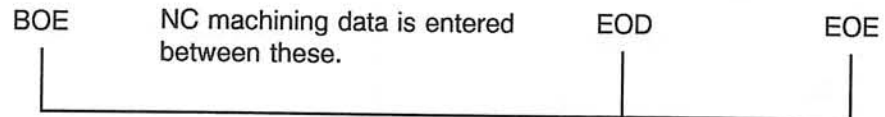
SECTION 2 PROGRAM INPUT/OUTPUT FUNCTIONS BY FLOPPY DISKS (IBM FORMAT)

8-4. File Directory

Sector addresses 08 to 26 of index cylinder (also sector 01 to 26 of side 1 for double side) contain the file directory. (128-byte unit) (See Fig. 2-8 and Fig. 2-12.)

Columns	Description
1 to 4	"HDR1" ("DDR1" during deletion and initialization).
6 to 13	8-digit file names (for the file name, refer to 3-1. of this section.).
23 to 27	Logic record lengths of files. → In the OSP500M-G/OSP5000M-G/OSP5020M, during writing, the length should always be the maximum byte of one sector.
29 to 33	Show the start address of file called "BOE" (Beginning of Extent). <div style="display: flex; align-items: center; justify-content: center;"> <div style="display: flex; flex-direction: column; align-items: center;"> <div>29</div> <div>30</div> <div>31</div> <div>32</div> <div>33</div> </div> <div style="margin: 0 10px;"> <div style="border-left: 1px solid black; height: 10px; margin-bottom: 5px;"></div> <div style="border-left: 1px solid black; height: 10px; margin-bottom: 5px;"></div> <div style="border-left: 1px solid black; height: 10px; margin-bottom: 5px;"></div> <div style="border-left: 1px solid black; height: 10px; margin-bottom: 5px;"></div> <div style="border-left: 1px solid black; height: 10px;"></div> </div> <div style="display: flex; flex-direction: column;"> <div>Cylinder address</div> <div>Head No.</div> <div>Sector address</div> </div> <div style="margin-left: 10px;"> <div style="font-size: 3em; line-height: 1;">}</div> </div> <div style="margin-left: 10px;">Decimal EBCDIC codes</div> </div>
34	The physical record length within one sector. " " (40H) 128 bytes "1" (F1H) 256 bytes
35 to 39	Show the end of file called "EOE" (End of Extent). (The format is the same as with BOE.) → In the OSP500M-G/OSP5000M-G/OSP5020M, during writing, the address just ahead of EOD described later is entered.
41	The information on file handling. If it is "B", this file should not exist. → This is not referenced in the OSP500M-G/OSP5000M-G/OSP5020M.
43	The information on file protection. If it is other than blank (40H), this file is inhibited from writing (for read only).
45	Shows the case in which the file includes a plurality of floppy disks. " " shows that the file is completed in this floppy disk. "C" shows the file continues on other floppy disks. "L" shows that the file continued from other floppy disk is completed here.
46 and 47	Show the floppy disk sequence number given when the file includes a plurality of floppy disks.
73	Records when the file is created by the data entry device. This shows the file in which "V" keying inspection has been completed. → This is not referenced in the OSP500M-G/OSP5000M-G/OSP5020M.

Columns	Description
75 to 79	Called "EOD" (End of Data), and indicate next record address now already recorded.
75	] Cylinder address
76	
77	Head No.
78	] Sector address
79	



Other column information is not referenced in the OSP500M-G/OSP5000M-G/OSP5020M.

SECTION 2 PROGRAM INPUT/OUTPUT FUNCTIONS BY FLOPPY DISKS (IBM FORMAT)

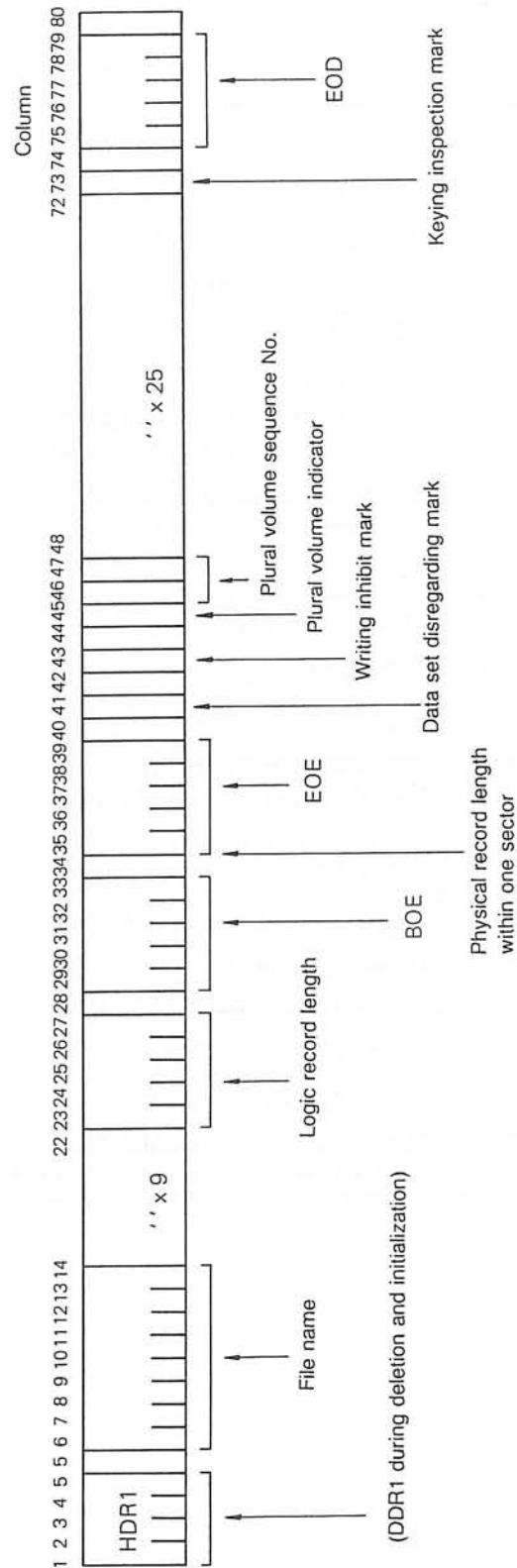


Fig. 2-12 File Directory

8-5. Floppy Disk Information Used in OSP Series

Information that the OSP series requires (is concerned with), which is selected from the aforementioned information, is as follows.

Table 2-4 Floppy Disk Information Used in OSP500M-G/OSP5000M-G/OSP5020M

Sector Address	Column	Contents
05 Faulty cylinder information	1 - 9	"ERMAP"
	7 - 9	1st faulty cylinder address
	11 - 13	2nd faulty cylinder address
07 Volume label information	1 - 4	"VOL1"
	72	Recording flag " " single-sided, "2" double-sided single-density, "M" double-sided double-density
	76	Cylinder 1 - 76 record length " " 128 bytes, "1" 256 bytes
	80	"W"
08 - 26 Including 01 to 26 of side 1 for double-side File directory	1 - 4	"HDR1" or "DDR1"
	6 - 13	8-digit file name
	23 - 27	Logic record length of file
	29 - 33	File start address (BOE) Cylinder address, head No., sector address
	34	Physical record length within one sector " " 128 bytes, "1" 256 bytes
	35 - 39	Final sector address (EOE) secured
	43	Writing protection " " writable; otherwise, writing is inhibited.
	45	Plural volume indicator " ", "C", "L"
	46 - 47	Plural volume sequence No.
	75 - 79	End-of-data address within file (EOD)
		Cylinder address, head No., sector address

8-6. Examples

(1) Faulty Cylinder Information

00	C5	D9	D4	C1	D7①	40	40	40	40②	40	40	40	40③	40	40	40
10	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
20	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
30	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
50	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
60	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
70	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00

① "ERMAP"

② 1st faulty cylinder address

③ 2nd faulty cylinder address

(2) Volume Label Information

00	E5	D6	D3	F1①	D6	D2	E4	D4	C1	40②	40③	40	40	40	40	40
10	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
20	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
30	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
40	40	40	40	40	40	40	40	40④	40	40	40	40⑤	40	40⑥	40	E6⑦
50	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
60	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
70	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00

① "VOL1"

⑤ Record length

② "OKUMA"

⑥ Sector access sequence

③ Secrecy

⑦ Volume label mark "W"

④ Recording flag

(3) Directory

00	C8	C4	D9	F1①	40	C2	C6	40	40	40	40	40②	40	40	40	40
10	40	40	40	40	40	40	40	40	F1	F2	F8③	40	F1	F0	F0	F0
20	F7④	40⑤	F0	F1	F0	F0	F8⑥	40	40⑦	40	D7⑧	40	40⑨	40	40⑩	40
30	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
40	40	40	40	40	40	40	40	40	40⑪	40	F0	F1	F0	F0	F9⑫	40
50	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
60	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
70	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00

① "HDR1"

⑦ Data set disregarding mark

② File name

⑧ Writing protection

③ Logic record length

⑨ Plural volume indicator

④ BOE

⑩ Plural volume sequence No.

⑤ Physical record length within one sector

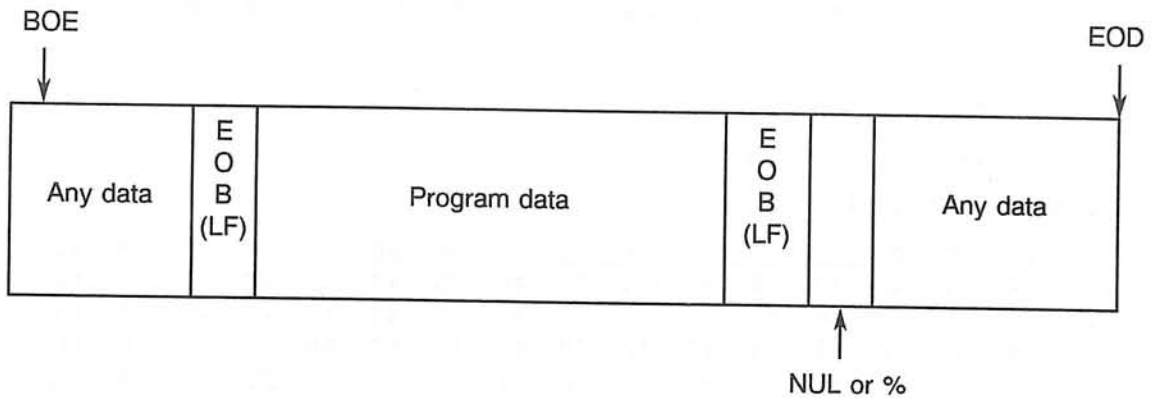
⑪ Keying inspection mark

⑥ EOE

⑫ EOD

8-7. Data Writing Method

- (1) Program read and write in the data area should be the same as with the paper tape. In other words, when the data starts to be read from the beginning of the corresponding track;
 - the data is handled as significant information from the next characters of the first EOB (LF).
(Note: Information up to the first EOB (LF) is skipped.)
 - the last of data should be NUL or %. (Select either one.)
- (2) The standard code should be ISO; however, EBCDIC code and ASCII code are also available if specified.



SECTION 2 PROGRAM INPUT/OUTPUT FUNCTIONS BY FLOPPY DISKS (IBM FORMAT)

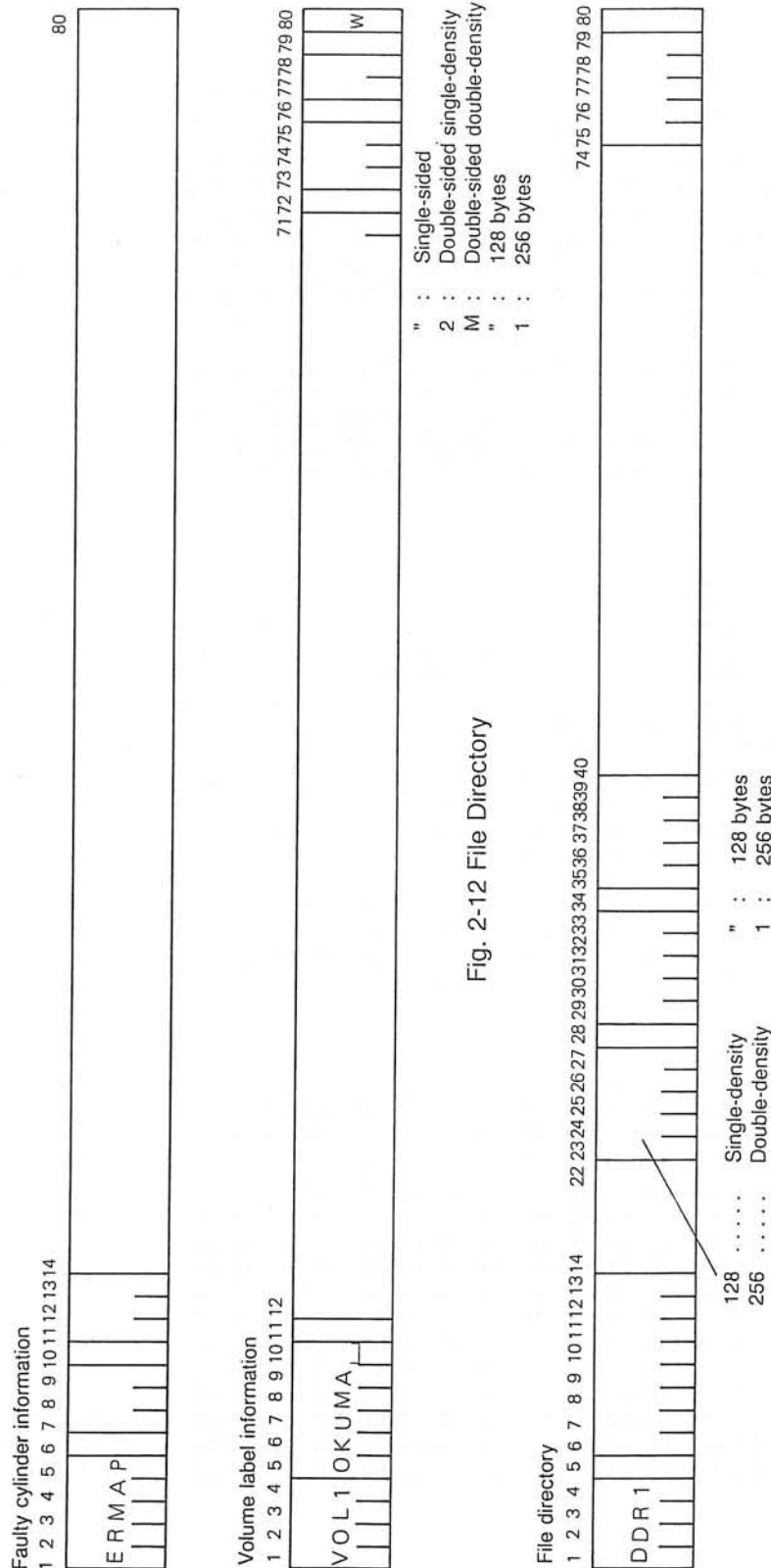


Fig. 2-12 File Directory

* All except the above are blank (40H) up to 80 columns,
and NUL (00H) or blank (40H) after 80 columns.

Fig. 2-13 Initial Status

SECTION 2 PROGRAM INPUT/OUTPUT FUNCTIONS BY FLOPPY DISKS (IBM FORMAT)

Examples of Index Cylinder after Initialization by Each Floppy Disk Drive:

(1) FD1-128 initialization

[illegible][illegible][illegible]

SECTION 2 PROGRAM INPUT/OUTPUT FUNCTIONS BY FLOPPY DISKS (IBM FORMAT)

	PSN=0003	LSN=0003	
	00	E5 D6 D3 F1 D6 D2 E4 D4 C1 40 40 40 40 40 40 40	VOL1OKUMA
Sector 7	10	40 40 40 40 40 40 40 40 40 40 40 40 40 40 40	
	20	40 40 40 40 40 40 40 40 40 40 40 40 40 40 40	
	30	40 40 40 40 40 40 40 40 40 40 40 40 40 40 40	
Volume	40	40 40 40 40 40 40 40 40 40 40 40 40 40 E6	W
label	50	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	????????????????
information	60	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	????????????????
	70	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	????????????????
	80	C4 C4 D9 F1 40 C4 C1 E3 C1 5C 5C 40 40 40 40 40	DDR1 DATA**
	90	40 40 40 40 40 40 40 40 40 F0 F8 F0 40 F7 F4 F0 F0	080 7400
	A0	F1 40 F7 F3 F0 F2 F6 40 40 40 40 40 40 40 40 40	1 73026
Sector 8	B0	40 40 40 40 40 40 40 40 40 40 40 40 40 40 40	
	C0	40 40 40 40 40 40 40 40 40 40 40 F7 F3 F0 F2 F6 40	73026
	D0	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	????????????????
Directory	E0	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	????????????????
	F0	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	????????????????

	PSN=0004	LSN=0004	
	00	C4 C4 D9 F1 40 C4 C1 E3 C1 5C 5C 40 40 40 40 40	DDR1 DATA**
Sector 9	10	40 40 40 40 40 40 40 40 40 F0 F8 F0 40 F7 F4 F0 F0	080 7400
	20	F1 40 F7 F3 F0 F2 F6 40 40 40 40 40 40 40 40 40	1 73026
	30	40 40 40 40 40 40 40 40 40 40 40 F7 F3 F0 F2 F6 40	
Directory	40	40 40 40 40 40 40 40 40 40 40 40 40 40 40 40	73026
	50	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	????????????????
	60	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	????????????????
	70	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	????????????????
	80	C4 C4 D9 F1 40 C4 C1 E3 C1 5C 5C 40 40 40 40 40	DDR1 DATA**
	90	40 40 40 40 40 40 40 40 40 F0 F8 F0 40 F7 F4 F0 F0	080 7400
	A0	F1 40 F7 F3 F0 F2 F6 40 40 40 40 40 40 40 40 40	1 73026
Sector 10	B0	40 40 40 40 40 40 40 40 40 40 40 40 40 40 40	
	C0	40 40 40 40 40 40 40 40 40 40 40 F7 F3 F0 F2 F6 40	73026
	D0	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	????????????????
Directory	E0	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	????????????????
	F0	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	????????????????

	PSN=0005	LSN=0005	
	00	C4 C4 D9 F1 40 C4 C1 E3 C1 5C 5C 40 40 40 40 40	DDR1 DATA**
Sector 11	10	40 40 40 40 40 40 40 40 40 F0 F3 F0 40 F7 F4 F0 F0	080 7400
	20	F1 40 F7 F3 F0 F2 F6 40 40 40 40 40 40 40 40 40	1 73026
	30	40 40 40 40 40 40 40 40 40 40 40 40 40 40 40	
Directory	40	40 40 40 40 40 40 40 40 40 40 40 F7 F3 F0 F2 F6 40	73026
	50	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	????????????????
	60	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	????????????????
	70	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	????????????????
	80	C4 C4 D9 F1 40 C4 C1 E3 C1 5C 5C 40 40 40 40 40	DDR1 DATA**
	90	40 40 40 40 40 40 40 40 40 F0 F8 F0 40 F7 F4 F0 F0	080 7400
	A0	F1 40 F7 F3 F0 F2 F6 40 40 40 40 40 40 40 40 40	1 73026
Sector 12	B0	40 40 40 40 40 40 40 40 40 40 40 40 40 40 40	
	C0	40 40 40 40 40 40 40 40 40 40 40 F7 F3 F0 F2 F6 40	73026
	D0	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	????????????????
Directory	E0	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	????????????????
	F0	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	????????????????

[illegible]

Sector 15

(Same as above)

Directory

Sector 16 to 24

(Same as above)

Directory

		PSN=000C				LSN=000C																
Sector 25	00	C4	C4	D9	F1	40	C4	C1	E3	C1	5C	5C	40	40	40	40	40	40	40	40	DDR1	DATA**
	10	40	40	40	40	40	40	40	40	F0	F3	F0	40	F7	F4	F0	F0				080 7400	
	20	F1	40	F7	F3	F0	F2	F6	40	40	40	40	40	40	40	40	40	40	40	1	73026	
	30	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40			
Directory	40	40	40	40	40	40	40	40	40	40	40	F7	F3	F0	F2	F6	40				73026	
	50	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
	60	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
	70	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
Sector 26	80	C4	C4	D9	F1	40	C4	C1	E3	C1	5C	5C	40	40	40	40	40	40	40	40	DDR1	DATA**
	90	40	40	40	40	40	40	40	40	F0	F8	F0	40	F7	F4	F0	F0				080 7400	
	A0	F1	40	F7	F3	F0	F2	F6	40	40	40	40	40	40	40	40	40	40	40	1	73026	
	B0	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40			
Directory	C0	40	40	40	40	40	40	40	40	40	40	F7	F3	F0	F2	F6	40				73026	
	D0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
	E0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
	F0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00

[illegible]

	PSN=0003	LSN=0003	
	00	E5 D6 D3 F1 D6 D2 E4 D4 C1 40 40 40 40 40 40 40 40	VOL10KUMA
Sector 7	10	40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40	
	20	40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40	
	30	40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40	
Volume label information	40	40 40 40 40 40 40 40 40 F2 40 40 40 40 40 40 40 E6	2 W
	50	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	????????????????
	60	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	????????????????
	70	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	????????????????
	80	C4 C4 D9 F1 40 C4 C1 E3 C1 5C 5C 40 40 40 40 40 40	DDR1 DATA**
	90	40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40	080 7400
	A0	F1 40 F7 F3 F1 F2 F6 40 40 40 40 40 40 40 40 40 40	1 73126
Sector 8	B0	40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40	
	C0	40 40 40 40 40 40 40 40 40 40 F7 F3 F1 F2 F6 40	73126
Directory	D0	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	????????????????
	E0	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	????????????????
	F0	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	????????????????

	PSN=0004	LSN=0004	
	00	C4 C4 D9 F1 40 C4 C1 E3 C1 5C 5C 40 40 40 40 40 40	DDR1 DATA**
Sector 9	10	40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40	080 7400
	20	F1 40 F7 F3 F1 F2 F6 40 40 40 40 40 40 40 40 40 40	1 73126
	30	40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40	
Directory	40	40 40 40 40 40 40 40 40 40 40 F7 F3 F1 F2 F6 40	73126
	50	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	????????????????
	60	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	????????????????
	70	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	????????????????
	80	C4 C4 D9 F1 40 C4 C1 E3 C1 5C 5C 40 40 40 40 40 40	DDR1 DATA**
	90	40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40	080 7400
	A0	F1 40 F7 F3 F1 F2 F6 40 40 40 40 40 40 40 40 40 40	1 73126
Sector 10	B0	40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40	
	C0	40 40 40 40 40 40 40 40 40 40 F7 F3 F1 F2 F6 40	73126
Directory	D0	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	??????????????
	E0	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	????????????????
	F0	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	????????????????

	PSN=0005	LSN=0005	
	00	C4 C4 D9 F1 40 C4 C1 E3 C1 5C 5C 40 40 40 40 40 40	DDR1 DATA**
Sector 11	10	40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40	080 7400
	20	F1 40 F7 F3 F1 F2 F6 40 40 40 40 40 40 40 40 40 40	1 73126
	30	40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40	
Directory	40	40 40 40 40 40 40 40 40 40 40 F7 F3 F1 F2 F6 40	73126
	50	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	????????????????
	60	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	????????????????
	70	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	????????????????
	80	C4 C4 D9 F1 40 C4 C1 E3 C1 5C 5C 40 40 40 40 40 40	DDR1 DATA**
	90	40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40	080 7400
	A0	F1 40 F7 F3 F1 F2 F6 40 40 40 40 40 40 40 40 40 40	1 73126
Sector 12	B0	40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40	
	C0	40 40 40 40 40 40 40 40 40 40 F7 F3 F1 F2 F6 40	73126
Directory	D0	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	????????????????
	E0	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	????????????????
	F0	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	????????????????

		PSN=000				LSN=000																					
Sector 13	00	C4	C4	D9	F1	40	C4	C1	E3	C1	5C	5C	40	40	40	40	40	DDR1 DATA**									
	10	40	40	40	40	40	40	40	40	F0	F8	F0	40	F7	F4	F0	F0	080 7400									
	20	F1	40	F7	F3	F1	F2	F6	40	40	40	40	40	40	40	40	40	1 73126									
	30	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40										
Directory	40	40	40	40	40	40	40	40	40	40	40	F7	F3	F1	F2	F6	40	73126									
	50	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	????????????????									
	60	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	????????????????									
	70	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	????????????????									
<hr/>																											
Sector 14	80	C4	C4	D9	F1	40	C4	C1	E3	C1	5C	5C	40	40	40	40	40	DDR1 DATA**									
	90	40	40	40	40	40	40	40	40	F0	F8	F0	40	F7	F4	F0	F0	080 7400									
	A0	F1	40	F7	F3	F1	F2	F6	40	40	40	40	40	40	40	40	40	1 73126									
	B0	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40										
Directory	C0	40	40	40	40	40	40	40	40	40	40	F7	F3	F1	F2	F6	40	73126									
	D0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	????????????????									
	E0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	????????????????									
	F0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	????????????????									

(Same as above)

Sector 15

Directory

(Same as above)

Sector 16 to 24

Directory

		PSN=000				LSN=000													
Sector 25	00	C4	C4	D9	F1	40	C4	C1	E3	C1	5C	5C	40	40	40	40	40	DDR1 DATA**	
	10	40	40	40	40	40	40	40	40	F0	F8	F0	40	F7	F4	F0	F0	080 7400	
	20	F1	40	F7	F3	F1	F2	F6	40	40	40	40	40	40	40	40	40	1 73126	
	30	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40		
Directory	40	40	40	40	40	40	40	40	40	40	40	F7	F3	F1	F2	F6	40	73126	
	50	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	????????????????	
	60	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	????????????????	
	70	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	????????????????	
<hr/>																			
Sector 26	80	C4	C4	D9	F1	40	C4	C1	E3	C1	5C	5C	40	40	40	40	40	DDR1 DATA**	
	90	40	40	40	40	40	40	40	40	F0	F8	F0	40	F7	F4	F0	F0	080 7400	
	A0	F1	40	F7	F3	F1	F2	F6	40	40	40	40	40	40	40	40	40	1 73126	
	B0	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40		
Directory	C0	40	40	40	40	40	40	40	40	40	40	F7	F3	F1	F2	F6	40	73126	
	D0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	????????????????	
	E0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	????????????????	
	F0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	????????????????	

	PSN=0004	LSN=0004		
Head 1	00	C4 C4 D9 F1	40 C4 C1 E3	C1 5C 5C 40
Sector 1	10	40 40 40 40	40 40 40 40	F0 F8 F0 40
	20	F1 40 F7 F3	F1 F2 F6 40	40 40 40 40
	30	40 40 40 40	40 40 40 40	40 40 40 40
Directory	40	40 40 40 40	40 40 40 40	40 40 F7 F3
	50	00 00 00 00	00 00 00 00	00 00 00 00
	60	00 00 00 00	00 00 00 00	00 00 00 00
	70	00 00 00 00	00 00 00 00	00 00 00 00
	80	C4 C4 D9 F1	40 C4 C1 E3	C1 5C 5C 40
	90	40 40 40 40	40 40 40 40	F0 F8 F0 40
Head 2	A0	F1 40 F7 F3	F1 F2 F6 40	40 40 40 40
Sector 2	B0	40 40 40 40	40 40 40 40	40 40 40 40
	C0	40 40 40 40	40 40 40 40	40 40 F7 F3
	D0	00 00 00 00	00 00 00 00	00 00 00 00
Directory	E0	00 00 00 00	00 00 00 00	00 00 00 00
	F0	00 00 00 00	00 00 00 00	00 00 00 00

Head 1
Sector 3

Directory

Head 1
Sector 4 to 24

Directory

	PSN=0005	LSN=0005		
Head 1	00	C4 C4 D9 F1	40 C4 C1 E3	C1 5C 5C 40
Sector 25	10	40 40 40 40	40 40 40 40	F0 F8 F0 40
	20	F1 40 F7 F3	F1 F2 F6 40	40 40 40 40
	30	40 40 40 40	40 40 40 40	40 40 40 40
Directory	40	40 40 40 40	40 40 40 40	40 40 F7 F3
	50	00 00 00 00	00 00 00 00	00 00 00 00
	60	00 00 00 00	00 00 00 00	00 00 00 00
	70	00 00 00 00	00 00 00 00	00 00 00 00
	80	C4 C4 D9 F1	40 C4 C1 E3	C1 5C 5C 40
	90	40 40 40 40	40 40 40 40	F0 F3 F0 40
Head 1	A0	F1 40 F7 F3	F1 F2 F6 40	40 40 40 40
Sector 26	B0	40 40 40 40	40 40 40 40	40 40 40 40
	C0	40 40 40 40	40 40 40 40	40 40 F7 F3
	D0	00 00 00 00	00 00 00 00	00 00 00 00
Directory	E0	00 00 00 00	00 00 00 00	00 00 00 00
	F0	00 00 00 00	00 00 00 00	00 00 00 00

SECTION 2 PROGRAM INPUT/OUTPUT FUNCTIONS BY FLOPPY DISKS (IBM FORMAT)

(3) FD2-256D initialization

		PSN=0000	LSN=0000												
Sector 1	00	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	10	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	20	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	30	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	50	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	60	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	70	40	40	40	40	40	40	40	40	40	40	40	40	40	40
Sector 2	80	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	90	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	A0	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	B0	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	C0	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	D0	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	E0	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	F0	40	40	40	40	40	40	40	40	40	40	40	40	40	40
		PSN=0001	LSN=0001												
Sector 3	00	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	10	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	20	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	30	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	50	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	60	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	70	40	40	40	40	40	40	40	40	40	40	40	40	40	40
Sector 4	80	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	90	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	A0	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	B0	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	C0	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	D0	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	E0	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	F0	40	40	40	40	40	40	40	40	40	40	40	40	40	40
		PSN=0002	LSN=0002												
Sector 5	00	D5	D9	D4	C1	D7	40	40	40	40	40	40	40	40	ERMAP
	10	40	40	40	40	40	40	40	40	40	40	40	40	40	
	20	40	40	40	40	40	40	40	40	40	40	40	40	40	
	30	40	40	40	40	40	40	40	40	40	40	40	40	40	
	40	40	40	40	40	40	40	40	40	40	40	40	40	40	
	50	40	40	40	40	40	40	40	40	40	40	40	40	40	
	60	40	40	40	40	40	40	40	40	40	40	40	40	40	
	70	40	40	40	40	40	40	40	40	40	40	40	40	40	
Sector 6	80	40	40	40	40	40	40	40	40	40	40	40	40	40	
	90	40	40	40	40	40	40	40	40	40	40	40	40	40	
	A0	40	40	40	40	40	40	40	40	40	40	40	40	40	
	B0	40	40	40	40	40	40	40	40	40	40	40	40	40	
	C0	40	40	40	40	40	40	40	40	40	40	40	40	40	
	D0	40	40	40	40	40	40	40	40	40	40	40	40	40	
	E0	40	40	40	40	40	40	40	40	40	40	40	40	40	
	F0	40	40	40	40	40	40	40	40	40	40	40	40	40	

Faulty
cylinder
information

[illegible]

Sector 7

Sector 8

Sector 9

Sector 10

ector 11

ector 12

VOL1OKUMA

DDR1 DATA**

1174126 H

DDR1 DATA**

1174126 H

DDR1 DATA**

1174126 H

DDR1 DATA**

1174126 H

DDR1 DATA**

1174126 H

		PSN=0006				LSN=0006													
Sector 13	00	C4	C4	D9	F1	40	C4	C1	E3	C1	5C	5C	40	40	40	40	40	DDR1	DATA**
	10	40	40	40	40	40	40	40	40	F2	F5	F6	40	F7	F5	F0	F0	256	7500
	20	F1	F1	F7	F4	F1	F2	F6	40	40	40	40	C8	40	40	40	40	1174126	H
	30	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40		
Directory	40	40	40	40	40	40	40	40	40	40	40	F7	F4	F1	F2	F6	40		74126
	50	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40		
	60	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40		
	70	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40		
Sector 14	80	C4	C4	D9	F1	40	C4	C1	E3	C1	5C	5C	40	40	40	40	40	DDR1	DATA**
	90	40	40	40	40	40	40	40	40	F2	F5	F6	40	F7	F5	F0	F0	256	7500
	A0	F1	F1	F7	F4	F1	F2	F6	40	40	40	40	C8	40	40	40	40	1174126	H
	B0	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40		
Directory	C0	40	40	40	40	40	40	40	40	40	40	F7	F4	F1	F2	F6	40		74126
	D0	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40		
	E0	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40		
	F0	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40		

Sector 15

(Same as above)

Directory

Sector 16 to 24

(Same as above)

Directory

		PSN=000C				LSN=000C																				
		00	C4	C4	D9	F1	40	C4	C1	E3	C1	5C	5C	40	40	40	40	DDR1 DATA**								
Sector 25	10	40	40	40	40	40	40	40	40	40	F2	F5	F6	40	F7	F5	F0	F0	256				7500			
	20	F1	F1	F7	F4	F1	F2	F6	40	40	40	40	C8	40	40	40	40	1174126				H				
	30	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40									
	40	40	40	40	40	40	40	40	40	40	40	F7	F4	F1	F2	F6	40					74126				
Directory	50	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40									
	60	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40									
	70	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40									
	80	C4	C4	D9	F1	40	C4	C1	E3	C1	5C	5C	40	40	40	40	40	DDR1 DATA**				256 7500				
Sector 26	90	40	40	40	40	40	40	40	40	40	F2	F5	F6	40	F7	F5	F0	F0	1174126				H			
	A0	F1	F1	F7	F4	F1	F2	F6	40	40	40	40	C8	40	40	40	40									
	B0	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40					74126				
	C0	40	40	40	40	40	40	40	40	40	40	F7	F4	F1	F2	F6	40									
Directory	D0	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40									
	E0	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40									
	F0	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40									

Head 1
Sector 2 to 25

(Same as above)

(Directory)

[illegible]

APPENDIX

[Code Table used in Converting EBCDIC to OSP]

Code Table used in Converting EBCDIC to OSP

L \ H	0 1 2 3	4 5 6 7	8 9 A B	C D E F
0	NUL	SP & -		[] 0
1		/		A J 1
2				B K S 2
3				C L T 3
4				D M U 4
5	HT NL (LF)			E N V 5
6	(BS)			F O W 6
7				G P X 7
8				H Q Y 8
9				I R Z 9
A		¥ ! :		
B		. \$, #		
C		< * % @		
D	(CR)	() _ '		
E		+ ; > =		
F		Δ ? "		

With the OSP, only the above codes are handled: all the other codes are converted as "?". Codes in circle above are ignored.

Note: NL (15H) is considered as EOB (LF). ¥ may sometimes be a backslash "/", depending on the machine.

If the NUL (00H) is not used as the program end command, the NUL code is ignored.

[EBCDIC Code Table]

EBCDIC Code Table

L \ H	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	NUL DLE DS				SP & -								[] 0			
1	SOH DC1 SOS				/				a j s				A J 1			
2	STX DC FS SYN								b k t				B K S 2			
3	EXT TM								c l u				C L T 3			
4	PF RES BYP PN								d m v				D M U 4			
5	HT NL LF RS								e n w				E N V 5			
6	LC BS ETB UC								f o x				F O W 6			
7	DLE iL ESC EOT								g p y				G P X 7			
8	CAN								h q z -				H Q Y 8			
9	EM								i r				I R Z 9			
A	SMMCC SM				Y ! | :											
B	VT CUI CU2 CU3				. \$, #											
C	FF iFS DC4				< % @											
D	CR iGS ENQ NAK				() _ '											
E	SO iRS ACK				+ ; > =											
F	Si iUS BEL SUB				| ~ ?											

SECTION 2 PROGRAM INPUT/OUTPUT FUNCTIONS BY FLOPPY DISKS (IBM FORMAT)

[ISO Code Table]

ISO Code Table

L \ H	0 1 2 3				4 5 6 7				8 9 A B				C D E F			
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	NUL			0	P				SP				@			
1		!			A					1			Q			
2		"			B					2			R			
3				3	S				#				C			
4			\$		D					4			T			
5				5	U				%				E			
6				6	V				&				F			
7			,		G					7			W			
8			(		H				BS		8		X			
9	HT			9	Y				)				I			
A	LF		:		Z				*				J			
B			+		K							;	[
C			<		¥				,				L			
D			-		M				CR		=]			
E			.		N						>		A			
F			?		-				/				0			DEL

[ASCII Code Table]

ASCII Code Table

L \ H	0 1 2 3				4 5 6 7				8 9 A B				C D E F			
0	SP 0				@ P											
1	! 1				A Q											
2	" 2				B R											
3	# 3				C S											
4	\$ 4				D T											
5	% 5				E U											
6	& 6				F V											
7	' 7				G W											
8	BS	(	8		H	X										
9	HT	)	9		I	Y										
A	NL	*	:		J	Z										
B		+	;		K	[
C		,	<		L	≠										
D	CR	-	=		M]										
E		.	>		N	Δ										
F		/	?		O	-		DEL								

SECTION 3 TAPE PUNCH INTERFACE

1. Function Overview

- (1) For the OSP5020M, RS-232C interface is provided. NC machining program files can be transmitted in batch to an external device (tape reader, tape punch, or other device equipped with either of these interfaces).
- (2) The interface is prepared on the punch panel using special connectors to which an external device is to be connected.
- (3) Since data communication using the RS-232C interface employs the conventional behind the tape reader (BTR) method and the DC code control method, connection of the external device varies depending on the device.
- (4) With the OSP500M-G/OSP5000M-G/OSP5020M, when the tape punch to be connected with the OSP is selected, the cable for connecting these two devices is determined by the type of tape punch selected. Since the protocol has already been determined, data communication between them is made possible by simply connecting them. If another type of punch is connected, it is then necessary to match the communication specifications.
- (5) Optionally, the RS-232C interface can be expanded to five channels.

2. Tape Punch Panel

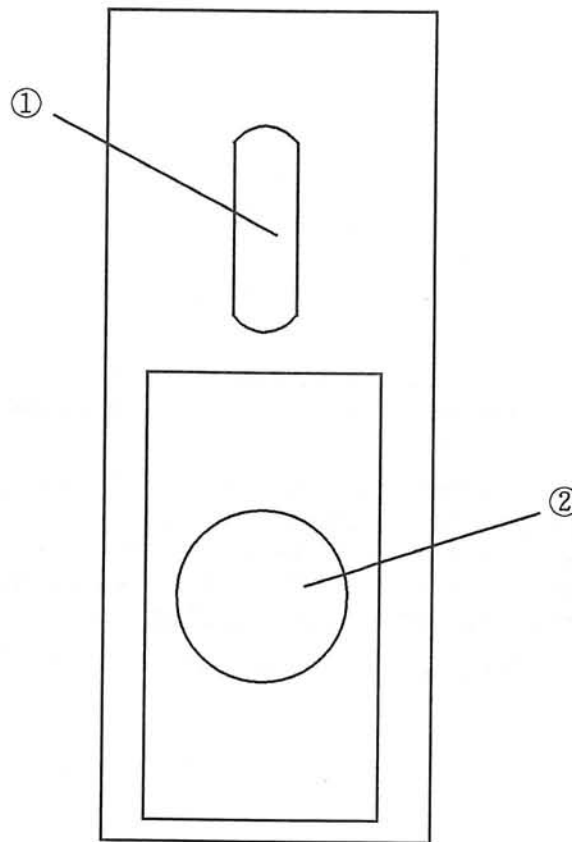


Fig. 3-1 Tape Punch Panel

- (1) RS-232C interface connector (DB25P female)

The device connected through this interface connector is assigned with device name CN0:.

- (2) Service Outlet

The outlet is used to supply power to the punch.

Rating: AC 100V, 2 A (maximum)

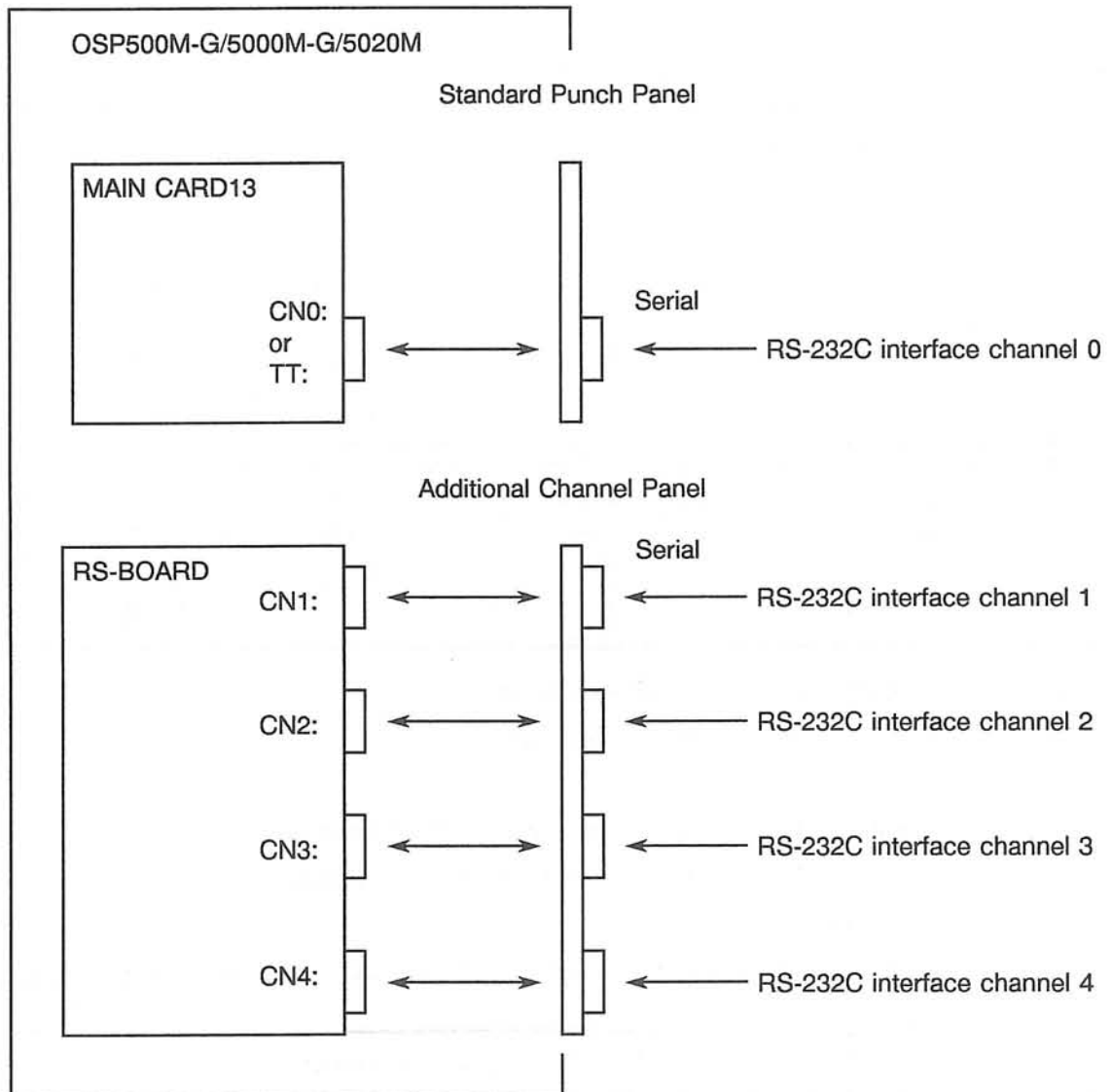


Fig. 3-2 Interface Channel Assignment

3. Parameter Setting

This section explains parameters to be set before connecting an external device.

After setting parameters, press the function key [F7] (BACKUP). After the completion of data backup, turn off the power supply once and turn it back on. This makes the parameters effective.

Note: Newly set parameters are not effective unless power supply is turned off and then back on again.

(1) NC Optional Parameter (Bit) No. 1

Bit No. Param-eter No.	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
1	Tape special code ignore	Tape special code alarm	Tape rewind	Tape read verify	Tape derimiter % (ER) code	Tape TV check	Auto-matic tape code recognition	Tape code setting

bit 0 . . . Setting 1 : Tape code ISO code

0 : Tape code EIA code

Initial setting : 1

bit 1 . . . Setting 1 : Automatic tape recognition effective

0 : Automatic tape recognition not effective

Initial setting : 1

Bits "0" and "1" are used to specify the coding system of tape punch out and tape verify.

bit 1	bit 0	Operation Condition
1	1	READ ISO/EIA (automatic tape recognition) VERIFY ISO/EIA (automatic tape recognition) PUNCH ISO
1	0	VERIFY ISO/EIA (automatic tape recognition) PUNCH EIA
0	1	VERIFY ISO* * Tape code nonconformity results in alarm. PUNCH ISO
0	0	VERIFY EIA* * Tape code nonconformity results in alarm. PUNCH EIA

bit 2 . . . Tape TV check

The number of characters in one block is checked: from the character preceded by LF (EOB) character to the next LF (EOB) character. The number of characters in one block must be even.

bit 2	Operation Condition	
0	READ	TV check is not performed.
	PUNCH	The number of characters in one block is not adjusted.
1	READ	The number of characters in one block is checked and if the number of characters in one block is odd, an alarm results.
	PUNCH	The number of characters in one block is adjusted so that one block contains an even number of characters.

Initial setting: 0

bit 3 . . . Tape delimiter % (ER) code

"%" or "ER" code can be used as a delimiter of programs on a tape instead of using feed holes.

bit 3	Operation Condition
0	The control accepts feed holes as the delimiter of a program.
1	The control accepts "%" or "ER" code as the delimiter of a program.

Initial setting: 0

Note: Tape data between the first CR (or LF (EOB)) and the following one is ignored.

bit 4 . . . Tape read verify

Program data is automatically verified when it is read.

bit 4	Operation Condition
0	Verify is not made after completion of tape reading in.
1	Verify is made after completion of tape reading in.

Initial setting: 1

Note: File name is not verified.

bit 5 . . . Tape rewind

Tape is rewound after the completion of tape reading when tape verify is not made.

bit 5	Operation Condition
0	After the completion of tape reading, tape is not rewound.
1	After the completion of tape reading, tape is rewound.

Initial setting: 0

bit 6 . . . Tape special code (\$20 - \$5F, HT) alarm

bit 7 . . . Tape special code ignored

bit 7	bit 6	Operation Condition
*	1	Alarm occurs when a special code is read.
1	0	A special code is ignored when it is read.
0	0	A special code is accepted when it is read.

Initial setting: bit 6 = 1

bit 7 = 0

(2) NC Optional Parameter (Bit) No. 8, 13, 14, 21, and 22

Data relating to RS-232C interface channel

NC Optional Parameter (Bit) No.	Channel	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
No.8	CN0:	File name used	DC code control type 2	DC code control used	8 bit JIS	Even parity	Parity check carried out	No ready signal	Stop bit 1 bit
No.13	CN1:								
No.14	CN2:								
No.21	CN3:								
No.22	CN4:								
Initial setting		0	0	0	0	0	0	1	0

bit 0 . . . RS-232C stop bit check

bit 0	Operation Condition
0	2 stop bits
1	1 stop bit

bit 1 . . . No ready signal
(EX-INT signal is used as the ready signal.)

bit 1	Operation Condition
0	EX-INT signal is used as the ready signal.
1	EX-INT signal is not used as the ready signal.

bit 2 . . . RS-232C parity check carried out
(Whether or not one parity bit is added to 8 bit data)

bit 2	Operation Condition
0	Parity check not carried out
1	Parity check carried out

bit 3 . . . RS-232C even parity

bit 3	Operation Condition
0	Odd parity
1	Even parity

bit 4 . . . RS-232C 8 bit JIS

bit 4	Operation Condition
0	7 bit JIS
1	8 bit JIS

bit 5, 6 . . Designation of DC code control

bit 6	bit 5	Operation Condition
0	0	No DC code control
1	0	No DC code control
0	1	Standard DC code control
1	1	DC code control type 2 (for DNC-A only)

bit 7 . . . File name used (requested file name in optional DNC-A)

bit 7	Operation Condition
0	Request file name not output
1	Request file name output

(3) NC Optional Parameter (Bit) No. 12

bit 2 . . . Designation whether or not the file name is output.

bit 2	Operation Condition
0	File name is output.
1	File name is not output.

Initial setting: 0

bit 3 . . . Designation of record end code for tape punch in ISO code

bit 3	Operation Condition
0	CR and LF are output.
1	Only LF is output.

Initial setting: 0

bit 4 . . . Designation of code punched in tape feed area for tape punch

bit 4	Operation Condition
0	NULL codes are output.
1	SPACE codes are output.

Initial setting: 0

bit 5 . . . Designation whether or not tape feed area is output in tape punch

bit 5	Operation Condition
0	Tape feed area is output.
1	Tape feed area is not output.

Initial setting: 0

(4) NC Optional Parameter (Bit) No. 27 - No. 31, No. 49

(a) These parameters are used to set special codes which are not supported by the EIA code.

Param- eter No. \ Bit No.	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
No.27	Combination of punched out holes for "=" symbol							
No.28	Combination of punched out holes for "*" symbol							
No.29	Combination of punched out holes for "[" symbol							
No.30	Combination of punched out holes for "]" symbol							
No.31	Combination of punched out holes for "\$" symbol							
No.49	Combination of punched out holes for "#" symbol							
No.50	Irregular code							
No.51	Normal code corresponding to irregular code (ISO)							
Initial setting	0	0	0	0	0	0	0	0

(b) Regardless whether the EIA or ISO code is being used, it is possible to use a code for other code for program read and punch operation.

(c) Set a code (irregular code) which should be interpreted as other code for optional parameter (bit) No. 50 and the normal code which corresponds to the irregular code for optional parameter (bit) No. 51. Note that the normal code must be set in the ISO code.

During reading : The irregular code in a program is interpreted as the normal code.

During punching : The normal code which corresponds to the irregular code is punched on tape with the irregular code.

(5) NC Optional Parameter (Word) No. 1 and 2

Parameter No.	Item	Contents	Factory Set Initial Value	Setting Range
1	Tape feed holes in punching	For punchout in the PIP holes in (transfer) mode, tape feed hole areas are punched out before and after program punch out. The number of feed holes is set by this parameter.	600	1 - 10000
2	Defaults of tape lengths in divided punching	A file of machining programs which is too long to be stored in a roll of paper tape is divided into smaller files to be punched out. The lengths of the divisions are set by this parameter. The divisions are closed at the breaks of each block, so that the actual tape length is slightly different from the setting. A divided punchout gives the beginning of each tape part a file name. Note that the setting does not include the lengths corresponding to the file name and feed holes.	180 m (590 ft)	1 - 300 m (3.3 - 984 ft)

(6) NC Optional Parameter (Word) No. 6, 39, 40, 41, and 42

Setting of baud rate for CN0: through CN4:

NC Optional Parameter (Word) No.	Channel	Contents	Initial Setting
No.6	CN0:	Baud rate is set from the following values: 110, 150, 200, 300, 600, 1200, 2400, 4800, 9600, 19200	600 (baud rate)
No.39	CN1:		
No.40	CN2:		
No.41	CN3:		
No.42	CN4:		

(7) NC Optional Parameter (Word) No. 34, 35, 36, 37, and 38

Setting of RS-232C ready waiting period for CN0: through CN4:

NC Optional Parameter (Word) No.	Channel	Setting Range (sec)	Contents	Initial Setting
No.34	CN0:	1 - 9999	These set time duration until data receiving or RS232C becomes ready (CTS or DSR goes ON) after the transmission of DC1 (tape reader start) or interruption of data receiving. If there is no response within the set time duration, an alarm occurs.	10 (sec)
No.35	CN1:			
No.36	CN2:			
No.37	CN3:			
No.38	CN4:			

(8) NC Optional Parameter (Word) No. 45

Designation of data communication input/output channel

Setting	External Device Name		Initial Setting
0	CN0:(TT)	[RS-232C]	0 (Designation of CN0:)
1	CN1:	[RS-232C]	
2	CN2:	[RS-232C]	
3	CN3:	[RS-232C]	
4	CN4:	[RS-232C]	

4. Operation Procedures

Data communication between OSP5020M and an external device is possible using the file transfer function in the EXIT AUX mode.

- (1) Command format to read, verify and punchout of NC programs (files):

<command-name>, <input-device-name> : <input-NC-program-name> ,
<output-device-name> : <output-NC-program-name>

The command name should be given by pressing one of the following function keys:

R for Read command

V for Verify command

P for Punch command

- (2) Command format to print an NC program (file) list or NC program directory:

<command-name> <input-device-name> : <input-NC-program-name> ,
<output-device-name> :

- (3) The command name should be given by pressing one of the following function keys:

L for program List print command

DI for program Directory print command

- (4) Connectable External Devices and Their Symbolic Designations

Sector device	BB1: User bubble memory FD0: 3.5" or 8" floppy disk* FD1: 3.5" or 8" floppy disk*
Tape reader	TR: Standard tape reader provided CN0: For RS-232C Channel 0 tape reader* CN1: For RS-232C Channel 1 tape reader* CN2: For RS-232C Channel 2 tape reader* CN3: For RS-232C Channel 3 tape reader* CN4: For RS-232C Channel 4 tape reader*
Tape punch	CN0: For RS-232C Channel 0 tape punch* CN1: For RS-232C Channel 1 tape punch* CN2: For RS-232C Channel 2 tape punch* CN3: For RS-232C Channel 3 tape punch* CN4: For RS-232C Channel 4 tape punch*
Printer	CN: Console PN: Operation panel CRT PR: Centronics compatible printer* CN0: For RS-232C Channel 0 printer* CN1: For RS-232C Channel 1 printer* CN2: For RS-232C Channel 2 printer* CN3: For RS-232C Channel 3 printer* CN4: For RS-232C Channel 4 printer*

* optional

- (a) FD0: 3.5" floppy disk, FD1: 8" floppy disk
- (b) CN0: uses the main card 3 RS-232C interface, while CN1: through CN4: uses respective CH1 through CH4 of the RS board.
- (c) CN0: may be used as the device name TT:.
- (d) The following is a list of input and output devices connectable with the RS-232C interface.

Command Name	Input Devices Connectable	Output Devices Connectable
R: Read	Tape reader	Sector device
V: Verify	Tape reader	Sector device
P: Punch	Sector device	Tape punch
L: List	Sector device	Printer
DI: Directory	Sector device	Printer
FR: Free	Sector device	Printer

- (e) When the name of a connectable device is not designated, the respective default device name is assumed.
 - BB1: for sector device
 - TR: for tape reader (selectable by NC optional parameter (word) No.57)
 - CN0: for tape punch (selectable by NC optional parameter (word) No. 45)
 - PN: for printer
- (f) When the output NC program name is omitted, the input NC program name is assumed.
- (g) When the input NC program name is omitted, A.MIN is assumed.

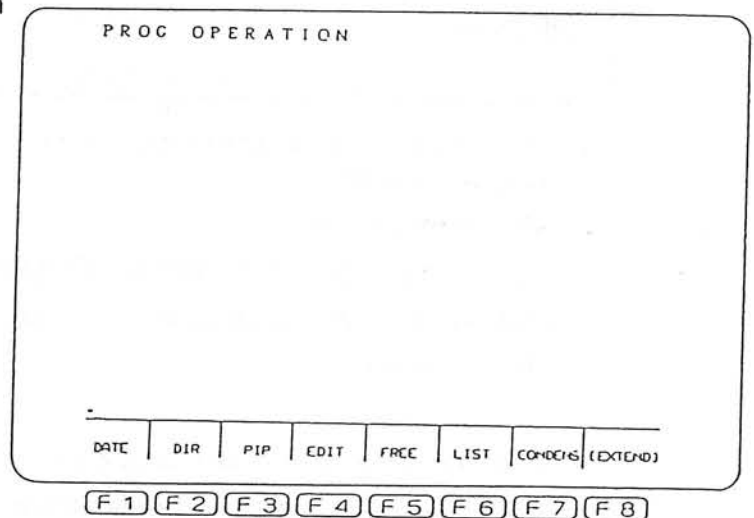
Notice any NC program name given on the tape is used for the input NC program name if it is omitted.

(5) The operation procedure is explained below.

- ① Press the EDIT AUX key. The CRT display changes to PROGRAM OPERATION screen.

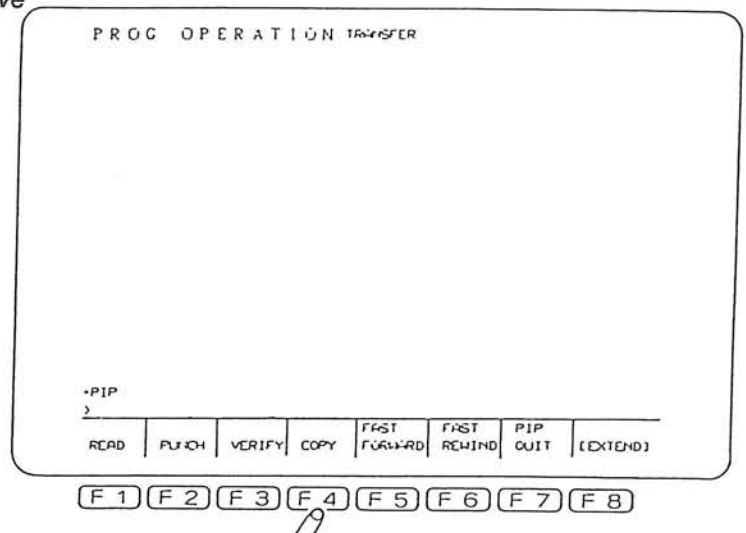


- ② Press the function key [F3] (PIP). This assigns another set of functions to individual function keys.



- ③ Read, punch and verify operations are possible by pressing the function keys [F1], [F2] and [F3], respectively.

Note: Function key [F4] (COPY) is used when an optional floppy disk drive is selected.



(a) Read Operation

Press [F1] (READ) and specify the device name.

For example, specifying

> R CN0: [WRITE]

causes an NC program to be read from the tape reader connected at CN0:. The RS-232C has five channels including CN0: through CN4: to which the user can correspond a desired external device. With the provided paper tape reader (TR:), if 1 has been set to bit 4 of NC optional parameter (bit) No. 1, or option V has been designated, a verify operation follows read and rewind operations. However, this operation will not be performed if CN0: through CN4: are specified.

(b) Verify Operation

Press [F3] (VERIFY) and specify the device name.

For example, specifying

> V CN0: [WRITE]

causes tape verification to be performed for NC program read from the tape reader connected at CN0:.

Note: If no device name is specified, the device is selected according to the setting of NC optional parameter (word) No.57 (designation of tape read device).

(c) Punch Operation

Press [F2] (PUNCH), and key in the NC program name (file name) and the output device name in this order.

For example, specifying

> P LAP1, CN1: [WRITE]

causes the device connected at CN1: to punch out the NC program tape named LAP1.MIN.

Note: If no device name is specified, output device is selected according to the setting of NC optional parameter (word) No. 45 (designation of tape punch device).

(d) Print Operation

To designate print operation using the RS-232C device, specify the desired command followed by device name according to the requirements of list print or directory print.

For example, specifying

= L LAP1, CN2: [WRITE]

= DI, CN2: [WRITE]

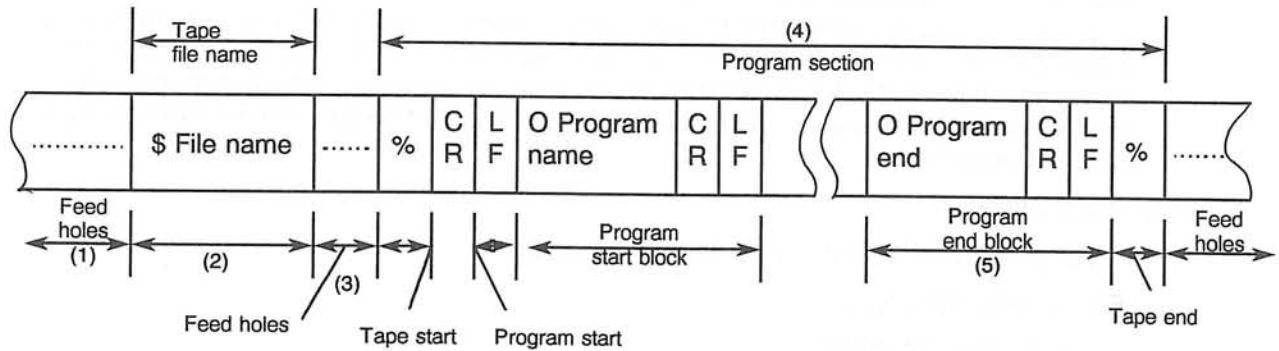
causes the device connected at CN2: to print the desired program list and directory, respectively.

Note: If no device name is specified, CRT is used as the output device.

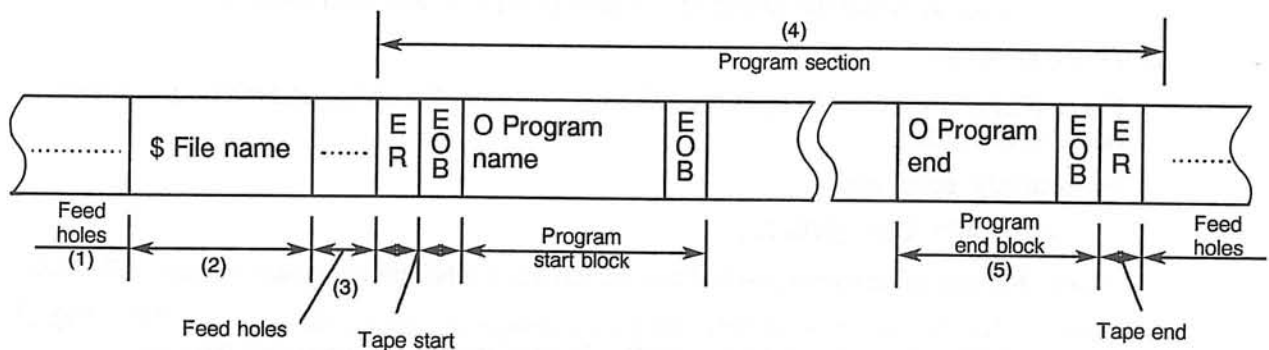
5. Tape Format

5-1. Input Format

ISO Code:



EIA Code:



(1) Feed holes (ISO: NUL or space, EIA: BLANK or space)

(2) Input a file name following "\$" code.

When a file name is omitted, the output NC program name is taken as the input file if it is designated. If the output NC program name is omitted, the input file name is A.MIN.

(3) Feed holes

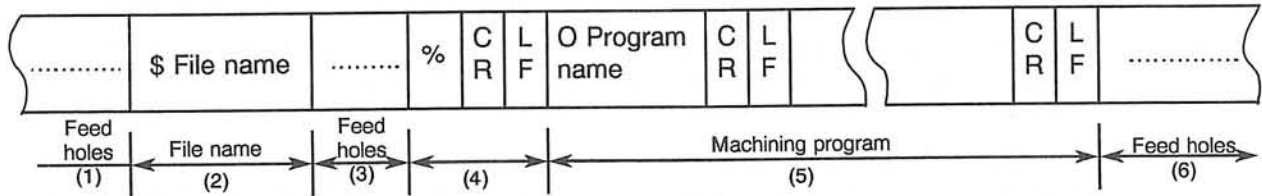
(4) The program section must begin and end with a % (ER) code.

(5) Always input M02, M30, END, or RTS code in the program end block.

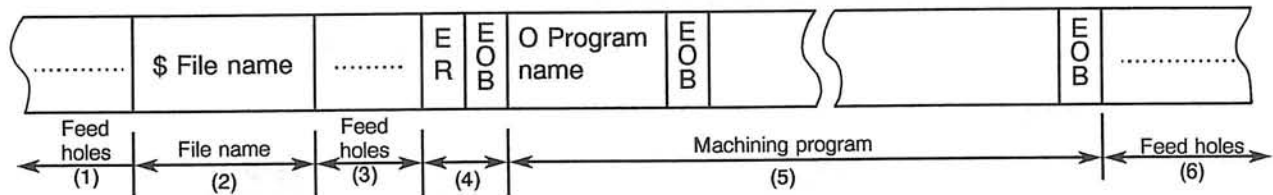
Note: Codes which cannot be set in the EIA code can be read by converting them into other readable codes. See 5-3.

5-2. Output Format

ISO Code:



EIA Code:



- (1) 600 tape feed holes are punched in the tape leader section.
The number of feed holes to be punched out can be set as desired in the range from 1 to 10000 with setting of NC optional parameter (word) No. 1.
- (2) The file name is punched out following "\$" code.
(Program data is punched out in ISO coding system.)
- (3) 50 tape feed holes are punched out.
The number of the tape feed holes cannot be changed.
- (4) Any of the following codes is punched out:
%, CR, LF, ER, EOB
- (5) The machining program data is punched out following the program name (number).
- (6) The same number of tape feed holes as in (1) are punched out in the tape trailing section.

Note 1: When tape punch out is made in the EIA code, punch out operation halts with error indication if a code not acceptable by EIA code is found in the machining program.

Note 2: When a tape delimiting code is the “%” (ER) code, i.e., bit 3 of NC optional parameter (bit) No. 1 is “1”, the “%” or the “ER” code is punched out before (6) feed holes.

Note 3: The machining program is split and punched out, if it is too long to be contained in one roll paper tape. Paper tape length may be changed from 1 to 300 meters (3.3 to 984 feet) using the NC optional parameter (word) No. 2.

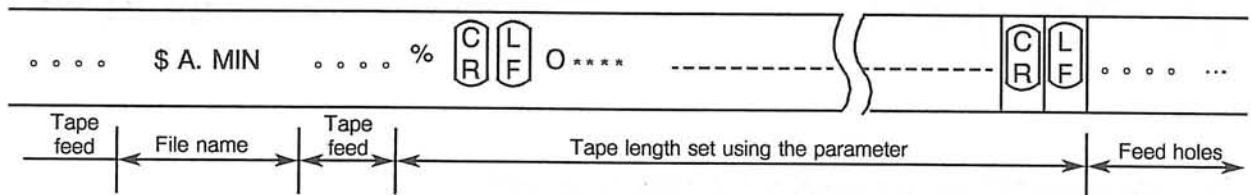
The file name is also punched out, for the tapes from the second on. Since the tape ends with “CR” or “LF”, actual tape length is somewhat different from tape length set using the parameter.

For punching out a program in more than one roll of paper tape, designate option D.

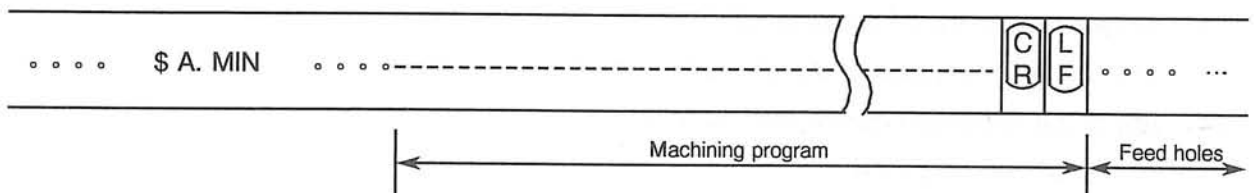
P__ file name, device name : D

Designate this option code.

First



Second



5-3. EIA Special Codes

- (1) In making a program in the EIA code, some characters cannot be used because it does not have corresponding codes. These characters are "=", "*", etc.

Therefore, to make an EIA coded program, it is necessary to replace such characters with other EIA code patterns temporarily.

- (2) When such characters are read by the OSP, they must be converted again to the original characters using the editing function.
- (3) The OSP has the function to automatically replace the such characters not supported by the EIA coding system in the stage of input to the OSP from paper tape and also output to a tape punch by setting them as the EIA special characters.

(a) Setting of EIA Special Characters

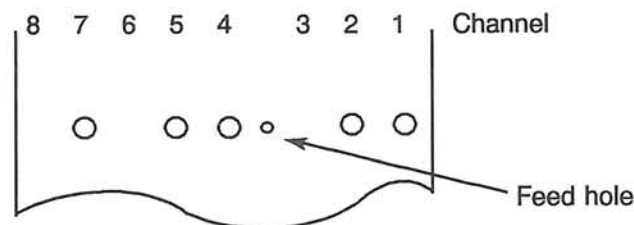
The characters which can be set as EIA special characters are the following six characters.

=, *, [,], \$, #

These special codes are set at NC optional parameter (bit) No. 27 through No. 31 and No. 49 in bit pattern.

NC optional parameter (bit) No.27	Set the EIA code pattern which substitutes "=" symbol.
NC optional parameter (bit) No.28	Set the EIA code pattern which substitutes "*" symbol.
NC optional parameter (bit) No.29	Set the EIA code pattern which substitutes "[" symbol.
NC optional parameter (bit) No.30	Set the EIA code pattern which substitutes "]" symbol.
NC optional parameter (bit) No.31	Set the EIA code pattern which substitutes "\$" symbol.
NC optional parameter (bit) No.49	Set the EIA code pattern which substitutes "#" symbol.

Example: Suppose the puncher key "□" is determined for punching the "=" code, and that the arrangement of punched holes by this key operation is as below.



Set this arrangement of punched holes by a "1" and a "0", where "1" indicating a punched hole and "0" a position not punched. Setting will be as below:

0 1 0 1 1 0 1 1

Set this at No. 27 of NC optional parameter (bit).

By repeating the same operations, set all the codes used on the OSP5020M.

- Note 1: When inputting an EIA code program, and if the first data is the special code "\$", the character-string following the "\$" character is read as the file name.*
- Note 2: When outputting a program using the EIA code, and when the "\$" special character is set, then the file name is output in the EIA code. When this special character is not set, output is made in the ISO code.*
- Note 3: When converting a special character into an EIA code pattern, the control does not check the character used for replacing the special character.*
Example: If "01100001" pattern ("A" in EIA code) is set for the "=" character, and when "A=B" is punched, the output from the tape punch is "AAB". Reading this into the control causes "= =B" to be stored.
- Note 4: Special code conversion is effective only in the PIP mode. It is not effective in the optional DNC mode.*

6. Specifications

6-1. RS-232C Interface

(1) Data Communications

Asynchronous transmission mode

In the asynchronous transmission mode, one character is transmitted with the preceding start signal and the succeeding end signal. The transmitted character is composed of a start bit ①, the eight data bits ②, a parity bit ③ and two stop bits ④ as shown in Fig. 3-3.

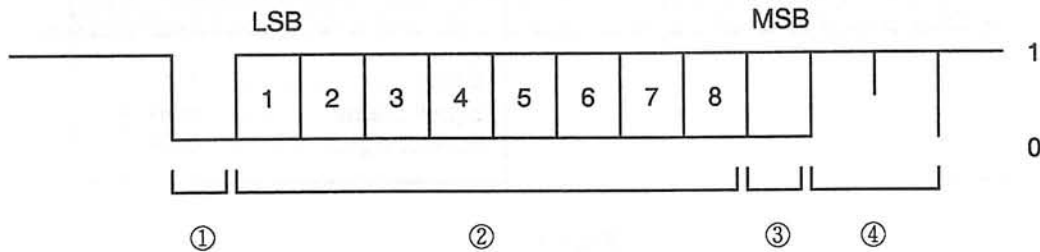


Fig.3-3 Bit Configuration

(2) Baud Rate (BPS baud)

110, 150, 200, 300, 600, 1200, 2400, 4800, 9600, 19200

(3) Data Configuration

Start bit : 1

Data bit : 8

Parity bit : 1 or none (selectable by setting proper parameter)

Stop bit : 1 or 2 (selectable by setting proper parameter)

(4) Parity Check (Character Parity)

Odd/Even parity or no parity (selectable by setting proper parameter)

(5) Data Transmissible Range

RS-232C : Up to 15 meters (49 feet)

RS-422 : Up to 1,200 meters (3,937 feet) (by using RS-232C/RS-422 converter)

Fiber optics : Up to 2,000 meters (6,562 feet)
(by using RS-232C/optical converter)

(6) RS-232C Signal Level

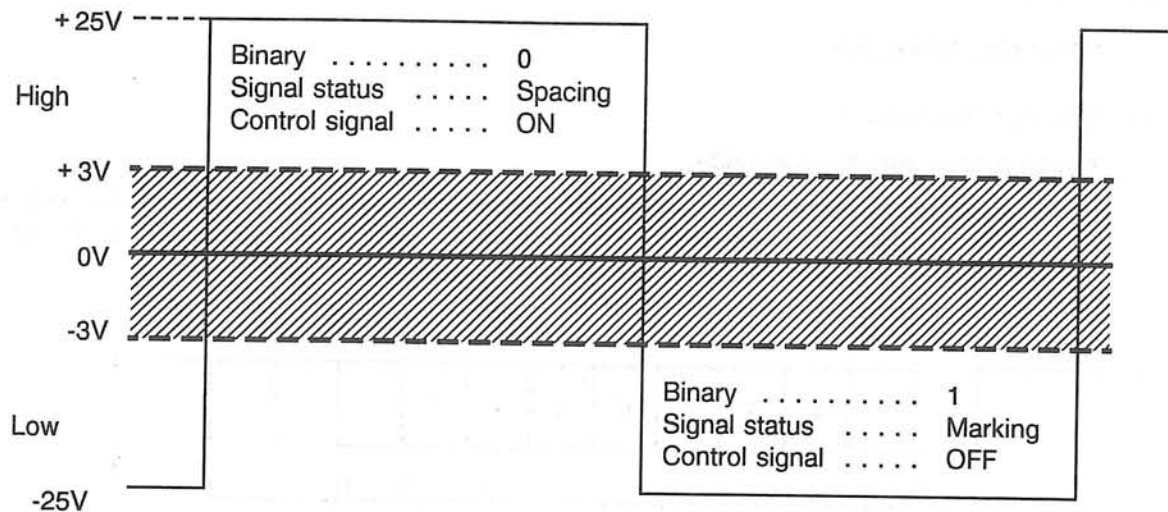
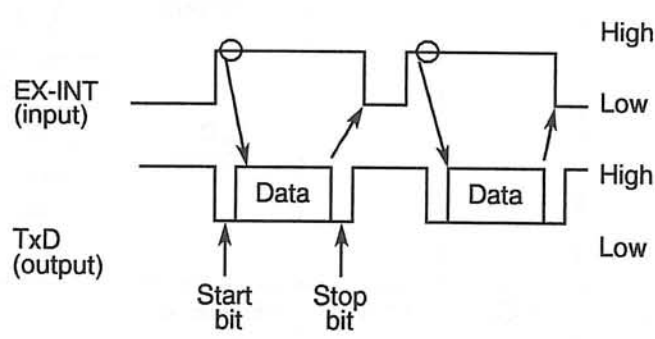


Fig.3-4

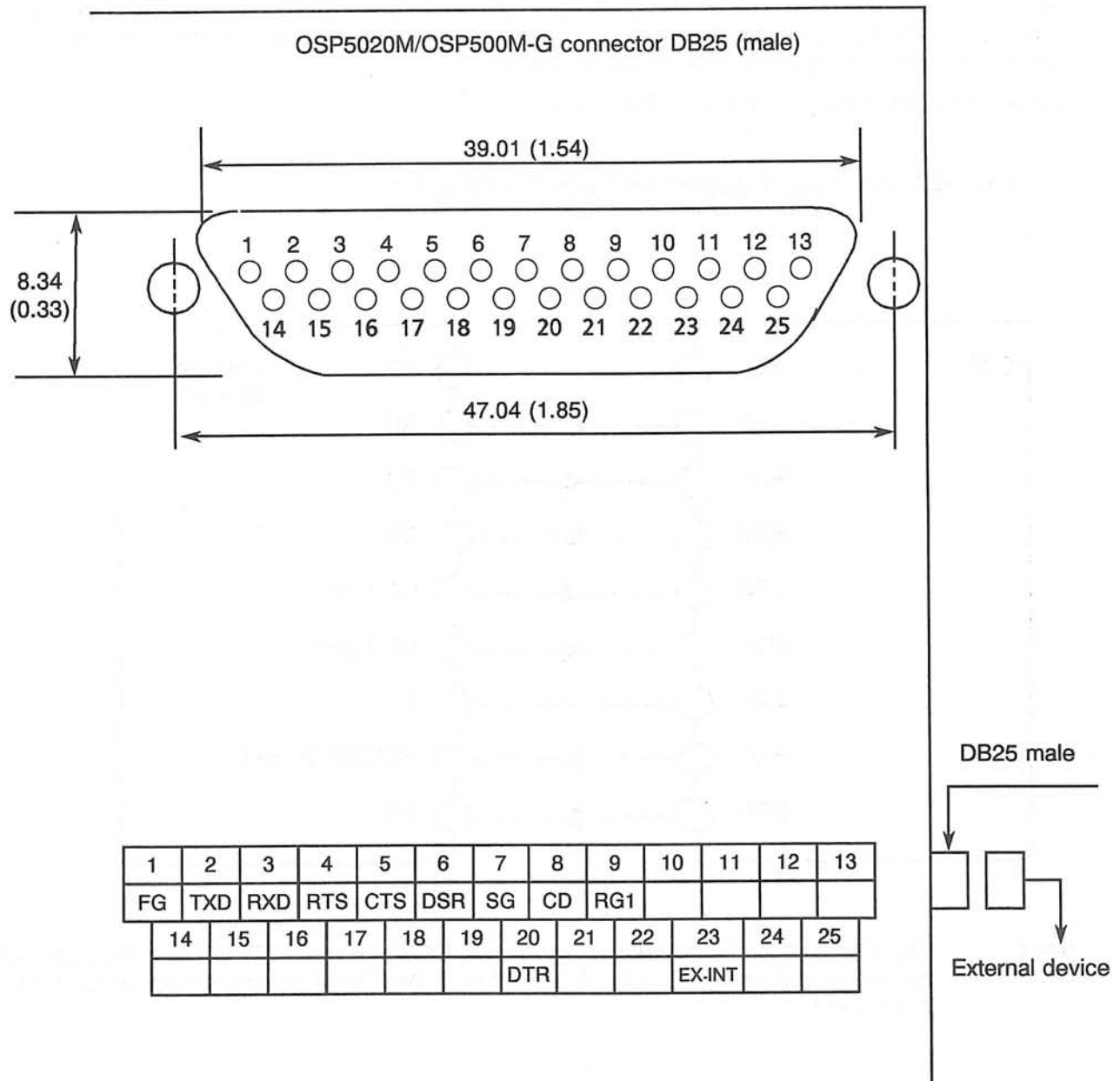
(7) Signal Description

Pin No. (DB25)	Signal Name	Signal Direction	Contents
1	FG	—	Protective Ground
2	TXD	Output	Transmission Data Data line (from OSP to external device)
3	RXD	Input	Transmission Data Data line (from external device to OSP)
4	RTS	Output	Request to Send Turned ON before data transmission or reception begins. Stays ON thereof.
5	CTS	Input	Clear to Send Data transmission from the OSP is impossible while this signal is OFF. Used for busy/ready control. When this signal is not used, connect the RTS signal from the OSP.
6	DSR	Input	Data Set Ready Indicates that the external device is ready for communication. The OSP is placed in the error status if this signal is OFF during data communication. The busy/ready control using this signal is not possible. When this signal is not used, connect the DTR on the OSP.

Pin No. (DB25)	Signal Name	Signal Direction	Contents
7	SG	——	Signal Ground
9	RGI	Output	<p>Data Request (Register 1)</p> <p>Used to control receive busy at the OSP.</p> <p>The signal is turned ON when the OSP, in the data receive ready state, requests the external device to send data.</p> <p>Turned off by the start bit of the data from the external device (turned off by each character).</p> <p>The diagram shows two waveforms. The top waveform is labeled 'RG1 (output)' and the bottom is 'RxD (input)'. RxD is a serial data stream with 'Start bit' and 'Stop bit' markers. RGI is high when RxD is low. When RxD starts a character (start bit), RGI goes low. When RxD finishes a character (stop bit), RGI goes high again. The signal levels are indicated as 'High' and 'Low' on the right.</p>
10	RG2	Output	<p>Register 2</p> <p>Not used</p>
11	SG	——	Signal Ground
12	SG	——	Signal Ground
13	SG	——	Signal Ground
20	DTR	Output	<p>Data Terminal Ready</p> <p>Turned on when the OSP is ready.</p> <p>If data are sent to the OSP while this signal is off, the data are not read.</p>

Pin No. (DB25)	Signal Name	Signal Direction	Contents
23	EX-INT	Input	<p>External Interruption</p> <p>Used for BUSY/READY control of the external device.</p> <p>When this signal is used (each character):</p> <ol style="list-style-type: none"> 1) The OSP does not start data transmission while this signal is off. 2) When data transmission starts, the signal is once turned off; the next data is sent when the signal is turned on again. <p>The signal is turned off and then on each time a character is sent.</p>  <p>For the external device which has buffer with the ready signal not turned on/off for each character, it cannot be used at the EX-INT signal. Use the CTS signal in this case.</p>

(8) Connector Layout



Connector DB-25 male(standard shell) (J.A.E.)

Lock D20418-J (heXxagonal) (J.A.E.)

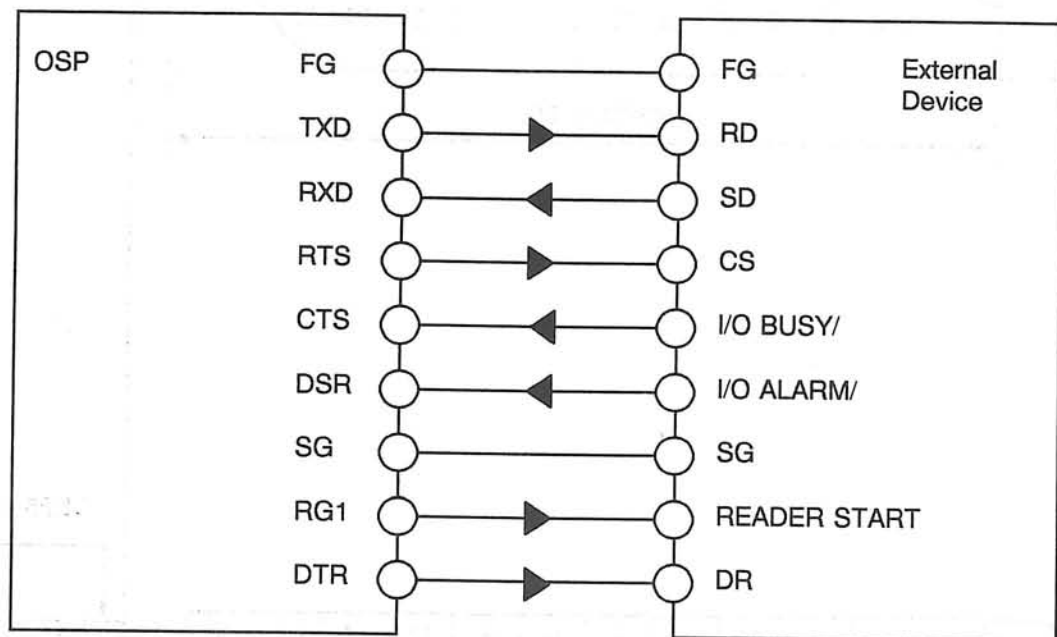
7. External Device Connection

When connecting an external device through the FACIT4070 parallel interface, match the cable with the OSP connector pin layout, and tape punch out using the parallel punch device is possible. However, if the RS-232C interface is used for punch connection, it is necessary to make the connection cable meeting the signals needed by the punch.

Connection examples are explained in what follows:

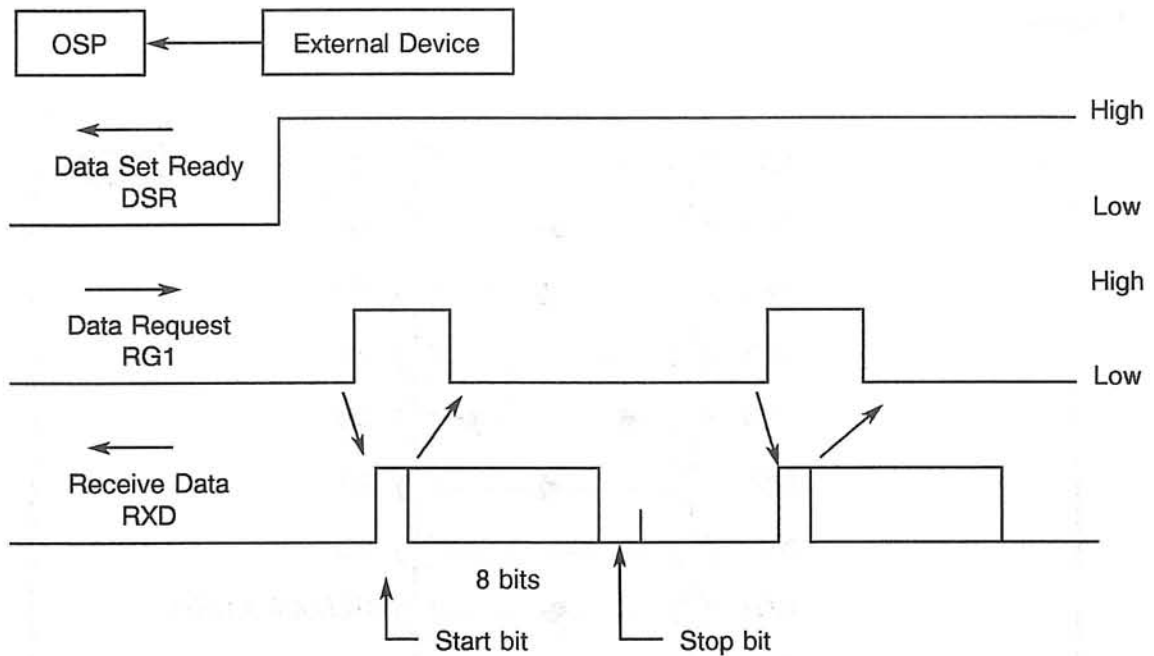
7-1. BTR (Behind Tape Reader) Method (No DC code)

Example 1:



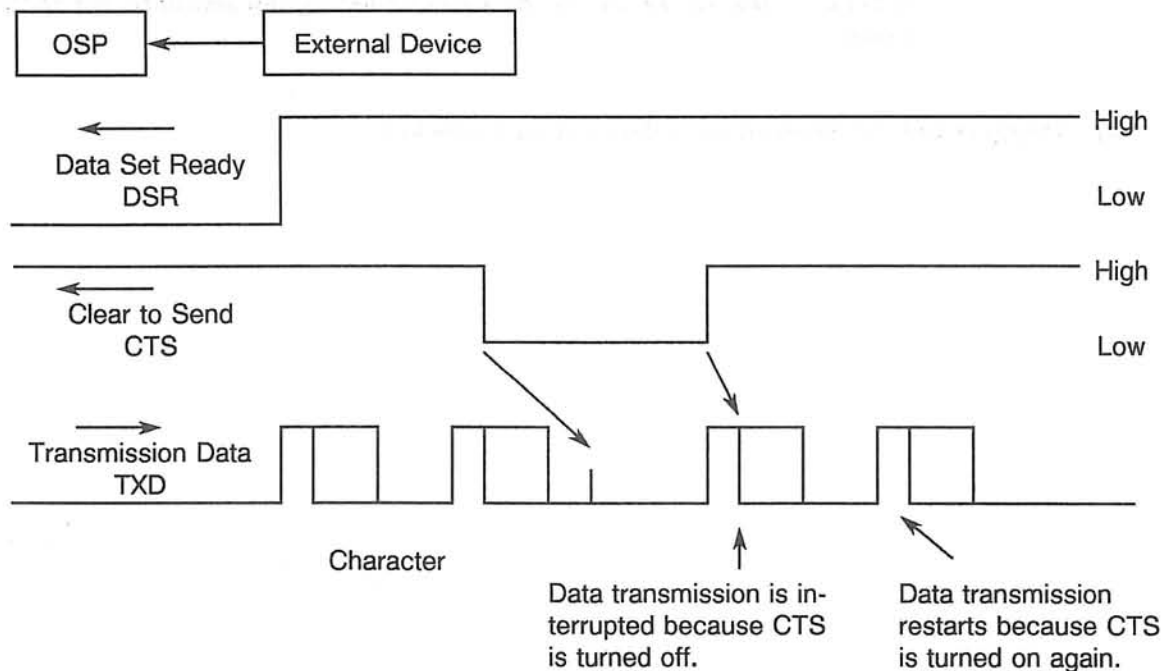
Note: The connection above does not use the EX-INT signal. Therefore, NC optional parameter (bit) No. 8 (No. 13, 14, 21, 22) bit 1 (No EX-INT signal) should be set at "1" beforehand.

(1) Timing Chart for Read Operation



- ① The data request signal RG1 is sent from the OSP.
- ② The external device, in response to this signal, transmits serial data.
- ③ The data request signal is forcibly set "Low" by the start bit of the data.

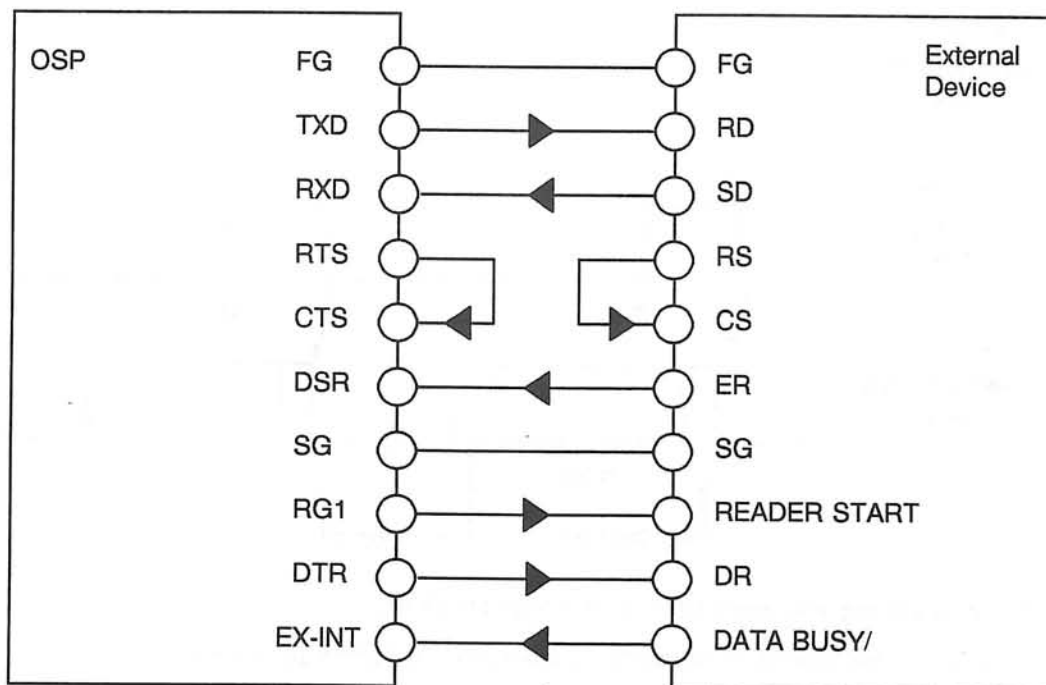
(2) Timing Chart for Punch and List Operations



- ① Data is not transmitted from the OSP while the CTS is off.
- ② If the CTS goes low during data transmission, data transmission halts within two characters.

- ③ Data transmission restarts when the CTS goes high again.

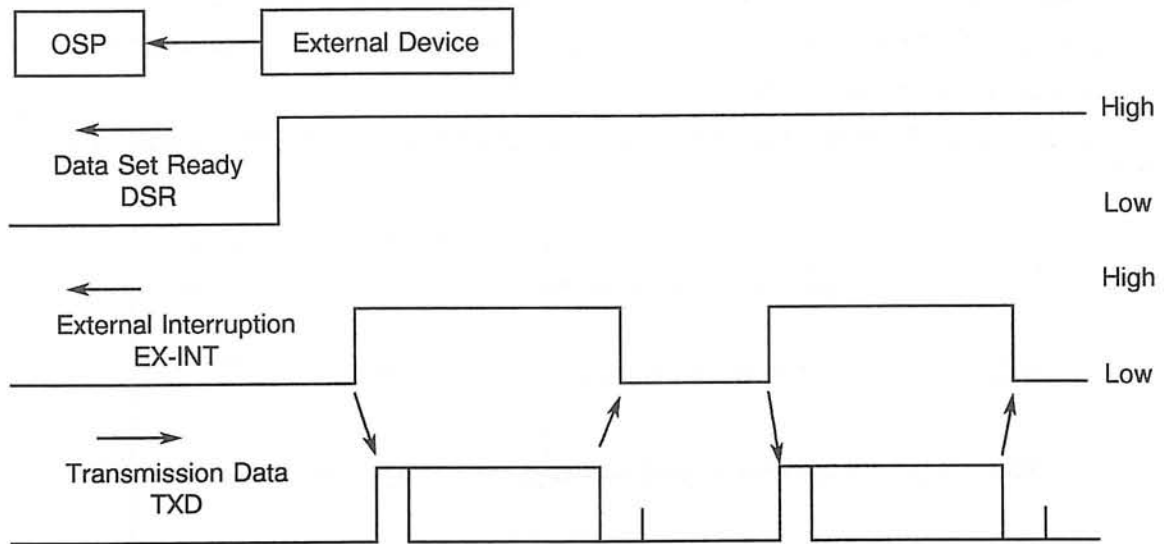
Example 2:



Note: The connection above uses the EX-INT signal. Therefore, NC optional parameter (bit) No. 8 (No. 13, 14, 21, 22) bit 1 (No EX-INT signal) should be set at "0" beforehand.

- (3) Timing chart for read operation is the same as Example 1.

(4) Timing Chart for Punch Operation



- ① The OSP begins data transmission when the EX-INT signal is turned on.
- ② The external device turns off the EX-INT signal when it reads the stop bit of the data received. Note that the EX-INT signal must be turned off once.
- ③ The external device turns on the EX-INT signal after completing processing of the data received.

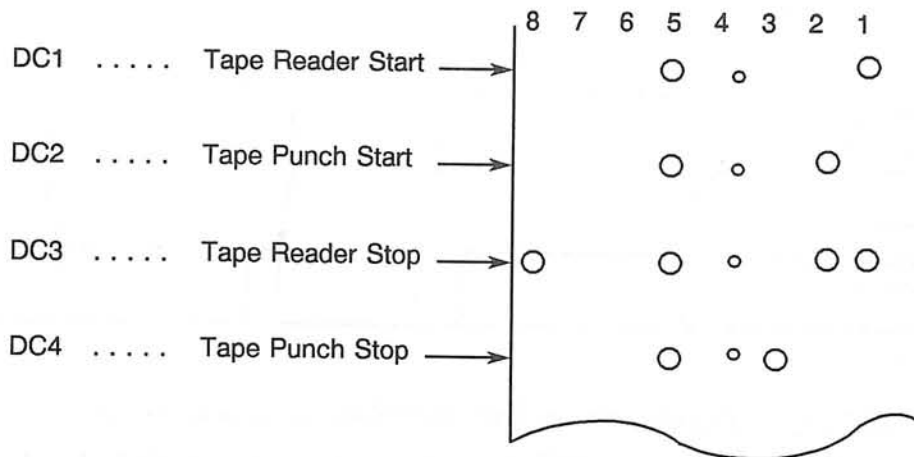
7-2. DC Code Control

Data transmission is controlled by the NC which outputs the DC control codes.

Whether or not the DC code control is executed can be changed by parameter setting.

There are four DC control codes - DC1 through DC4.

Here, the term DC represents "Device Control" and DC codes control the start and stop of the external devices.

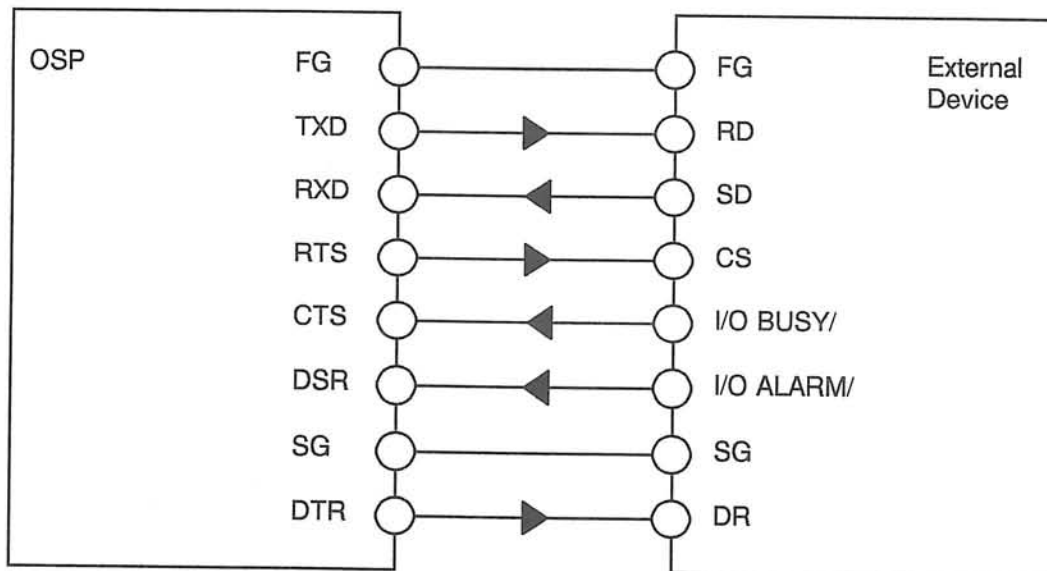


Note 1: The operator does not have to be conscious of these DC codes because they are automatically generated by the OSP.

Note 2: The DC codes are as indicated above independent of the coding system whether the ISO or the EIA.

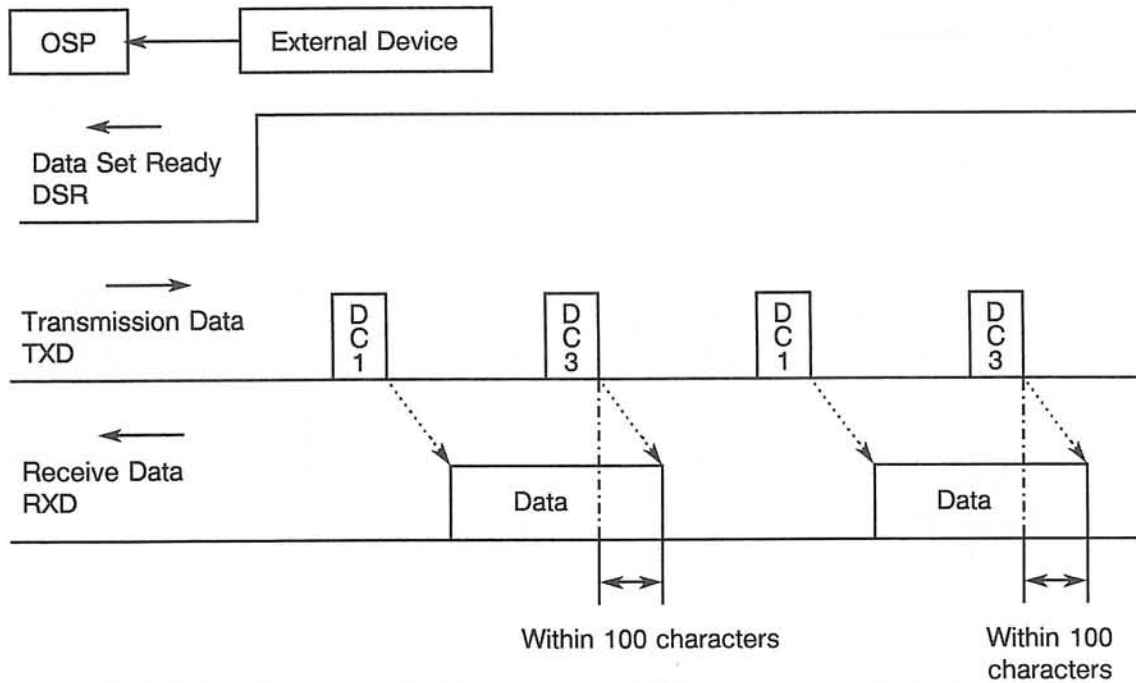
Note 3: It is not possible to control the OSP using the control code output from the external device.

Example 1:



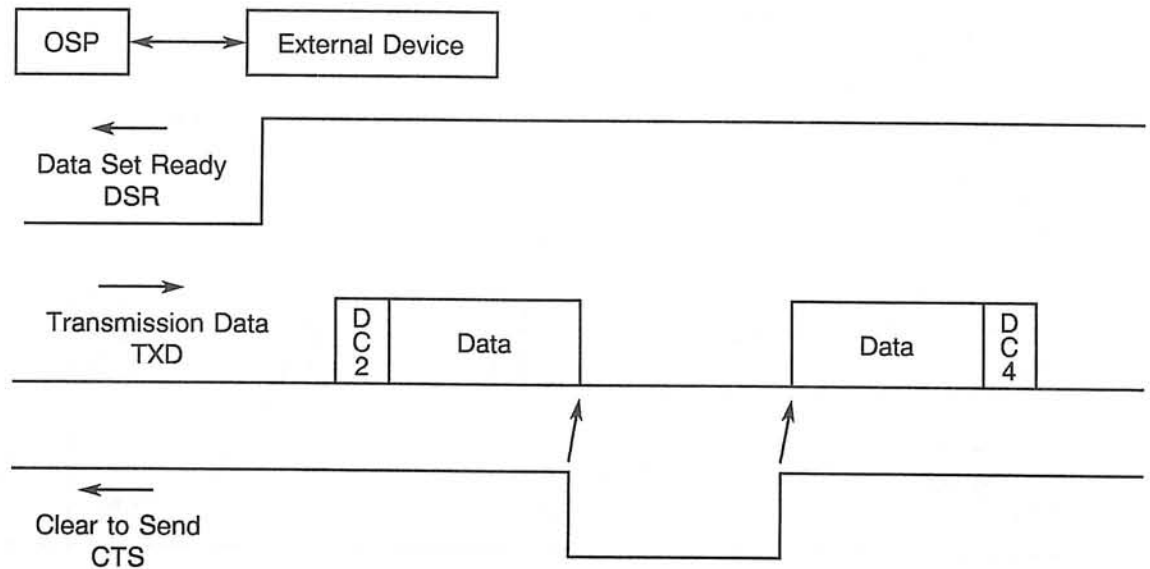
Note: The connection above does not use the EX-INT signal. Therefore, NC optional parameter (bit) No. 8 (No. 13, 14, 21, 22) bit 1 (No EX-INT signal) should be set at "1" beforehand.

(1) Timing Chart for Read Operation



- ① The OSP sends the DC1 code.
- ② The external device, in response to the reception of the DC1 code, begins transmission of data to the OSP.
- ③ The OSP sends the DC3 code after reading a program name.
- ④ Upon the reception of the DC3 code, the external device interrupts transmission of data to the OSP. The data transmission stops within 100 characters after the DC3 code has been sent.
- ⑤ After the received data has been processed, the OSP sends the DC1 code again.
- ⑥ The external device restarts data transmission in response to the DC1 code sent from the OSP.
- ⑦ The OSP sends DC3 and DC1 codes after reading and processing each 256 characters (equivalent to 0.65 meters (2.13 feet) of tape length) of NC program.
- ⑧ The external device completes the data transmission by sending the end code.
- ⑨ After the completion of data reading, the OSP sends the DC3 code.

(2) Timing Chart for Punch Operation



- ① The OSP sends the DC2 code.
- ② When the data busy signal CTS is high, the OSP continuously transmits data.
- ③ The OSP interrupts transmission of data when the CTS is turned off.
It restarts data transmission when the CTS is turned on again.
- ④ After the completion of data transmission, it sends out the DC4 code.

7-3. DC Code Control Type 2

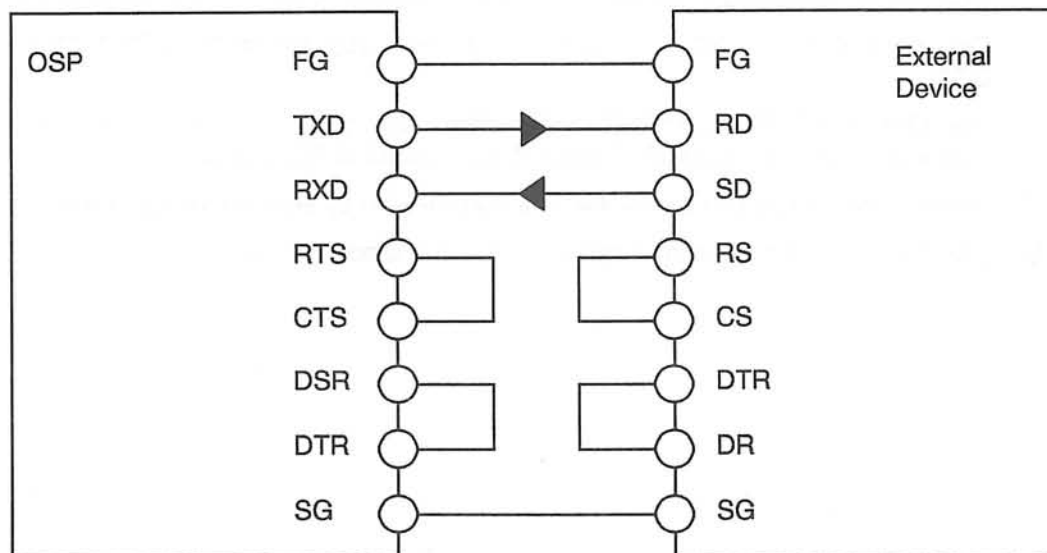
In the DC code control explained in 7-2, DC codes can be output only from the OSP. With the type 2, an external device can output DC codes.

In this case, the OSP uses the four DC codes, DC1, DC2, DC3, and DC4, and the host computer uses the two control codes, DC1 and DC3.

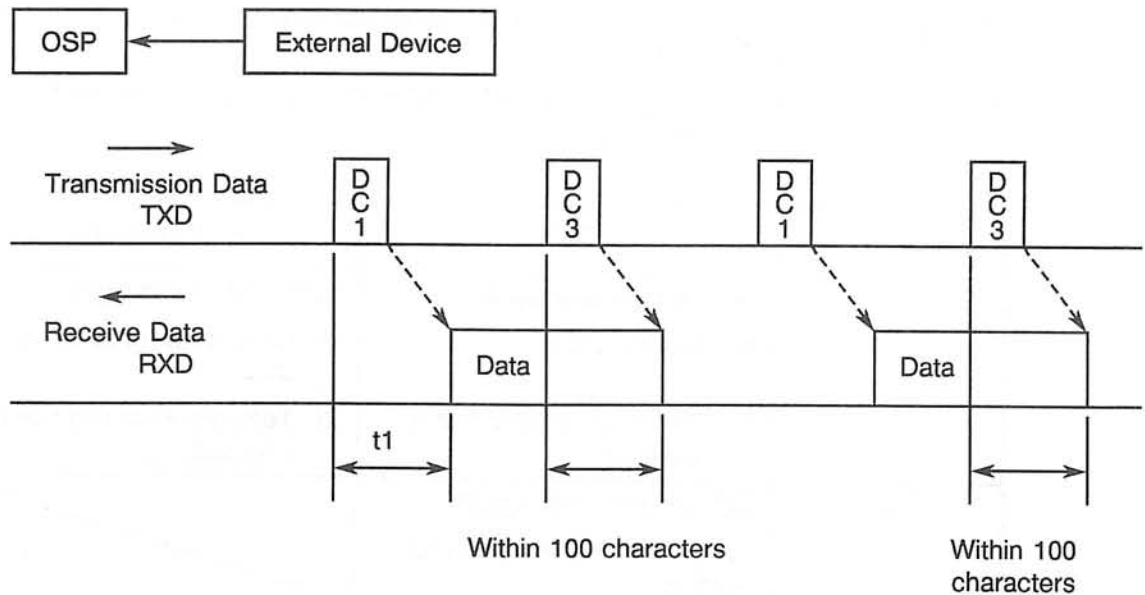
DC Code	OSP	Host Computer
DC1	Data read enable signal; 1) Reading starts 2) Temporary reading halt is released.	Data read enable signal; 1) Given as a response to DC2 2) Temporary reading halt is released.
DC2	Data read request signal; Sent at the beginning of data sending	
DC3	Temporary data send halt for data sending from the mating device	Temporary data send halt for data sending from the mating device
DC4	Completion of data sending	

To make the type 2 control effective, set "1" both for the corresponding NC optional parameter (bit) for DC code control and DC code control type 2.

Example 1:

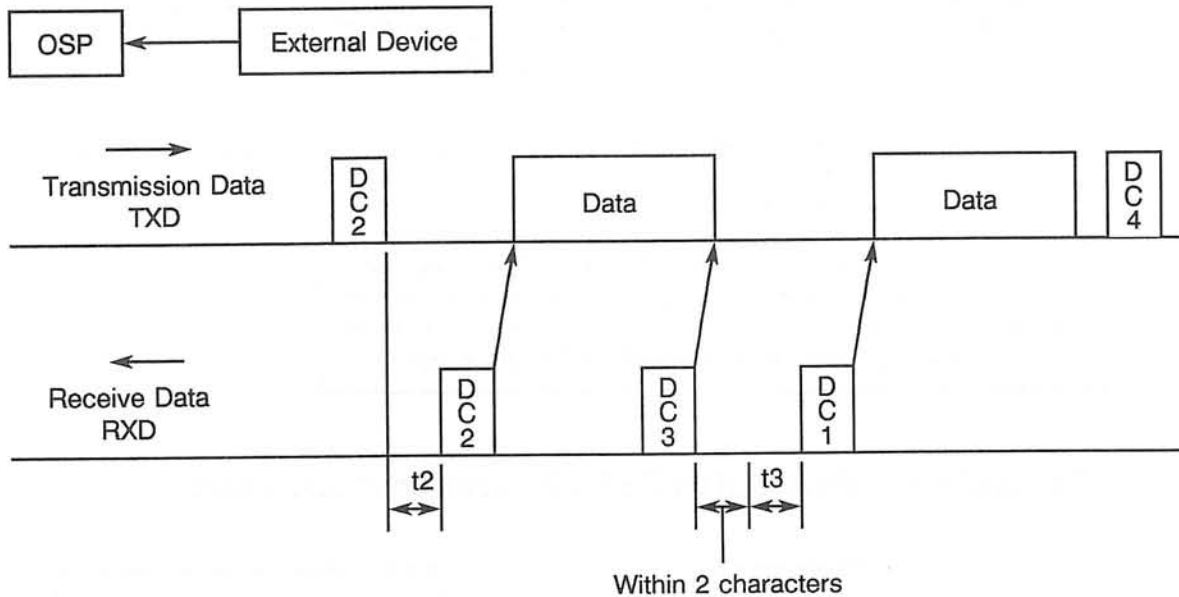


(1) Timing Chart for Read Operation



- ① The OSP sends the DC1 code.
- ② The external device, in response to the reception of the DC1 code, begins transmission of data to the OSP.
- ③ The OSP sends the DC3 code after reading a program name.
- ④ Upon the reception of the DC3 code, the external device interrupts transmission of data to the OSP. The data transmission stops within 100 characters after the DC3 code has been sent.
- ⑤ After the received data has been processed, the OSP sends the DC1 code again.
- ⑥ The external device restarts data transmission in response to the DC1 code sent from the OSP.
- ⑦ The OSP sends DC3 and DC1 codes after reading and processing each 256 characters (equivalent to 0.65 meters (2.13 feet) of tape length) of NC program.
- ⑧ The external device completes the data transmission by sending the end code.
- ⑨ After the completion of data reading in, the OSP sends the DC3 code.

(2) Timing Chart for Punch Operation



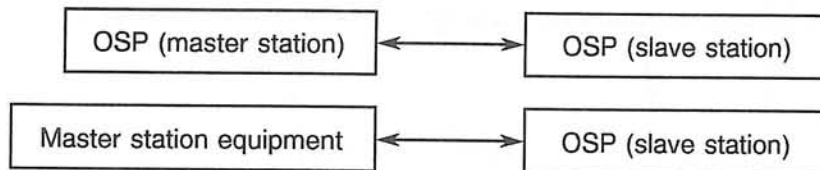
- ① The OSP sends the DC2 code.
- ② The external device, in response to the reception of the DC2 code, sends the DC1 code.
- ③ The OSP begins transmission of data to the external device after reading the DC1 code.
- ④ The external device sends the DC3 code when its reception processing speed fails to match the data transmission speed.
- ⑤ Upon the reception of the DC3 code, the OSP stops the data transmission within 2 characters after the DC3 code has been received.
- ⑥ After the data received has been processed, the external device sends the DC1 code again.
- ⑦ The OSP restarts data transmission in response to the DC1 code sent from the external device.
- ⑧ The OSP sends the end code at the end of sending data. And after the completion of data sending, the OSP sends the DC4 code.

Note: If time duration t_1 , t_2 , and/or t_3 exceeds the value set as waiting time for RS-232C channel ready completion at NC optional parameter (word), "RS-232C device read" error occurs.

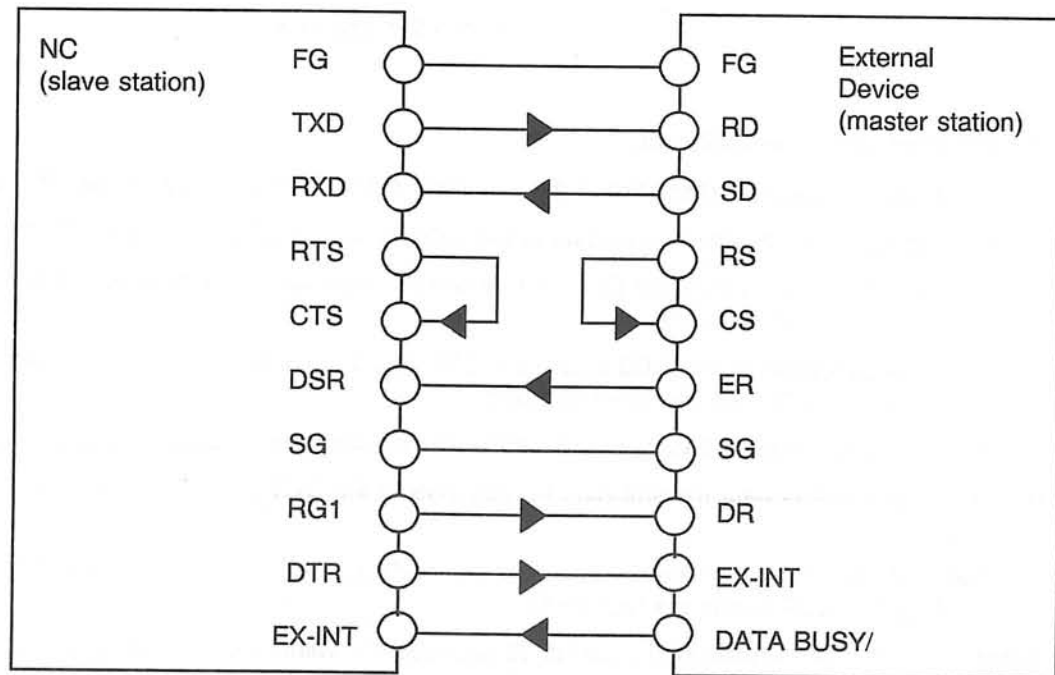
7-4. Slave Station Function

Communication between the two OSPs is not possible because both of these OSPs function as the master station. The slave station function allows one of the OSPs to function as the slave station, thus making communication between the two OSPs possible.

With the slave station function active, the OSP is controlled in the same manner as if it is a tape punch or a tape reader connected to the master station OSP.



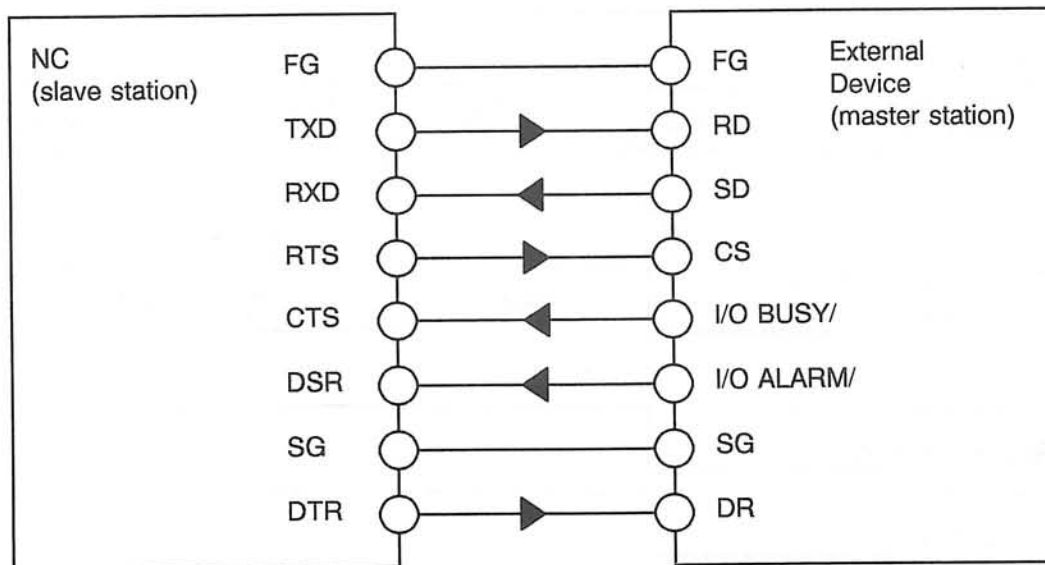
7-4-1. Connections of slave station OSP with an external equipment



Note: Because the connection above uses the EX-INT signal, "0" must be set for NC optional parameter (bit) No. 8 (No. 13, 14, 21, or 22) bit 1 "No EX-INT" signal.

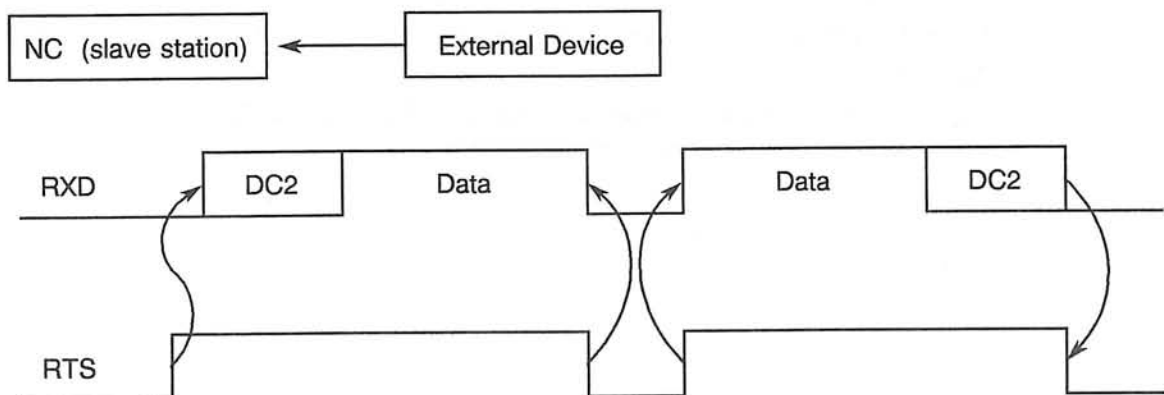
- (1) Timing chart for reading is the same as in Example 1, "BTR (Behind Tape Reader) Method".
- (2) Timing chart for punching is the same as in Example 2, "BTR (Behind Tape Reader) Method".
- (3) In reading, tape feed holes punched following the program are read but not stored in memory.
- (4) In punching, tape feed data following the program is not punched. However, if the end of program code is NULL, a single NULL data is output.

7-4-2. Connections of slave station OSP with an external equipment
(DC code control)



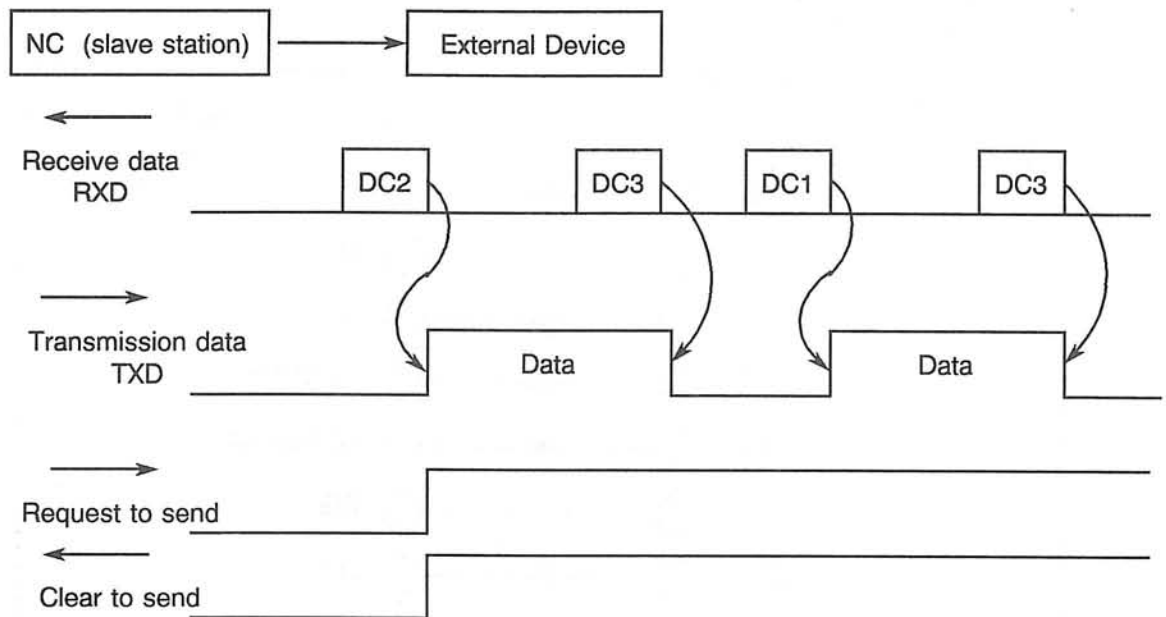
Note: Because the connection above does not use the EX-INT signal, "1" must be set for NC optional parameter (bit) No. 8 (No. 13, 14, 21, or 22) bit 1 "No EX-INT" signal.

(1) Timing chart (read):



- ① When program read operation is attempted at the NC, the RTS signal is turned on.
- ② The external equipment outputs the DC2 code.
- ③ Upon reading the DC2 code, the NC begins processing of the input data.
- ④ The NC turns the RTS signal off when it becomes necessary to suspend reading due to delay in processing of the input data. The external equipment halts transmission of the data to the NC.
- ⑤ After the completion of processing of the data having been input, the NC turns the RST signal on again.
The external equipment restarts data transmission.
- ⑥ At the end of transmission of the data, the external equipment outputs the DC4 code.
- ⑦ Upon reading the DC4 code, the NC turns off the RTS signal and terminates communication.

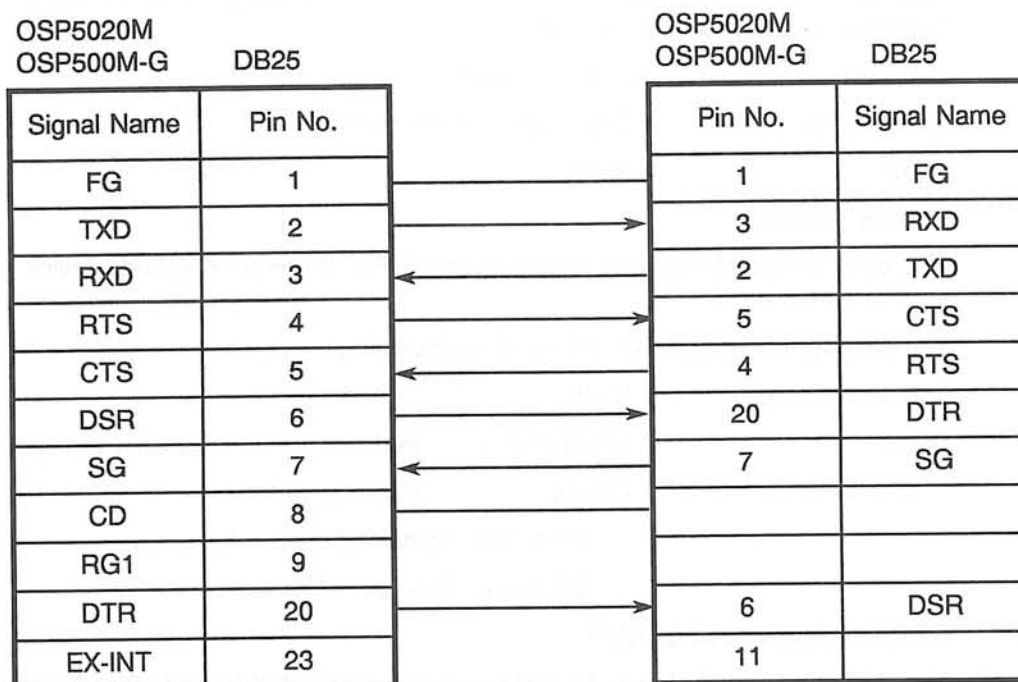
(2) Timing chart (punch):



- ① Upon reading the DC1 code sent from the external equipment, the NC begins data punching processing.
- ② Upon reading the DC3 code sent from the external equipment, the NC temporarily suspends punching processing.
- ③ The NC restarts punching processing again when it reads the DC1 code from the external equipment.
- ④ After all data has been punched and when the NC reads the DC3 code sent from the external equipment, punching processing terminates.

7-4-3. Two OSPs connected using the slave station function

Communication between the two OSPs is possible by setting one of the two OSP5020Ms/OSP500M-G as the slave station while the other is operating as the master station.



NC Optional Parameter OSP5020M/OSP500M-G

NC Optional Parameter (Bit) No.8	bit	7	6	5	4	3	2	1	0
	Data	0	0	1	*	0	0	1	0
	Contents	File name read	DC code control type 2	DC code control	8 bit JIS	Even parity	Parity check carried out	No ready signal	Stop bit, 1 bit

NC Optional Parameter (Word) No.6	Baud Rate
	2400

Note: * 0 or 1 as required

- (1) For the parameters indicated above, the settings must be the same for both of the OSP5020M/OSP500M-G.
- (2) For the punch device number (parameter (word) No. 45) and the read device number (parameter (word) No. 47), set the channel to be used by parameter.
- (3) Bits 0 to 4 of optional parameter (bit) No. 40 are used to set the station type (master or slave). Set "1" for one of the two OSPs which is used as the master station and set "0" for the other OSP which is used as the slave station.
- (4) With these settings, communications between the two OSPs become possible.

8. Error Messages

2124 Puncher device name ERROR

A device name not allowed as a punch device name is designated in one of parameters to be transferred to punch driver routine.

(Ex.: >P A.MIN, CN0: ← Device name)

Character-string : Designated device name

Code : None

2125 Puncher ERROR

This error is related only with parallel punch (PP:). When an RS-232C device is used, this error does not occur.

The puncher is not ready or error with the puncher.

Character-string : None

Code : FFFFFFFF . . . Puncher is not ready after the specified period.

Others Puncher status

Bit 1 ON: Remaining tape volume low

Bit 2 ON: Tape cut off or too tight

2127 RS-232C device read ERROR

The DSR signal which indicates that the device connected is ready, has been turned off during data reading operation through the RS-232C interface.

The device is not in the ready status for output, or the DSR line is not connected properly.

Character-string : None

Code : Contents of RS-232C interface status

Bit 0 OFF: DSR signal OFF status

2128 RS-232C terminal not ready ERROR

The DSR signal which indicates that the device connected is ready, is not turned on.

The device is not in the ready status for input/output, or the DSR line is not connected properly.

Character-string : Error has occurred at

input : input

output : output

print : printer output

Code : Contents of RS-232C interface status

Bit 0 OFF: DSR signal OFF status

2129 RS-232C ready status time out ERROR

Signals and status of the device connected through the RS-232C interface are not set in the ready state after the specified period. (NC optional parameter (word) No.34 through 38).

During input (read operation):

RxRDY of RS-232C USART status is not turned on (no data from the device connected).

During output (punch operation):

TxEMP and TxRDY of RS-232C USART status are not turned on.

CTS signal of RS-232C interface status is not in the ON state. In case the communication parameter is set at "READY YES", EX-INT signal is not in the ON state.

Character-string : Error has occurred at
 input : input
 output : output
 print : printer output

Code : FFFFFFFF

2132 PTR ready status time out ERROR

The ready status of the PTR is not turned on within one second.

If this error occurs in reading operation from the RS-232C device, it indicates that the read device name is wrong.

Character-string : None

Code : FFFFFFFF

2134 RS-232C ready interrupt time out ERROR

The interruption by the RS-232C device ready signal does not occur within the time specified for individual channels. (NC optional parameter (word) No. 34 - No. 38)

Character-string : Error has occurred at
 input : input
 output : output

Code : FFFFFFFF

2150 RS-232C channel in use ERROR

An attempt to use the RS-232C channel being used.

Character-string : None

Code : 1

2152 File name ERROR

Characters "*" and "?" are used for a command not used as a file name.

Character-string : Designated file name

Code : None

2153 File attribute ERROR

File cannot be read since file attribute differs.

Character-string : None

Code : File attribute code

2156 Option ERROR

Wrong option character is designated.

(Ex.: >P A.MIN; I ← Option)

Character-string : Commanded option

Code : None

2168 RS-232C device name ERROR

An attempt is made to conduct RS-232C control for devices other than RS-232C devices.

(Ex.: >P A.MIN, CN0: ← Device name)

Character-string : None

Code : None

2503 Tape TV check ERROR

In the TV check for one block of read tape proved that the number of data in a block is odd.

The tape TV check is conducted when parameter (bit) No. 1 bit 2 is 1. The term TV represents "Tape Vertical Check", which checks whether the number of data in a block is even.

Character-string : None

Code : XX Data which has caused tape TV check error

2504 No tape data

No data is punched on the tape when reading or verifying is attempted.

After the beginning of tape data reading, the tape end code (either "NUL" or "%") is read before the first "CR" or "LF" is read.

Character-string : None

Code : None

2505 Tape parity ERROR

Tape parity unconformity

(ISO code even parity, EIA code odd parity)

Since the tape contains the data which causes parity error, correct the wrong tape data. Or complete reading operation by designating option C to convert wrong data into "I" symbol. After that correct it using the edit function.

(Ex.: >R A.MIN; C [WRITE] ← option C command)

Character-string : None

Code : XX Data which has caused parity error

2506 Tape file name ERROR

Wrong tape file name - illegal characters used, too much number of characters, etc.

Character-string : Commanded file name

Code : 5 The number of characters in a file name is more than 19.
6 Other than a period "." was used as a delimiter between the file name and extension.
7 The first character of the file name and extension is other than alphabet.

2524 No file data

An attempt to read the tape not containing file data

After the beginning of tape data reading, the tape end code (either "NUL" or "%") is read before the first "CR" or "LF" is read.

Character-string : None

Code : None

2537 File record read ERROR

Mismatch between the end of file and the end of record

Character-string : None

Code : 1 When reading one record, more than 156 characters are read.
2 When reading a file, the end of a file and the end of record do not match. A file does not contain the end of record code (CR or LF) at the end of the file.

Example 1: In tape reading operation, a file which does not have CR or LF after M02 is read and such a file is punched out.

Example 2: A tape which has the % (ER) code at the end of the tape data is read with NC optional parameter (bit) No. 1 bit 3 set at "0" and such a file is punched out.

2544 EIA code ERROR

An attempt is made to punch, read or verify the code not accepted by the EIA code.

Character-string : None

Code : XX Data which has caused EIA code error

Note: Characters not accepted by the EIA code can be used as explained in 5-3.

2546 RS-232C channel in use ERROR

The RS-232C channel specified is being used for other job.

Character-string : None

Code : 1 CN0:
2 CN1:
3 CN2:
4 CN3:
5 CN4:

2554 RS-232C device read ERROR

In tape reading operation using DC control codes, the DC1 code is not sent from the mating device.

Character-string : None

Code : Code read instead of DC1 code

2559 RS-232C device not ready

The device being used for transmission of data while the DC code is not in the terminal ready status.

Character-string : None

Code : 0 CN0:
1 CN1:
2 CN2:
3 CN3:
4 CN4:

2560 RS-232C read buffer overflow

Overflow with the read buffer for the OSP which uses DC codes for communications.

Although DC3 code is sent from the OSP, data transmission from the mating station does not halt.

Character-string : None

Code : None

2561 RS-232C ready interrupt time out

The ready signal interruption does not occur for a specified length of time (NC optional parameter (word) No. 34 - No. 38) during data transmission using DC control codes.

Character-string : None

Code : None

9. Tape Punch Connection Examples

The parameter settings described below assume the device name is "CN0:" (main card 13).

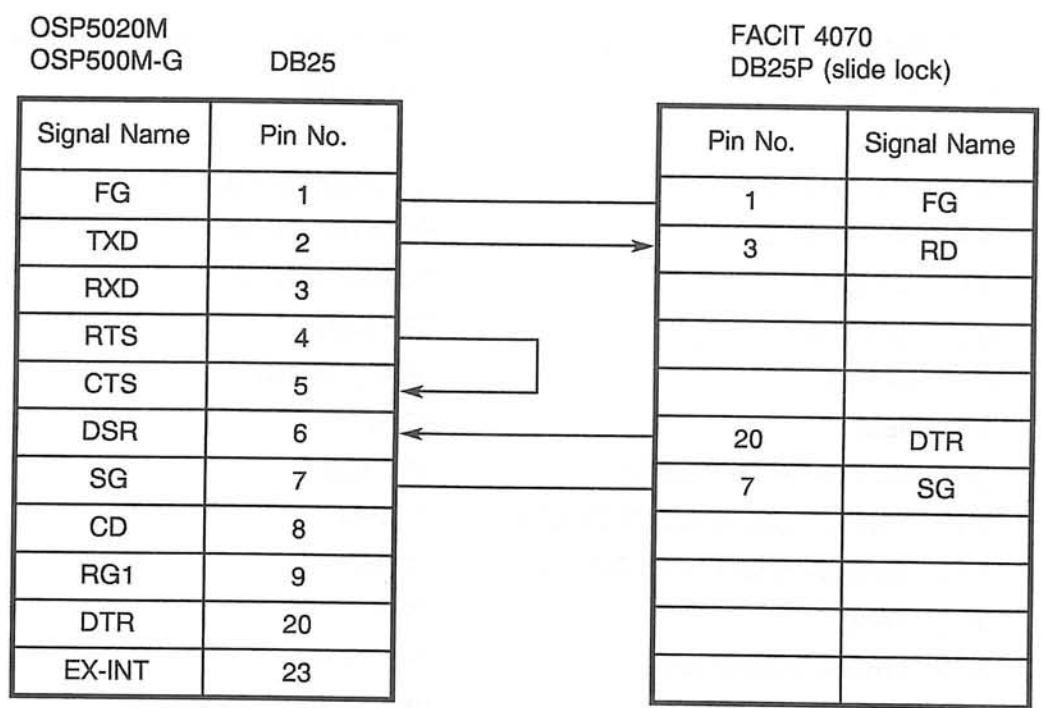
9-1	FACIT	FACIT 4070
9-2	FACIT	FACIT N1000
9-3	KYORITSUSHA	All models (tape punch)
9-4	KYORITSUSHA	Accumulator D60
9-5	CITIZEN	Protyper 7652NC
9-6	CITIZEN	CRP-2500
9-7	CASIO	650NC, 750NC
9-8	JBM	PR30
9-9	NEC DATA TERMINALS	NDT-9501
9-10	TANAKA BUSINESS MACHINES	PT30RS
9-11	TANAKA BUSINESS MACHINES	PT30RP
9-12	FANUC	PPR
9-13	MIKUNI TOKUSHU KIKI	CF30, CF10
9-14	TAKAHASI DENKI	HFD-35
9-15	ANRITSU	DPT610A
9-16	ACC SYSTEM	PT-PR

Note: The tape punch specifications are subject to without previous notice.

If the punch specifications are changed from those effective at the time this manual was made, tape punch out may be impossible.

The examples in this manual are effective for the tape punches as of March '86.

9-1. FACIT 4070



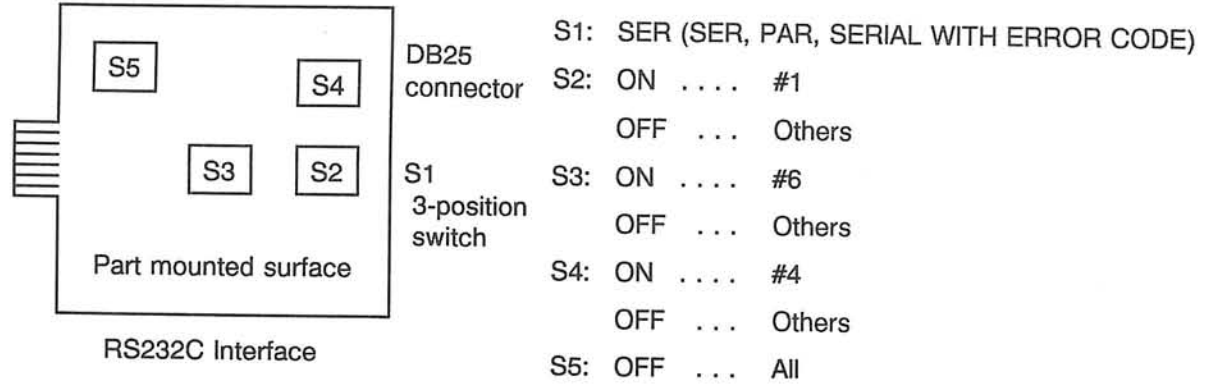
NC Parameter OSP5020M/OSP500M-G

NC Optional Parameter (Bit) No.8	Bit	7	6	5	4	3	2	1	0
	Data	0	0	0	*	0	0	1	0
	Contents	File name used	DC code control type 2	DC code control	8 bit JIS	Even parity	Parity check carried out	No ready signal	Stop bit 1 bit

NC Optional Parameter (Word) No.6	Baud Rate
	600

Note: * 0 or 1 as required

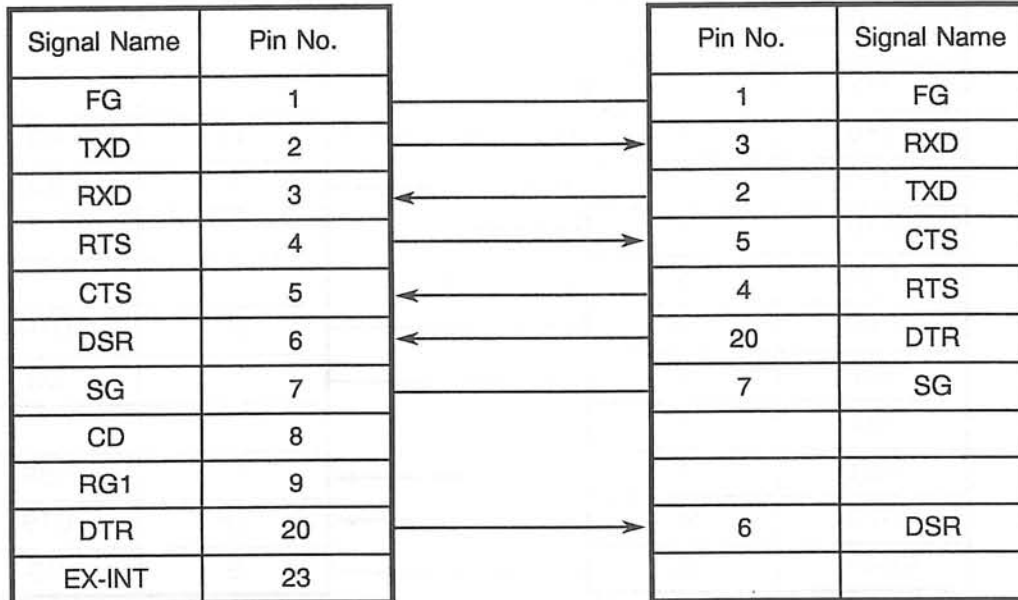
Switch Setting at Tape Punch:



9-2. FACIT N1000

OSP5020M
OSP500M-G DB25

FACIT N1000



NC Parameter OSP5020M/OSP500M-G

NC Optional Parameter (Bit) No.6	Bit	7	6	5	4	3	2	1	0
	Data	0	0	1	*	0	0	1	0
	Contents	File name used	DC code control type 2	DC code control	8 bit JIS	Even parity	Parity check carried out	No ready signal	Stop bit 1 bit

NC Optional Parameter (Word) No.6	Baud Rate
	2400

Note: * 0 or 1 as required
Set "1" at NC optional parameter (bit) No.1 bit 3.
(tape delimiting code; %)

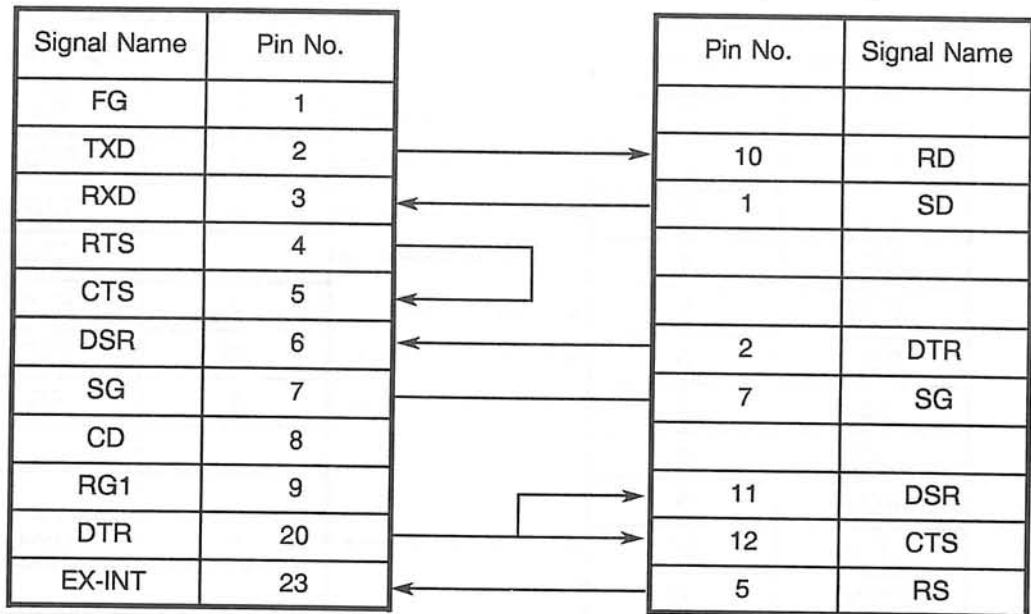
Setting at FACIT N1000:

Parameter	1-1 RS-232C (input port)	2-1	2400 (baud rate)
	1-2 RS-232C (output port)	2-2	7 (work length)
	1-3 ASC (input code)	2-3	2 (stop bit)
	1-4 ASC (output code)	2-4	EVEN (even parity)
	1-5 ON (file mark for input)	2-5	NC (DC1/DC3 control made)
	1-6 DC (end code)		
	1-7 OFF (file mark for output)		
	1-8 OFF (TV check)		

9-3. KYORITSUSHA - All Models (Tape Punch)

OSP5020M
OSP500M-G DB25

Kyoritsu Tape Punch
DB25P (slide lock)



NC Parameter OSP5020M/OSP500M-G

NC Optional Parameter (Bit) No.8	Bit	7	6	5	4	3	2	1	0
	Data	0	0	1	*	0	0	0	0
	Contents	File name used	DC code control type 2	DC code control	8 bit JIS	Even parity	Parity check carried out	No ready signal	Stop bit 1 bit

NC Optional Parameter (Word) No.6	Baud Rate
	2400

Note: * 0 or 1 as required

Left

Right

Switch Setting at Tape Punch:
KRP8250

Left Right

0	5
---	---

No.	Function
0	DC code used
1	Not used
2	ISO/EIA
3	ISO/ASCII
4	DC code not used
5	Not used
6	Not used
7	Local test
8	Stop bit 1
9	Not used

No.	Baud Rate
0	Not used
1	110
2	300
3	600
4	1200
5	2400
6	4800
7	Not used
8	Not used
9	Not used

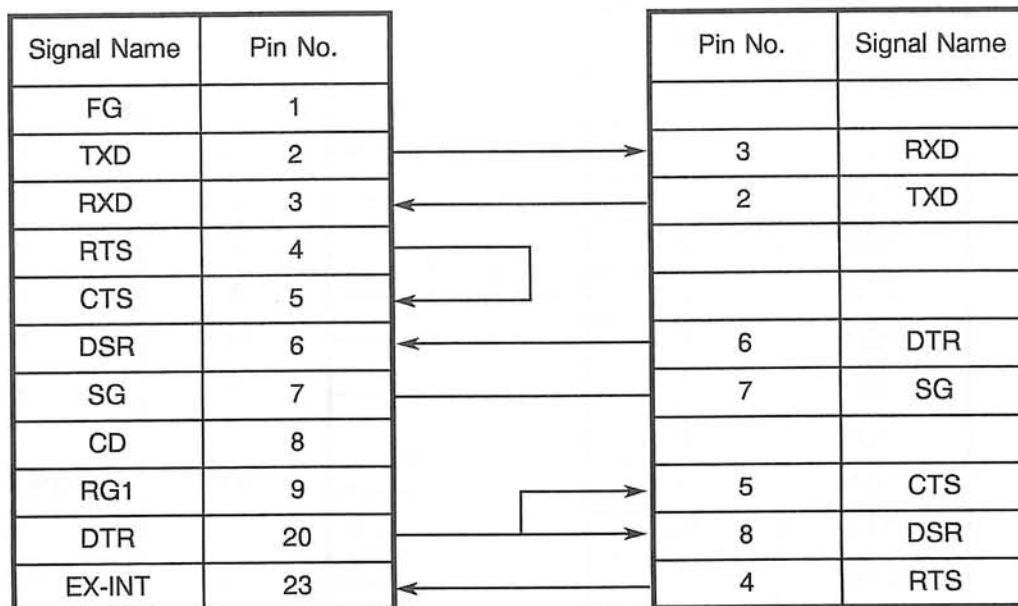
9-4. KYORITSUSHA - Accumulator D60

OSP5020M
OSP500M-G

DB25

D60

DB25P (screw lock type)



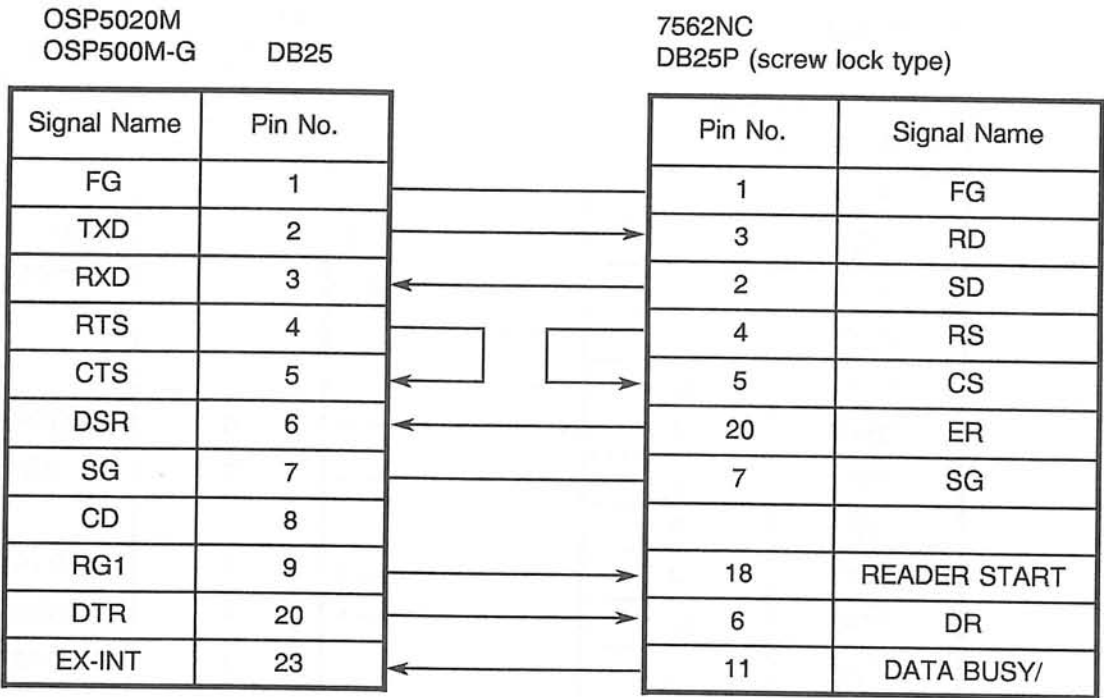
NC Parameter OSP5020M/OSP500M-G

NC Optional Parameter (Bit) No.8	Bit	7	6	5	4	3	2	1	0
	Data	0	0	1	*	0	0	0	0
	Contents	File name used	DC code control type 2	DC code control	8 bit JIS	Even parity	Parity check carried out	No ready signal	Stop bit 1 bit

NC Optional Parameter (Word) No.6	Baud Rate
	2400

Note: * 0 or 1 as required

9-5. CITIZEN - 7652 NC



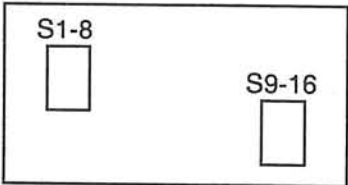
NC Parameter OSP5020M/OSP500M-G

NC Optional Parameter (Bit) No.8	Bit	7	6	5	4	3	2	1	0
	Data	0	0	1	*	0	0	1	0
	Contents	File name used	DC code control type 2	DC code control	8 bit JIS	Even parity	Parity check carried out	No ready signal	Stop bit 1 bit

NC Optional Parameter (Word) No.6	Baud Rate
	2400

Note: * 0 or 1 as required

Switch Setting at 7652NC:
(to be set by opening the tape punch side back door)



S1, S2, S4, S5, S9, S10, S12, S13, S15 : ON

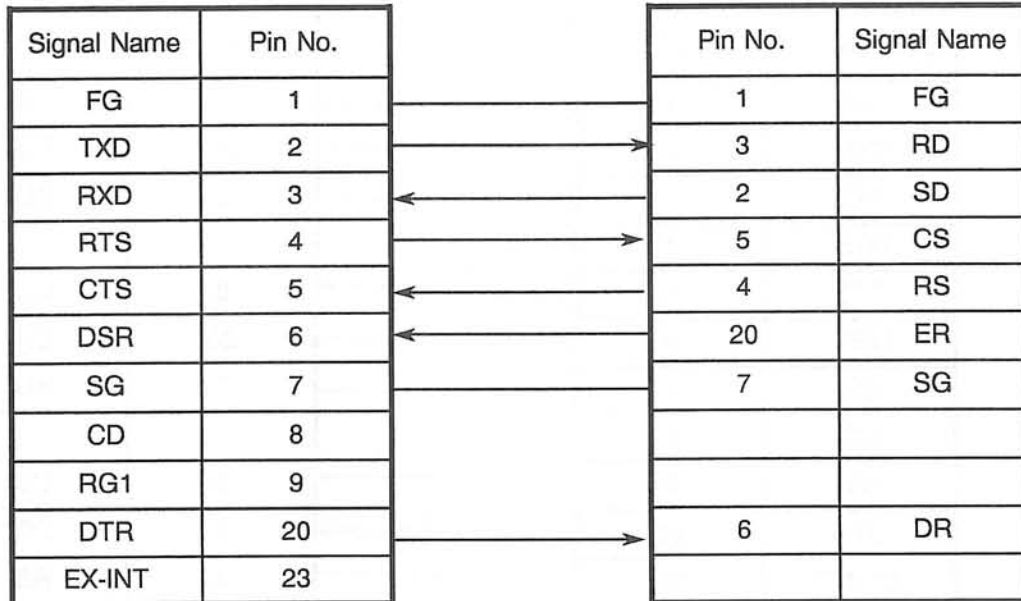
S3, S6, S7, S8, S11, S14, S16 : OFF

S17 through S36 : OFF

9-6. CITIZEN - CRP-2500

OSP5020M
OSP500M-G DB25

CRP-2500



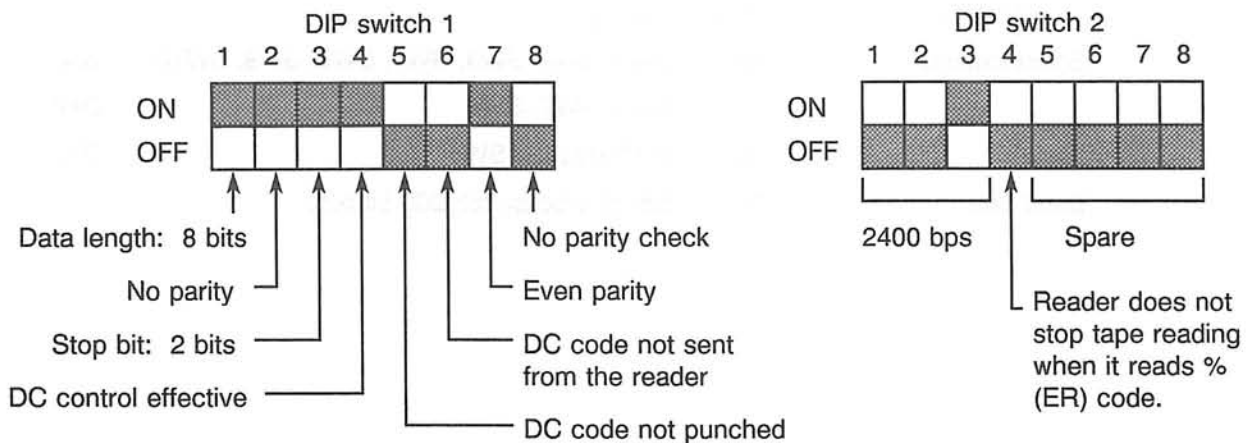
NC Parameter OSP5020M/OSP500M-G

NC Optional Parameter (Bit) No.8	Bit	7	6	5	4	3	2	1	0
	Data	0	0	1	*	0	0	1	0
	Contents	File name used	DC code control type 2	DC code control	8 bit JIS	Even parity	Parity check carried out	No ready signal	Stop bit 1 bit

NC Optional Parameter (Word) No.6	Baud Rate
	2400

Note: * 0 or 1 as required

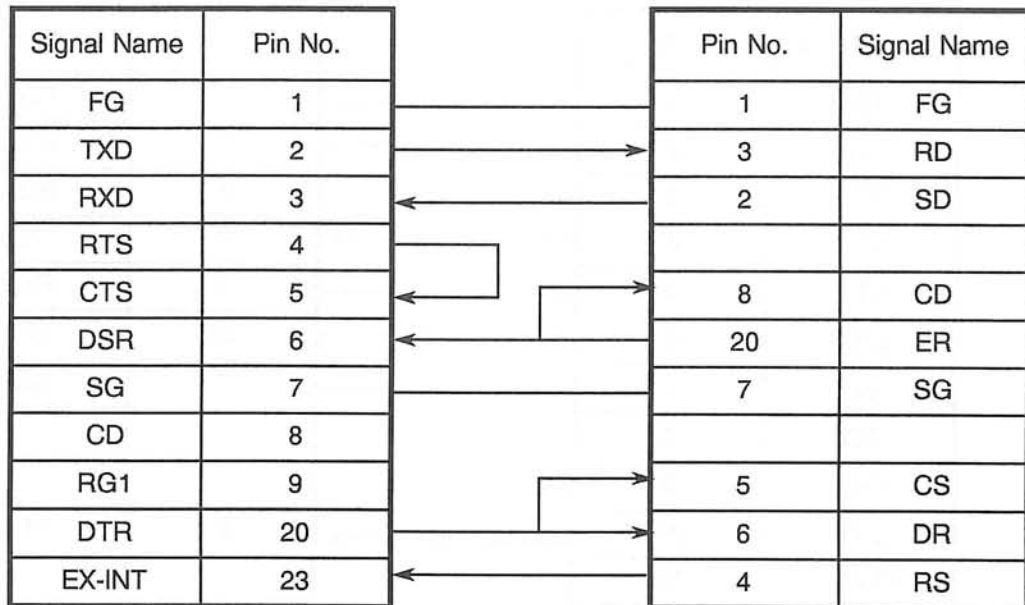
Switch Setting at Tape Punch:



9-7. CASIO - 650NC, 750NC

OSP5020M
OSP500M-G DB25

650NC, 750NC
DB25P (screw lock type)



NC Parameter OSP5020M/OSP500M-G

NC Optional Parameter (Bit) No.8	Bit	7	6	5	4	3	2	1	0
	Data	0	0	0	*	0	0	1	0
	Contents	File name used	DC code control type 2	DC code control	8 bit JIS	Even parity	Parity check carried out	No ready signal	Stop bit 1 bit

NC Optional Parameter (Word) No.6	Baud Rate
	300

Note: * 0 or 1 as required

Switch Setting at 650NC:

(Switch Name)	(Switch Setting)
Specifications	10C SW1, SW2, SW3, SW4, SW5, SW9, SW10 : ON SW6, SW7, SW8 : OFF
Level	1B SW1 through SW4 : ON
Baud rate	11G Set at slide switch 300 bit/sec.

9-8. JBM - PR30

OSP5020M
OSP500M-G

DB25

Signal Name	Pin No.
FG	1
TXD	2
RXD	3
RTS	4
CTS	5
DSR	6
SG	7
CD	8
RG1	9
DTR	20
EX-INT	23

JBM PP-30

DB25P (screw lock type)

Pin No.	Signal Name
9	RD
14	SD
15	CTS
13	RTS
24	P.ON
25	GND

NC Parameter OSP5020M/OSP500M-G

NC Optional Parameter (Bit) No.8	Bit	7	6	5	4	3	2	1	0
	Data	0	0	0+	*	0	0	1	0
	Contents	File name used	DC code control type 2	DC code control	8 bit JIS	Even parity	Parity check carried out	No ready signal	Stop bit 1 bit

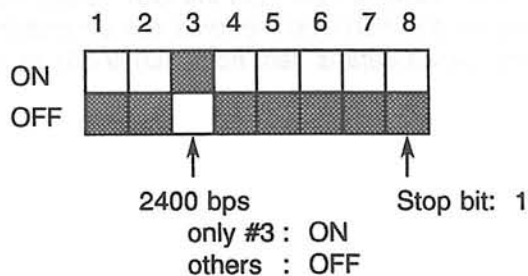
NC Optional Parameter (Word) No.6	Baud Rate
	2400

Note: * 0 or 1 as required

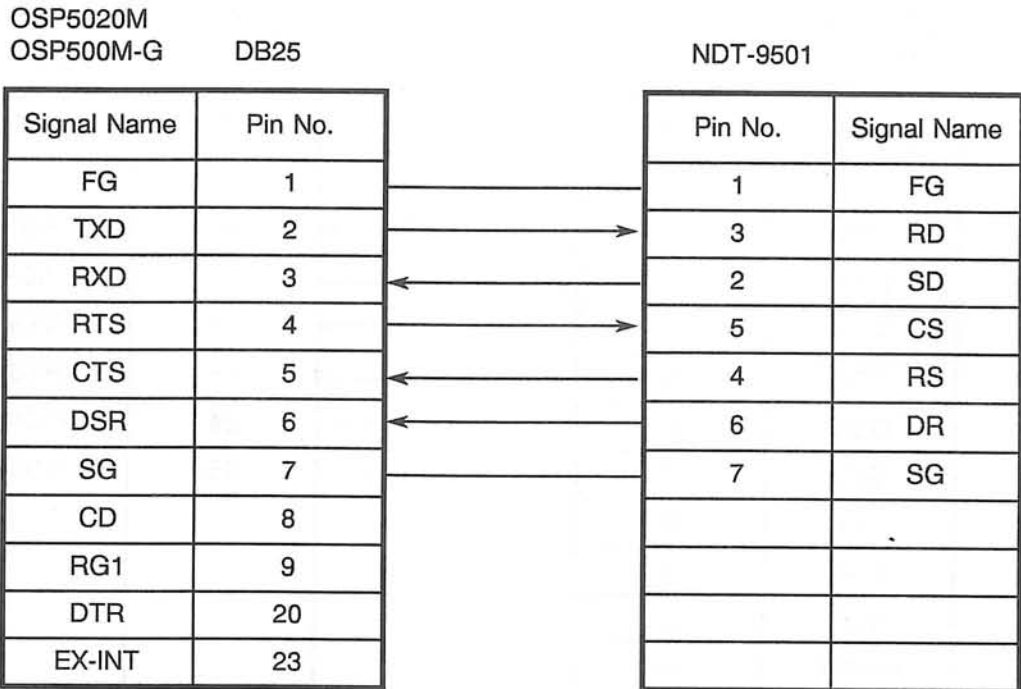
+ The tape punch can be used disregarding of the use of DC code control. However, the DC code control must be set to be used for the tape reader provided with the tape punch.

Note: The JBM punch not provided with indication ☐×☐☐☐ on the name plate at the connector is the parallel model and not used for RS-232.

Switch Setting at PR-30:
Setting is made with DIP switch.



9-9. NEC DATA TERMINALS - NDT-9501



NC Parameter OSP5020M/OSP500M-G

NC Optional Parameter (Bit) No.8	Bit	7	6	5	4	3	2	1	0
	Data	0	0	1	*	0	0	1	0
	Contents	File name used	DC code control type 2	DC code control	8 bit JIS	Even parity	Parity check carried out	No ready signal	Stop bit 1 bit

NC Optional Parameter (Word) No.6	Baud Rate
	2400

Note: * 0 or 1 as required

Set "1" at NC optional parameter (bit) No.1 bit 3.

(Tape delimiting % code)

Switch Setting at NDT-9501:

Code : ISO (OSP standard)

Baud rate : 2400 bps (OSP standard)

JBM's data collector DC1 is the same hardware as NDT-9501.

Note: When program data preceded by a file name is sent from the OSP to the NDT-9501, the file name is not recorded because the NDT-9501 ignores the information until it receives the first % code. Therefore, when data is sent from NOT-9 501 to the OSP, it is not assigned a file name.

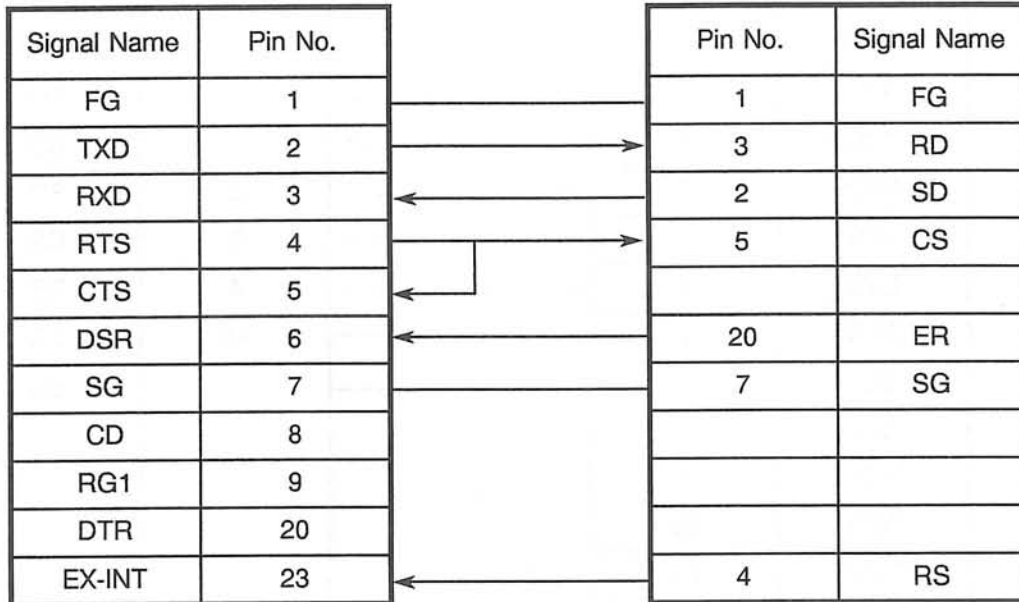
9-10. TANAKA BUSINESS MACHINE - PT-30RS

OSP5020M
OSP500M-G

DB25

JBM PP-30

DB25P (screw lock type)



NC Parameter OSP5020M/OSP500M-G

NC Optional Parameter (Bit) No.8	Bit	7	6	5	4	3	2	1	0
	Data	0	0	1 +	*	0	0	1	0
	Contents	File name used	DC code control type 2	DC code control	8 bit JIS	Even parity	Parity check carried out	No ready signal	Stop bit 1 bit

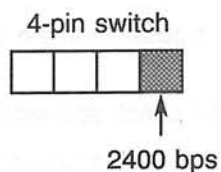
NC Optional Parameter (Word) No.6	Baud Rate
	2400

Note: * 0 or 1 as required

+ Punch (printer) : Possible disregarding of the use of the DC control code

Reader : Possible only when the DC code control is set effective

Switch Setting at Tape Punch:



9-11. TANAKA BUSINESS MACHINE - PT-30RP

OSP5020M
OSP500M-G DB25

TBM PT-30RP
DB25P (screw lock type)

Signal Name	Pin No.
FG	1
TXD	2
RXD	3
RTS	4
CTS	5
DSR	6
SG	7
CD	8
RG1	9
DTR	20
EX-INT	23

Pin No.	Signal Name
1	FG
3	RD
2	SD
5	CS
4	RS
20	ER
7	SG

NC Parameter OSP5020M/OSP500M-G

NC Optional Parameter (Bit) No.8	Bit	7	6	5	4	3	2	1	0
	Data	0	0	1 +	*	0	0	1	0
	Contents	File name used	DC code control type 2	DC code control	8 bit JIS	Even parity	Parity check carried out	No ready signal	Stop bit 1 bit

NC Optional Parameter (Word) No.6	Baud Rate
	2400

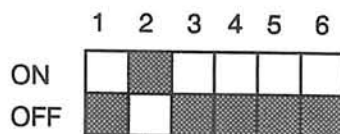
Note: * 0 or 1 as required

Punch (printer) : Possible disregarding of the use of the DC control code

Reader : Possible only when the DC code control is set effective

Switch Setting at Tape Punch:

6-pole DIP switch



2400 bps
only #2 : ON
others : OFF

PT-30R
PT-30P
PT-30RP
PT-30MINI

Tape punching possible in the same connection.

R : Tape punch and reader

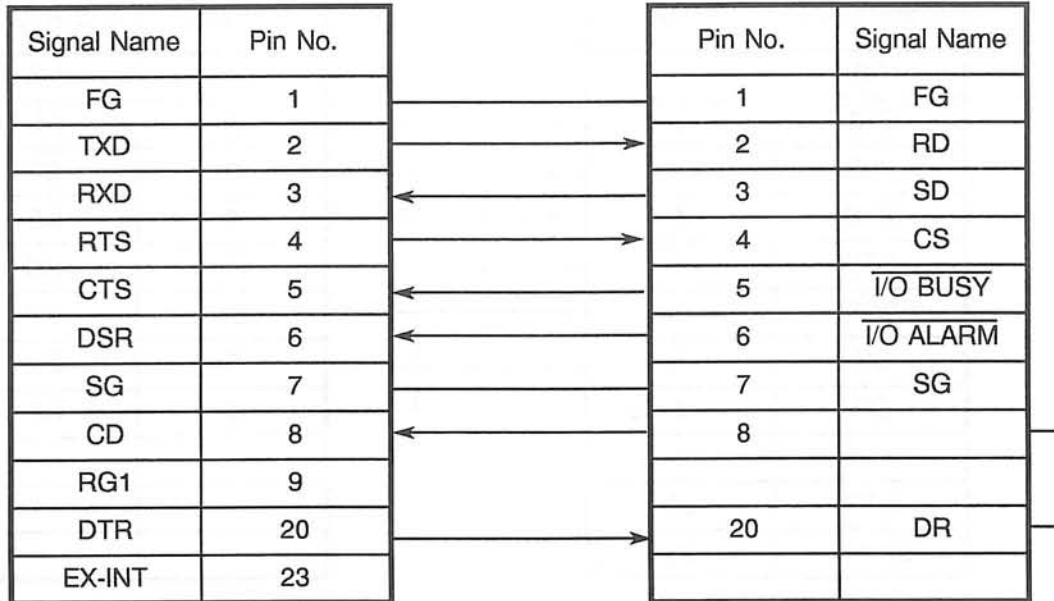
P : Tape punch and printer

PR : Tape punch, reader, and printer

9-12. FANUC - PPR

OSP5020M
OSP500M-G DB25

PPR
DB25S (screw lock type)



NC Parameter OSP5020M/OSP500M-G

NC Optional Parameter (Bit) No.8	Bit	7	6	5	4	3	2	1	0
	Data	0	0	1 +	*	0	0	1	0
	Contents	File name used	DC code control type 2	DC code control	8 bit JIS	Even parity	Parity check carried out	No ready signal	Stop bit 1 bit

NC Optional Parameter (Word) No.6	Baud Rate
	4800

Note: * 0 or 1 as required

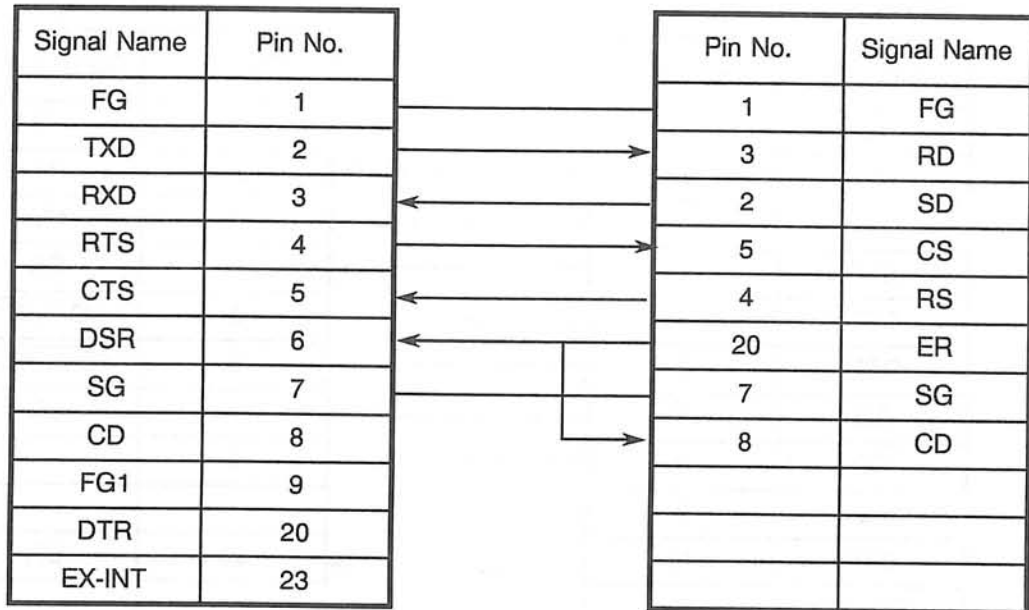
- + When "1" is not set for the DC code control bit, press on FANUC PPR.
- + The tape punch can be used disregarding of the use of DC code control. However, the DC code control must be set to be used for the tape reader provided with the tape punch.

9-13. MIKUNI TOKUSHU KIKI - CF30, CF10

OSP5020M
OSP500M-G

DB25

CF30, CF10
DP25P



NC Parameter OSP5020M/OSP500M-G

NC Optional Parameter (Bit) No.8	Bit	7	6	5	4	3	2	1	0
	Data	0	0	1	*	0	0	1	0
	Contents	File name used	DC code control type 2	DC code control	8 bit JIS	Even parity	Parity check carried out	No ready signal	Stop bit 1 bit

NC Optional Parameter (Word) No.6	Baud Rate
	4800

Note: * 0 or 1 as required

NC Optional Parameter (Bit) No.1	Bit	7	6	5	4	3	2	1	0
	Data	*	*	*	*	1	*	1	1
	Contents	Tape special code ignore	Tape special code alarm	Tape special code used	Tape read verify	Tape deli- miter % (ER) code	Tape TV check	Auto- matic tape code recog- nition	Tape code, ISO code setting

NC Optional Parameter (Word) No.34	RS232 Busy Time
	60 (sec)

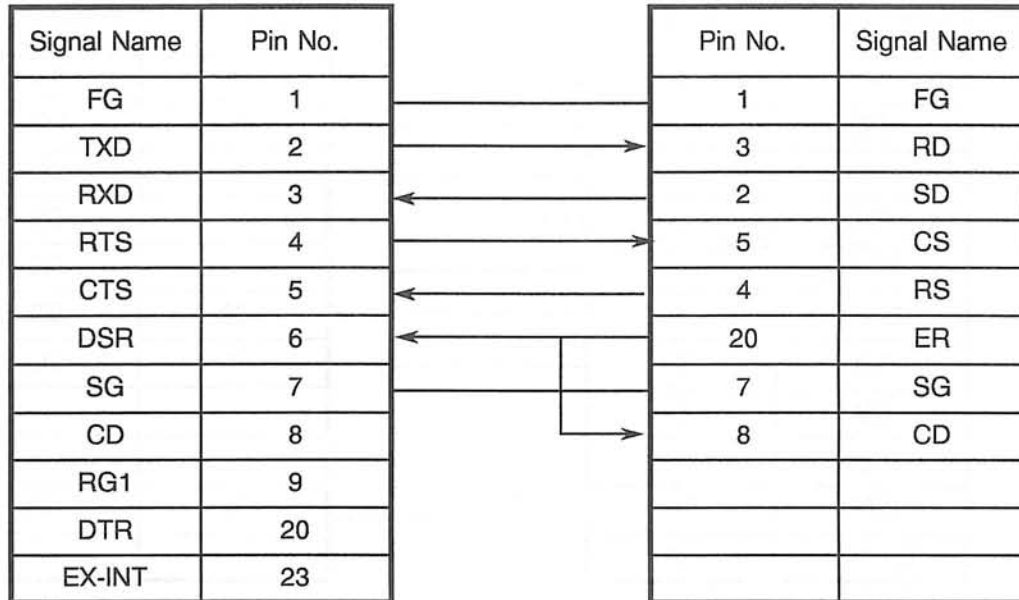
Note: * 0 or 1 as required

9-14. TAKAHASI DENKI - HFD-35

OSP5020M
OSP500M-G

DB25

HFD-35



NC Parameter OSP5020M/OSP500M-G

NC Optional Parameter (Bit) No.8	Bit	7	6	5	4	3	2	1	0
	Data	0	0	1	*	0	0	1	0
	Contents	File name used	DC code control type 2	DC code control	8 bit JIS	Even parity	Parity check carried out	No ready signal	Stop bit 1 bit

NC Optional Parameter (Word) No.6	Baud Rate
	2400

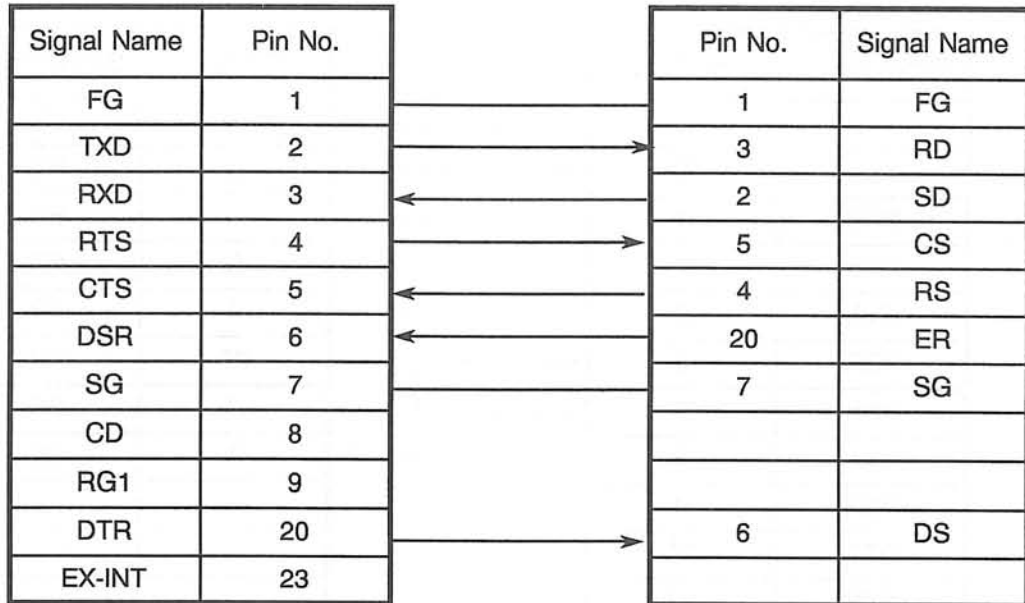
Note: * 0 or 1 as required

NC Optional Parameter (Bit) No.1	Bit	7	6	5	4	3	2	1	0
	Data	*	*	*	*	1	*	1	1
	Contents	Tape special code ignore	Tape special code alarm	Tape special code used	Tape read verify	Tape deli- miter % (ER) code	Tape TV check	Auto- matic tape code recog- nition	Tape code, ISO code setting

9-15. ANRITSU - DPT610A

OSP5020M
OSP500M-G DB25

DPT610A



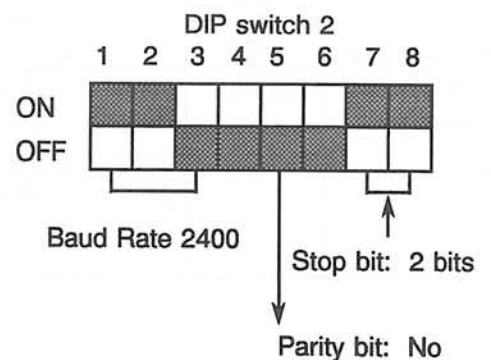
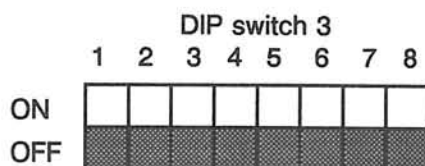
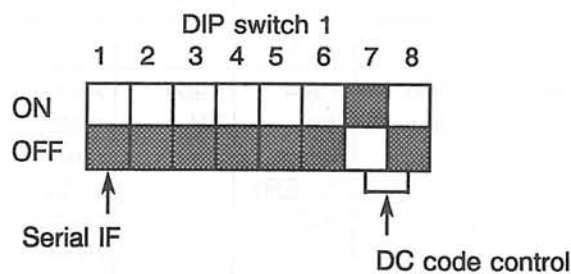
NC Parameter OSP5020M/OSP500M-G

NC Optional Parameter (Bit) No.8	Bit	7	6	5	4	3	2	1	0
	Data	0	0	1	*	0	0	1	0
	Contents	File name used	DC code control type 2	DC code control	8 bit JIS	Even parity	Parity check carried out	No ready signal	Stop bit 1 bit

NC Optional Parameter (Word) No.6	Baud Rate
	2400

Note: * 0 or 1 as required

Switch Setting at Tape Punch:

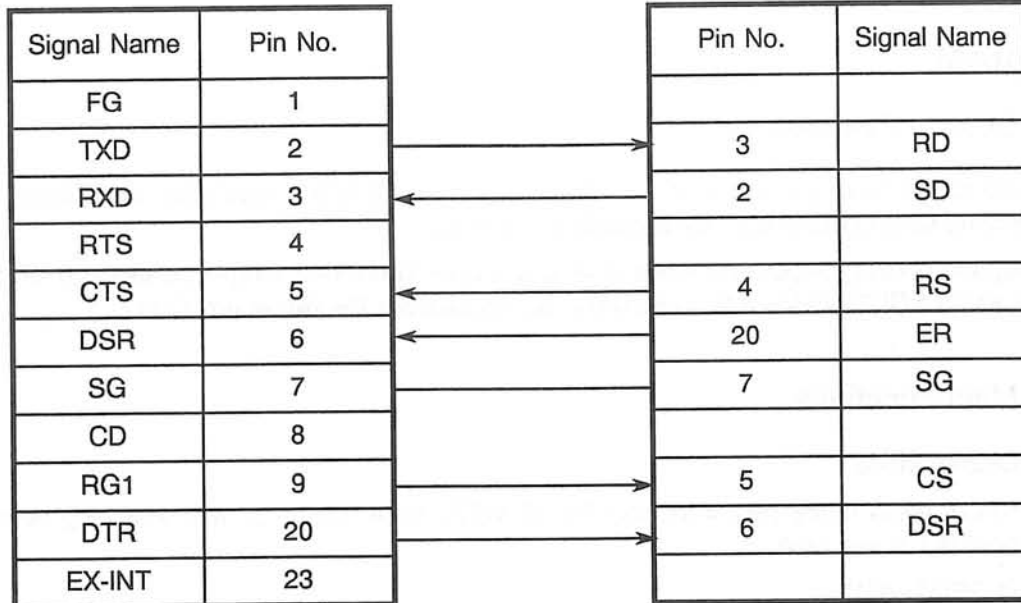


9-16. ACC SYSTEM - PT-PR

OSP5020M
OSP500M-G

DB25

PT-PR



NC Parameter OSP5020M/OSP500M-G

NC Optional Parameter (Bit) No.8	Bit	7	6	5	4	3	2	1	0
	Data	0	0	0	*	0	0	1	0
	Contents	File name used	DC code control type 2	DC code control	8 bit JIS	Even parity	Parity check carried out	No ready signal	Stop bit 1 bit

NC Optional Parameter (Word) No.6	Baud Rate
	600

Maximum baud rate of this punch is 600 bps.

Note: * 0 or 1 as required

SECTION 4 ANIMATION FUNCTION

1. General

1-1. Special Features

The animation function makes it possible to monitor the blank machining conditions such as tool movement, cutting depth etc., by simulation (drawing).

High-speed drawing is possible while in Machine Lock condition. Graphic display consists of a SPLIT VIEW and a SOLID VIEW, with switching possible between the two at any time.

1-2. Main Functions

(1) Display Mode

SPLIT VIEW mode (Fig. 4-1), and SOLID VIEW mode (Fig. 4-2), with switching between the two possible at any time.

Fig 4-1 SPLIT VIEW

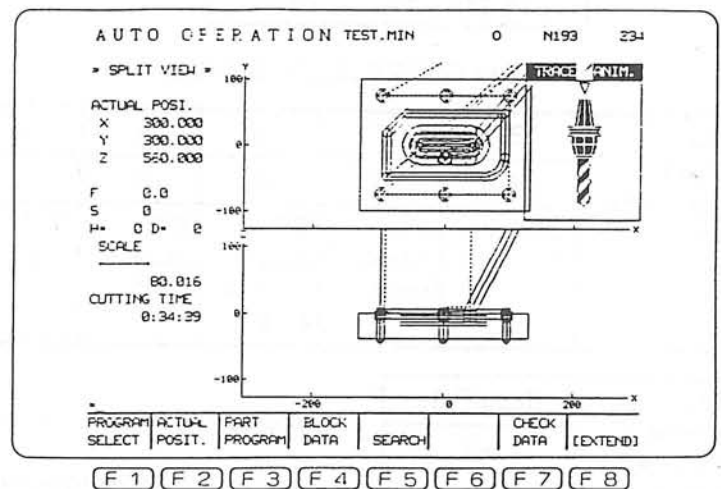
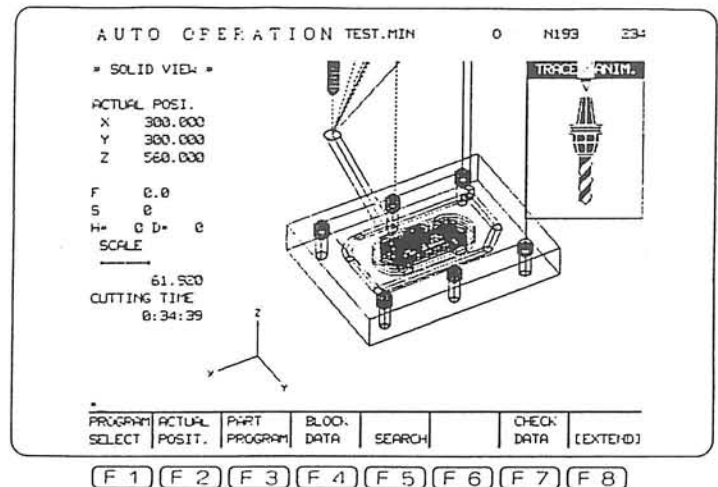


Fig 4-2 SOLID VIEW



(2) Projection Angle Change

In the SOLID VIEW mode, the TILT angle and PAN angle can be freely changed so that the object can be viewed from the desired direction (Fig. 4-3).

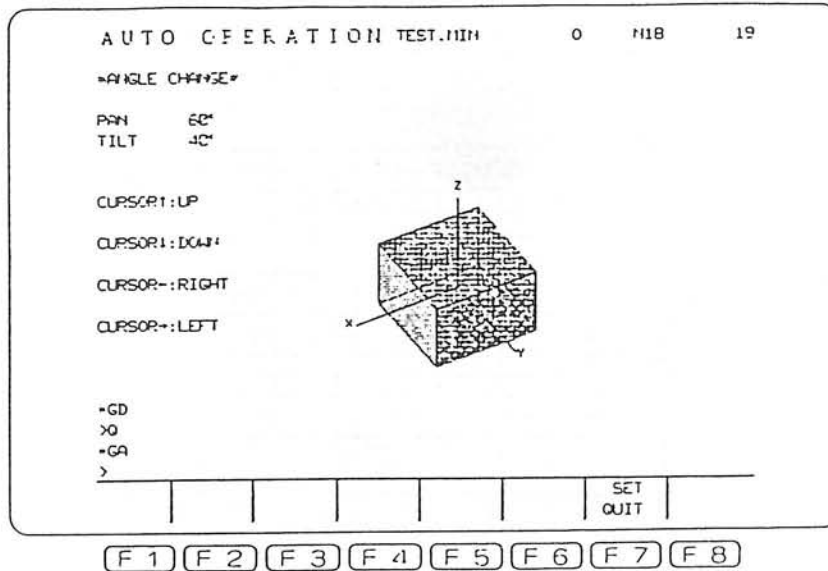


Fig. 4-3 Projection Angle Change

(3) Display Area Change

The display area settings can be changed for both the SPLIT and SOLID VIEW modes. (Fig. 4-4)

(4) Painting

Display of the cut pattern changes according to the cutting depth of the machined area.

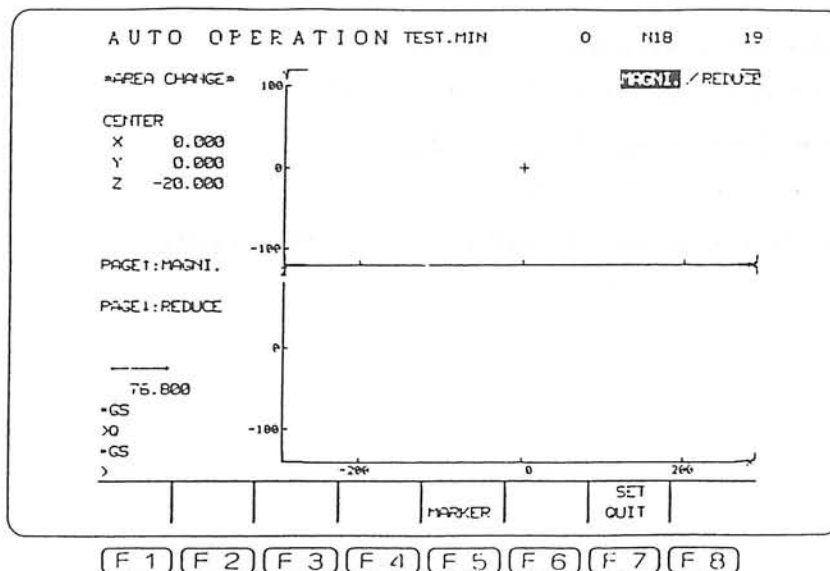


Fig. 4-4 Display Area Change

(5) Blank Definition

Settings can be made for the blank contour and position (Fig. 4-5).

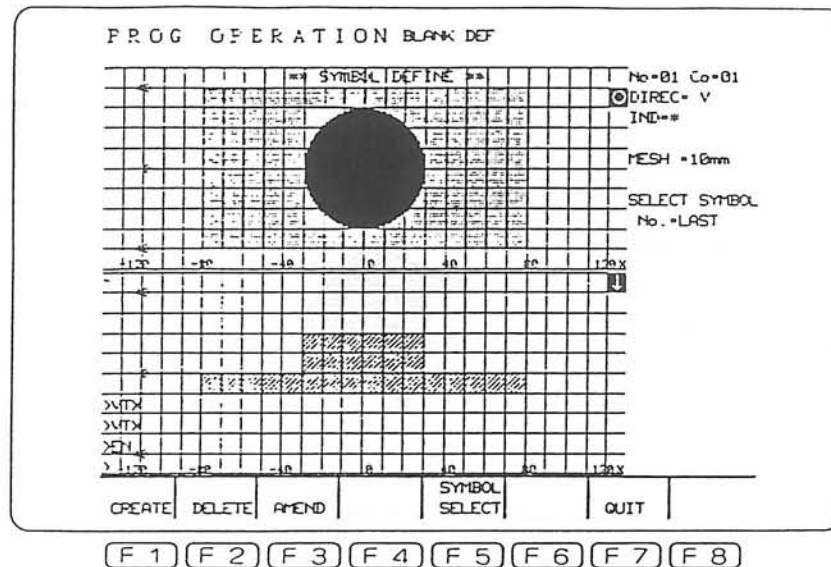


Fig. 4-5 Blank Definition

(6) Automatic Setting for Display Size

Appropriate display size can be automatically determined according to blank size.

(7) Setting of Cutting Tool Shape

Setting can be made for the cutting tool shape.

(8) Selection of Drawing Speed

Display is possible for actual cutting speed or high speed.

(9) Cutting Time Calculation

Cutting time calculation function is available.

(10) Compatible for Rotary Axis and Five-face Machining

Rotary axis, five-face machining is possible.

(11) Intervention for Return Operation

Return search, sequence return operation intervention is possible.

1-3. Screen Layout

For color graphic display, the screen layout is as follows:

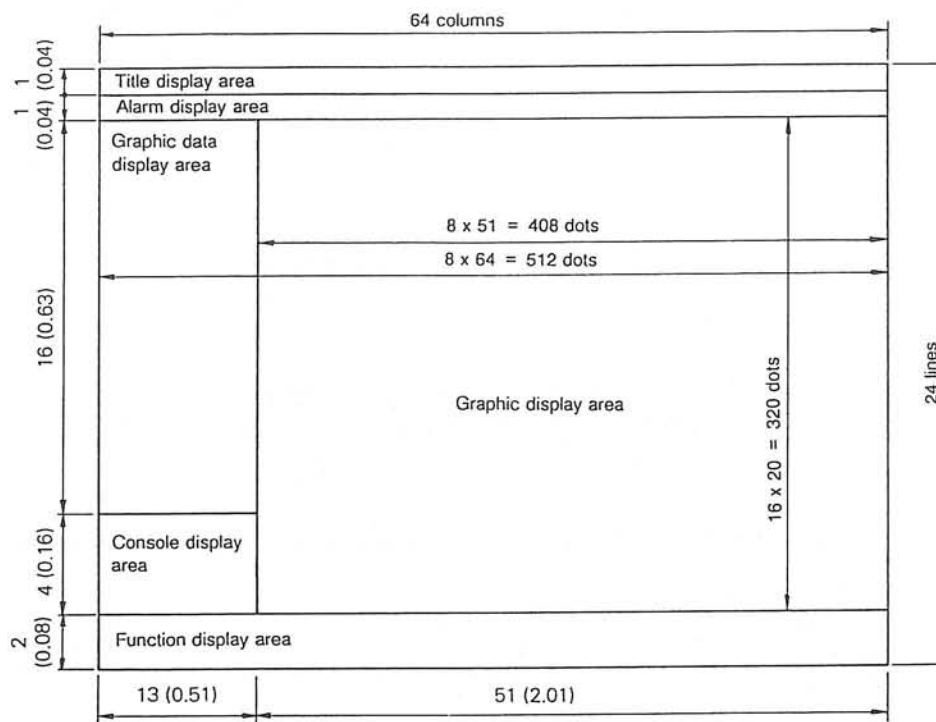
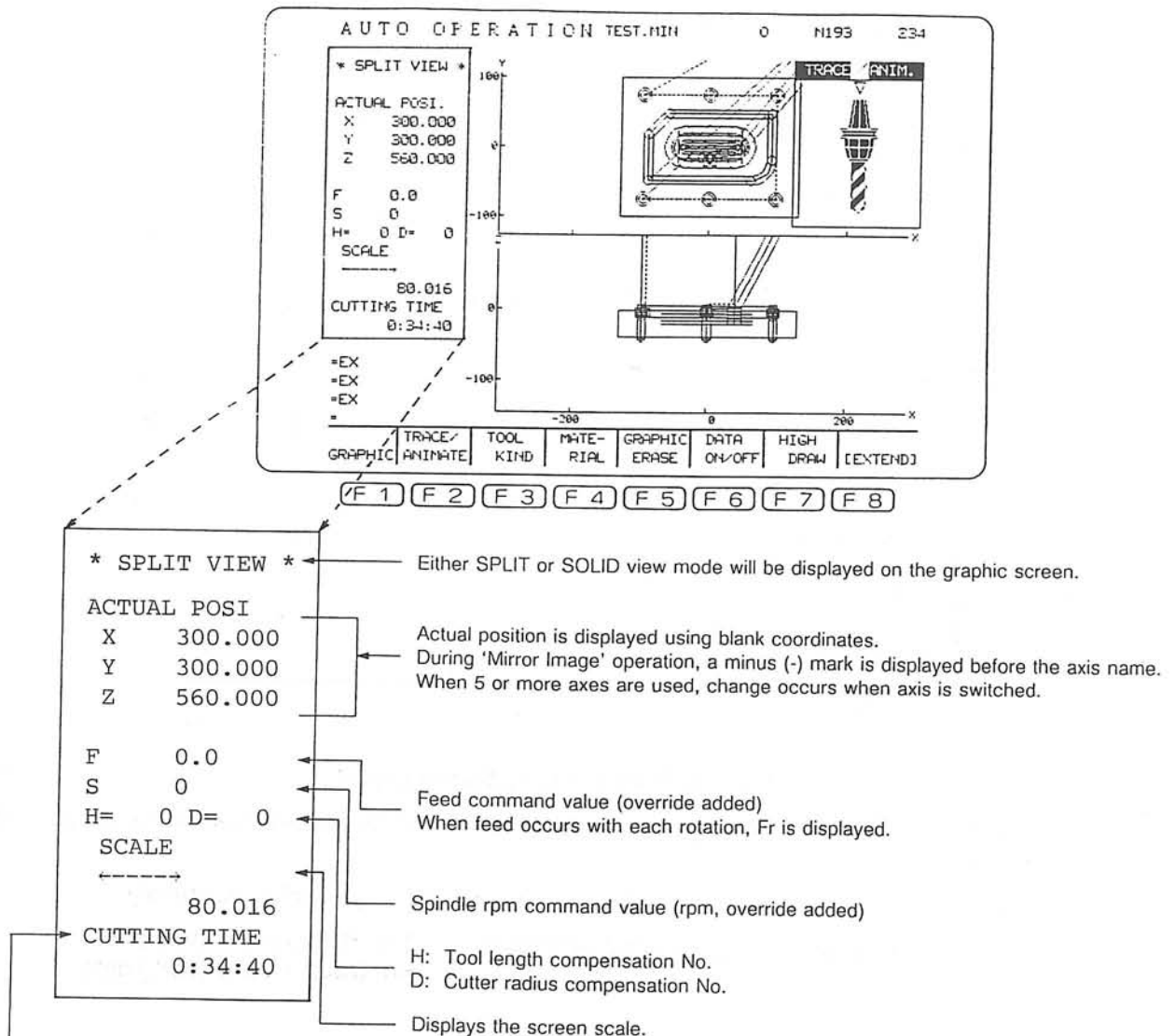


Fig. 4-6 Graphic Display Screen Layout

- (1) On color graphic CRTs, a moving trace line and blank contour are displayed in the graphic display area.
- (2) If a graphic display and a character display overlap, the character display has priority.
- (3) The graphic display area can be switched as follows:
 - 408 (Horiz.) x 320 (Vert.) dot
 - 512 (Horiz.) x 320 (Vert.) dots

1-4. Animation Screen, Explanation of Terminology



Displays the cutting time.

Cutting time varies for 'Machine Lock' and 'Non-Machine Lock'.

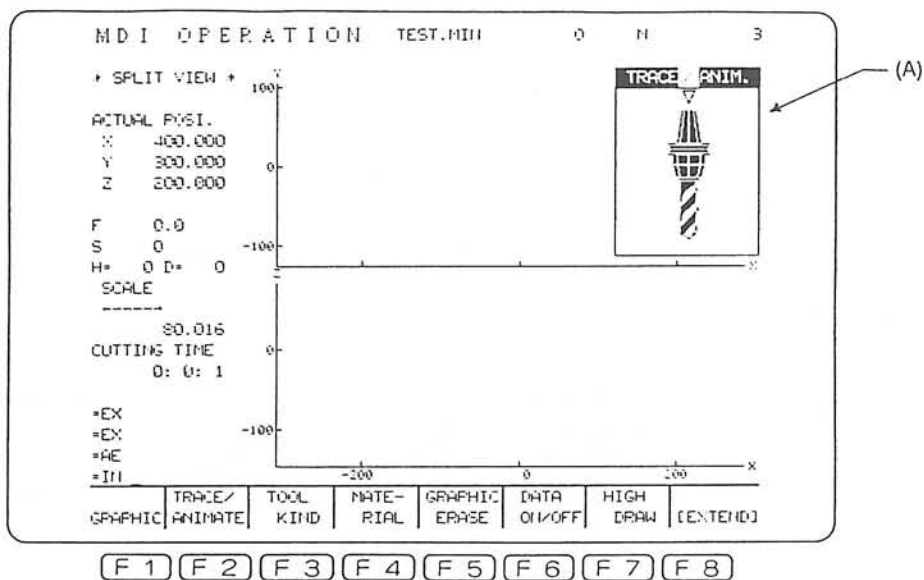
Machine lock mode: At the completion of one program block, time necessary for axis motion in that block is calculated and totaled at the completion of the program.

In this calculation, time required for the execution of M, S, T and G04 commands is not included.

Cutting time is calculated using the feedrate obtained by multiplying programmed F value by feedrate override setting (the setting at the start of the block). Axis feed time in the rapid feed mode is calculated assuming the override setting of 100 %.

Non-machine lock mode: Actual time during operation is counted.

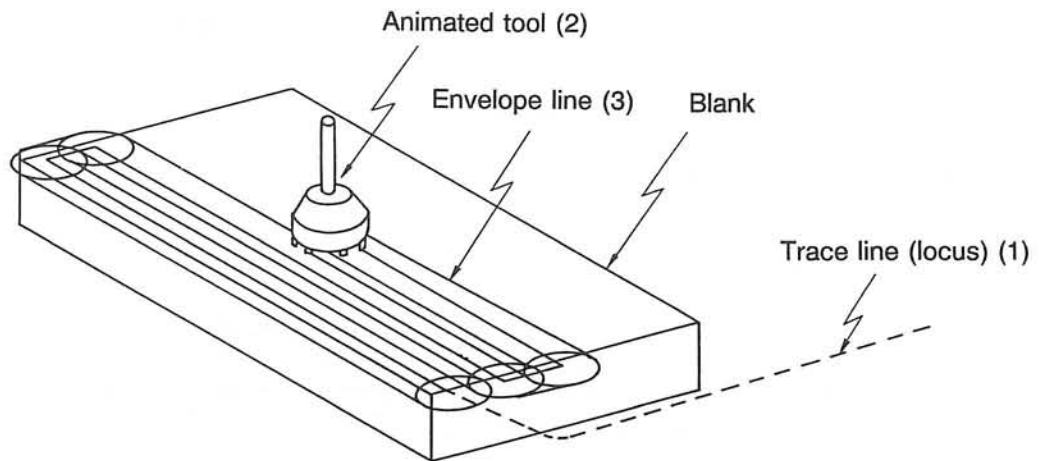
Cutting time is not cleared until the initial START button of the program is pressed. The information in the graphic data display area changes according to the function key which is pressed.



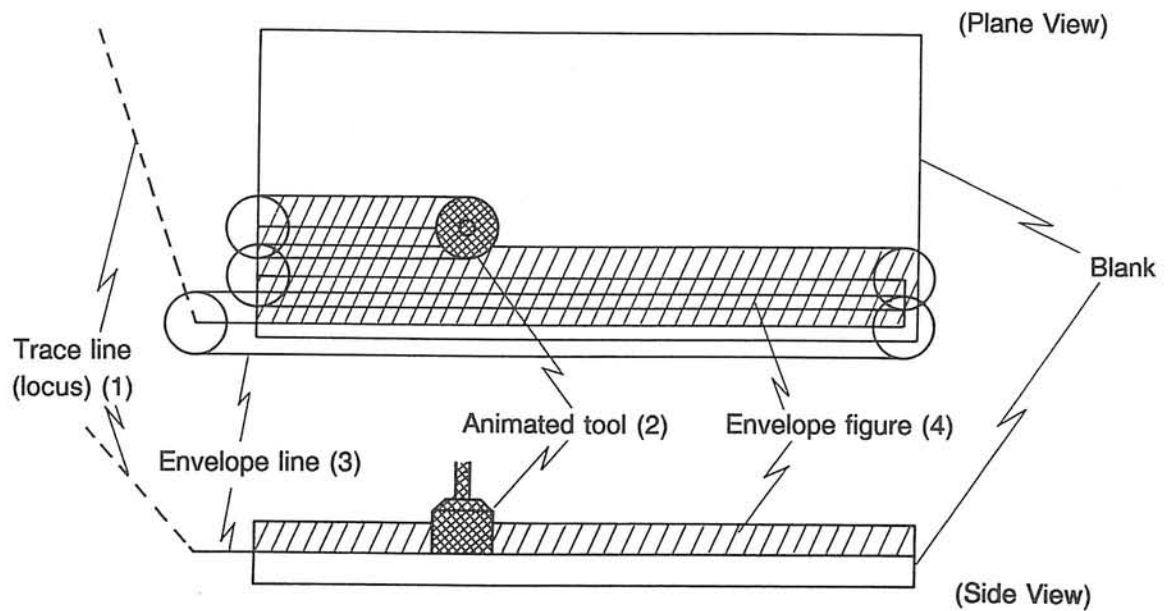
The (A) area displays the tool presently being used, which will henceforth be referred to as the "Tool Kind".

The animation display consists of drawings of the trace line (locus), envelope line, envelope figure, blank, and animated tool.

SOLID VIEW



SPLIT VIEW



(1) Trace Line

Displays the tool locus.

(a) The trace display type varies according to the feed type as follows:

Positioning : broken line

Cutting feed : solid line

Manual rapid traverse : dashed line

Manual cutting feed : dashed line

(b) The trace line has a single color (multi-color is impossible) which is designated by the GRAPH DATA setting.

(c) Drawing (EXIST/NONE) of positioning, cutting, and manual (rapid, cutting) feed can be designated by the GRAPH DATA setting.

(2) Animated Tool

Tool position is displayed.

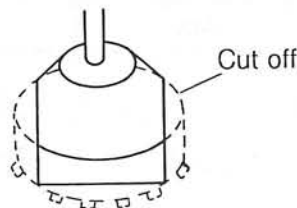
(a) The simulated likeness of the tool in that position will be displayed.

(b) Animated tool is set by graphic system variables and by the tool number which is in use.

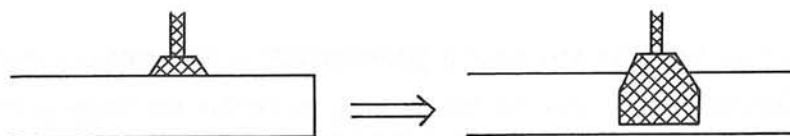
(c) Animated tool color can be designated by the GRAPH DATA setting.

(d) Drawing (EXIST/NONE) is also designated by the GRAPH DATA setting.

(e) If the simulation magnification is large, or the tool diameter is large, part of the display may be cut off (see figure below).



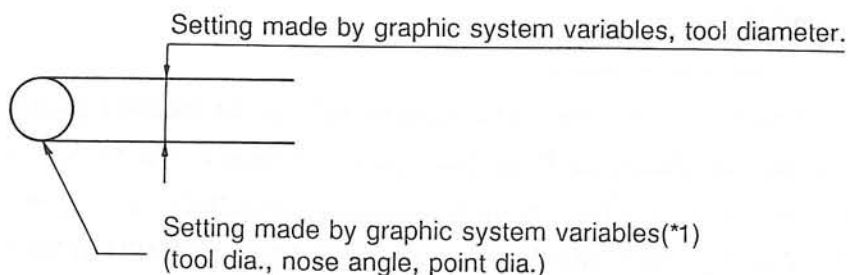
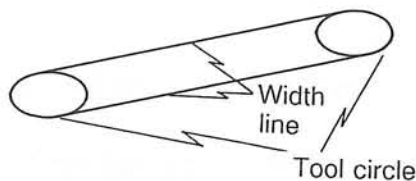
(f) Because the animated tool has priority over the workpiece blank, if the tool is positioned behind the workpiece blank, it will appear in front of the workpiece blank on the display (see figure below).






(3) Envelope Line

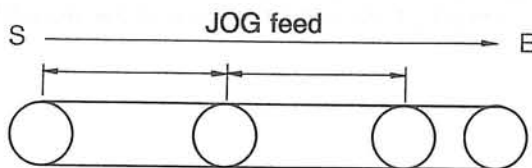
The image line of the tool passage space which is defined at each block of the NC part program is displayed. This drawing occurs only for the cutting mode (cutting feed, manual cutting feed).

- (a) The envelope line consists of tool passage width indicated by the width line, and the tool circle indicated at each block change. The width and tool circle configurations are set by the tool number in use, and by the graphic system variables.



Tool Dia.	$\neq 0$	$\neq 0$	$\neq 0$
Nose Angle	180 °	$> 0, < 180 ^\circ$	Same as left
Point Dia.	Any	0	$\neq 0$
			
	Cycle	Cone	Truncated cone

- (b) During manual cutting feed, the tool circle drawing is displayed periodically.



Envelope line color and drawing (EXIST/NONE) is designated by the GRAPH DATA setting.

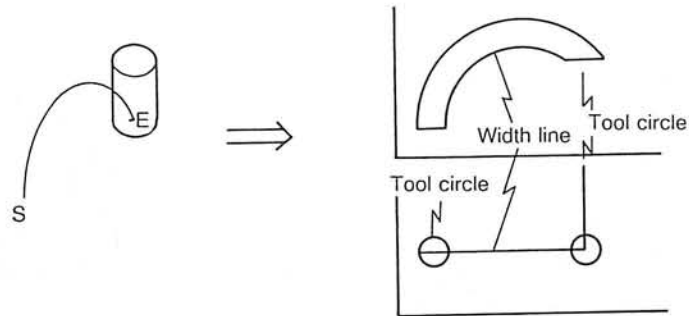
*1 Graphic system variables can be freely set within the range given on Section 2-3, and are not dependent on the tool classification number. However, the tool shape selection may be made automatically by the tool classification number.

(c) Plane envelope line drawing occurs as follows:

Tool circle drawing occurs on the normal plane of the cutting axis.

The width line drawing for arc cutting occurs on the plane designated by commands G17 - G19.

For non-arc cutting, drawing is the same as for the tool circle. (see figure below)



(4) Envelope Figure

The workpiece blank area where tool cutting has occurred is displayed.

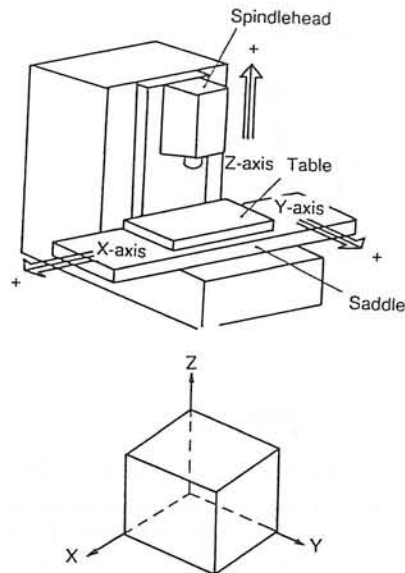
- (a) Depending on the machining height, 42 gradation patterns are available. Workpiece blank area is also changeable. This simulation occurs only in the cutting mode (cutting feed, JOG feed), and is not available for SOLID VIEW, or for the side face only SPLIT VIEW display. Furthermore, for two-plane SPLIT VIEW, drawing movement is restricted to the plane drawing range.
- (b) Side face drawing uses a fixed gradation pattern regardless of the cutting height.
- (c) The shape of the envelope figure is determined by graphic system variable of the tool number in use.
- (d) The envelope figure is ineffective when 3 or more axes are moved simultaneously.

2. Types of Animation

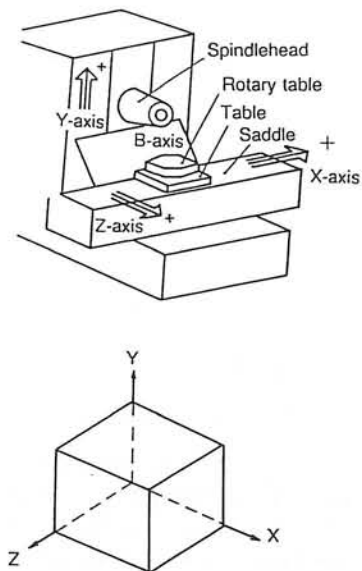
2-1. Graphic Display Coordinate System

The graphic coordinate system varies depending on whether the machine is a vertical or horizontal model.

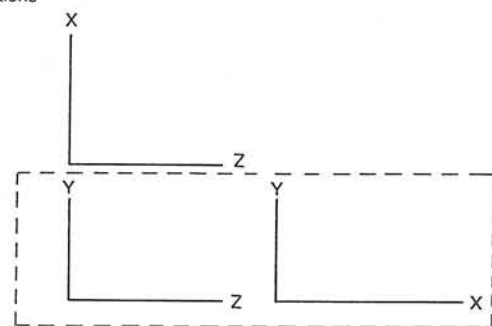
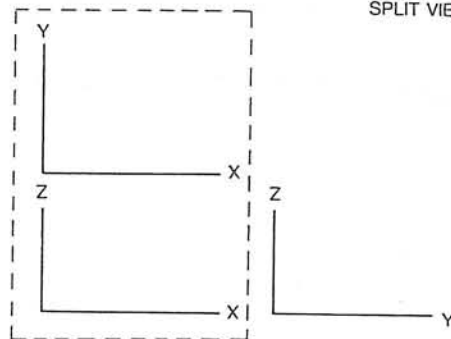
Coordinate system for vertical models:
A coordinate system is assumed in which the vertical axis is the Z-axis.



Coordinate system for horizontal models:
A coordinate system is assumed in which the vertical axis is the Y-axis.

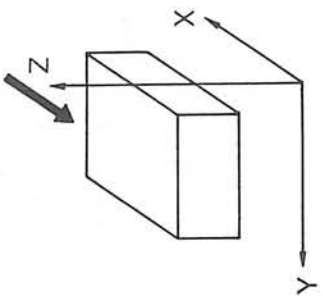
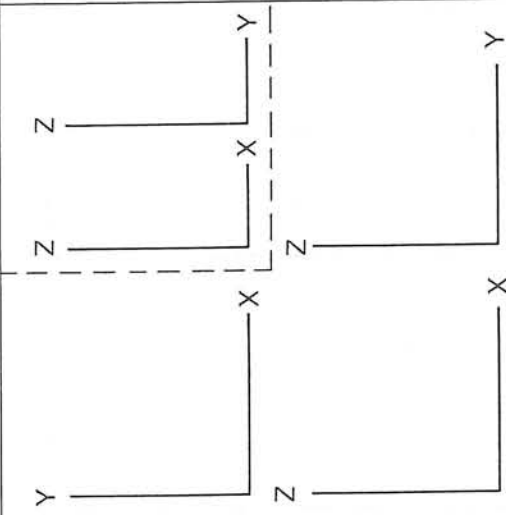
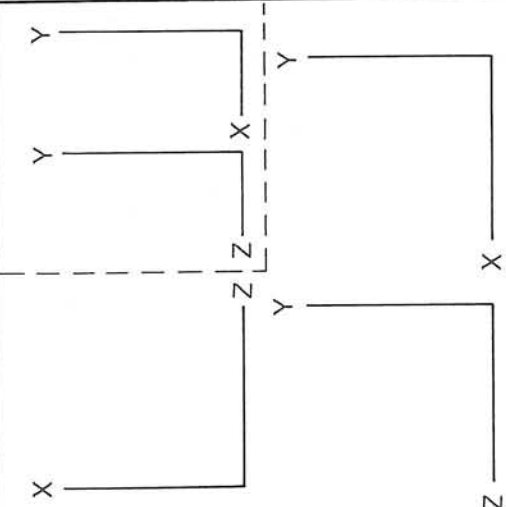
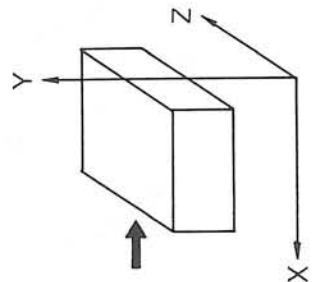
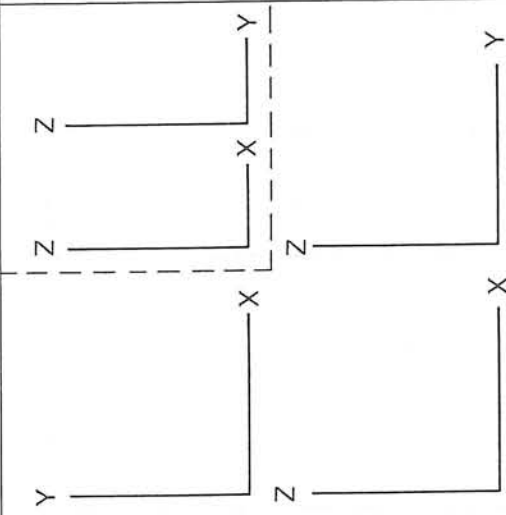
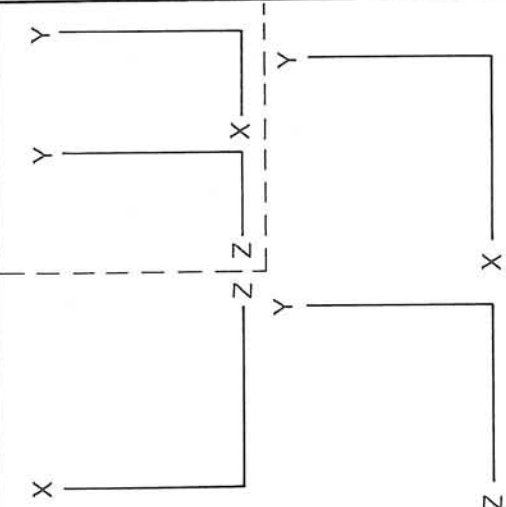
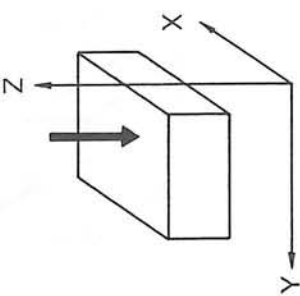
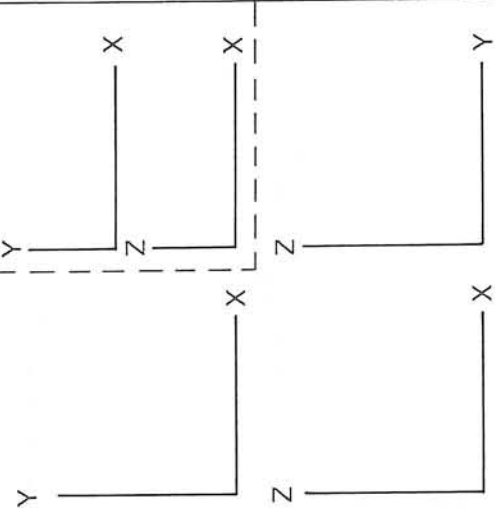
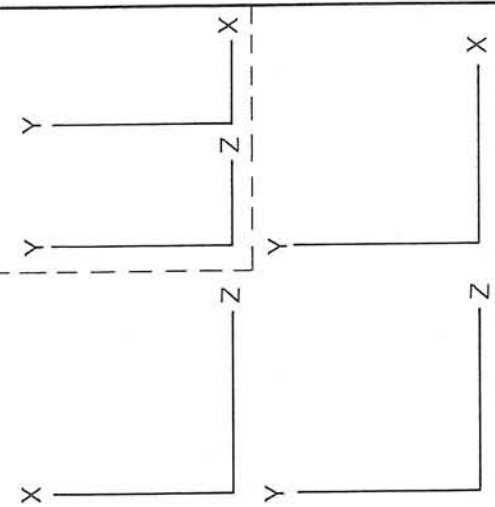
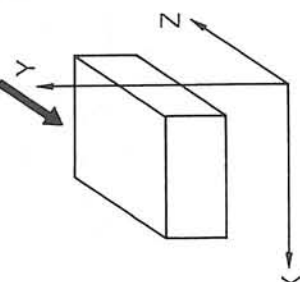
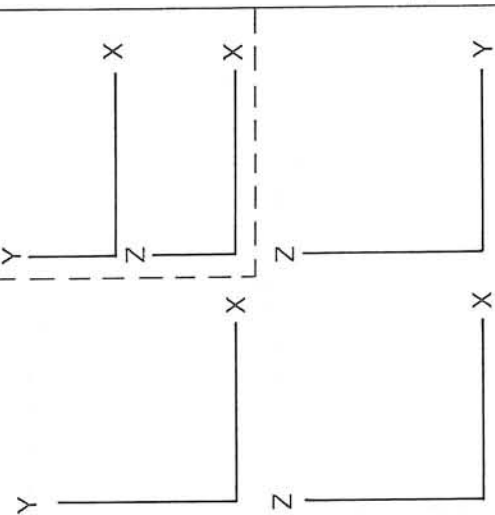
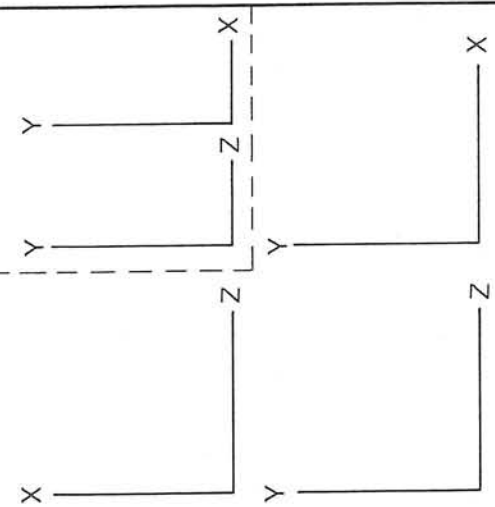


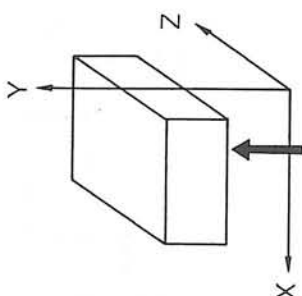
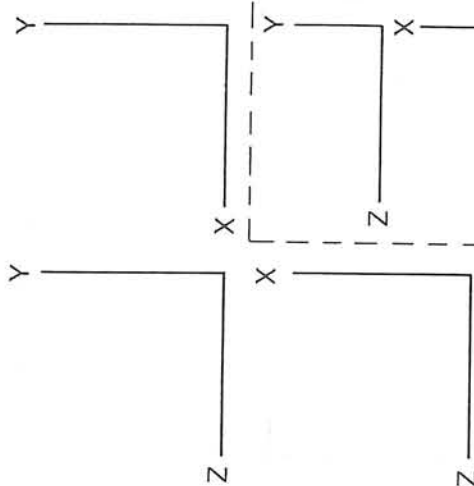
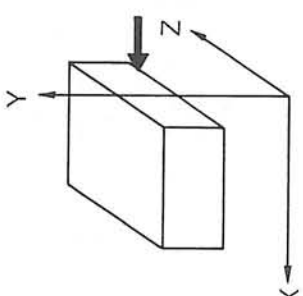
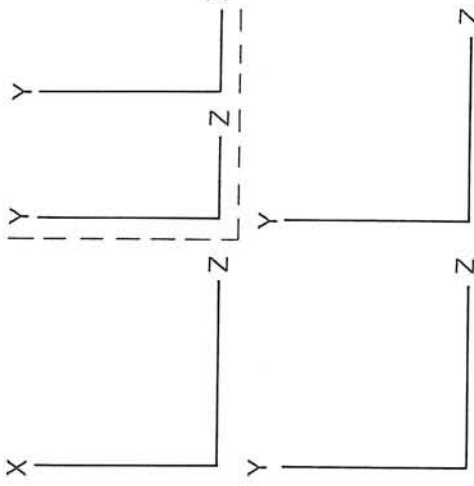
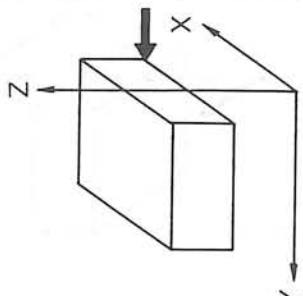
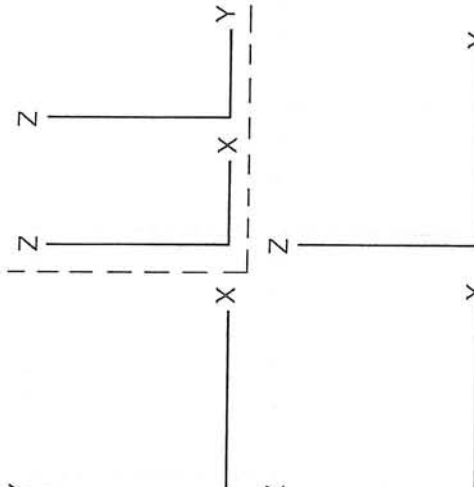
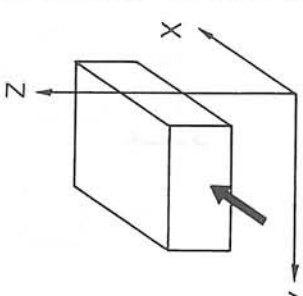
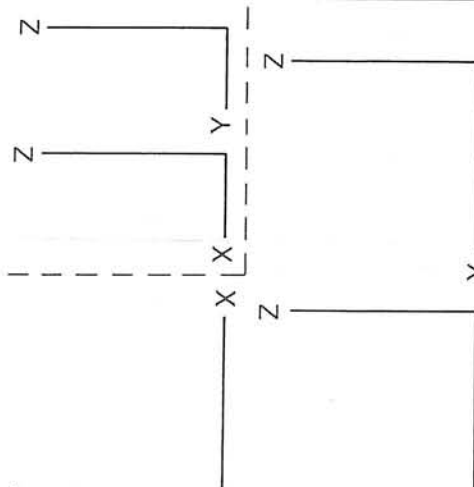
SPLIT VIEW selections

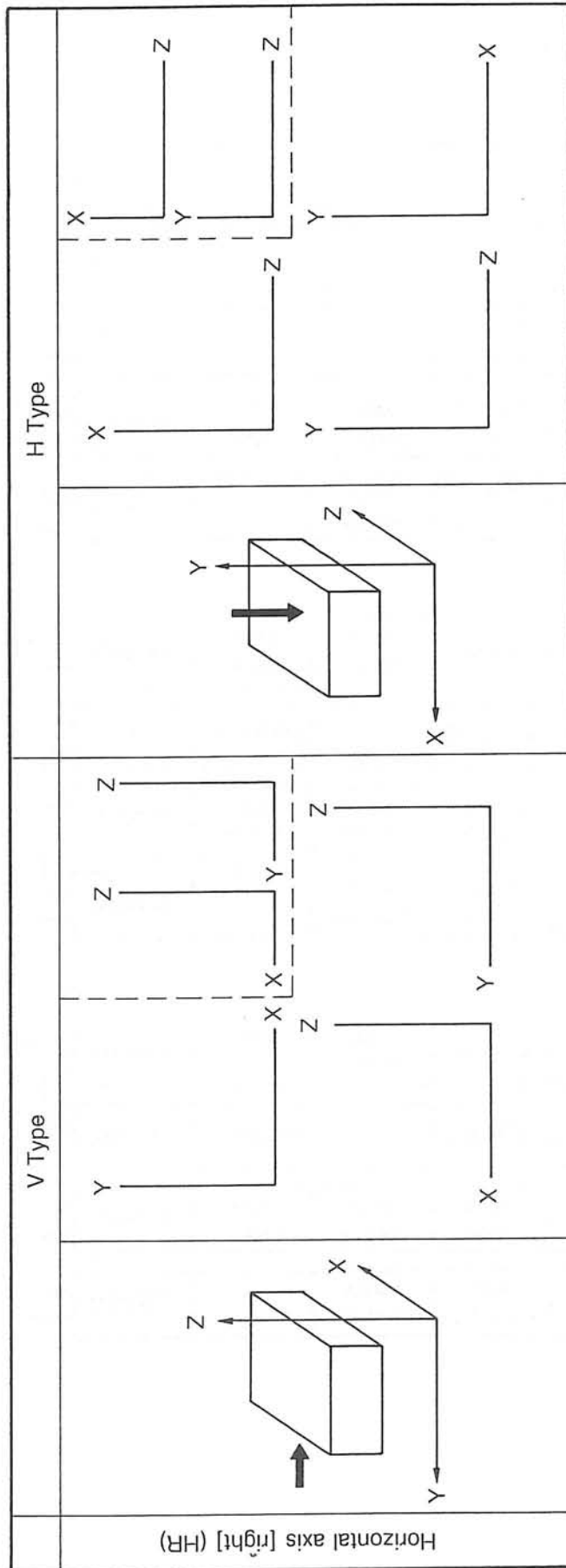


Dotted line area indicates two-surface SPLIT VIEW.

The following SPLIT VIEWS are possible depending on the cutting axis direction (indicated by arrow). Broken line areas indicate two-plane SPLIT VIEW.

		H Type	
Horizontal axis [front] (HF)			
			
		V Type	
Vertical axis (V)			
			

H Type		V Type	
			
			
Horizontal axis [left] (HL)		Horizontal axis [back] (HB)	



2-2. Explanation of Animation Related Functions (* indicates graphic related function.)

AUTO OPERATION

PROGRAM SELECT	ACTUAL POSIT	PART PROGRAM	BLOCK DATA	SEARCH	AXIS CHANGE	CHECK DATA	[EXTEND]	←
LIBRARY P.SET		TOOL DISPLAY	PERSONAL	DIAGNOSIS		MESSAGE	[EXTEND]	←
NUMBER SEARCH	RESTART	NUMBER STOP	SP SELECT	SP-NO. SEARCH			[EXTEND]	←
* GRAPHIC	TRACE /ANIMATE	TOOL KIND	MATERIAL	GRAPHIC ERASE	DATA ON/OFF	HIGH DRAW	[EXTEND]	←
* GRAPHIC	GRAPHIC DATA	AUTO SCALE		AREA CHANGE	ANGLE CHANGE		[EXTEND]	←

MDI OPERATION

DATA INPUT	ACTUAL POSIT	PART PROGRAM	BLOCK DATA	SEARCH	AXIS CHANGE	CHECK DATA	[EXTEND]	←
LIBRARY P.SET		TOOL DISPLAY	PERSONAL	DIAGNOSIS		MESSAGE	[EXTEND]	←
* GRAPHIC	TRACE/ANI MATE	TOOL KIND	MATERIAL	GRAPHIC ERASE	DATA ON/OFF	HIGH DRAW	[EXTEND]	←
* GRAPHIC	GRAPHIC DATA	AUTO SCALE		AREA CHANGE	ANGLE CHANGE		[EXTEND]	←

MANUAL OPERATION

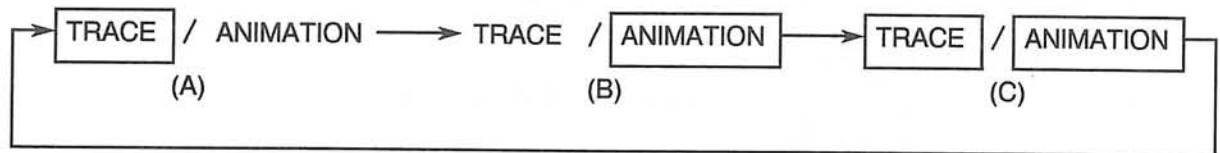
	ACTUAL POSIT	PART PROGRAM	BLOCK DATA	SEARCH	AXIS CHANGE	CHECK DATA	[EXTEND]	←
		TOOL DISPLAY	PERSONAL	DIAGNOSIS		MESSAGE	[EXTEND]	←
* GRAPHIC	TRACE /ANIMATE	TOOL KIND	MATERIAL	GRAPHIC ERASE	DATA ON/OFF	HIGH DRAW	[EXTEND]	←
* GRAPHIC	GRAPHIC DATA	AUTO SCALE		AREA CHANGE	ANGLE CHANGE		[EXTEND]	←

Except for the [F1] (GRAPHIC) function, all graphic related functions are ineffective during non-graphic display.

F1	GRAPHIC	For graphic display
F2	TRACE/ ANIMATE	For trace/animation switchover
F3	TOOL KIND	For tool kind display ON/OFF
F4	MATERIAL	For blank drawing
F5	GRAPHIC ERASE	Erases graphic display
F6	DATA ON/OFF	ON/OFF switch for graphic data area
F7	HIGH DRAW	ON/OFF switch for high-speed drawing (Not effective in manual mode.)
F8	[EXTEND]	
F1	GRAPHIC	For graphic display
F2	GRAPHIC DATA	Establishes the Graph Data Set mode.
F3	AUTO SCALE	Automatic setting of the drawing area
F4		
F5	AREA CHANGE	Establishes the area change (display size) mode.
F6	ANGLE CHANGE	Establishes the projection angle change mode.
F7		
F8	[EXTEND]	

2-2-1. Trace/Animation

Each time this function key is pressed, the display at the upper right of the screen changes as follows:

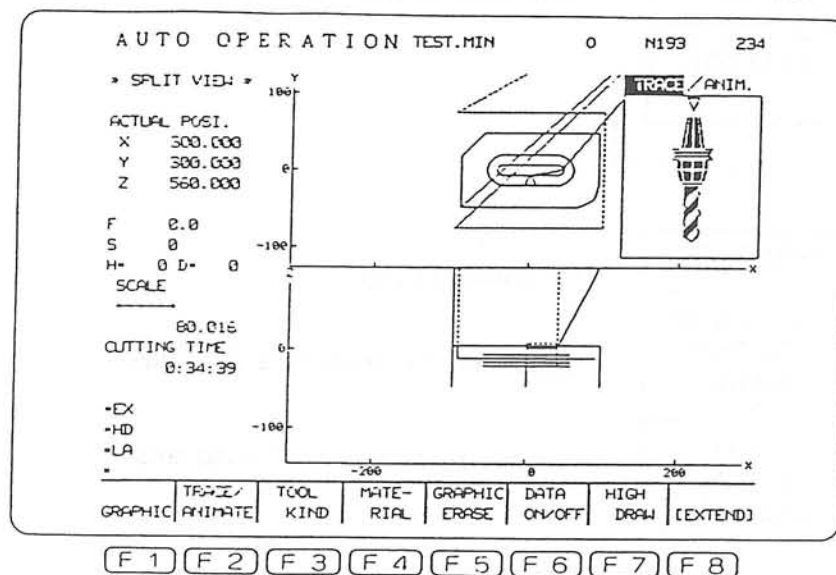


The graphic display changes as follows:

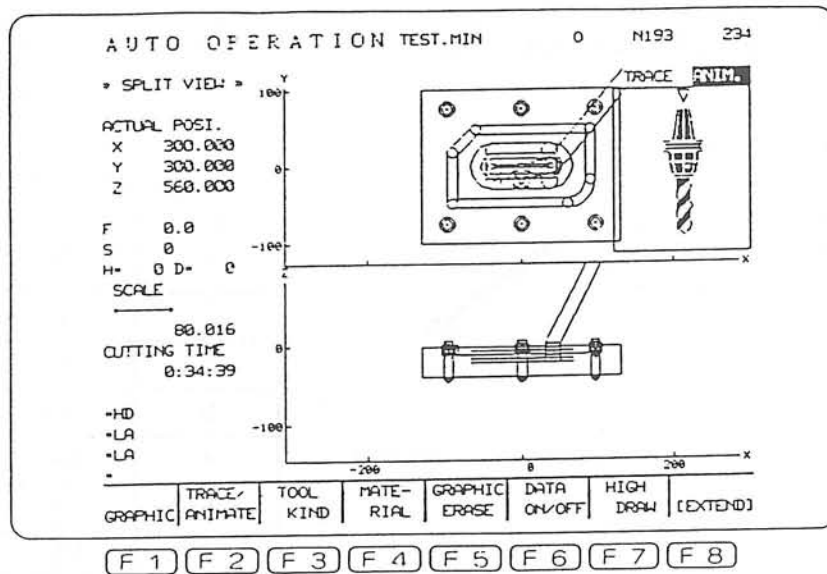
- (A) : Only the trace line is displayed.
- (B) : Only the animation (blank, envelope figure, envelope line, animated tool) is displayed.
- (C) : Both the trace line and animation are displayed.

This function is used only for switching as shown above, and cannot be used to erase, or stop drawing.

This function is effective for SOLID VIEW and SPLIT VIEW modes.



(A) Screen



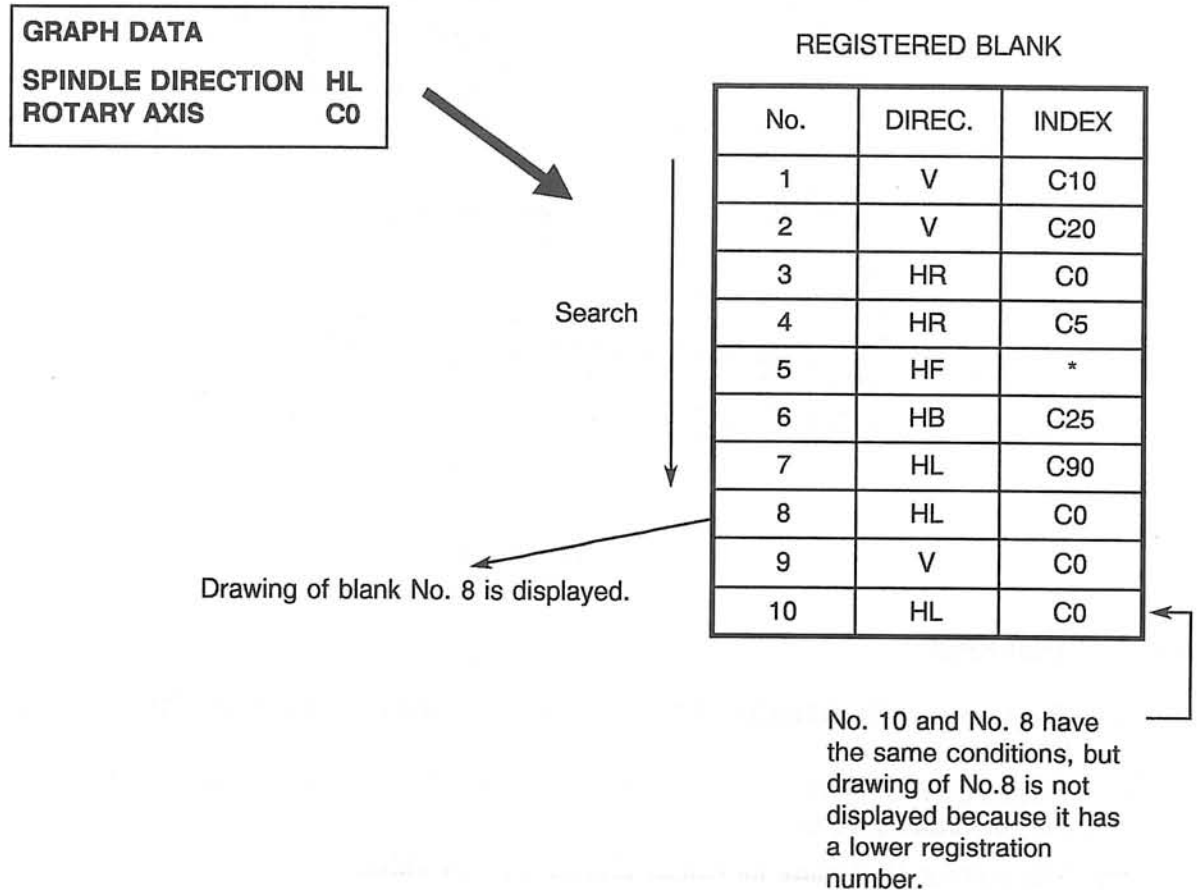
(B) Screen

2-2-2. Tool Kind

- (1) This is the key for drawing/non-drawing of the tool indicated at the upper right of the screen (tool kind).
- (2) This function is not effective when the GRAPH DATA setting for animated tool and tool kind is in the non-drawing mode.
- (3) This function is effective for SOLID VIEW and SPLIT VIEW.

2-2-3. Material

- (1) When the material drawing function is activated, a search is conducted for the registered blank (beginning with the lowest number) which matches the spindle direction and rotary axis conditions of the GRAPH DATA setting. Drawing of this blank is executed after the graphic screen is erased.



- (2) This function is not effective under the following conditions:
 - There are no registered blanks with conditions matching those of the GRAPH DATA setting.
 - Animation speed override is active.
 - GRAPH DATA setting is in the material non-drawing mode.
- (3) This function is effective for SOLID VIEW and SPLIT VIEW.

2-2-4. Graphic Erase

- (1) This function erases the graphic screen.
- (2) If the animation speed override is active, this function will release it.
- (3) This function also erases trace, blank, envelope line, and envelope figure.
- (4) This function is effective for SOLID VIEW and SPLIT VIEW.

2-2-5. Data ON/OFF

- (1) This is the ON/OFF function key for the graphic data display area at the left side of the screen.
- (2) This function is not effective if the graphic display area is designated as PART.
- (3) This function is effective for SOLID VIEW and SPLIT VIEW.

2-2-6. High Draw

This function enables high-speed drawing.

- (1) High-speed drawing mode ON/OFF occurs each time this function key is pressed in the auto, and manual modes with machine lock established.
- (2) With high speed drawing mode, animation occurs at each block. Drawing occurs in the following order: trace, envelope line, and envelope figure. Animated tool drawing does not occur at this time.
- (3) The high-speed drawing mode is released by NC reset or program end.

Note 1: In the high-speed drawing mode, both the G00 and G01 commands designate straight line interpolation to the designated value.

Therefore, the actual trace (locus) will be different.

Note 2: During high-speed drawing, display occurs at the upper center portion of the screen.

Note 3: The line connecting the start and end point of the arc is displayed for the 3-dimensional arc (including 3-dimensional coordinate shift; G02 and G03) in the high-speed drawing mode or on the cycle start with the return search.

2-2-7. Graphic Data

This is the function for setting the graphic drawing conditions.

- The GRAPH DATA setting mode can be entered from either the SPLIT VIEW or the SOLID VIEW. If entered from SPLIT VIEW display, setting data will be available which applies to the SPLIT VIEW only, as well as data which applies to both the SPLIT VIEW and SOLID VIEW displays. If the GRAPH DATA setting mode is entered from the SOLID VIEW display, the reverse applies.
- Setting data which applies only to the SPLIT VIEW display is called 'SPLIT VIEW setting data', setting data which applies only to the SOLID VIEW display is called 'SOLID VIEW setting data', and setting data which applies to both is called 'common data'.
- The GRAPH DATA settings consist of 7 pages. Pages 5 through 7 are reserved for data where infrequent settings are made, and access to these pages is restricted unless the PAGE LIMIT setting on page 3 is set to NONE (no page limit). If this setting is EXIST, the system will not proceed beyond page 4.

GRAPH DATA Setting - List of Data Setting and Setting Range (1)

Page	Data Setting Item		Data and Area Setting				Function					
							[F1] SET	[F2] ADD	[F3] SELECT			
1	Common	SPINDLE DIRECTION		0 - 4 (0:V, 1:HF, 2:HL, 3:HB, 4:HR)				○	×	×		
		ROTARY AXIS		* (not designated) (A, B, C) angle 0 ≤ angle ≤ 359 (deg.)				○	×	×		
		GRAPHIC COORDINATE NUMBER		0 to max. value used				○	×	×		
		GRAPHIC AREA		PART		ALL		×	×	○		
2	SPLIT VIEW	PLANE		Menu No. 1 - 4				○	×	×		
		DIVIDING RATIO		30 - 70 (%)				○	×	×		
	SOLID VIEW	PAN		0 - 359 (deg.)				○	○	×		
		TITLE		- 89 - 89 (deg.)								
3	SPLIT VIEW	CENTER	CX	- 9999.999 - 9999.999 (mm)				○	○	×		
			CY									
			CZ									
		PAGE LIMIT		EXIST		NONE		×	×	○		
	SOLID VIEW		AX	4.000 - 999.999 (mm)				○	○	×		
			AY									
AZ												
PAGE LIMIT		EXIST		NONE		×	×	○				
4	Common	MASTER		X-DIR.		Y-DIR.		Z-DIR.		×	×	○
				X	U	Y	V	Z	W			
		SLAVE AXIS		X-DIR.		Y-DIR.		Z-DIR.		×	×	○
				NONE	EXIST	NONE	EXIST	NONE	EXIST			
SLAVE STANDARD COOR.VALUE		- 99999.999 - 99999.999 (mm)				○	○	×				

GRAPH DATA Setting-List of Data Setting and Setting Range (2)

Page	Data Setting Item		Data and Area Setting		Function		
					[F1] SET	[F2] ADD	[F3] SELECT
5	Common	MANUAL FEED TRACE DRAW	EXIST	NONE	×	×	○
		RAPID FEED TRACE DRAW	EXIST	NONE	×	×	○
		CUTTING FEED TRACE DRAW	EXIST	NONE	×	×	○
		ENVELOP LINE DRAW	EXIST	NONE	×	×	○
		BLANK DRAW	EXIST	NONE	×	×	○
		TOOL DRAW	EXIST	NONE	×	×	○
		ENVELOP FIGURE PAINT	EXIST	NONE	×	×	○
6	Common	TRACE COLOR	1- 7 1: BLUE 2: GREEN 3: CYAN 4: RED 5: MAGENTA 6: YELLOW 7: WHITE		○	×	×
		ENVELOP LINE COLOR					
		BLACK COLOR					
		ANIMATION TOOL COLOR					
		GUIDANCE TOOL COLOR					
		SCALE LINE COLOR					
7	Common	FRAME MOVING UNIT IN AREA CHANGE (dot)	1 - 16 (dot)		○	○	×
		ANIMATION COMMAND OUTPUT INTERVAL (dot)	1 - 4 (dot)		○	○	×
		RATIO OF ROOM AREA IN AUTO SCALE (%)	0 - 100 (%)		○	○	×
		ANGLE CHANGE PITCH	PAN	1 - 30 (deg.)	○	○	×
			TITLE	1 - 30 (deg.)	○	○	×

Setting Method:

There are 3 types of setting methods as shown below.

(a) Using the function key [F1] (SET):

- ① Cursor keys [↑], [↓] are used to move the cursor to the data to be set.
- ② Press the function key [F1] (SET).
- ③ Input the numeric value setting.
- ④ Press the **WRITE** key.

(b) Using the function key [F2] (ADD):

- ① Cursor keys [↓], [↑] are used to move the cursor to the data to be set.
- ② Press the function key [F2] (ADD) and enter the numeric value to be added, which is selected from previously set numeric values.
- ③ Press the **WRITE** key.

(c) Using the function key [F3] (SELECT):

- ① Cursor keys [↓], [↑] are used to move the cursor to the data to be set.
- ② Press the function key [F3] (SELECT) until the data to be set is displayed.

(1) Page 1

AUTO OPERATION TEST.M11 0 N18 19

* GRAPH DATA *

SPINDLE DIRECTION **V**

0:V 1:HF 2:HL 3:HB 4:HR

ROTARY AXIS *

GRAPHIC COORDINATE NUMBER 0

GRAPHIC AREA PART

=EX
=EX
=GD
>

REGISTERED BLANK		
NO.	DIREC.	INDEX
1	V	*
2		
3		
4		
5		
6		
7		
8		
9		
10		

SET
ADD
SELECT

QUIT

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

(a) SPINDLE DIRECTION

Set the spindle direction used for animation by entering a numeric value 0 - 4.

Function key to use: [F1] (SET)

Note: For machine models which do not have a swivel head, the cursor does not move.

(b) ROTARY AXIS

Set the axis name and angle of the rotary axis for which animation occurs. If a (*) setting is made, the rotary axis is ignored.

Input example: A230

Animation occurs only when A-axis is at 230° position.

Function key to use: [F1] (SET)

Note: When there is no rotary axis, the cursor does not move.

(c) GRAPHIC COORDINATE NUMBER

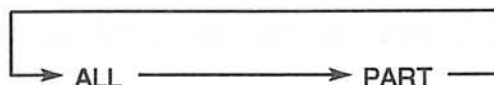
The graphic coordinate system's zero point offset value is designated by the blank coordinate system's offset value number.

Function key to use: [F1] (SET)

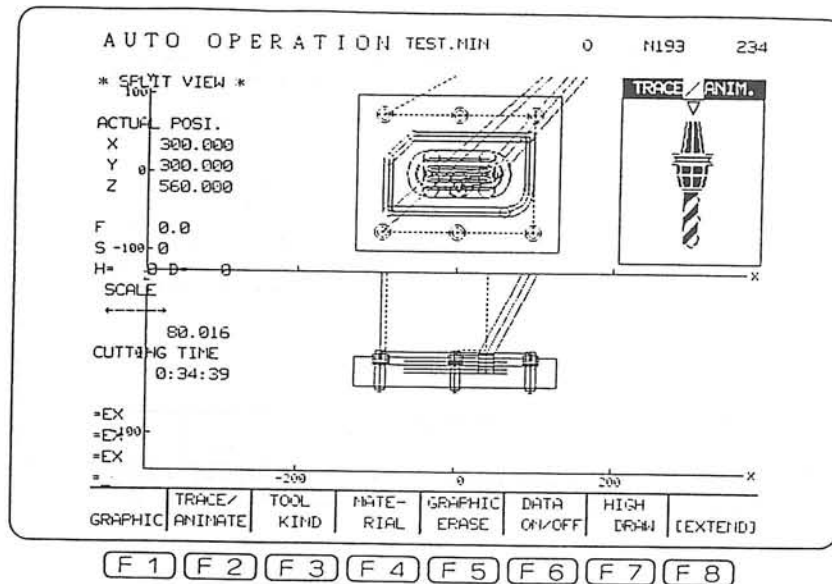
(d) GRAPHIC AREA

Designate whether the graphic display area on the CRT is to consist of ALL or PART of the data display column.

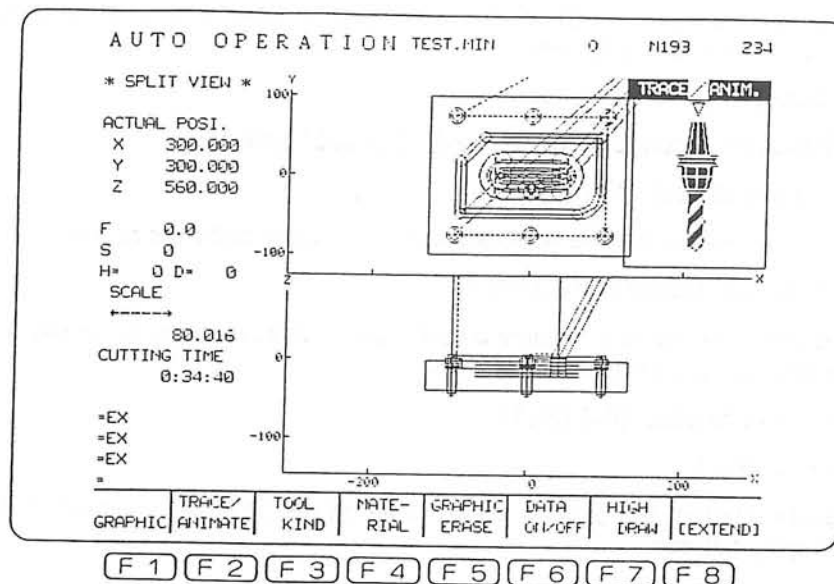
Function key to use: [F3] (SELECT)



ALL (includes graphic data display area)



PART (graphic display area only)



Note: If the graphic area has been designated as PART, data ON/OFF will not be effective.

(2) Page 2

SPLIT VIEW Setting Data

AUTO OPERATION TEST.MIN
0 N22 23

* PLANE SELECT *

PLANE 4

DIVIDING RATIO 50

≡HD
≡EX
≡GD
>

1

4

2

3

SET
ADD
SELECT

QUIT

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

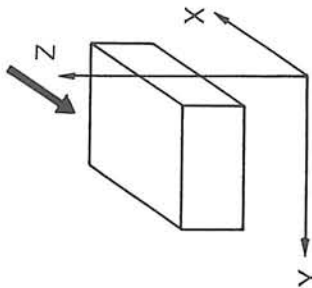
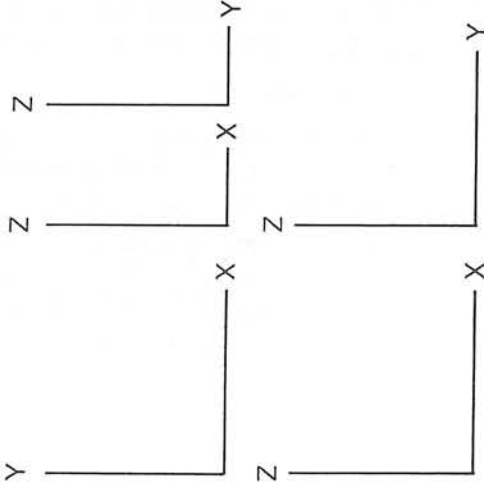
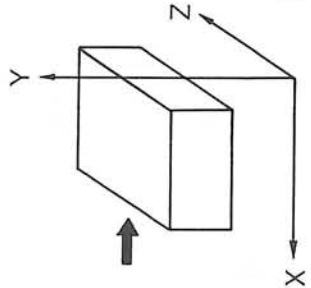
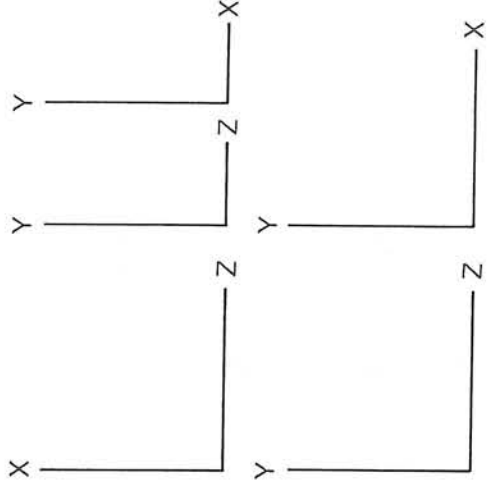
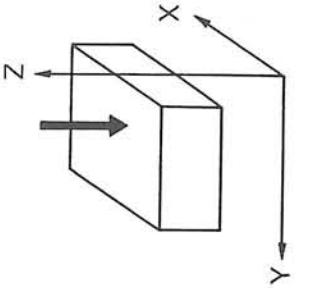
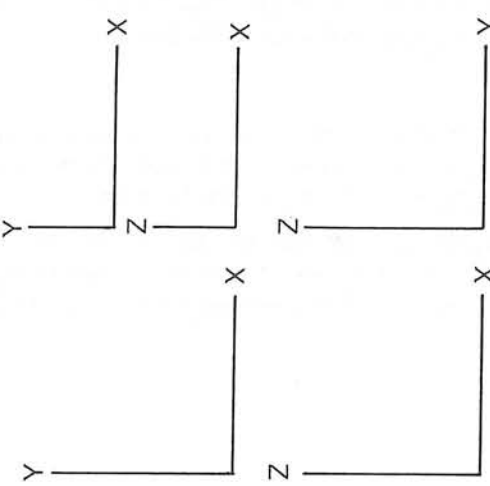
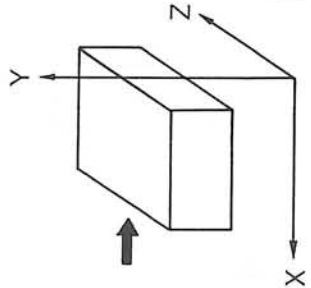
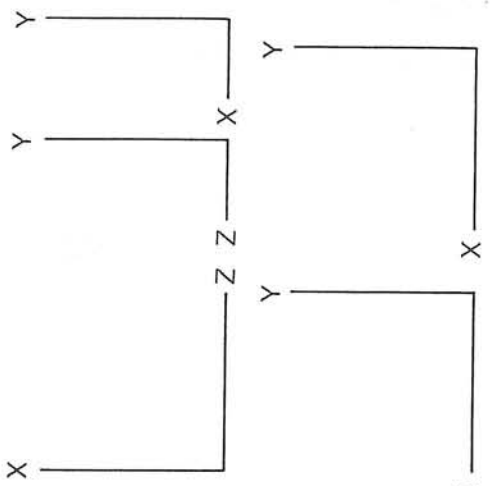
(a) PLANE

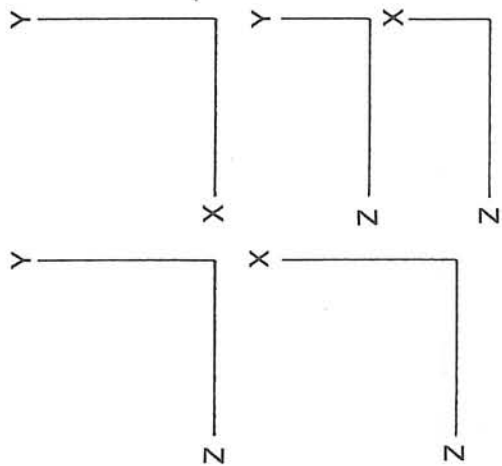
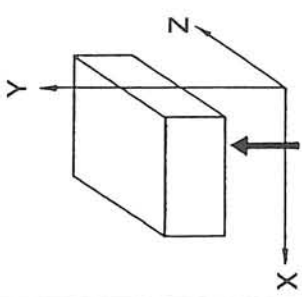
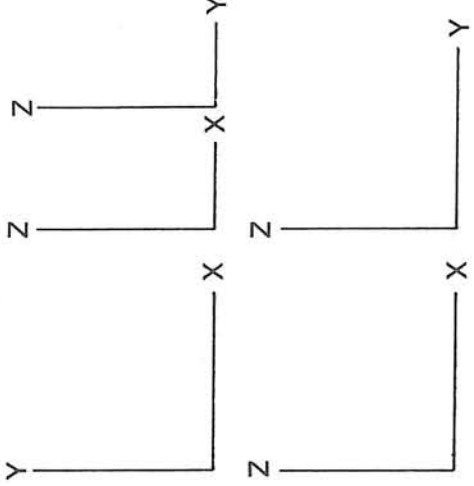
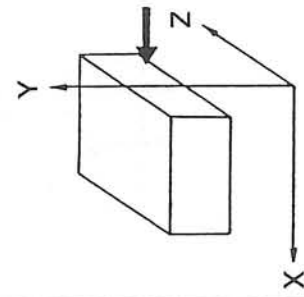
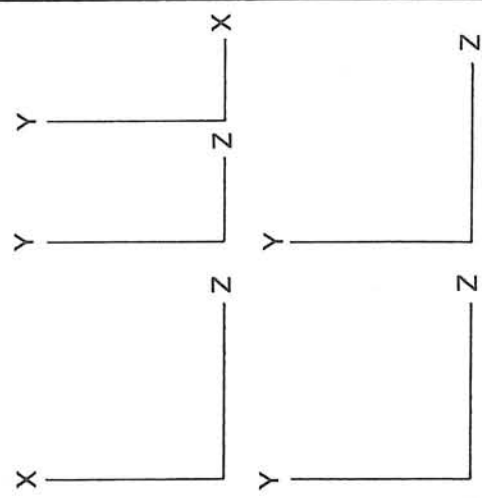
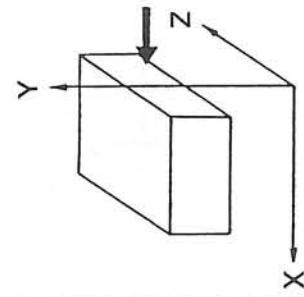
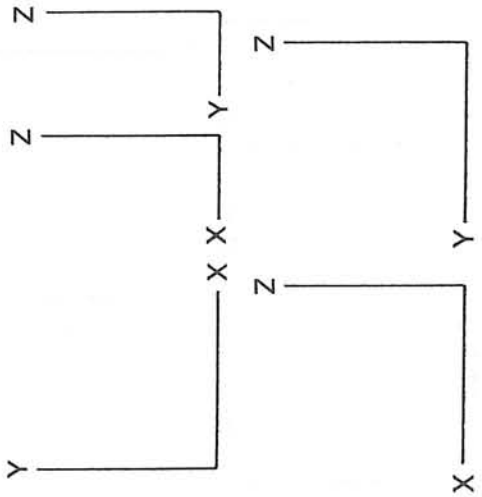
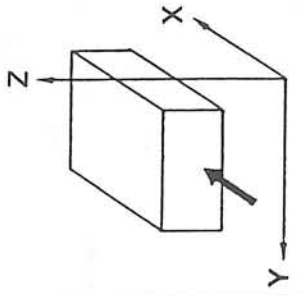
The plane to be displayed is designated by the menu number. The following displays are possible: Front face, plane, side face 1-plane display, and 2-plane display.

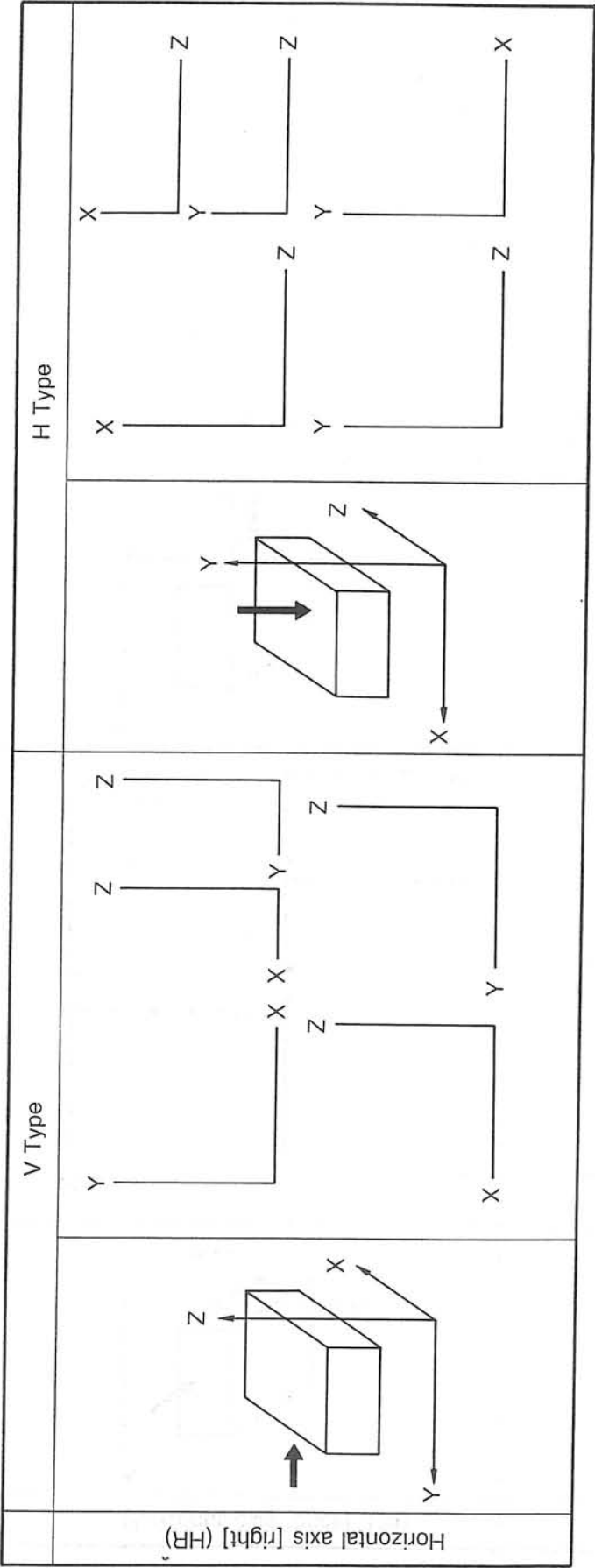
(b) DIVIDING RATIO

When the 2-plane display is designated as the PLANE (item a)), the relative proportions of the display areas for the 2 planes must be designated. This setting value will be the vertical plane display ratio for the spindle position in relation to the entire display area.

Note: The graphic plane menu diagrams are different for the 'H type' and 'V type' models. For both models, there are 5 types of diagrams depending on the page 1 SPINDLE DIRECTION setting. On the following pages, all 10 of these diagrams are shown.

Horizontal axis [front] (HF)				
Vertical axis (V)				
	V Type	H Type		

H Type		V Type	
			
			
Horizontal axis [left] (HL)		Horizontal axis [back] (HB)	



SOLID VIEW Display Setting Data

AUTO OPERATION TEST.MIN 0 N22 23

* PROJECTION ANGLE DATA *

PAN AP 60

TILT AT 40

=GD
>S 60
>S 40
>

SET	ADD	SELECT				QUIT
-----	-----	--------	--	--	--	------

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

The direction of the line of vision for parallel projection is designated by the PAN and TILT settings.

(a) PAN

Indicates the angle from the X-axis, above the horizontal plane.

0° - 359°

(b) TILT

Indicates the angle from the horizontal plane.

-89° - 89°

(3) Page 3

AUTO OPERATION TEST.MIN 0 N22 23

* AREA DATA * 0.001mm

CENTER	CX	0.000	Y AY CY CX	X AX CY CX
	CY	0.000		
	CZ	0.000		
WIDTH	AX	250.000	Z AZ CY CX	Y AY CY CX
	AY	250.000		
	AZ	250.000		
PAGE LIMIT	EXIST			

*GD
/O
*GD
>

SET	ADD	SELECT			QUIT
-----	-----	--------	--	--	------

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

Although the display format is the same regardless of whether entered from SPLIT VIEW or SOLID VIEW display, the data values will be different.

(a) CENTER

The center screen coordinate values for graphic display are designated by the X, Y, Z settings. The graphic coordinate system values are set by the X, Y, Z settings.

Function key to use : [F1] (SET)

Setting range : -9999.999 - 9999.999 mm

(b) WIDTH

With the graph center value as the central point, the graph display width (area) is designated by the X, Y, Z settings.

Function key to use : [F1] (SET)

Setting range : 4.000 - 9999.999 mm

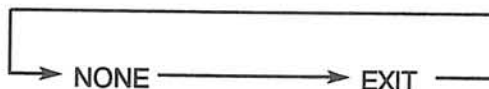
(c) PAGE LIMIT

EXIST : Data setting beyond page 4 (5 - 7) is impossible.

NONE : Data setting beyond page 4 (5 - 7) is possible.

Function key to use: [F3] (SELECT)

Limit EXIST/NONE switching occurs each time the function key [F3] (SELECT) is pressed.



(4) Page 4

AUTO OPERATION TEST.MIN		0	N22	23
* GRAPH DATA *				
	X-DIR.	Y-DIR.	0.001mm	
MASTER	X	Y	Z	
SLAVE AXIS	NONE	NONE	NONE	
SLAVE STANDARD COOR. VALUE	10000.000	0.000	0.000	

>Q
=GD
>SL
>

SET
ADD
SELECT

QUIT

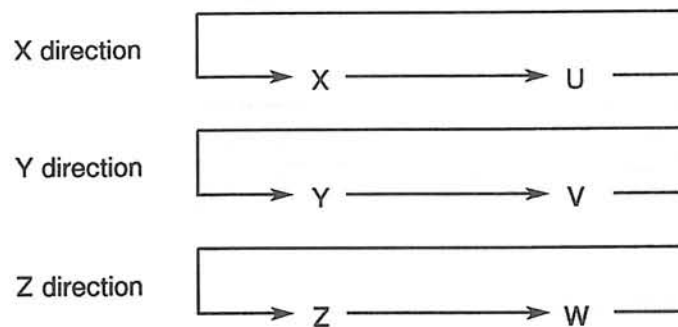
[F 1]
[F 2]
[F 3]
[F 4]
[F 5]
[F 6]
[F 7]
[F 8]

(a) MASTER

When equipped with an additional parallel axis, the axis where animation is to occur must be designated. This will be the master axis and the other axis is the slave axis. For example, if the W-axis is designated as an additional parallel axis, either the Z-axis coordinate value or the W-axis coordinate value must be designated for Z direction animation.

For directional data where there is no additional parallel axis, the cursor does not move.

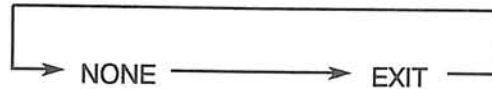
Each time the function key [F3] (SELECT) is pressed, the designation changes for X, Y, and Z directions as follows:



(b) SLAVE AXIS

To incorporate the coordinate values of both axes (when an additional parallel axis exists) into the animation coordinates, the EXIST setting is designated. If this is not desired, the NONE setting is designated. For directional data with no additional parallel axis, the cursor does not move.

Each time the [F3] (SELECT) function key is pressed, the setting will change for X, Y, and Z directions as follows:



(c) SLAVE STANDARD COOR. VALUE

When the master/slave axis combination designation is EXIST, the standard coordinate value for the slave axis must be set. For directional data with no additional parallel axis, the cursor does not move.

(5) Page 5

AUTO OPERATION TEST.MIN		0	122	23
* GRAPH DATA *				
MANUAL FEED TRACE DRAW	EXIST			
RAPID FEED TRACE DRAW	EXIST			
CUTTING FEED TRACE DRAW	EXIST			
ENVELOP LINE DRAW	EXIST			
BLANK DRAW	EXIST			
TOOL DRAW	EXIST			
ENVELOP FIGURE PAINT	EXIST			
>D =GD >SL >				
SET	ADD	SELECT		QUIT
F 1	F 2	F 3	F 4	F 5 F 6 F 7 F 8

(a) MANUAL FEED TRACE DRAW

Manual cutting feed and manual rapid feed trace drawing EXIST/NONE designation is made.

EXIST: A dashed line (— — —) will be displayed.

(b) RAPID FEED TRACE DRAW

Rapid feed trace drawing EXIST/NONE designation is made.

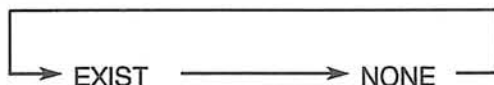
EXIST: A dotted line (- - - - -) will be displayed.

(c) CUTTING FEED TRACE DRAW

Cutting feed trace drawing EXIST/NONE designation is made.

EXIST: A solid line (———) will be displayed.

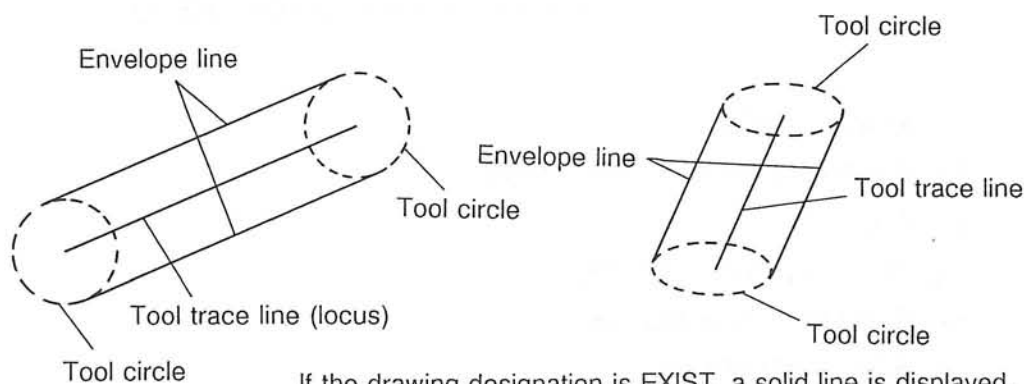
Function key to use: [F3] (SELECT)



(d) ENVELOP LINE DRAW

Envelope line drawing EXIST designation is made.

EXIST: A solid line (———) is displayed.



If the drawing designation is EXIST, a solid line is displayed.

(e) BLANK DRAW

Drawing EXIST/NONE designation is made for the material which has been defined.

(f) TOOL DRAW

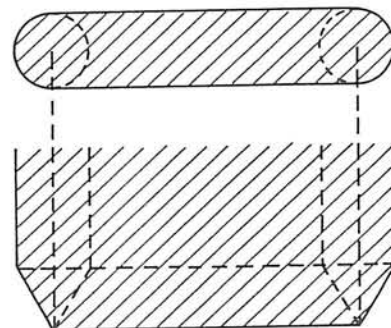
Animated tool and tool kind drawing EXIST designation are made.

EXIST: The animated tool will be drawn at the graphic animation display area, and the tool kind will be drawn at tool kind display area of the screen.

(g) ENVELOP FIGURE PAINT

Envelope figure paint drawing EXIST designation is made.

EXIST: The envelope figure will be drawn when the animated tool passes across the area of the blank which is drawn. For the area of the material not drawn, envelope line (item c)) drawing will occur.



(6) Page 6

A U T O O P E R A T I O N T E S T . M I N		0	N22	23
* GRAPH DATA *				
TRACE COLOR	MAGENTA			
ENVELOP LINE & FIGURE COLOR	BLUE	1. BLUE		
		2. GREEN		
BLANK COLOR	YELLOW	3. CYAN		
		4. RED		
ANIMATION TOOL COLOR	CYAN	5. MAGENTA		
		6. YELLOW		
GUIDANCE TOOL COLOR	CYAN	7. WHITE		
SCALE LINE COLOR	WHITE			
>0 =GD >SL >				
SET	ADD	SELECT		QUIT
F 1	F 2	F 3	F 4	F 5
F 6	F 7	F 8		

- (a) TRACE COLOR
- (b) ENVELOP LINE & FIGURE COLOR
- (c) COLOR
- (d) ANIMATION TOOL COLOR
- (e) GUIDANCE TOOL COLOR
- (f) SCALE LINE COLOR

Each of the above colors must be designated.

Function key to use: [F1] (SET)

Select the color by entering a numeric value 1 - 7.

(7) Page 7

```

AUTO OPERATION TEST.MIN      0      122      23

      * GRAPH DATA *

FRAME MOVING UNIT IN AREA CHANGE (dot)  4
ANIMATION COMMAND OUTPUT INTERVAL (dot)  2
RATIO OF ROOM AREA IN AUTO SCALE (%)    20
ANGLE CHANGE PITCH      PAN      5
                        TILT      5

>Q
>GD
>SL
>

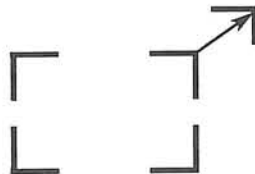
```

SET	ADD	SELECT				QUIT
-----	-----	--------	--	--	--	------

(a) FRAME MOVING UNIT IN AREA CHANGE (dot)

For area change (explained later), the distance which the scale frame is moved is designated by pressing the [P ↑], [P ↓] keys.

Distance is designated by dot units.



Movement is designated by number of dots.

(b) ANIMATION COMMAND OUTPUT INTERVAL (dot)

The details of movement during animation is designated by the distance (dot units) of the tool position's nose movement on the CRT.

(c) RATIO OF ROOM AREA IN AUTO SCALE (%)

The surplus area of the graph format is designated here (explained later) in proportion to the blank.

(d) ANGLE CHANGE PITCH

The amount of rotation (degrees) which occurs each time the cursor key is pressed, is designated here.

2-2-8. Auto Scale

The auto scale function determines the graphic area in which the blank is drawn automatically.

The auto scale function is as follows:

- (1) A registered blank search occurs (beginning with lowest registered number) for the blank with conditions which match the spindle direction and rotary axis settings of the GRAPH DATA.

When the blank is found, the graph area is automatically calculated according to the blank data.

Graph area setting is made after the graphic screen is erased. At this time, a GRAPH DATA setting can be made for the surplus area around the blank. This setting is made as a percentage of the blank area.

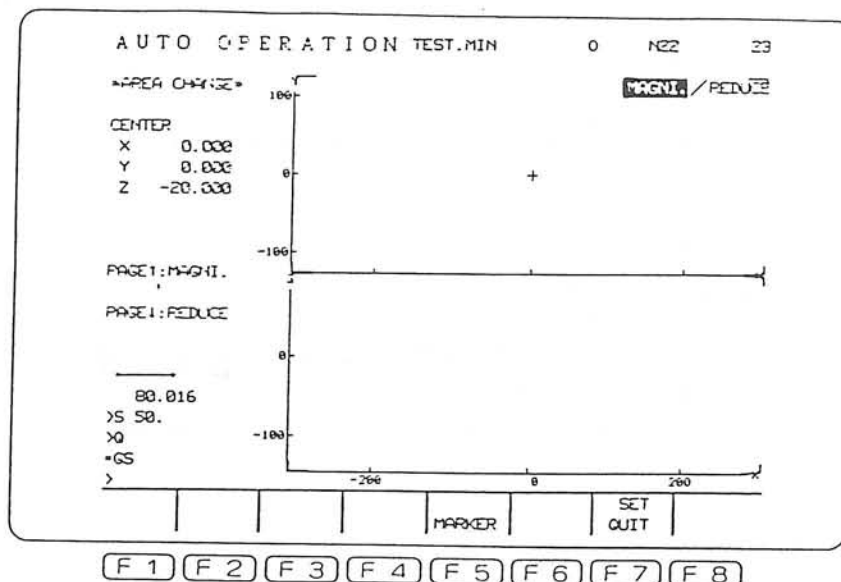
- (2) The auto scale function is only effective for the data which is displayed while auto scale is being executed.
- (3) If no registered blanks with the appropriate settings are found, a no blank data ERROR will occur.

2-2-9. Area Change

Area change for the Graph Data area is determined while viewing the graphic display. The area change mode can be entered from either the SPLIT VIEW or SOLID VIEW displays. If entered from the SOLID VIEW display, the SOLID VIEW display area will be determined. If entered from the SPLIT VIEW display, the SPLIT VIEW display area will be determined.

(1) SPLIT VIEW Area Change

Area change is executed by using the page keys and the cursor keys to move the scale frame (☐ ☐) and the marker (+).



(a) Page key [P ↑] : → Magnify (screen format range is enlarged)

Page key [P ↓] : → Reduce (screen format range is reduced)

With the marker (+) as the center point, the scale frame will be magnified or reduced each time the respective page key is pressed. If the page key is pressed continuously, magnification or reduction will be continuous.

Note: The existing area can be enlarged by up to 10 times, but drawing will not occur below 4.000 mm. The existing area can be reduced to 1/10th, but drawing will not occur above 9999.999 mm.

(b) Cursor keys [↑] [↓] [←] [→]

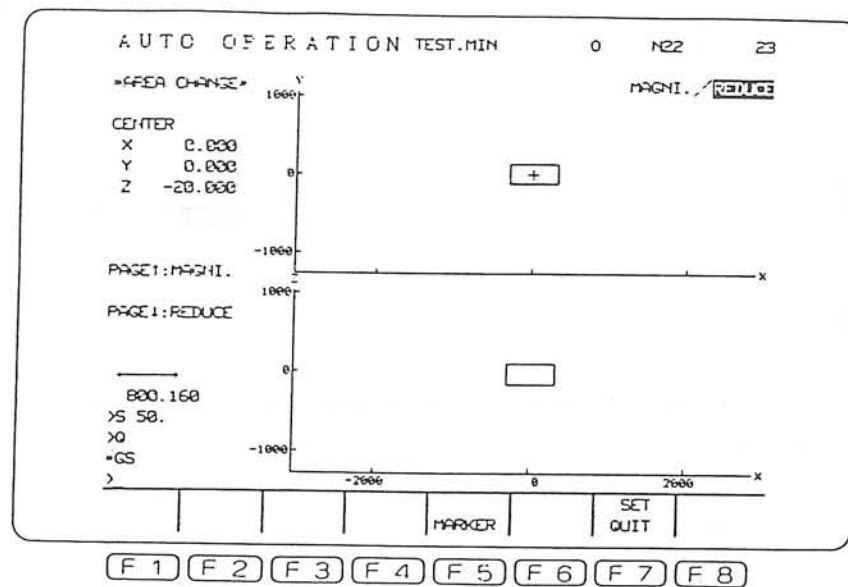
These keys are used to determine the center of the graph format. When a cursor key is pressed, the scale frame will move (with the marker (+) as its center point) in the direction indicated by the arrow on the key. If the key is pressed continuously, movement will be continuous.

Note: The distance which the scale frame moves each time the cursor key is pressed is designated by the GRAPH DATA setting (FRAME MOVING UNIT IN AREA CHANGE (dot)).

(c) Function key [F5] (MARKER) [View point maker]

For 2-plane SPLIT VIEW display, area change occurs between planes $XY \leftrightarrow XZ$, or between planes $ZY \leftrightarrow XY$ by using this function key. If the marker is at the side face, it will move to the flat face (plane), and if it is at the flat face (plane), it will move to the side face.

(d) Reduction to 1/10th

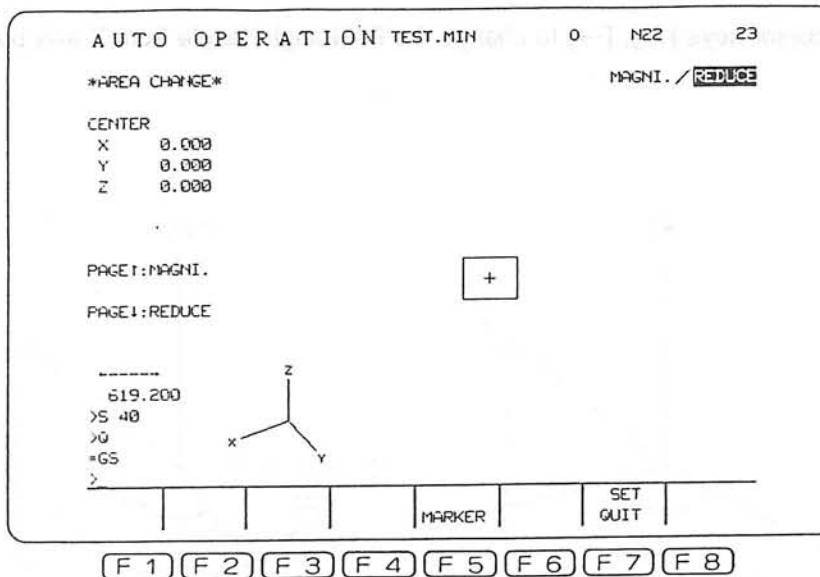
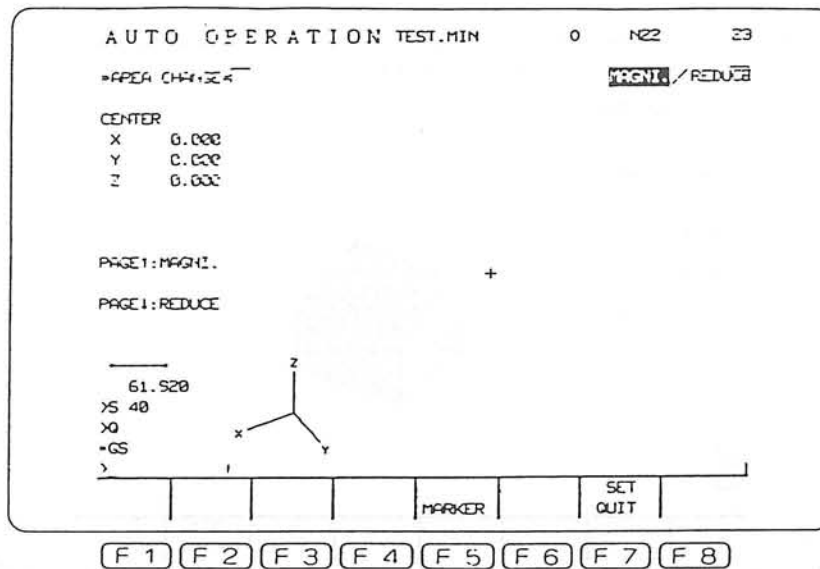


(e) Function key [F7] (SET QUIT)

Area change is completed by pressing this key. With the marker as the center point, the area enclosed by the scale frame will be the designated graph data area.

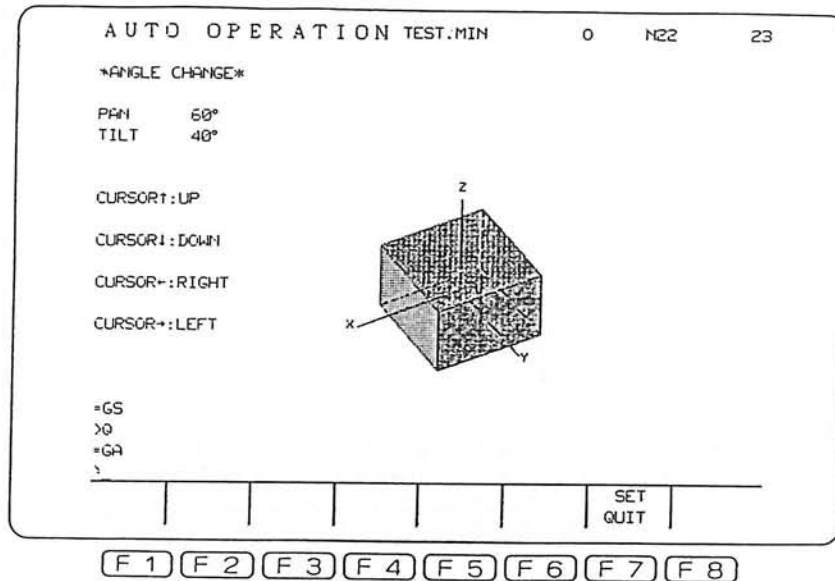
(2) SOLID VIEW Area Change

SOLID VIEW area change is identical to SPLIT VIEW area change except that the function key [F5] (MARKER) is ineffective.

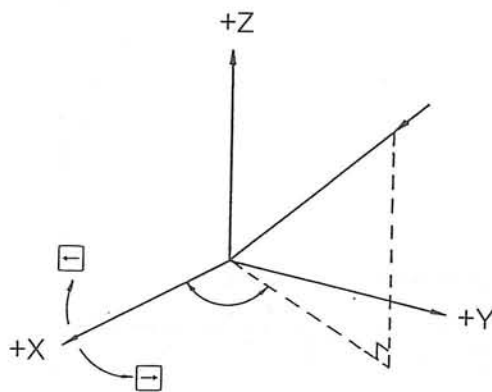


2-2-10. Angle Change

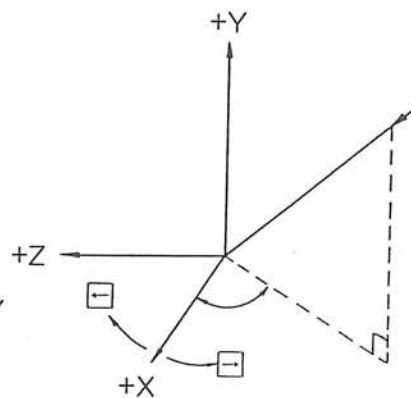
The direction setting for the projection angle is made while viewing the graphic display of the SOLID VIEW model. Rotate the model until the desired projection angle is achieved. This function is not effective during SPLIT VIEW drawing.



- (1) Use the cursor keys [←], [→] to change the PAN angle (angle from X-axis positive direction).

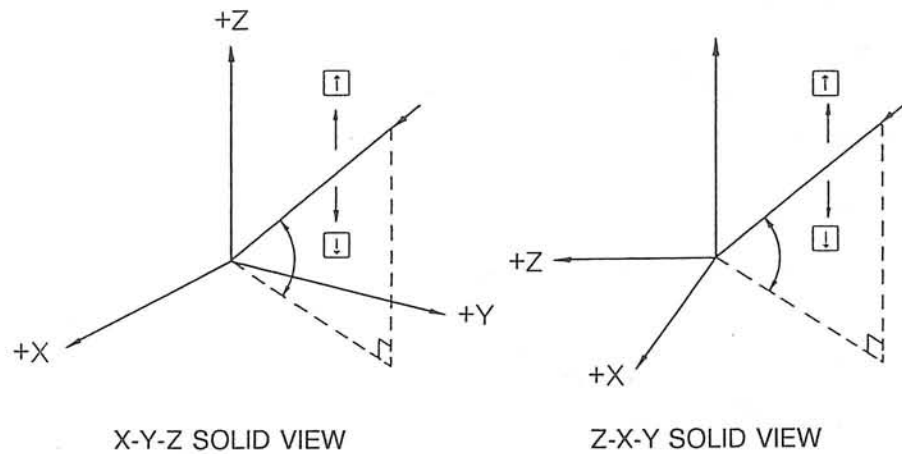


X-Y-Z SOLID VIEW

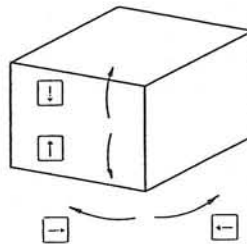


Z-X-Y SOLID VIEW

- (2) Use the cursor keys [↑], [↓] to change the TILT angle (angle from horizontal plane).



- (3) Use cursor keys to move the projection angle model.



- (4) Function key [F7] (SET QUIT)

When this function key is pressed, the projection angle change is completed.

Note: The amount of angle increase/decrease each time the cursor key is pressed is determined by the GRAPH DATA setting (ANGLE CHANGE PITCH).

2-2-11. Blank Definition Function (Blank Define)

(1) Function Summary

This function defines the blank contour which is used for animation, and creates new part program files for the UGC command configuration.

(2) Condition Transition Chart

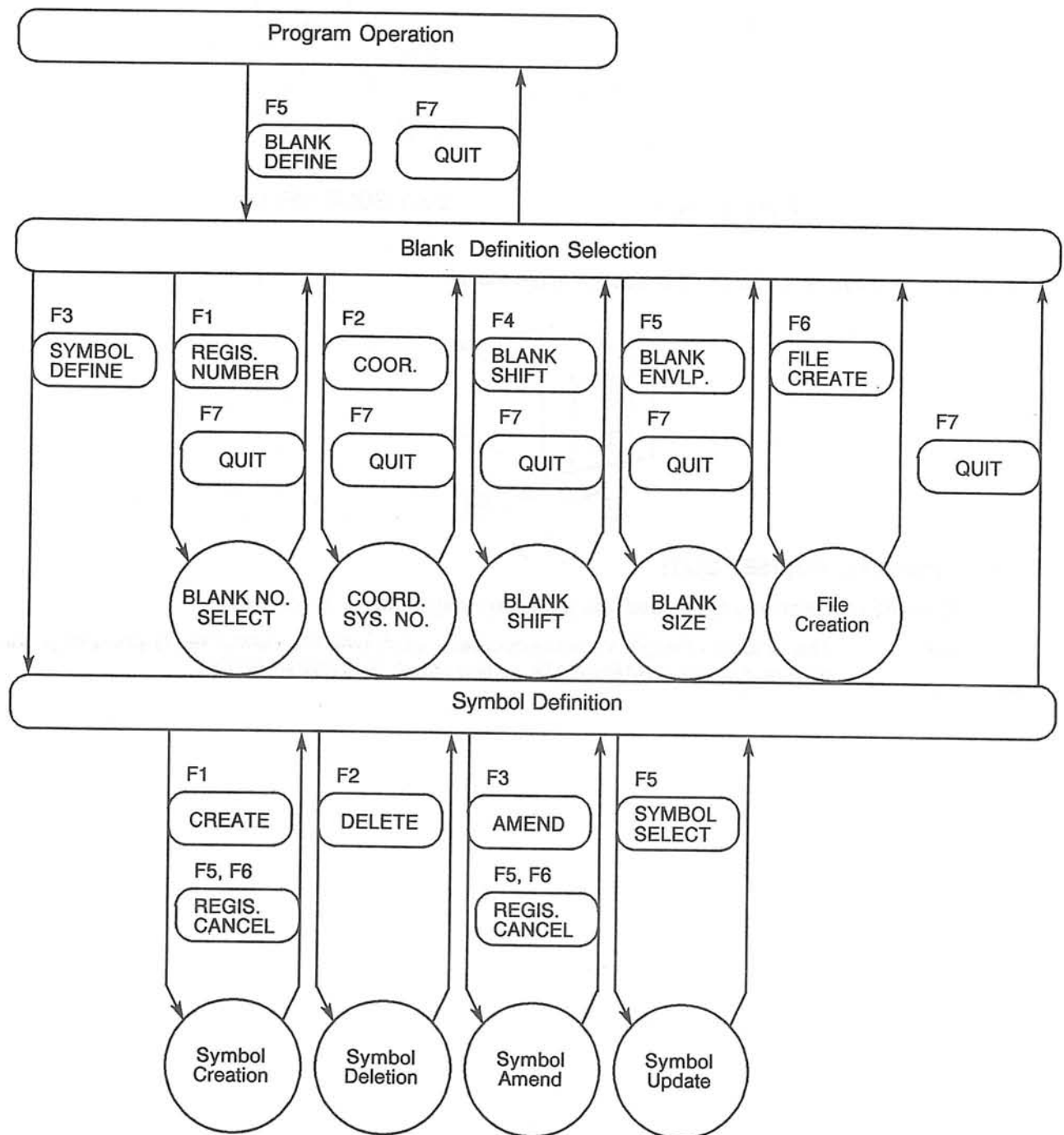


Fig. 4-7 Blank Definition Condition Transition Chart

(3) Explanation of Each Function

When the function key [F5] (BLANK DEFINE) is pressed while in the PROGRAM OPERATION mode, the on-screen display will be as shown in Fig. 4-8.

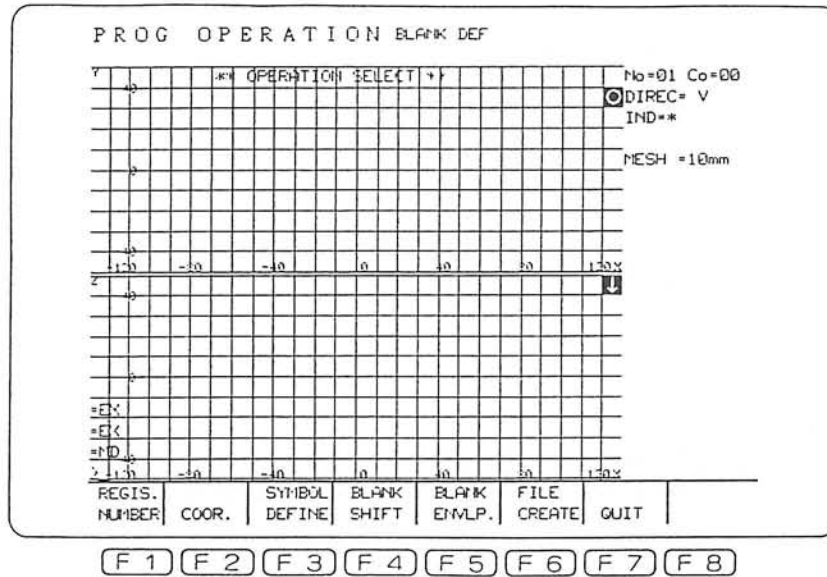
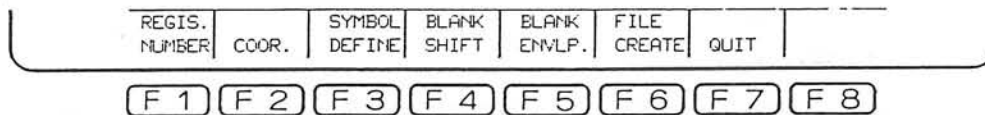


Fig. 4-8 Initial Display for Black Definition

The following pages will explain the use of each function key (shown below) which is used in the blank definition process.



(4) Register No. selection

When the function key [F1] (REGIS. NUMBER) is pressed, the on-screen display will be as shown in Fig. 4-9.

PRG OPERATION BLANK DEF

** BLANK No. SELECTION ** P-AXIS:* PAGE 1/1

! No.	DIREC	INDEX	COORDINATE SYSTEM No.
1	V	* 00	
2	V	* 00	
3	V	* 00	
4	V	* 00	
5	V	* 00	
6	V	* 00	
7	V	* 00	
8	V	* 00	
9	V	* 00	
10	V	* 00	

*EX
*MD
>EN

Select a registration number.

REGIS. NUMBER	COORD.	SYMBOL DEFINE	BLANK SHIFT	BLANK ENMLP	FILE CREATE	QUIT

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

Fig 4-9 Register No. Selection Display

(a) Function

Selection of blank register number and setting of blank conditions.

(b) Setting procedure

As the initial values for blank conditions, the following have been set for register No. 1 - 10.

DIREC: V

INDEX: *

- ① Use the cursor keys [↑], [↓] to move the cursor to the selected register No. position, and then press the **WRITE** key.

- ② The following data will be displayed on the console line:

O:V_1:HF_2:HL_3:HB 4:HR___O:V!

Enter the numeric values for the desired spindle direction.

Note 1: If the present settings for the spindle direction are to be used without changes, press the **WRITE** key.

Note 2: When swivel head compensation is not used, a message is not displayed.

③ Next, the following message will be displayed on the console line:

*: No specified index Index * !

At this point, enter the cutting face angle setting, then press the **WRITE** key. Setting data can be either [*], or [0 - 359] face angle numeric value. (If there are multiple rotary axes, enter the axis name at the beginning of the face angle setting. Ex.: B190)

*Note 1: If the present setting for the face angle is to be used without changes, press the only **WRITE** key.*

Note 2: If there is no rotary axis, message is not displayed.

④ On-screen display returns to that shown in Fig. 4-8.

(5) Coordinate system

When the function key [F2] (COOR.) is pressed, the on-screen display will be as shown in Fig. 4-10.

PROG OPERATION BLANK DEF

** CORD. SYS. DESIG. ** No:01 DIREC: V IND:* PAGE 1/1

COORD.SYS.No. = 0

00

0:V 1:HF 2:HL 3:HB 4:HR

Spindle direction D:V

>CO

SET COPY DELETE QUIT

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

Fig. 4-10 Coordinate System Selection Display

(a) Function

Coordinate system number setting and selection.

SET COPY DELETE QUIT

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

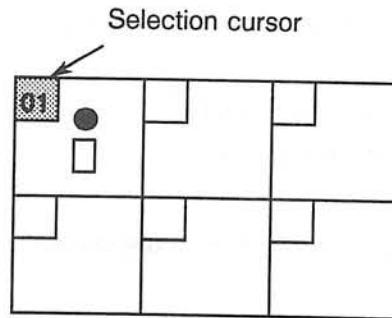
SET: The coordinate system number is set at the position the selection cursor indicates.

(b) Setting procedure for coordinate system number

① Setting a new coordinate system number

Setting example:

Coordinate System No. = 1



Coordinate System No. = 2

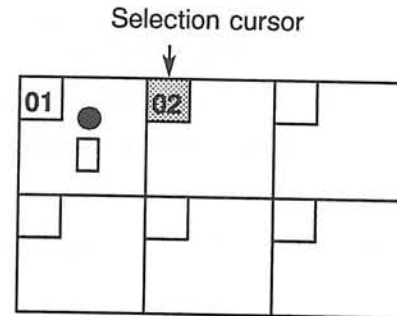


Fig. 4-11 Blank Symbol Register (Ex. 1)

- The selection cursor is located at coordinate system No.1 where the symbol for a cylindrical blank is registered (left diagram above).
- A new selection is desired at coordinate system No. 2.
- Press the cursor key [→] to move the selection cursor to the next setting area (right diagram above).
- Press the function key [F1] (SET), enter the numeral '2', and press the **WRITE** key to make the coordinate system No. 2 setting.
- With the selection cursor still at this position, press the function key [F7] (QUIT) to complete the coordinate system setting.

② Selecting from previously set coordinate system numbers.

Setting example:

Coordinate System No. = 01

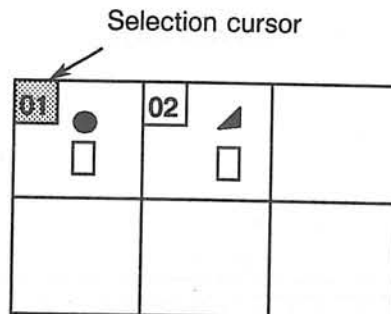


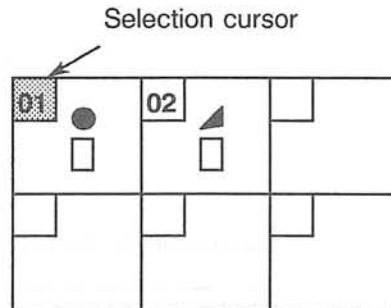
Fig. 4-12 Blank Symbol Register (Ex. 2)

- The symbol for a cylindrical blank is registered at coordinate system No. 1. The symbol for a triangular blank is registered at coordinate system No. 2.
- Coordinate system No. 2 setting is desired.
- If the selection cursor location is as shown in Fig. 4-12, press the cursor key [→] to move the selection cursor to the coordinate system No. 2 position.
- Press the function key [F7] (QUIT) to designate the coordinate system No. 2 setting.

③ Changing previously set coordinate system number

Example of setting change:

Coordinate System No. = 01



Coordinate System No. = 03

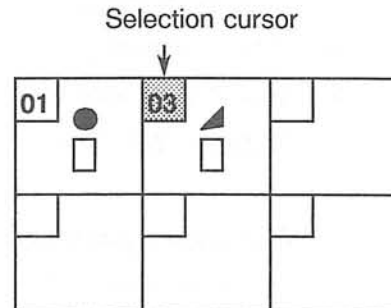


Fig. 4-13 Blank Symbol Register (Ex.3)

- The symbol for a cylindrical blank is registered at coordinate system No. 1. The symbol for a triangular blank is registered at coordinate system No. 2.
- The coordinate system No. 2 setting is to be changed to No. 3.
- The cursor is located as shown in the left diagram of Fig. 4-13.
- Press the cursor key [→] to move the cursor to the next setting area.
- Press the function key [F1] (SET), enter the numeral '3', and press the **WRITE** key to make the setting.
- Press the function key [F7] (QUIT) to complete the coordinate system No. 3 setting.

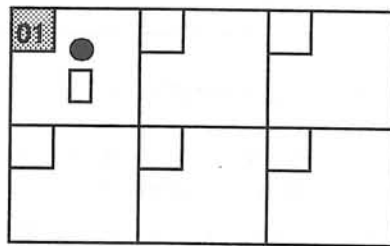
COPY: The copy function permits copying of the registered symbol data for coordinate system No. m (integer: $0 \leq m \leq 50$), to coordinate system No. n (integer: $0 \leq n \leq 50$). However 'm' and 'n' must not be the same.

< < Procedure > >

Copying the blank register data from coordinate system No. 1 to coordinate system No. 2:

- 1) Press the function key [F5] (COPY).
- 2) Enter the numeral '1'.
- 3) Enter a comma (,).
- 4) Enter the numeral '2'.
- 5) Press the **WRITE** key.

Coordinate System No. = 01



Coordinate System No. = 01

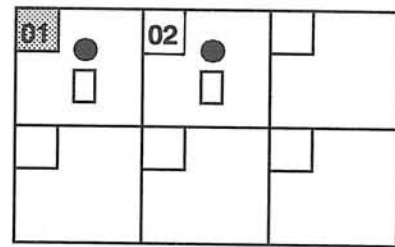


Fig. 4-14 Example of COPY Function

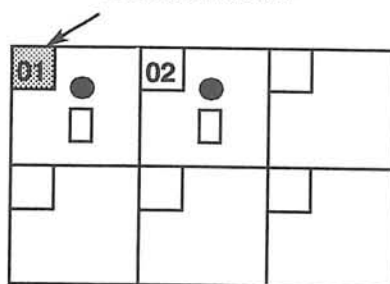
A maximum of 32 blank symbols can be registered for each register number. If the number of blank symbols exceeds 32, , copying cannot occur. The copy function will overwrite any blank symbols previously registered for that coordinate system No., and the copied symbol will be effective.

DELETE: The delete function is designated by the function key [F6] (DELETE).

When this key is pressed, the blank data of the coordinate system No. indicated by the selection cursor will be deleted. Although the blank data is deleted, the coordinate system No. remains unchanged.

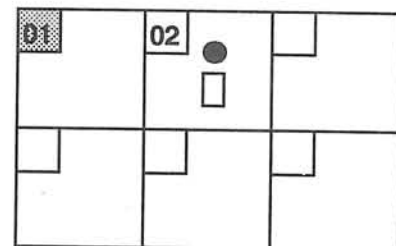
Coordinate System No. = 01

Selection cursor



(Before Deletion)

Coordinate System No. = 01



(After Deletion)

Fig. 4-15 Example of DELETE Function

< <Procedure> >

To delete the blank symbol data registered at coordinate system No. 1, use the cursor key to move the selection cursor to the coordinate system No. 1 location. Then press the function key [F6] (DELETE). At this time, the following message will be displayed.

Blank data delete OK (Y/N) !

[Y] Deletes the blank symbol data.

[N] Does not delete the blank symbol data.

QUIT: Press the function key [F7] (QUIT). When this key is pressed, the coordinate system indicated by the selection cursor will be designated as the blank shape (symbol) definition coordinate system No., and setting is completed.

(6) Symbol definition

When the function key [F3] (SYMBOL DEFINE) is pressed, the on-screen display will be as shown in Fig. 4-16.

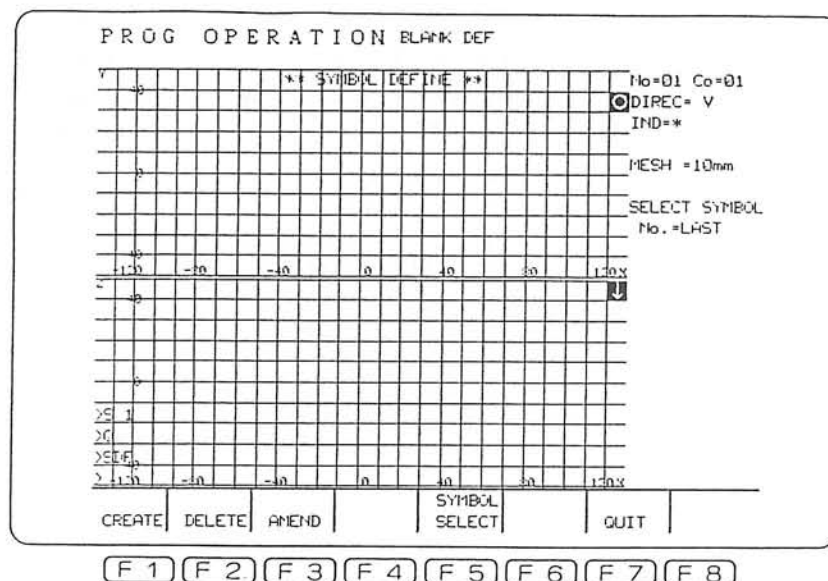


Fig. 4-16 Initial Display for SYMBOL DEFINE

(a) Function

This is the function for symbol definition. The blank shape is defined by combinations of these symbols.

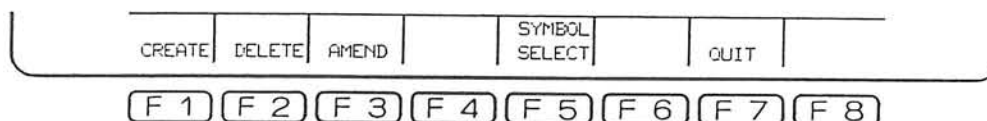
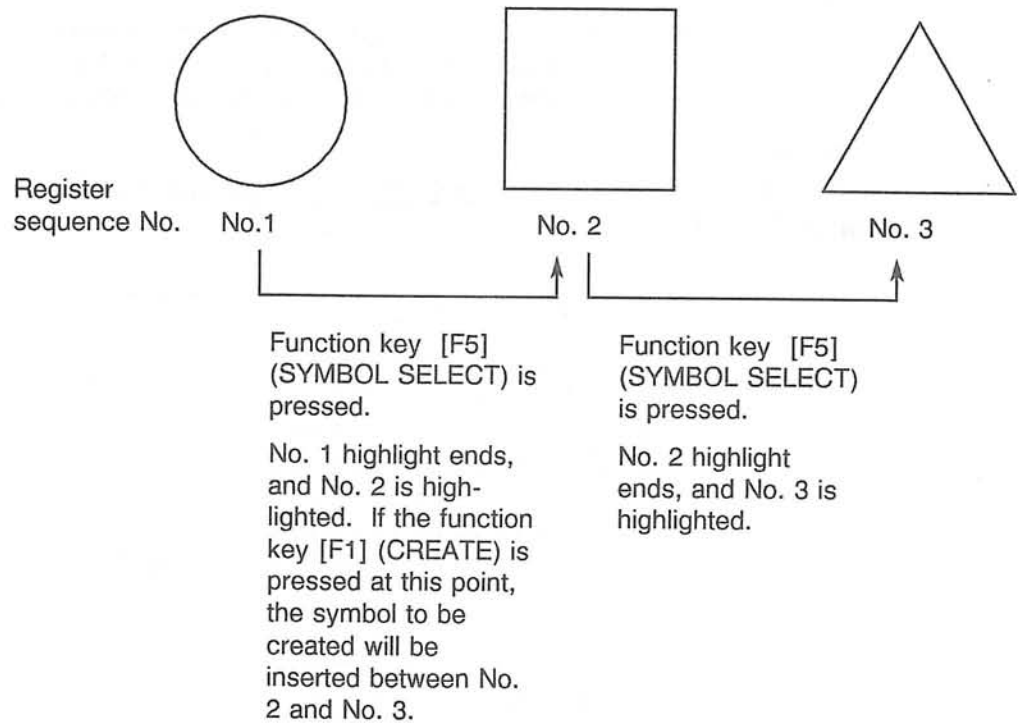


Fig. 4-17 Initial Function for SYMBOL DEFINE Setting Procedure

(b) Setting procedure

- ① At the initial display for SYMBOL DEFINE (Fig. 4-16), press the function key [F5] (SYMBOL SELECT). The function key [F5] (SYMBOL SELECT) moves the pointer through the symbol register sequence. Each time this key is pressed, the pointer proceeds to the next symbol, and that symbol is highlighted. Normally the pointer is located at the end of the register sequence.



- ② At the initial display for SYMBOL DEFINE (Fig. 4-16), press the function key [F1] (CREATE).

Fig. 4-18 shows the symbol select display. First, the symbol shape is determined. Use the cursor key to move the pointer to the desired pattern, selected from among the 8 patterns displayed at the left side of the screen. With the pointer at the desired pattern, press the **WRITE** key, and this pattern is selected.

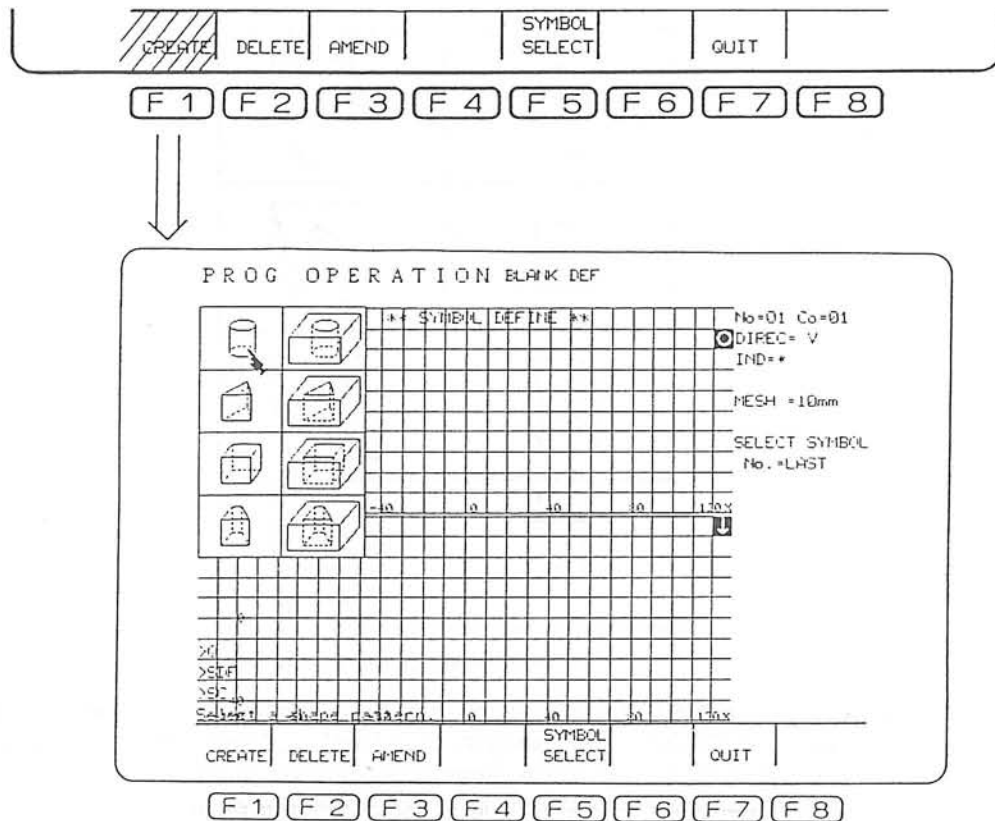


Fig. 4-18 SYMBOL CREATE Function of Symbol Select Display

Note: The blank symbol patterns shown at the left side of the Fig. 4-17 are as follows:

The left column represents the 'plus' area.

The right column represents the 'minus' area.

From top to bottom, the right column patterns are:

minus cylinder, minus triangular pole, minus quadrilateral, minus arbitrary quadrilateral, and the left column patterns area: cylinder, triangular pole, quadrilateral, arbitrary quadrilateral.

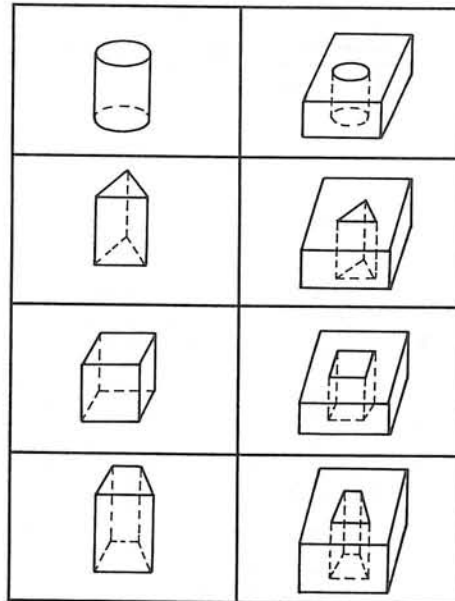
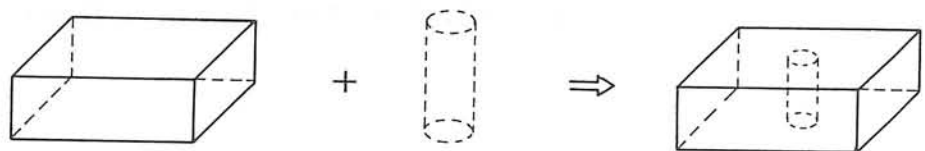


Fig. 4-19 Blank Symbol Patterns

The 'plus' area is the area which has actual existence. The 'minus' area does not have actual existence. For example, if a blank definition consisting of a cylinder shaped opening in the center of the rectangular parallelopiped shown below is desired, a quadrilateral pattern is combined with a minus cylinder pattern.



Rectangle

Minus Cylinder

- ③ With the blank shape determined, the next step is to determine the blank position and size.

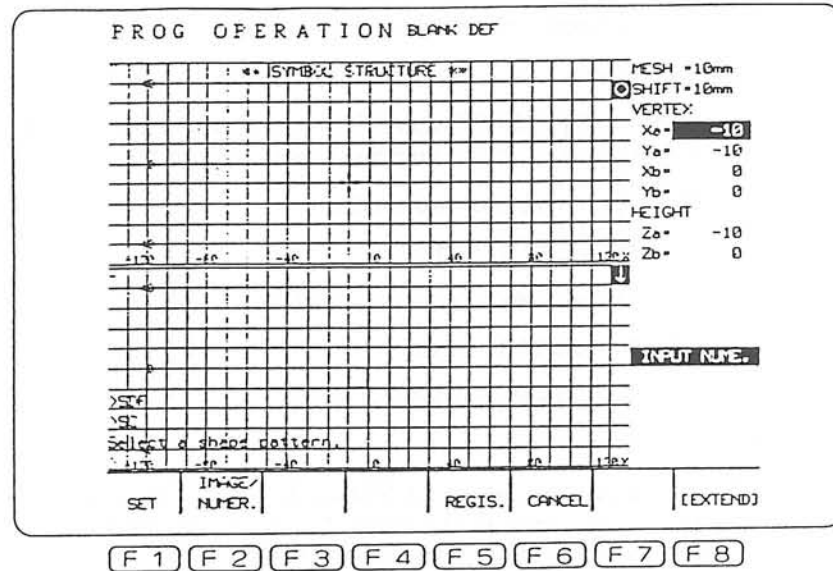


Fig. 4-20 Symbol Creation, Position, Size Setting Display

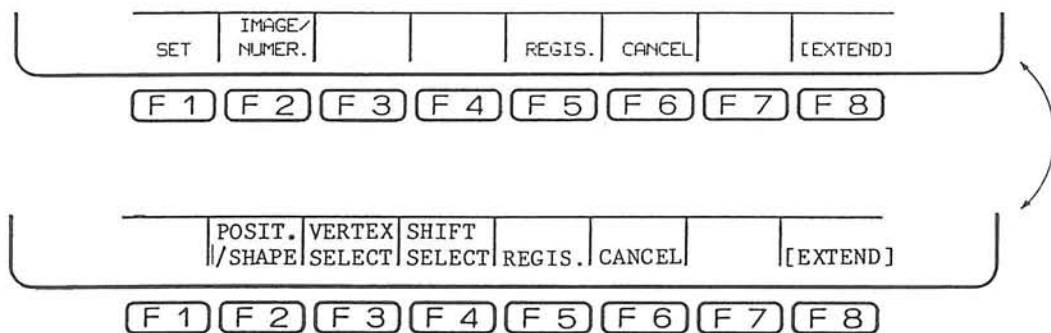


Fig. 4-21 Symbol Creation, Position, Size Setting Functions

After the pattern has been determined (item ②), the on-screen display will change to that shown in Fig. 4-20. The blank position and size setting method consists of two formats: numeric input, and image input.

① Numeric input format:

Press the function key [F2] (IMAGE/NUMBER.) until INPUT NAME is displayed in the lower right portion of the display shown in Fig. 4-20. At the right side of the display shown in Fig. 4-20, there are coordinate values which apply to each symbol item. Press the function key [F1] (SET), enter the numeric value, and press the **WRITE** key. This sets the desired coordinate values which determine the symbol position and size.

② Image input format:

Press the [F2] (IMAGE/NUMBER.) function key until INPUT IMAGE is displayed in the lower right portion of the display shown in Fig. 4-20.

Image input consists of two modes:

a) Position determine mode

Determines the symbol position.

b) Shape determine mode

Determines the symbol size.

③ Position determine mode:

Press the function key [F2] (POSIT./SHAPE) shown in Fig. 4-21 until POSITION is displayed in the lower right portion of the display shown in Fig. 4-21. Use the cursor to move the symbol to the desired position.

④ Shape determine mode:

Press the function key [F2] (POSIT./SHAPE) shown in Fig. 4-21 until SHAPE is displayed in the lower right portion of the display shown in Fig. 4-20. The desired shape can be determined by using the cursor key. The page key is used for magnification/reduction. The blank symbol pattern changes which occur by using the page and cursor keys are shown in Figs. 4-23 - 4-25.



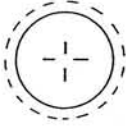
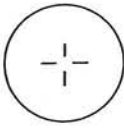
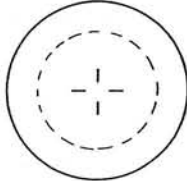
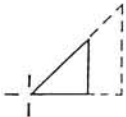
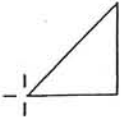
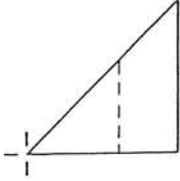

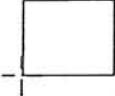
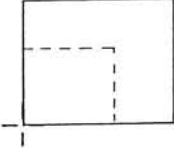

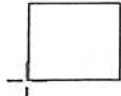
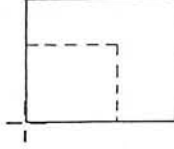
 Page Key for Reduction	Actual Size (Plane)	 Page Key for Magnification
	 (Cylinder)	
	 (Triangular)	
	 (Quadrilateral)	
	 (Arbitrary Quadrilateral)	

Fig. 4-22 Use of PAGE Key for Blank Symbol Magnify/Reduce

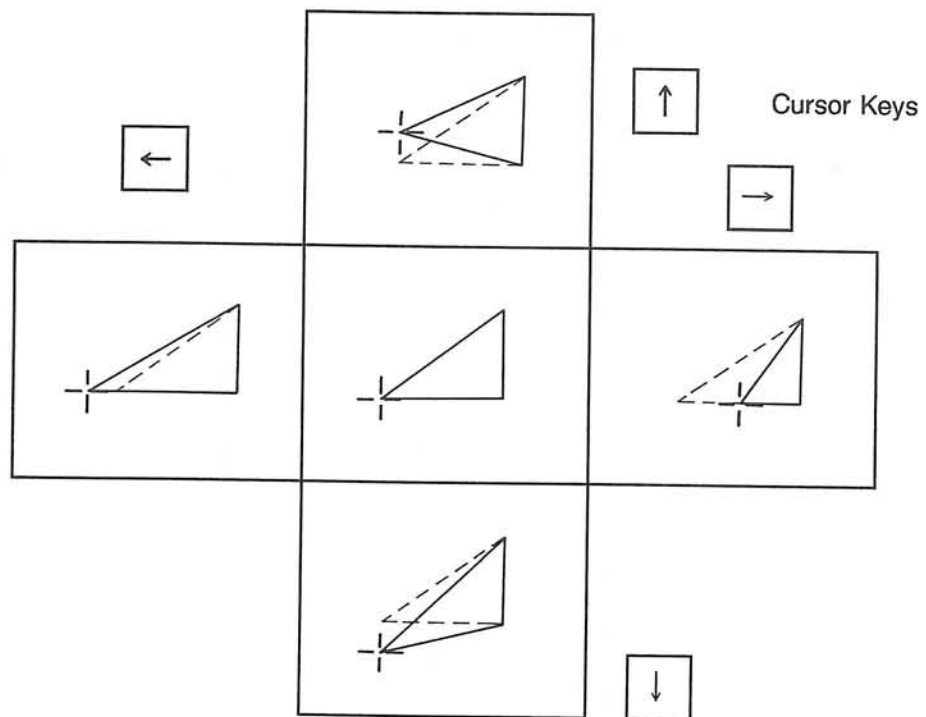


Fig. 4-23 Triangular Change by Using Cursor Key

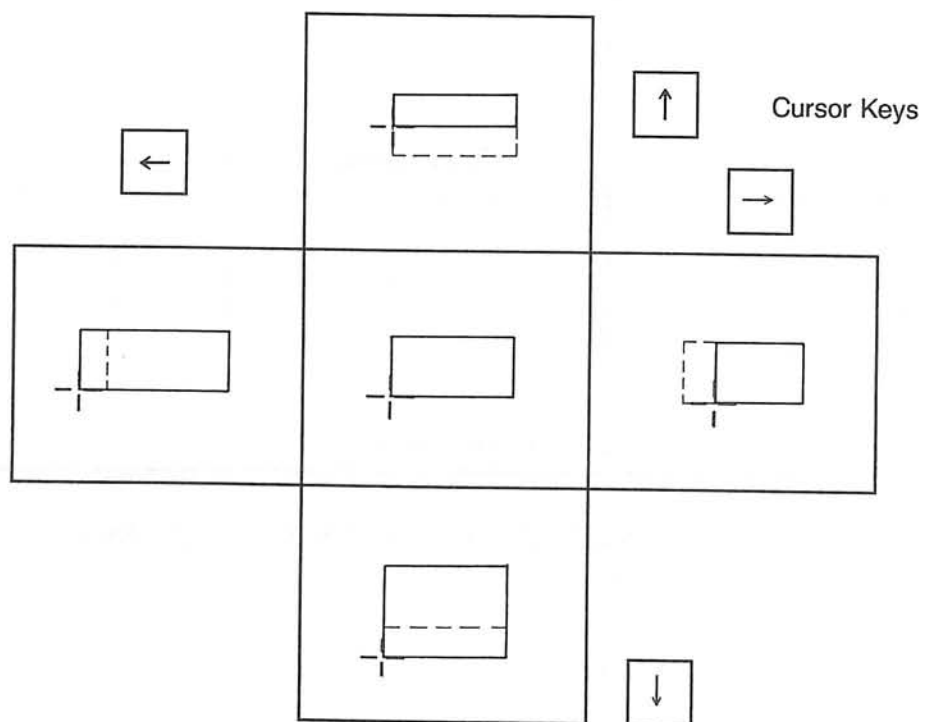


Fig. 4-24 Using Cursor Key Change

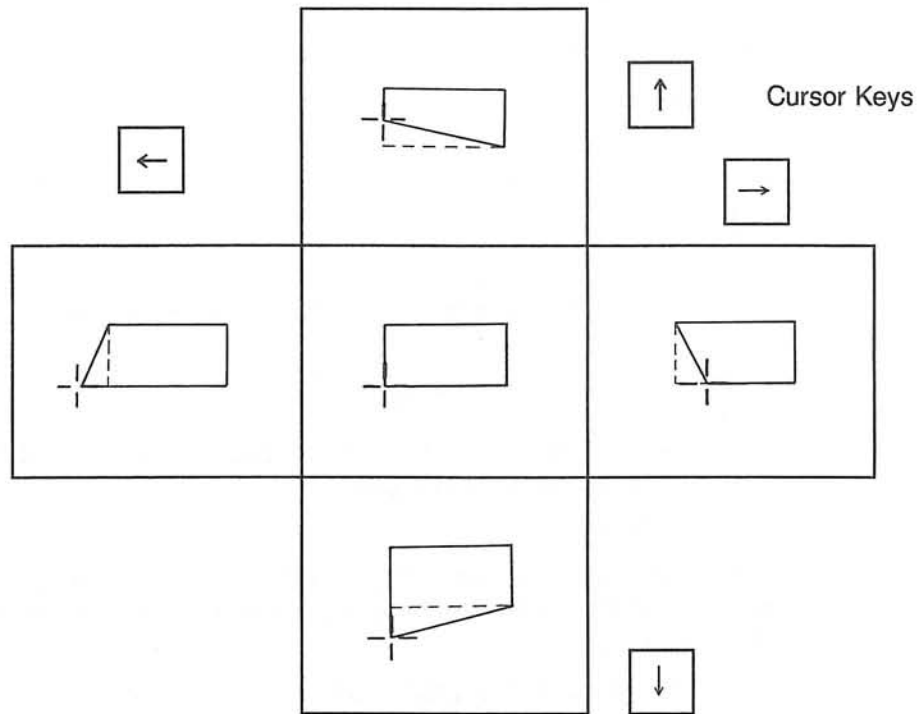


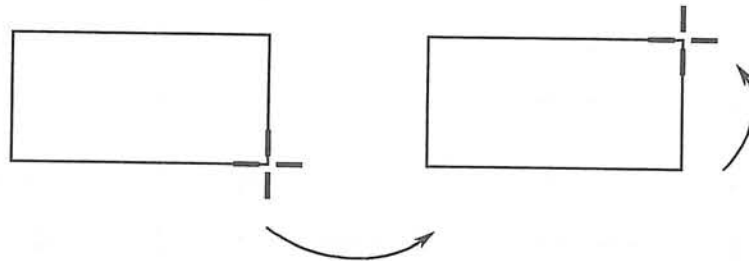
Fig. 4-25 Arbitray Quadrilateral Change by Using Cursor key

Explanation of function keys

[F3] (VERTEX SELECT)

Changes the vertex which is indicated by the marker.

Example:




When the function key [F3] (VERTEX SELECT) is pressed, the vertex which is indicated by the marker is changed.

[F4] (SHIFT SELECT)

Determines the movement amount each time the marker is moved. The desired amount should be entered at the upper right portion of the screen where SHIFT = ▼ is displayed.

The blank symbol shape, position and size which have been determined in items ② and ③, are registered at the designated coordinate system No. by pressing the function key [F5] (REGIS.).

Precautions regarding blank definition

- 1) Shapes which have no area cannot be defined.
- 2) Arbitrary quadrilateral shapes with plane indentions () cannot be defined.
- 3) If the symbol item's coordinate value is not within a -9999 mm to 9999 mm (-999.9 inch to 999.9 inch) range, it cannot be defined.
- 4) The minimum unit designation for the coordinate value is 1 mm (0.1 inch).

(7) Symbol delete

(a) Function

Selected symbol is deleted.

(b) Procedure

- ① Select the desired symbol by using the function key [F5] (SYMBOL SELECT) shown in Fig. 4-17.
- ② Press the function key [F2] (DELETE).

(8) Symbol amend

(a) Function

The shape of the selected symbol is changed. However the symbol shape pattern cannot be changed.

(b) Procedure

- ① Select the desired symbol by using the function key [F5] (SYMBOL SELECT) shown in Fig. 4-17.
- ② Press the function key [F3] (AMEND) to the symbol shape.

(9) Symbol select

(a) Function

Symbol is selected.

(b) Procedure

- ① Press the function key [F5] (SYMBOL SELECT) shown in Fig. 4-17. The selected symbol highlighting will be magenta for 'plus' area symbols, and cyan for 'minus' area symbols.

(10) Blank shift

When the function key [F4] (BLANK SHIFT) is pressed, the on-screen display will be as shown in Fig. 4-26.

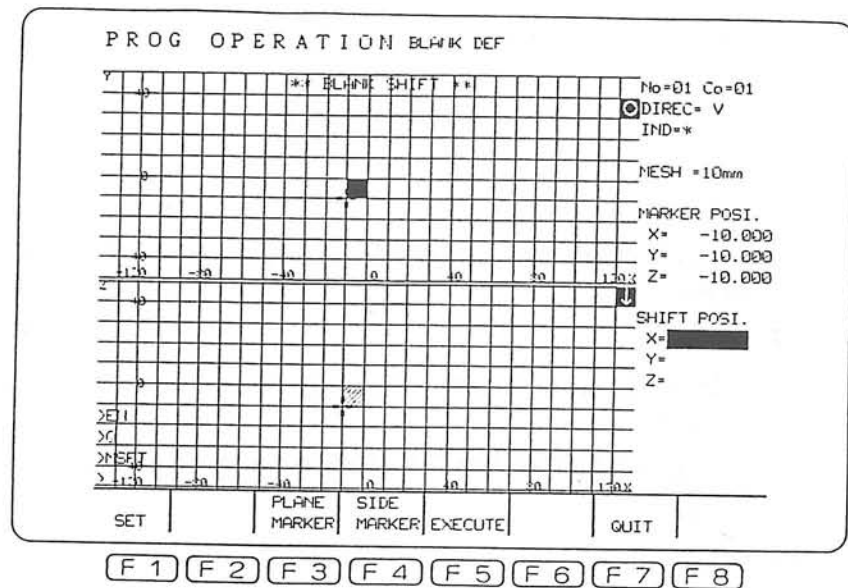


Fig. 4-26 Blank Shift Display

(a) Function

The blank position is moved.

(b) Function Key

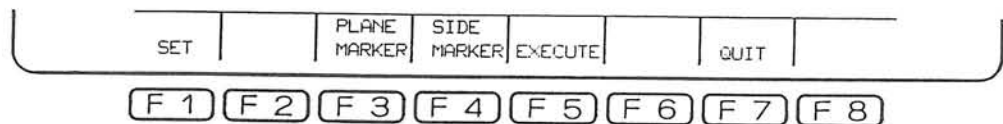


Fig. 4-27 Blank Shift Function Key

(c) Procedure

- ① The reference point (zero point) is moved to the pattern by using the function key [F3] (PLANE MARKER) for the $\left(\begin{smallmatrix} \blacksquare \\ \blacksquare \end{smallmatrix}\right)$ cursor, and the function key [F4] (SIDE MARKER) for the $\left(\begin{smallmatrix} \blacksquare \\ \blacksquare \end{smallmatrix}\right)$ cursor.
- ② The setting for the position to which the zero point is moved is made at the 'X =, Y =, Z =' display, located at the lower right portion of the screen shown in Fig. 4-26. To make the setting, move the cursor to the position where setting is desired, press the function key [F1] (SET), enter the numeric value, and press the WRITE key.
- ③ When the function key [F5] (EXECUTE) shown in Fig. 4-26 is pressed, the $\left(\begin{smallmatrix} \blacksquare \\ \blacksquare \end{smallmatrix}\right)$ cursor will move to the X, Y, Z position designated in item 2) above.

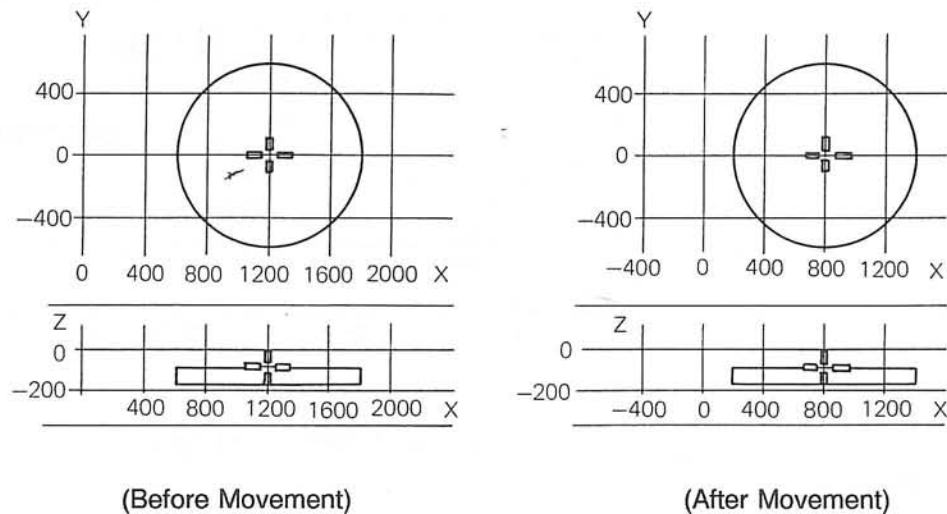


Fig. 4-28 Example of Blank Movement

In the example given in Fig. 4-29, the following movement procedure occurs:

- In the left side diagram (before movement), the cursor position (zero point) X, Y, Z setting is (1200, 0, -100).
- A movement destination setting of X = 800, Y = 0, Z = -100, is made.
- The function key [F5] (EXECUTE) is pressed, and the cursor moves to the (X = 800, Y = 0, Z = -100) position shown in the right side diagram at the right (after movement).

(11) Blank size

When the function key [F5] (BLANK ENVLP.) is pressed, the on-screen display will be as shown in Fig. 4-29.

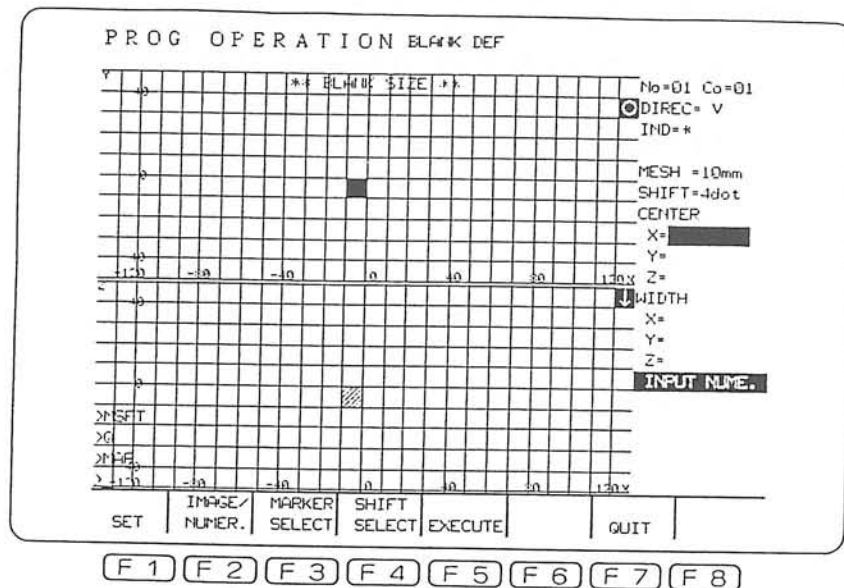


Fig. 4-29 Blank Size Display

- (a) Function
Blank display size setting is made.
- (b) Function Key

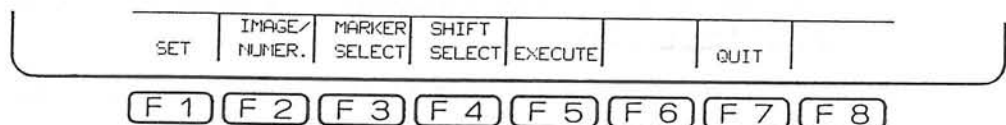


Fig. 4-30 Blank Size Function Keys

(c) Procedure

The setting method consists of two formats:

- ① Display center, display size setting made by 'numeric input'.
- ② Display center, display size made using a marker (+), and frame (□□) respectively. This format is referred to as 'image input'.

Numeric input:

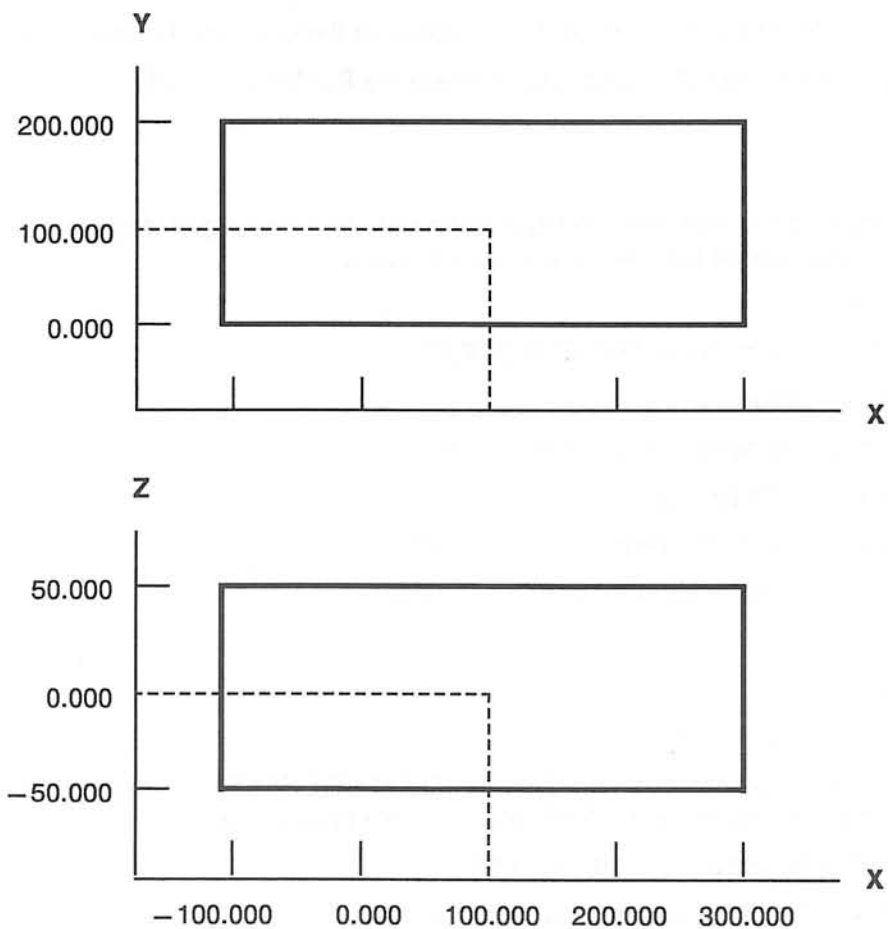
- 1) Press the function key [F2] (IMAGE/NUMER.) shown in Fig. 4-30 until INPUT NUME. is displayed at the lower right portion of the screen.
- 2) At the right side of the screen, the X, Y, Z setting area is displayed for display center and display size (width). Press the function key [F1] (SET) to make these settings.

Example:

The blank display size will be as shown in the figure below if the following settings are made:

CENTER: X=100 Y=100 Z=0

WIDTH : X=200 Y=100 Z=50



- 3) When the function key [F5] (EXECUTE) is pressed, the designated display size will be established.

Image input:

- 1) Press the function key [F2] (IMAGE/NUMBER.) shown in Fig. 4-30 until INPUT IMAG. is displayed at the lower right portion of the screen.
- 2) Determine the display center by using the cursor key to move the marker (—|—).
- 3) Determine the display width by using the page keys to increase or reduce the frame ([]) width.

Note: By using the function key [F3] (MARKER SELECT), plane marker or side marker can be selected. The function key [F4] (SHIFT SELECT) can be used to select the movement amount for each frame and marker movement.

[P ↓] : Increases the frame width.

[P ↑] : Reduces the frame width.

- 4) Press the function key [F5] (EXECUTE) to establish the designated display size.
Press the function key [F7] (QUIT) to complete the BLANK SIZE setting.

(12) File Create

(a) Function

Blank shape data is converted to UGC commands to create a part program file. All register numbers which define the blank shape are converted.

(b) Procedure

- ① Press the function key [F6] (FILE CREATE).
- ② Enter the following:
 < <main file name> > . < <extension> >
- ③ Press the **WRITE** key.

Default values: < <ain file name> > W
 < <extension> > MIN

(13) Quit

(a) Function

Completes the blank definition.

Note: If the QUIT function occurs before the [F6] (FILE CREATE) function has been executed, the following message will be displayed on the console line:

File noncreation END OK (Y/N) !

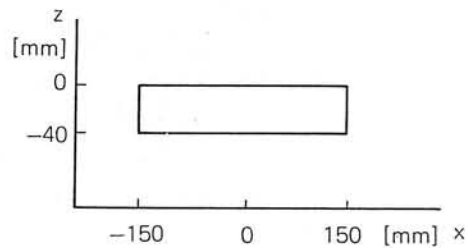
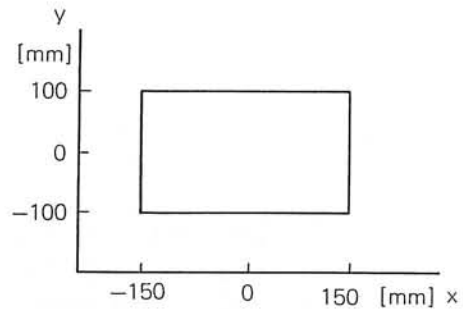
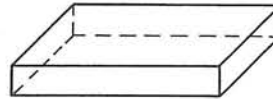
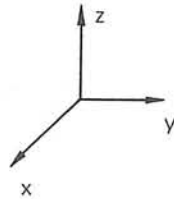
[Y] [WRITE] Executes the QUIT function.

[N] [WRITE] Cancels the QUIT function.

(14) Example of Blank Definition

The following example illustrates the blank definition function.

[Blank to be defined]



(a) Machine specifications

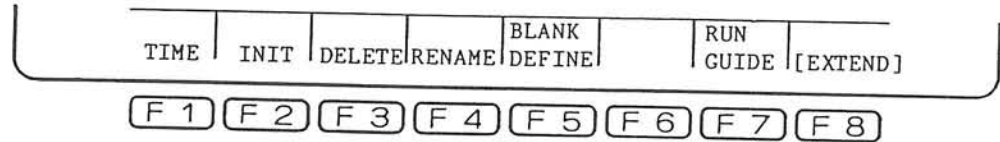
- Vertical type
- No swivel head specification
- No rotary axis specification

(b) Other

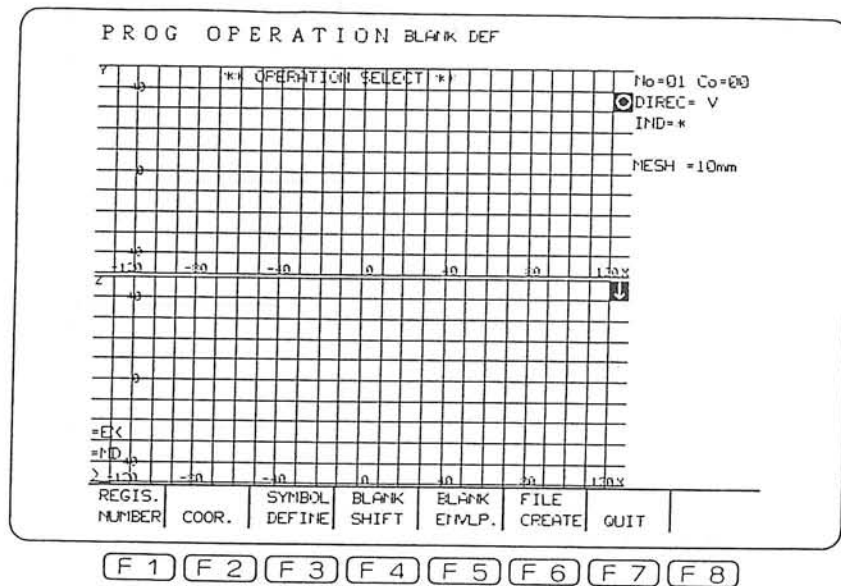
Blank defined at coordinate system No. 1

(c) Definition Procedure

- ① Select the PROGRAM OPERATION mode is selected.
- ② Press the function key [F8] (EXTEND) until the functions shown below are displayed.



- ③ Press the function key [F5] (BLANK DEFINE), and the display will be as shown in the figure below.



Initial Display for Blank Definition

- ④ At this time, press the function key [F1] (REGIS. NUMBER). The display will change to that shown below.

PRG OPERATION BLANK DEF

** BLANK No. SELECTION ** P-Axis: * PAGE 1/1

! No.	DIREC	INDEX	COORDINATE SYSTEM No.
1	V	* 00	
2	V	* 00	
3	V	* 00	
4	V	* 00	
5	V	* 00	
6	V	* 00	
7	V	* 00	
8	V	* 00	
9	V	* 00	
10	V	* 00	

*EX
*MD
>EN
Select a registration number.

REGIS. NUMBER	COORD.	SYMBOL DEFINE	BLANK SHIFT	BLANK ENLUP.	FILE CREATE	QUIT
------------------	--------	------------------	----------------	-----------------	----------------	------

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

Register Number Selection Display

- ⑤ To define the blank at register No. 1:
- Use the [↑], [↓] keys to move the selection cursor to the **1** position.
 - Press the **WRITE** key.
 - The following will be displayed on the console line:
0:V 1:HF 2:HL 3:HB 4:HR
Spindle direction 0: V!
When this display appears, press the **WRITE** key.
 - The following will be displayed on the console line:
*: No specified index
Index * !
When this display appears, press the **WRITE** key.
- At this point, the display page returns to that shown in item ③.

- ⑥ Press the function key [F2] (COOR.). The on-screen display will change to that shown in the following figure.

The screen displays the following information:

- Header: PROG OPERATION BLANK DEF
- Sub-header: ** CORD. SYS. DESIG. ** No:01 DIREC: V IND:* PAGE 1/1
- COORD. SYS. No. : 0
- Grid labels:
 - 0:V 1:HF 2:HL 3:HB 4:HR
 - Spindle direction 3:V !
 - XCO
- Function keys at the bottom: SET, COPY, DELETE, QUIT, F1, F2, F3, F4, F5, F6, F7, F8

Coordinate System Selection Display

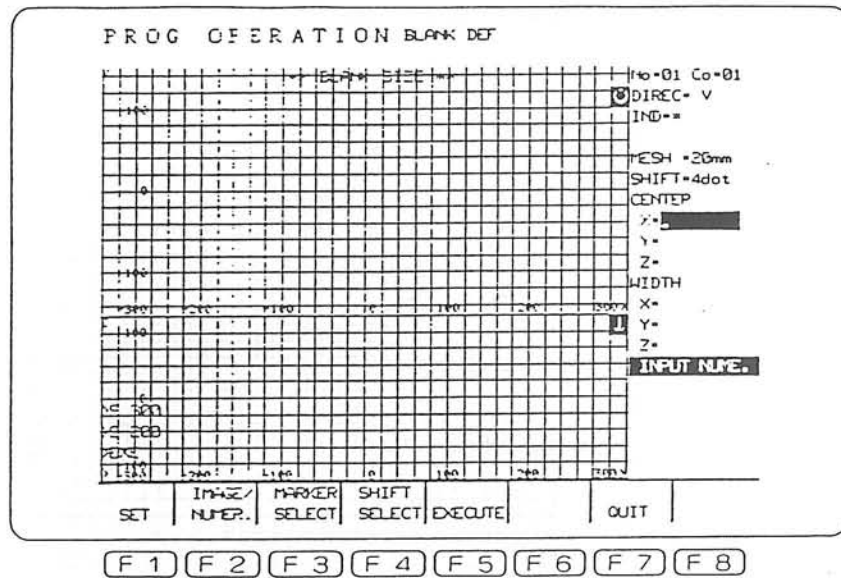
- ⑦ Since registration is to occur at coordinate system No. 1, press the function key [F1] (SET), enter the numeral "1", and press the **WRITE** key.
- ⑧ Press the function key [F7] (QUIT). At this point, the display page will return to that shown in item 3).
- ⑨ In order to select the appropriate display size for the blank to be defined, press the function key [F5] (BLANK ENVL.).

On the resulting display screen enter the display area settings as follows:

CENTER: X=0, Y=0, Z=0

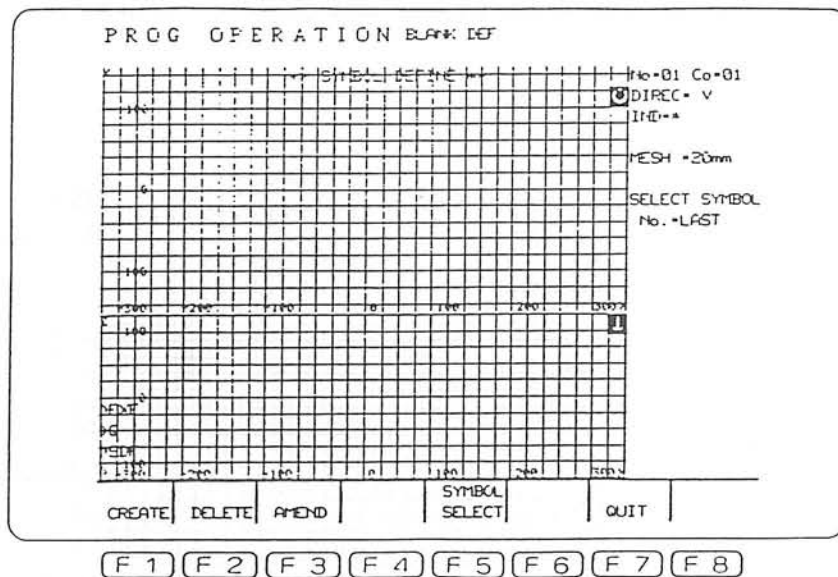
WIDTH : X=200, Y=300, Z=200

After making these settings, press the function key [F5] (EXECUTE). The display page will change to that shown in the following figure.



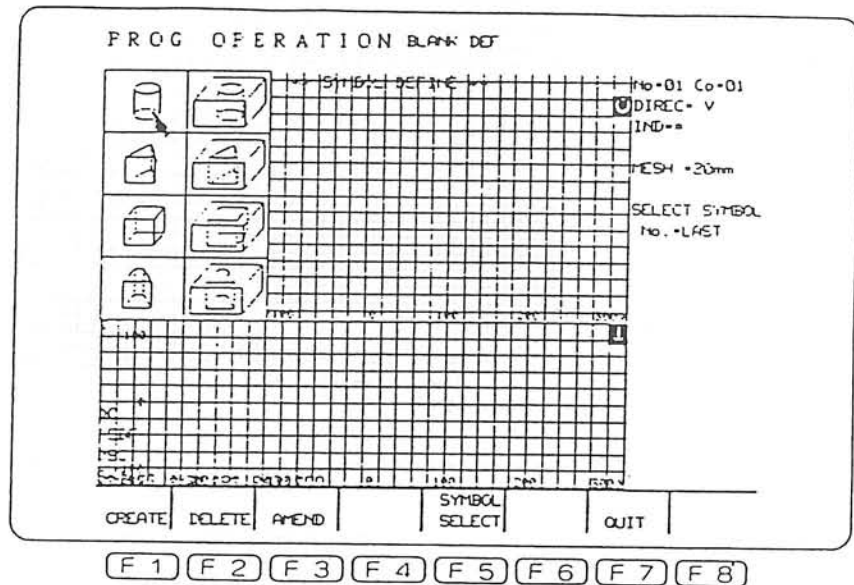
Blank Size Display Page

- ⑩ Press the function key [F7] (QUIT).
- ⑪ The display page will return to that shown in item ③. Press the function key [F3] (SYMBOL DEFINE), and the display page will change to that shown below.



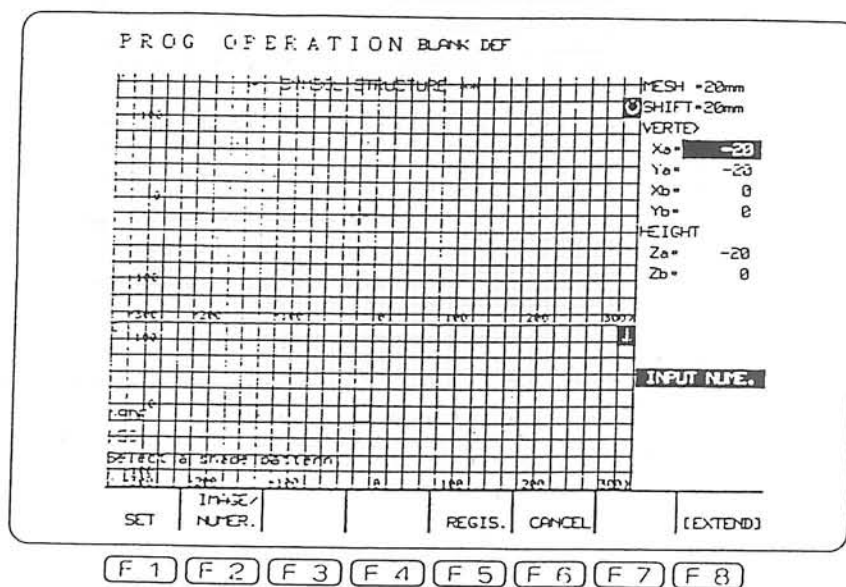
Symbol Define Display Page

- ⑫ As this is the initial registration for this blank, there is no register sequence. Press the function key [F1] (CREATE), and the display page will change to that shown below.




Pattern Selection Display Page

- ⑬ Use the cursor keys to move the selection marker to the rectangle position, and press the **WRITE** key. The display page will change to that shown below.

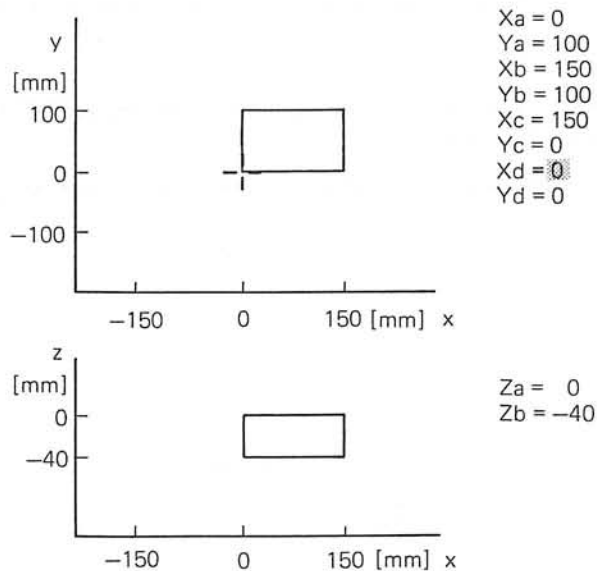


Symbol Size, Position Display Page

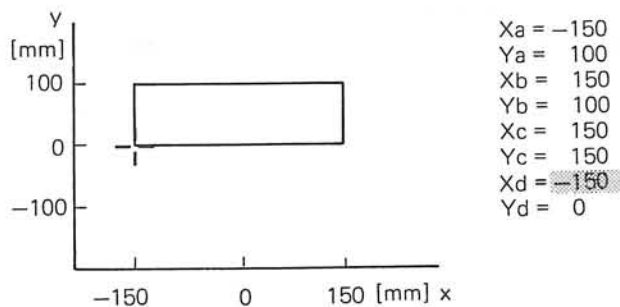
⑭ For size, position designation using numeric input:

- i) Press the function key [F2] (IMAGE/NUMER.) until INPUT NUME. is displayed at the lower right portion of the screen.
- ii) As the pattern point marker () corresponds with coordinate value marker at the right side of the screen, enter the coordinate value for the desired pattern point locations.

Example:

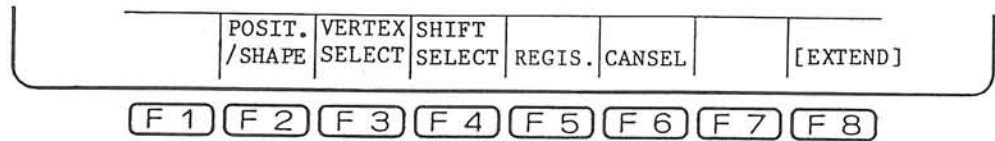


When the marker and cursor are positioned as shown in the above example, press the function key [F1] (SET), enter -150, and press the **WRITE** key. The display will now be as shown in the figure below.



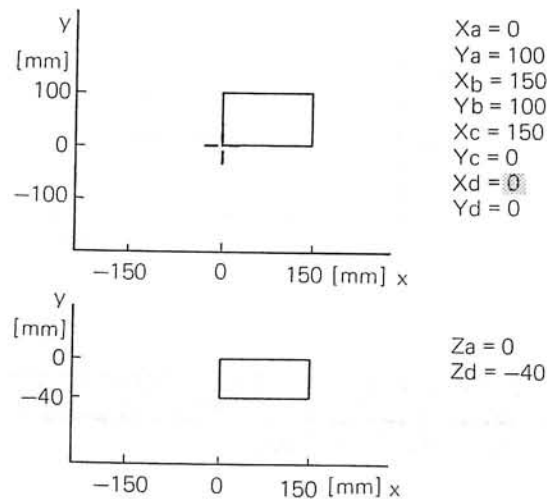
⑮ For size, position designation using image input:

- i) Press the function key [F2] (IMAGE/NUMER.) until INPUT IMAG. is displayed at the lower right portion of the screen.
- ii) Press the function key [F8] (EXTEND). The functions shown below will be available.

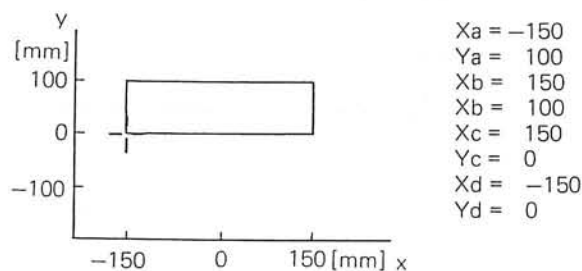


- iii) Press the function key [F2] (POSIT./SHAPE) until SHAPE is displayed at the lower right portion of the screen.
- iv) Use the page keys and the cursor keys to determine the blank size.

Example:

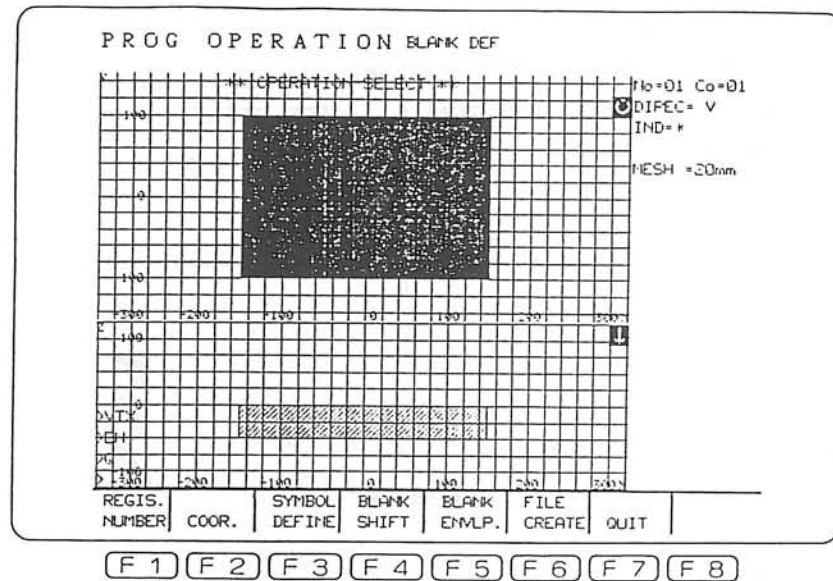


With the marker and cursor positioned as shown above, use the cursor key to move the marker to the appropriate position, as shown in the following figure.



- ⑩ Press the function key [F5] (REGIS.). This will register the blank at coordinate system No. 1 of register No. 1.

At this time, the display page will be as shown below.



- ⑪ For part program file creation of the blank data which has been defined, press the function key [F6] (FILE CREATE). The file name will be registered as "W. MIN" on floppy disk 1. After pressing the function key [F6] above, press the **WRITE** key.
- ⑫ Press the function key [F7] (QUIT). This completes the blank definition procedure.

2-2-12. Tool Shape Setting

(1) Function Summary

The shape settings (nose dia., nose angle, tool dia.) are made for the animated tool which is displayed.

(2) Setting Procedure

- ① Press the TOOL DATA setting mode key.
- ② Press the function key [F6] (ITEM ↑), or [F7] (ITEM ↓) until the display page shown at the right appears.

TOOL DATA SET

* TOOL SHAPE DEFINITION *


TOOL NO. 2

[TOOL NAME] DRILL

--- TOOL DIMENSION ---

DIAM. D= 12.000

NOSE ANGLE A= 180.000



0.001mm

ACT POSIT (WORK)

X	Y	Z
300.000	300.000	500.000
A-Ntd		

SET	ADD	TOOL NAME	SEARCH	ITEM↑	ITEM↓	[EXTEND]
-----	-----	--------------	--------	-------	-------	----------

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

Fig. 4-31 Initial Display for Tool Shape Setting

(3) Setting Method

- (a) Select the display page for the tool No. to be set. Selection of each tool No. display page can be executed in two ways:
 - 1) The function key [F4] (SEARCH) method
 - i) Press the function key [F4] (SEARCH).
 - ii) Enter the tool No. to be set.
 - iii) Press the **WRITE** key.

2) The PAGE key method

Use the [P ↓], [P ↑] keys to select the desired tool No. display page.

Note 1: The maximum value for the tool No. can be any of the following, depending on specifications:

50, 100, 200, 300

Note 2: If there is no tool setting for a given tool No., the following display will occur:

TOOL DATA SET							
* TOOL SHAPE DEFINITION *						0.001mm	
TOOL NO.		1					
[TOOL NAME] UNDEFINITION							
ACT POSIT (WORK)		X	Y	Z			
		300.000	300.000	560.000			
		A-Mtd					
SET	ADD	TOOL NAME	SEARCH		ITEM↑	ITEM↓	[EXTEND]
F 1	F 2	F 3	F 4	F 5	F 6	F 7	F 8

Fig. 4-32 Unregistered tool Display

(b) Registering a tool at a designated tool No.









1) Press the function key [F3] (TOOL NAME)

The display page shown below will appear.

TOOL DATA SET

* TOOL NAME SELECTION *

TOOL NO. 2

1. CENTER DRILL 	2. DRILL 	3. TAP 	4. REAMER 
5. BORING BAR 	6. END MILL 	7. FACE MILL 	8. 

*TN
Select a number of tool name. !

SET	ADD	TOOL NAME	SEARCH	ITEM*	ITEM*	[EXTEND]
-----	-----	-----------	--------	-------	-------	----------

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

- 2) Use the page keys to select tool 1 to 8 or 9 to 16, enter the number of the tool to be set, and press the **WRITE** key.
- 3) With the tool registered, the system returns to the item 1 display page where the necessary items for tool shape data setting are displayed.

These items are as shown below:

Tool	CENTER DRILL	DRILL	TAP	REAMER	BORING BAR	END MILL	FACE MILL
DIAM. D	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
NOSE ANGLE A	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Note 3	Note 3
TOP DIAM. ND	Note 1	Note 1	<input type="radio"/> Note 2	<input type="radio"/> Note 2	<input type="radio"/> Note 2		

Note 1: For center drill and drill, ND = 0.

Note 2: If nose angle setting is A = 180 degrees, this data will not be referenced.

Note 3: For end mill and face mill, nose angle setting is A = 180 degrees.

Note 4: The permissible input at this time is as follows: numeric character (1 - 16), an asterisk (*) or the WRITE key.

Note 5: If a numeric character (1 - 16) is entered for a tool which is not displayed, an error will occur, and input will be impossible.

Note 6: If an asterisk (*) is entered, a "tool not registered" undefinition status is established at the tool number which was designated.

Note 7: If the WRITE key is pressed, the tool which is registered at the designated tool number will remain as is, and the display page will return to that which was displayed before the function key [F3] (TOOL NAME) was pressed.

2-3. Explanation of Animation Related NC Program

Table for NC Codes Related to Graphic Display

NC Code	Function	Remarks
DEF WORK [n] { END	Blank "start" declaration "end" declaration The shape of the blank which is defined between the 'start' and "end" declarations is registered at the number indicated by the asterisk (*). A new NC program is registered following the deletion of the previously registered NC program.	[n] is an integer from 1 - 10 If [n] is omitted, the system will adopt [1] as the setting. The NC codes which are effective between the 'start' and 'end' declarations are: CYLNDR, CYLNDRI, ORIGIN, DIREC, INDEX
DELET WORK [n]	The blank definition data at the register No. indicated by the asterisk (*), is deleted.	[n] is an integer from 1 - 10. If [n] is omitted, the system will adopt [1] as the setting.
SAVE	A backup PBU file is created for the blank definition data.	
DRAW	Blank drawing occurs after the graphic display is erased. (Blank drawing will not occur when a blank has not been registered.)	
CLEAR	The graphic display is erased.	

Table for NC Codes Which are Effective between 'DEF WORK [n]' and 'END'

NC Code	Function	Remarks
ORIGIN Hn	The work coordinate system No. which defines the blank is designated by [n].	[n] is the work coordinate system.
INDEX A INDEX B INDEX C Angle	Designates the rotary axis name and angle when cutting occurs for the defined blank.	If there is no rotary axis specification, this NC code should not be entered. Angle is an integer from 0 - 359 degrees.
DIREC V DIREC HL DIREC HR DIREC HB DIREC HF	Designates the tool rotary axis direction (cutting direction) when cutting occurs for the defined blank.	If there is no swivel head specification, this setting must be 'DIREC V' V: Vertical axis HL: Horizontal axis (left) HR: Horizontal axis (right) HB: Horizontal axis (back) HF: Horizontal axis (front)
CYLNDR	For cylinder, triangular pole quadrilateral registration.	Absolute coordinate
CYLNDRI	For cylinder, triangular pole quadrilateral registration.	Relative coordinate

(a) DEF WORK [n] - END

[Format] DEF WORK [n] - END, $1 \leq n \leq 10$

[Explanation] The blank shape is registered. Between the start (DEF WORK[n]) declaration and the "END" declaration, the appropriate shape command string and procedure statement (refer to the INDEX, DIREC items in the following pages) are registered.

[Example] A cylindrical blank will be registered as follows:

When registering a cylindrical blank of the bottom center (250,0), bottom diameter (226), bottom height (0) and top face height (81) with cutting direction (V) and no rotary axis spec. at register No. 1, the data input is as follows:

DEF WORK[1]	(1)
DIREC V	(2)
ORIGIN H1	(3)
CYLNDR OP, [250,0], 226, 0, 81	(4)
END	(5)

(1): Blank definition "start" declaration

(2): Register procedure statement

(3): Shape command string

(4): Shape command string

(5): “end” declaration

Note: The coordinate system which is used when blank definition occurs, is that which is used for the NC program. The unit is fixed at 1 mm (0.1 inch). A total of 32 blanks can be registered for CYLND R and CYLNDRI (combined). A total of 32 blanks can be registered for ORIGIN.

(b) CYLNDRI and CYLNDRI:

These coordinates vary according to the spindle direction.

Henceforth, all explanations will assume a spindle direction setting of (V: vertical axis). The coordinates for the other settings are as follows:

HL (horiz. left) : $X \rightarrow Z, Y \rightarrow X, Z \rightarrow Y$

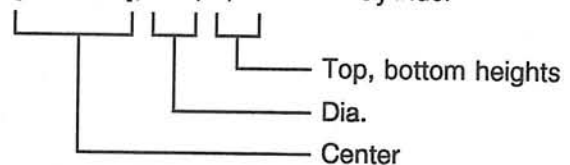
HR (horiz. right) : $X \rightarrow Z, Y \rightarrow X, Z \rightarrow Y$

HF (horiz. front) : $X \rightarrow Y, Y \rightarrow Z, Z \rightarrow X$

HB (horiz. back) : $X \rightarrow Y, Y \rightarrow Z, Z \rightarrow X$

Example:

Blank shape command; CYLNDR 0P [-250, 0], 226, 0, 81. . . Cylinder



If the above cylinder definition is given, the axes which apply to the center and height values according to the procedure statement (DIREC.) data will be as the following table.

DIREC \	Center [- 250, 0]	Height [0, 81]
V	X, Y	Z
HF	Y, Z	X
HL	Z, X	Y
HB	Y, Z	X
HR	Z, X	Y

(c) DELETE WORK

[Format] DELETE (WORK, WORK [n]), $1 \leq n \leq 10$

[Explanation] The blank definition data at the register No. indicated by n, is deleted.

[Example] DELETE (WORK, WORK [1]):

Blank definition data at register No. 1 is deleted.

(d) ORIGIN

[Format] ORIGIN Hn n: Work coordinate system No.

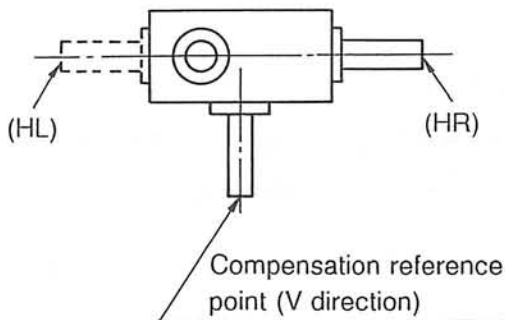
[Abbreviation] OR

[Explanation] The work coordinate system No. is designated by [n]. This coordinate system No. will be effective until the next "ORIGIN", or the "END". If no designation is made, the system will adopt 'H0' as the designation. The maximum value for [n] can be 1, 20, or 50 depending on specifications. LP (Last Reference Point) will designate a new coordinate system value, but absolute coordinates do not change.

(e) DIREC

[Format] DIREC (V, HL, HR, HB, HF)

[Explanation] This designates the tool rotation axis direction (cutting direction) when cutting of the defined blank occurs. If there is no swivel head specification, this setting must be "DIREC V". With the spindlehead direction as a reference point, the following are the horizontal axis directions:



HL	....	Horiz. axis (left)
HR	....	Horiz. axis (right)
HB	....	Horiz. axis (back)
HF	....	Horiz. axis (front)

(f) INDEX

[Format] INDEX (A,B,C), angle

[Explanation] Designates the rotary axis name and angle when cutting of the defined blank occurs.

Rotary axis names : A, B, C

Angle : An integer from 0 - 359 degrees

(g) CYLNDR

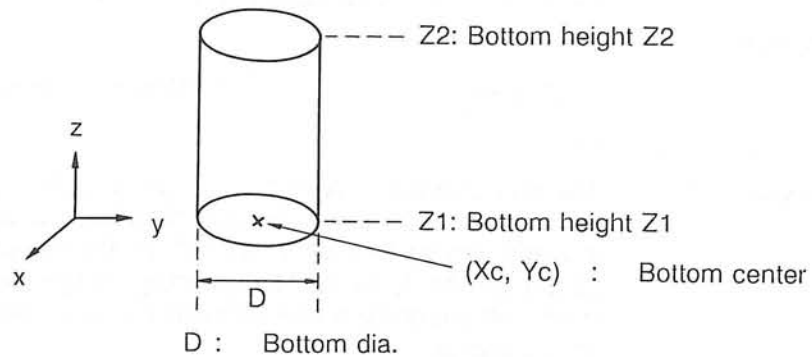
[Format] CYLNDR (0, 0P, 0H), [bottom center Xc, Yc], bottom dia. D, bottom height Z1, top face height Z2

[Abbreviation] CY

[Explanation] Designates either cylinder or cylindrical hole shape (absolute value).

0 or 0P Cylinder

0H Cylindrical hole



(h) CYLNDR

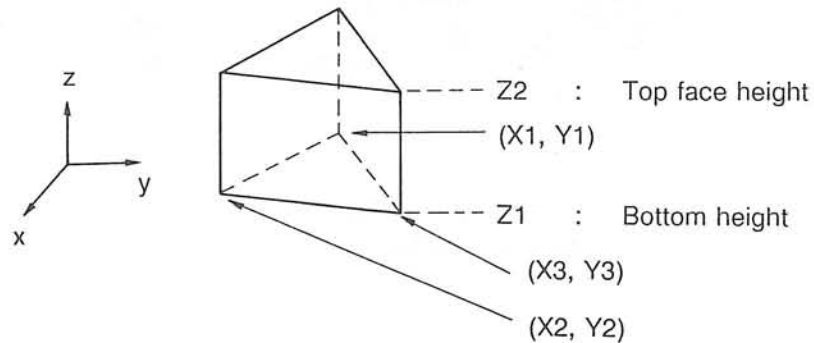
[Format] CYLNDR (3, 3P, 3H), [bottom coordinates X1, Y1], [bottom coordinates X2, Y2], [bottom coordinates X3, Y3], bottom height Z1, top face height Z2

[Abbreviation] CY

[Explanation] Designates either triangular pole or triangular hole shape (absolute value).

3 or 3P Triangular pole

3H Triangular hole



(i) CYLNDR

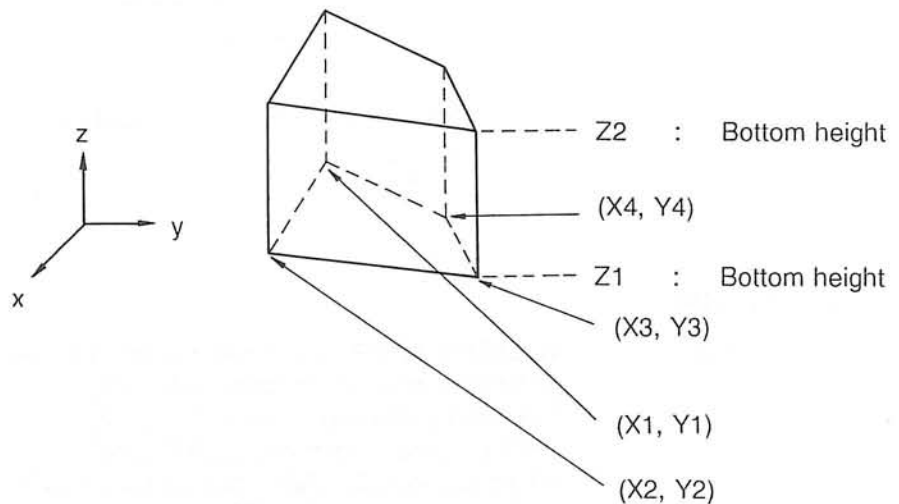
[Format] CYLNDR (4, 4P, 4H), [bottom coordinates X1, Y1], [bottom coordinates X2, Y2], [bottom coordinates X4, Y4], bottom height Z1, top face height Z2

[Abbreviation] CY

[Explanation] Designates either quadrilateral pole or quadrilateral hole shape (absolute value).

4 or 4P Quadrilateral pole

4H Quadrilateral hole



This is a shape which allows the segments for the bottom of the quadrilateral pole (X1, Y1), (X2, Y2), (X3, Y3), (X4, Y4) to be connected in order. If these segments are changed, or the quadrilateral has an indentation, this command will not be effective.

(j) CYLNDRI

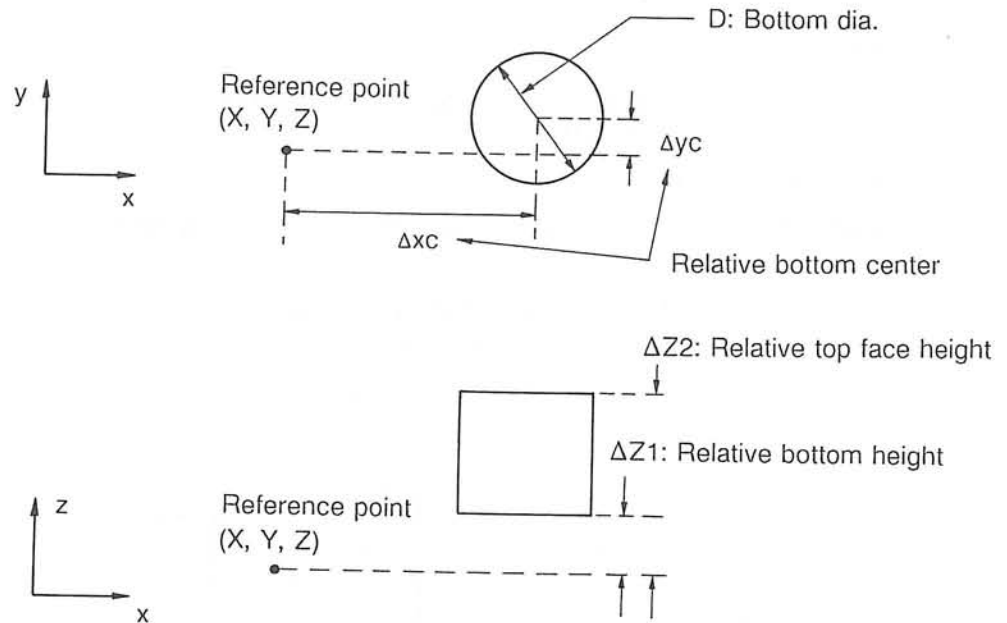
[Format] CYLNDRI (0, 0P, 0H), [reference point X, Y], [relative bottom center ΔX_c , ΔY_c], bottom dia. D, reference point Z, relative bottom height $\Delta Z1$, relative top face height $\Delta Z2$

[Abbreviation] CYI

[Explanation] Designates either quadrilateral or quadrilateral hole shape (relative value).

0 or 0P Cylinder

0H Cylinder hole



(k) CYLNDRI

[Format]

CYLNDRI (3, 3P, 3H), [reference point X, Y],
[relative bottom coordinates $\Delta x1$, $\Delta y1$],
[relative bottom coordinates $\Delta x2$, $\Delta y2$],
[relative bottom coordinates $\Delta x3$, $\Delta y3$],
reference point Z, relative bottom height $\Delta z1$,
relative top face height $\Delta z2$

[Abbreviation]

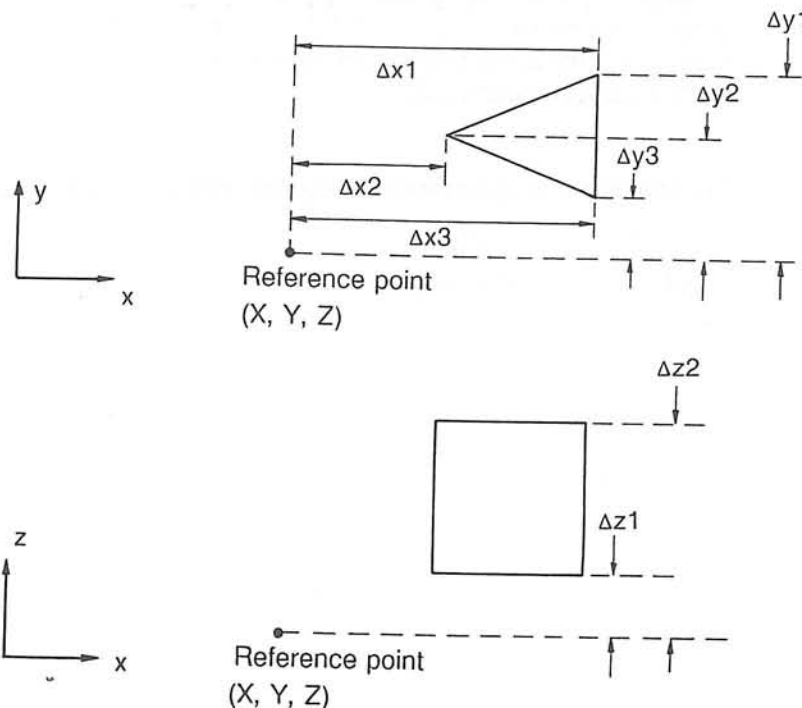
CYI

[Explanation]

Designates either triangular pole or triangular hole shape (relative value).

3 or 3P Triangular pole

3H Triangular hole



(I) CYLNDRI

[Format]

CYLNDRI (4, 4P, 4H), [reference point X, Y],
[relative bottom coordinates $\Delta X1$, $\Delta Y1$],
[relative bottom coordinates $\Delta X2$, $\Delta Y2$],
[relative bottom coordinates $\Delta X3$, $\Delta Y3$],
[relative bottom coordinates $\Delta X4$, $\Delta Y4$],
reference point Z, relative bottom height $\Delta Z1$,
relative top face height $\Delta Z2$

[Abbreviation]

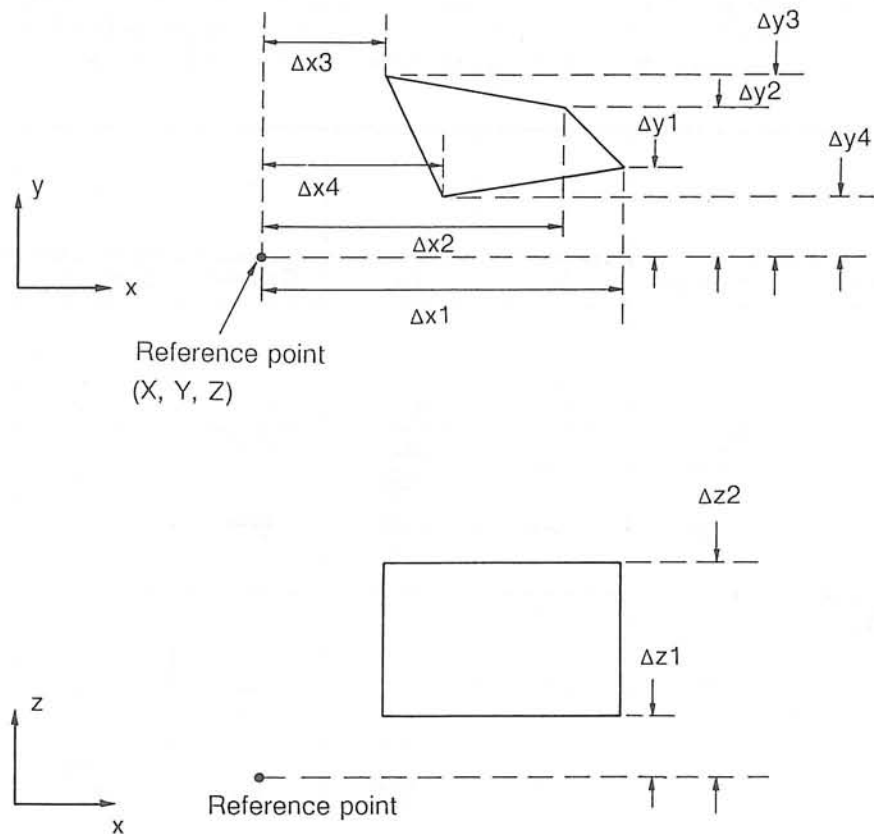
CYI

[Explanation]

Designates either quadrilateral or quadrilateral hole shape (relative value).

4 or 4P Quadrilateral pole

4H Quadrilateral hole



This is a shape which allows the segments for the bottom of the quadrilateral ($X + \Delta X1$, $Y + \Delta Y1$), ($X + \Delta X2$, $Y + \Delta Y2$), ($X + \Delta X3$, $Y + \Delta Y3$), ($X + \Delta X4$, $Y + \Delta Y4$) to be connected in order. If these segments are changed, or the quadrilateral has an indentation, this command will not be effective.

(m) System Variables (Note 1)







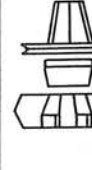







The tool dia., tool nose angle, tool nose dia., and tool classification No. appear in the NC program as shown in the table below.

Variable Name	Description	Data Range	Note 2
VTLTD [I]	Tool Dia.	$0.000 \leq * \leq 9999.999$	
VTLNA [I]	Tool nose angle	$0.000 \leq * \leq 180.000$	
VTLND [I]	Tool nose Dia.	$0.000 \leq * \leq 9999.999$	Note 3
VTLIN [I] (Note 4)	Tool classification No.	$1 \leq * \leq 7$	

Note 1: Direct setting can be made at TOOL SHAPE DEFINITION of the TOOL DATA SET mode.

Note 2: Used at position tool, envelope line, and envelope figure drawing.

Note 3: Although 16 are available, only 1 - 7 tools are presently registered. Therefore the maximum range is 7. The tool classification No. and tool name relationship, and the animated tool and tool classification relationship is as shown in the table below.

Tool Clarification No,	1	2	3	4	5	6	7
Tool Name	Center drill	Drill	Tap	Reamer	Boring bar	End mill	Face mill
Tool Kind							
Animated Tool							

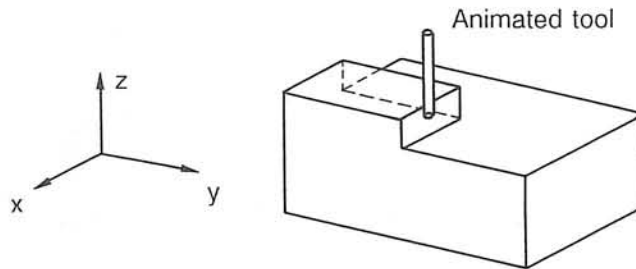
Note 4: The system variable permits the setting of separate service life management groups. To accomplish this, the VTL**[I] setting is changed to VGR**[G]. [G] indicates the group number.

2-4. Rotary Axis, Parallel Axis, 5-Face Cutting

(1) Rotary Axis

By designating the rotary axis name (A, B, C) and angle for which animation is to occur, it is possible to execute animation only when at the designated angle. Animation is not possible for cutting which occurs during rotation.

Example 1:

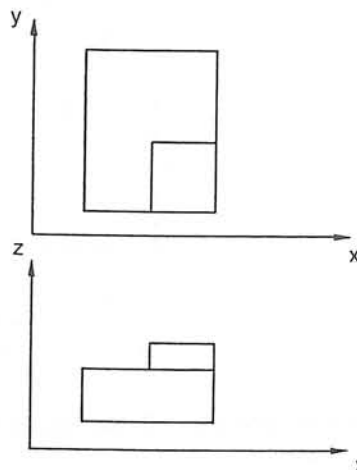


< < Conditions > >

- [V] type machine with no swivel head specification.
- Rotary axis : B
- Angle : 0 degree

With these conditions, the animation procedure for the blank shown in the figure at left, is as follows.

- ① At the BLANK DEFINE page, set the spindle direction to V, and the cutting face angle to B0.
- ② At the BLANK DEFINE page, the X-Y, X-Z coordinate axes will be displayed. Define the blank shape as shown in the figure at below.



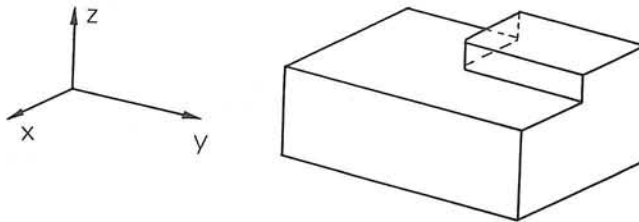
- ③ At the GRAPH DATA page, set the spindle direction to [V], and the rotary axis to [B0]. Animation can now be executed. If the spindle direction is set to other than [V], or if the rotary axis is set to other than [B0], animation will not occur.

Example 2:

< Conditions >

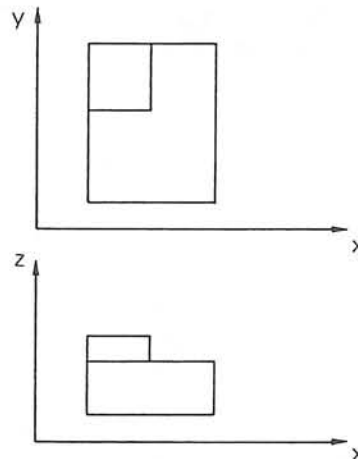
- Using the same blank as in Example 1, with a [V] type machine with no swivel head specification.
- Rotary axis : B axis
Angle : 180 degrees

With these conditions, the animation procedure will be as follows:



With the rotary axis angle set at 180 degrees, the blank will be positioned as shown in the figure above.

- ① At the BLANK DEFINE page, set the spindle direction to [V], and the cutting face angle to [B180].
- ② At the BLANK DEFINE page, the X-Y, X-Z coordinate axes will be displayed. Define the blank shape as shown in the figure below.



- ③ Animation will occur only when the GRAPH DATA page settings are as follows:

Spindle direction : V
Angle : 180 degrees

If there is a rotary axis specification for the above animation, the blank which corresponds to the cutting angle must be defined, and the rotary axis name and cutting angle must be set at the GRAPH DATA page.

(2) 5-face Cutting

With swivel head specification, the spindle direction setting where animation is desired in the same manner as the rotary axis, must be set when defining the blank.

For animation to occur, the spindle direction, rotary axis name, and cutting angle settings which are made at the BLANK DEFINE page must match the spindle position and rotary axis designations made at the GRAPH DATA page.

If animation is to occur from various angles depending on the spindle direction and cutting angle, each spindle direction and cutting angle setting which determines the blank shape must be defined. Furthermore, the GRAPH DATA designations must match these settings for animation to occur.

(3) Parallel Axis

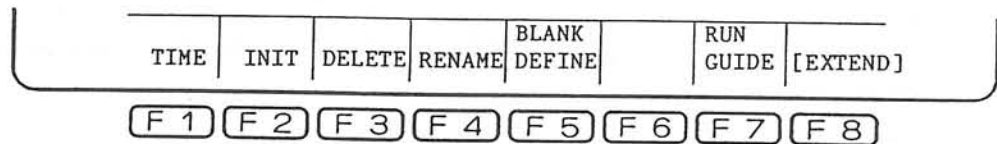
The parallel axis (U, V, W) applies only to the NC axis. The following 3 master/slave axis selections are possible at the GRAPH DATA page:

- Master axis only
- Slave axis only
- Master axis + slave axis

3. Animation Display Method

(1) Blank definition

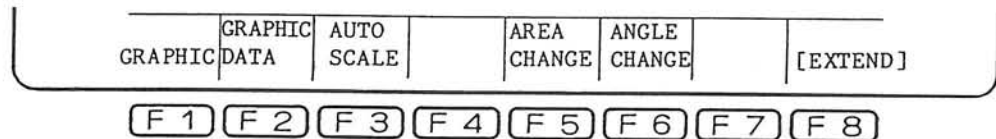
- ① Select the PROGRAM OPERATION mode.
- ② Press the function key [F8] (EXTEND) until the function keys shown in the figure below are displayed.



- ③ Press the function key [F5] (BLANK DEFINE), and define the blank.

(2) Animation data setting required at GRAPH DATA

- ① Select the AUTO mode.
- ② Press the function key [F8] (EXTEND) until the function keys shown in the figure below are displayed.



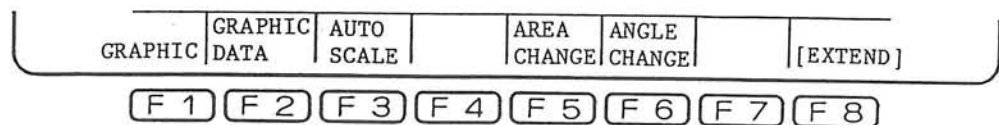
- ③ Press the function key [F2] (GRAPHIC DATA), and make the data settings.

(3) Running program

- ① Select the file, created in step (1), using the program selection function and press the **CYCLE START** button to run the program to register the file.

(4) Determining blank display area

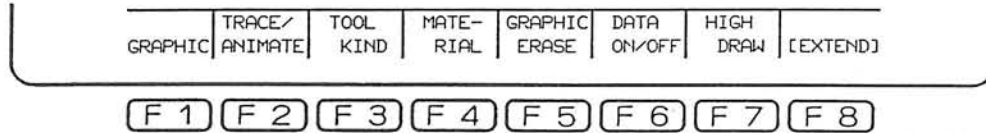
- ① Select the AUTO mode.
- ② Press the function key [F8] (EXTEND) until the function keys shown in the figure below are displayed.



- ③ Press the function key [F3] (AUTO SCALE). It is also possible to press the function key [F5] (AREA CHANGE), and use the area change function to determine the display area.
- ④ For SOLID VIEW display, the function key [F6] (ANGLE CHANGE) can be pressed to change the projection angle if necessary.

(5) Blank display

- ① Press the function key [F1] (GRAPHIC).
- ② Press the function key [F4] (MATERIAL) to display the blank.



(6) Program selection and start

- ① Select the cutting program using the program selection function and start it.

Note: *Animation Speed-Over*

*There are cases where the animation processing speed can not keep up with rapid axis movement, in magnification, etc. In such cases, **ANIM. SPEED OVER** will be displayed at the upper left of the screen, and the animation control is stopped and divided into 3 steps as shown below.*

- Drawing: yes
 × Drawing: no

	Trace Line	Envelope Figure	Envelope Line	Animated Tool
Normal	○	○	○	○
Speed over 1	○	○	×	○
Speed over 2	○	×	×	×
Speed over 3	×	×	×	×

Blank drawing cannot occur during the animation speed-over condition. This condition is released by pressing function key [F5] (GRAPHIC ERASE).

SECTION 5 TOOL PATH DISPLAY FUNCTION

1. Overview

1-1. Features

Programmed tool paths and workpiece shape are drawn on the graphic CRT on the operation panel of OSP5020M/OSP500M-G.

1-2. Major Functions

(1) Display modes can be selected from the following two modes.

- Split (2-view) (Fig. 5-1)
- 3-D (Fig. 5-2)

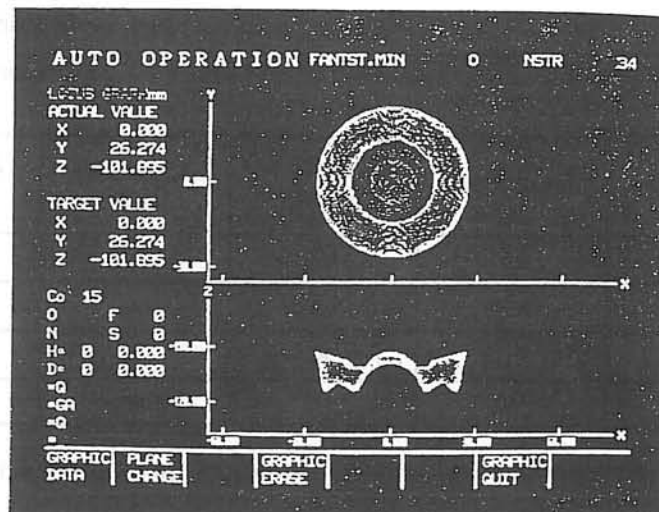


Fig. 5-1

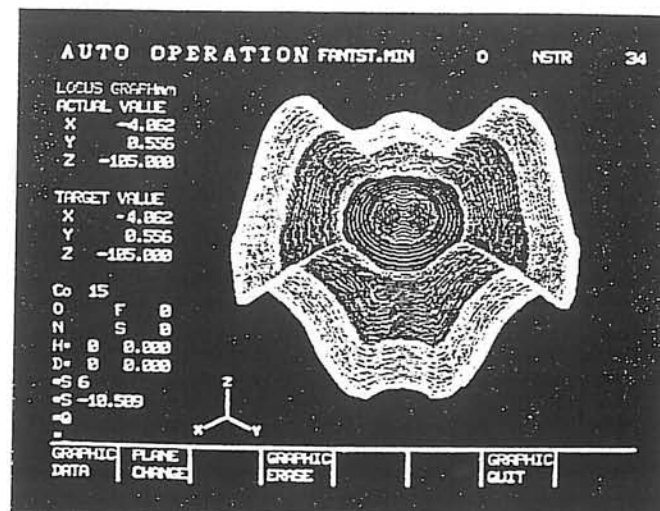


Fig. 5-2

- (2) Drawing speed can be selected from the following two modes.
 - Programmed feedrate
 - High drawing speed
- (3) Display position and scale can be changed while looking at the tool paths being drawn.
- (4) Programmed shape display without actual axis movements is possible.
- (5) With 3-D display mode, view angle (elevation and rotation angles) can be changed as required so that the operator can check the programmed shape in any angle from any height level. (Fig. 5-3)

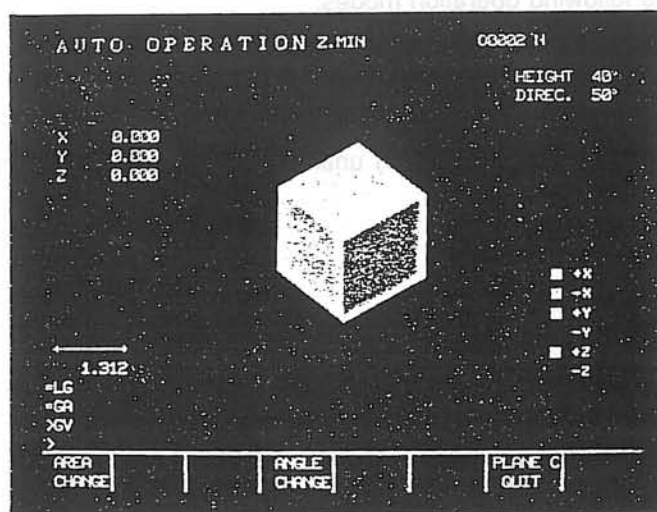


Fig. 5-3

- (6) Restart and sequence restart operations are both possible.
- (7) Zero offset, cutter radius offset and 3-D offset data are all added to draw the programmed tool paths.

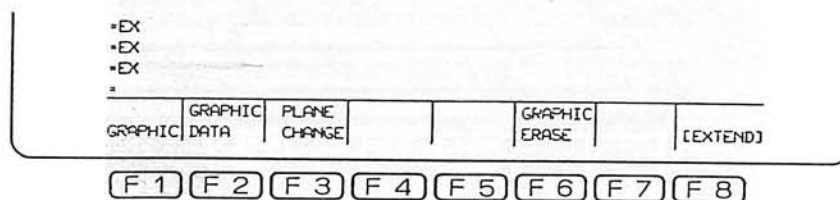
2. Setting of Display Data

Set the data necessary for drawing the programmed tool paths, as required.

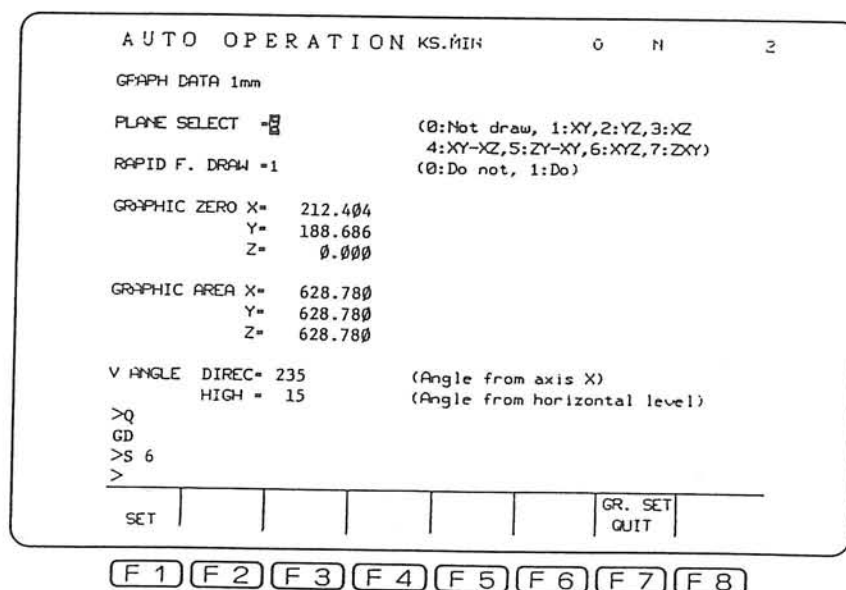
2-1. Data Setting in The Graphic Data Mode

Operation Procedure:

- (1) Select any of the following operation modes:
 - AUTO
 - MDI
 - MANUAL
- (2) Press the function key [F8] (EXTEND) until the CRT displays the function key names indicated below.



- (3) Press the function key [F1] (GRAPHIC).
- (4) Press the function key [F2] (GRAPHIC DATA).



- (5) Press the cursor keys [\uparrow], [\downarrow] to locate the cursor on the desired data position. For the data displayed on the CRT, refer to 2-2, "Graphic data Display Parameters".

- (6) Press the function key [F1] (SET) and key in the data through the keyboard.
- (7) Press the **WRITE** key.
- (8) Make sure that the data has been correctly entered on the CRT.
- (9) Repeat the steps 5) through 8) to enter all data. After all data has been set, press the function key [F7] (GR. SET QUIT).

2-2. Graphic Data Setting Parameters

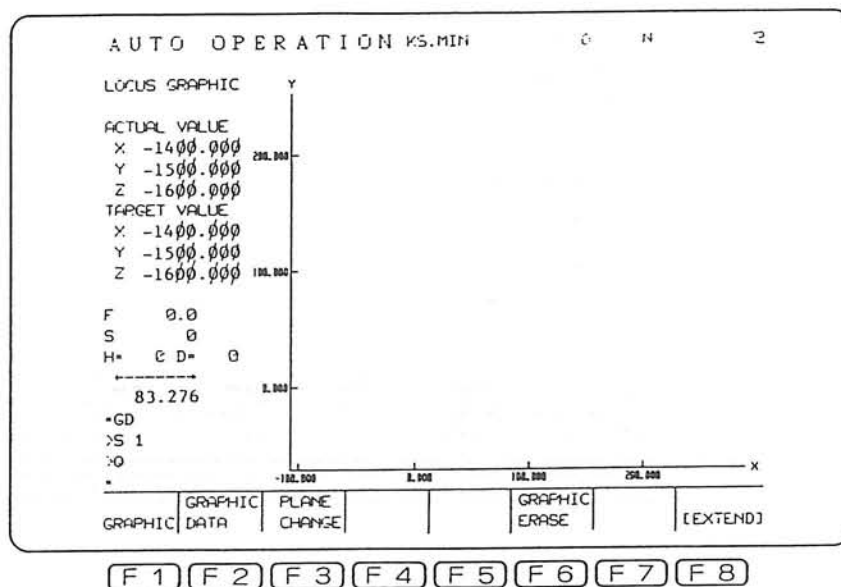
(1) Parameter: PLANE SELECT

This parameter selects the plane(s) on which tool paths are to be drawn.

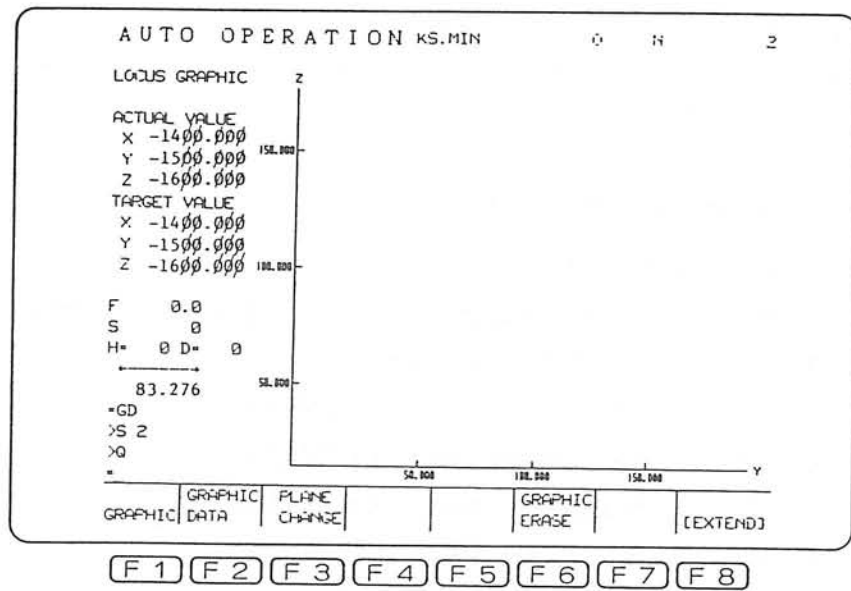
- 0: Not draw Tool path is not drawn.
- 1: XY Tool path is drawn on the XY plane.
- 2: YZ Tool path is drawn on the YZ plane.
- 3: XZ Tool path is drawn on the XZ plane.
- 4: XY - XZ Split display of XY and XZ planes
- 5: ZY - XY Split display of ZY and XY planes
- 6: XYZ 3D display of X-Y-Z space
- 7: ZXY 3D display of Z-X-Y space

Examples of graphics drawn for each selection are given on the following pages.

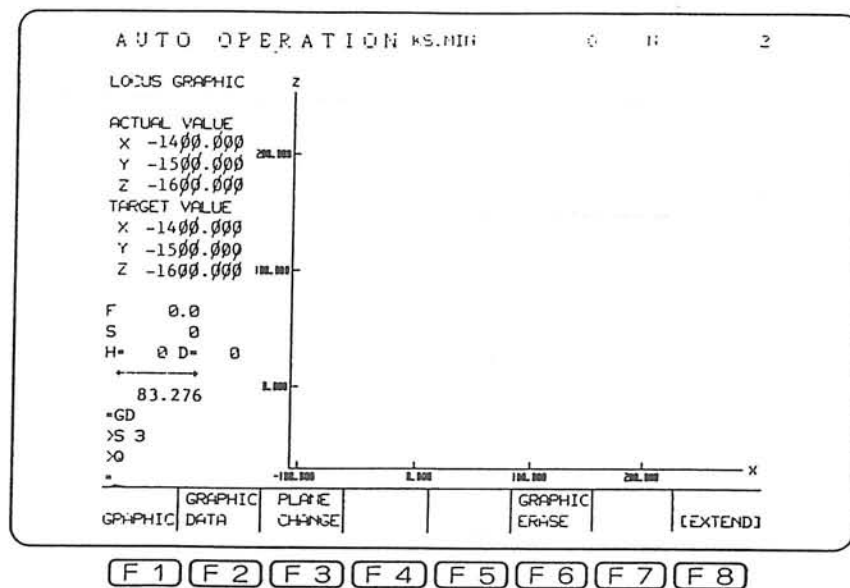
1: XY



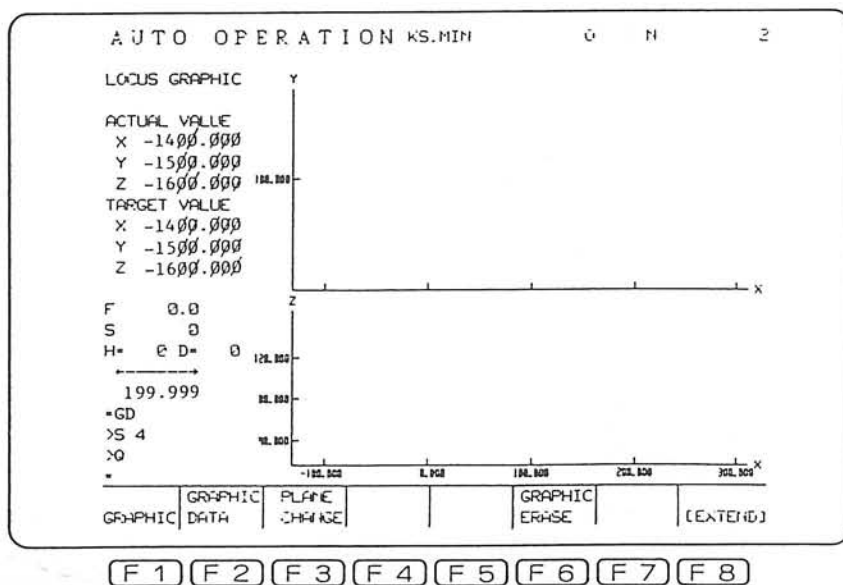
2: YZ



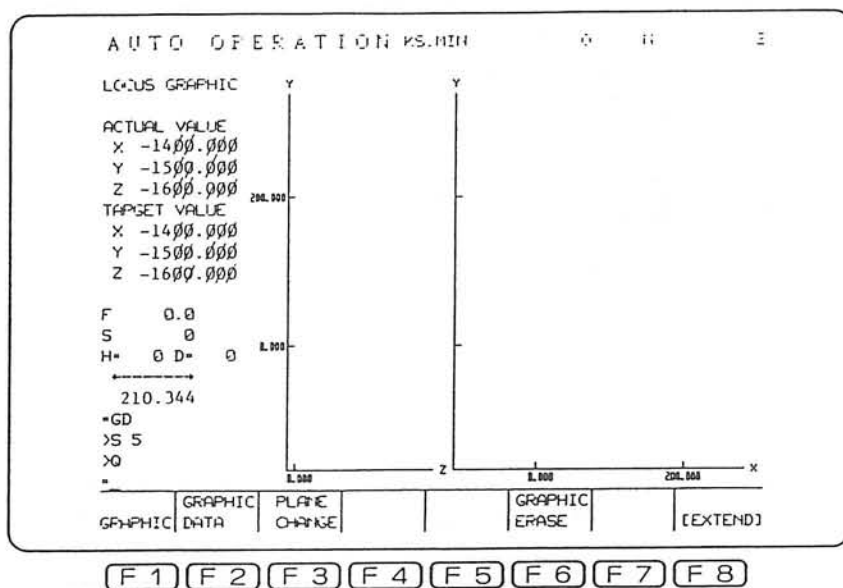
3: XZ



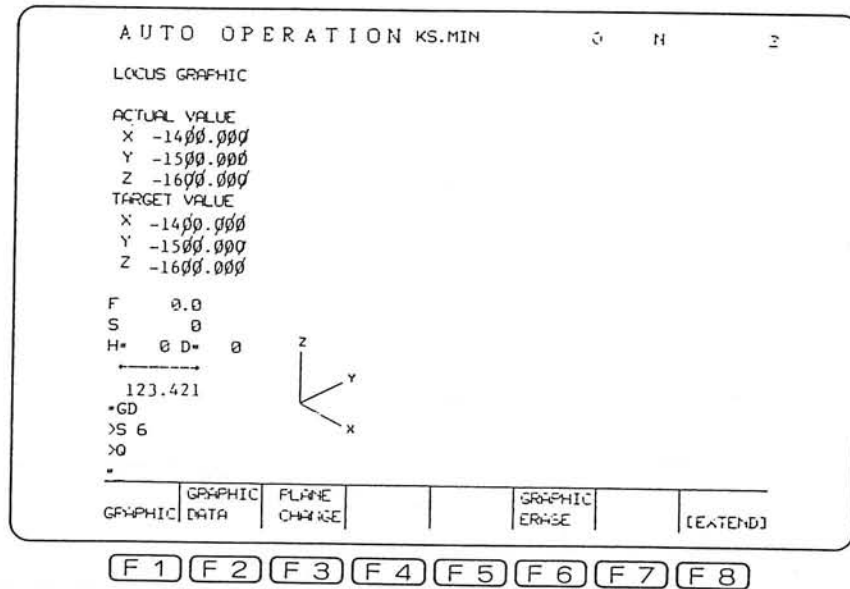
4: XY - XZ



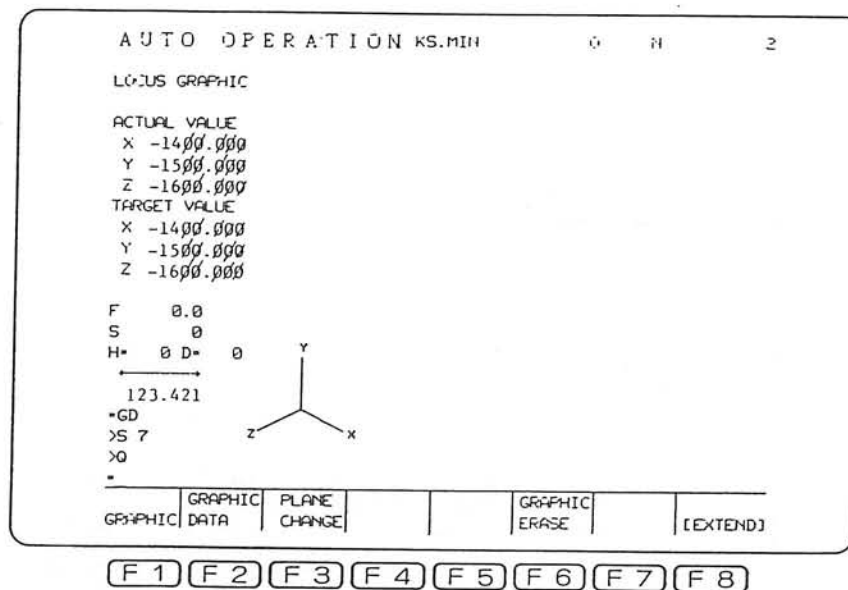
5: ZY - XY



6: XYZ



7: ZXY



(2) Parameter: RAPID F. DRAW

This parameter sets whether the tool paths controlled under the G00 rapid feed mode are to be drawn or not.

0: Do not . . . G00 mode tool paths are not drawn.

1: Do G00 mode tool paths are drawn.

(3) Parameter: GRAPHIC ZERO

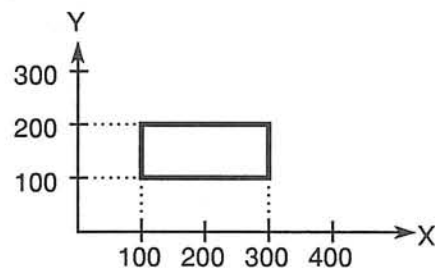
The center of the display area is called "graphic zero", and should be set in terms of the coordinate values of the work coordinate system.

(4) Parameter: GRAPHIC AREA

This parameter sets the area in which the tool paths should be drawn.

Example:

This example shows how the same rectangle shown at the right is drawn on the CRT depending on the setting of the GRAPHIC ZERO and GRAPHIC AREA.

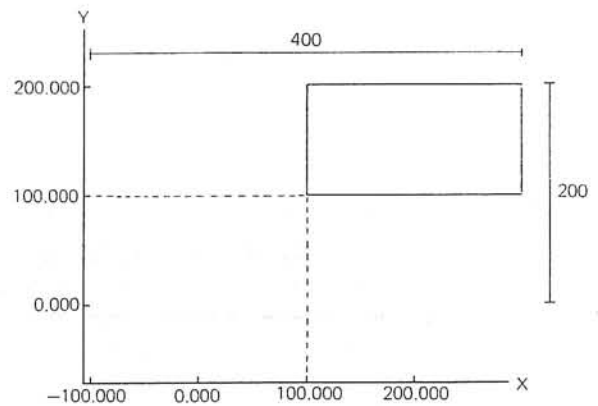


a) GRAPHIC ZERO X = 100

Y = 100

GRAPHIC AREA X = 400

Y = 200

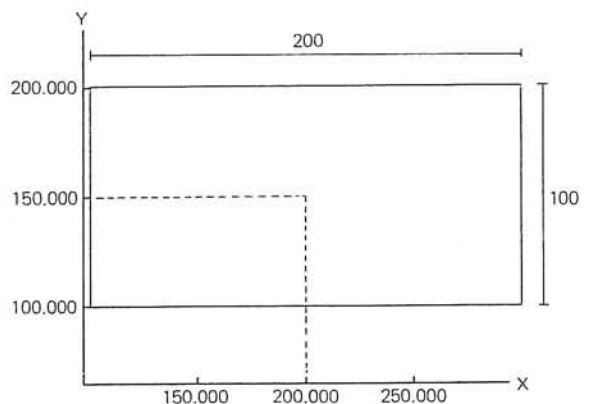


b) GRAPHIC ZERO X = 200

Y = 150

GRAPHIC AREA X = 200

Y = 100



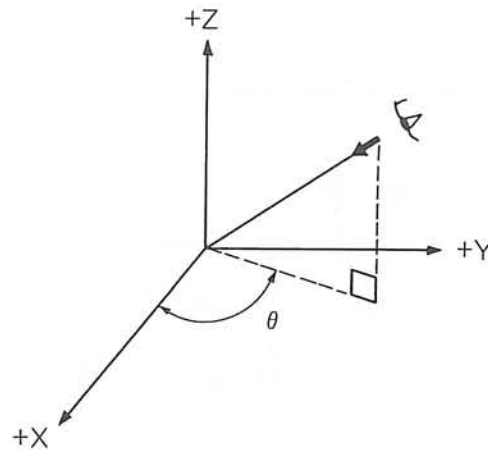
(5) Parameter: V ANGLE

This parameter sets the view angle in the 3-D mode drawing.

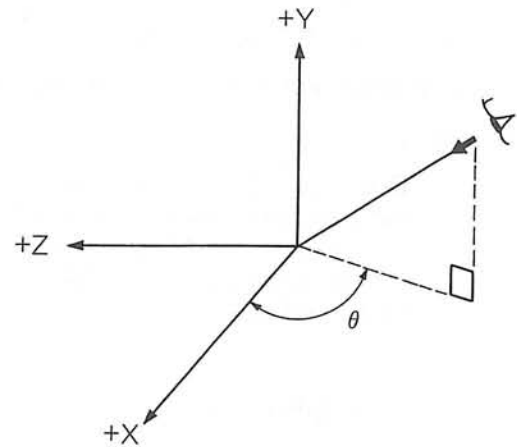
For the split display mode, setting of this parameter is unnecessary.

(a) DIREC (Angle from axis X)

This parameter sets the view angle referenced to the positive direction of X-axis in units of 5 degrees.

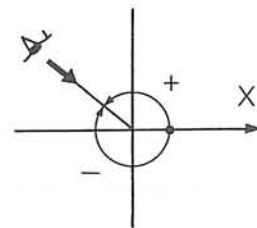


X-Y-Z 3D



Z-X-Y 3D

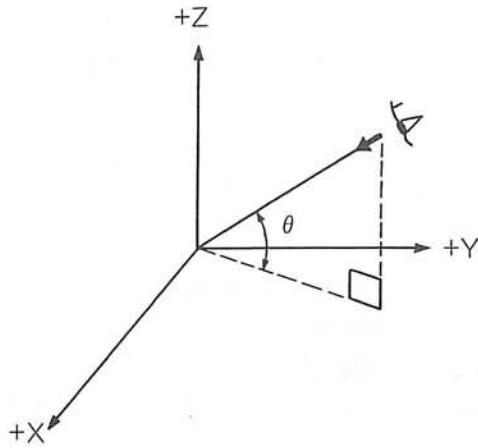
The plus or minus sign of the angle is determined by viewing the plane from the top. An angle measured in the counterclockwise direction has a positive value and an angle measured in the clockwise direction has a negative value.



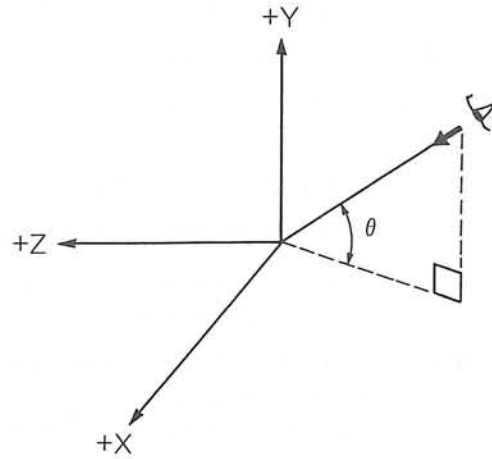
Viewing from the Top

(b) HIGH (Angle from horizontal level)

This parameter sets the view angle referenced to the horizontal plane in units of 1 degree.

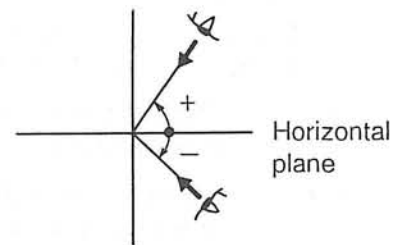


X-Y-Z 3D



Z-X-Y 3D

The plus or minus sign of the angle is determined by viewing the vertical plane from the side. An angle measured in the counterclockwise direction has a positive value and an angle measured in the clockwise direction has a negative value.



Viewing from the Side

(6) Parameter: GRAPH. COOR.

The work coordinate system solely used for drawing can be registered as the graphic coordinate system. This coordinate system is very convenient for drawing the programmed tool paths and cutting processes on the CRT screen, using a single coordinate system independent of the work coordinate systems used in a part program.

This parameter sets whether the graphic coordinate system is made effective or ineffective.

0: To make the graphic coordinate system ineffective.

Drawing is conducted so that the origin of the work coordinate system in a part program is set at the center of the graphic display ((X, Y, Z) = (0, 0, 0)).

1: To make the graphic coordinate system effective.

Drawing is conducted so that the origin of the graphic coordinate system is set at the center of the graphic display ((X, Y, Z) = (0, 0, 0)).

Note : Whether the graphic coordinate system is made effective or not when power supply to the control is turned on or when it is reset, can be determined by the setting of NC optional parameter (bit) No. 33 bit 0.

(7) Parameter: GRAPH. COOR. NUMBER

The number for the work coordinate system solely used for graphic drawing can be set as the graphic coordinate system number.

Setting range: 0 - 50

0 Machine coordinate system
1 - 50 Work coordinate system number

Note 1: Once set, the graphic coordinate system number is not cleared when the control is reset or power supply to the control is turned off.

Note 2: Setting range is 0 - 50 as stated above. If a value greater than the maximum number of work coordinate system sets is set, drawing is made on the machine coordinate system depending on the specification.

2-3. Data Setting In The Plane Change Mode

The color graphic display function permits the set data - GRAPHIC ZERO, GRAPHIC AREA, and V ANGLE - to be changed while the operator is looking at the tool paths being drawn.

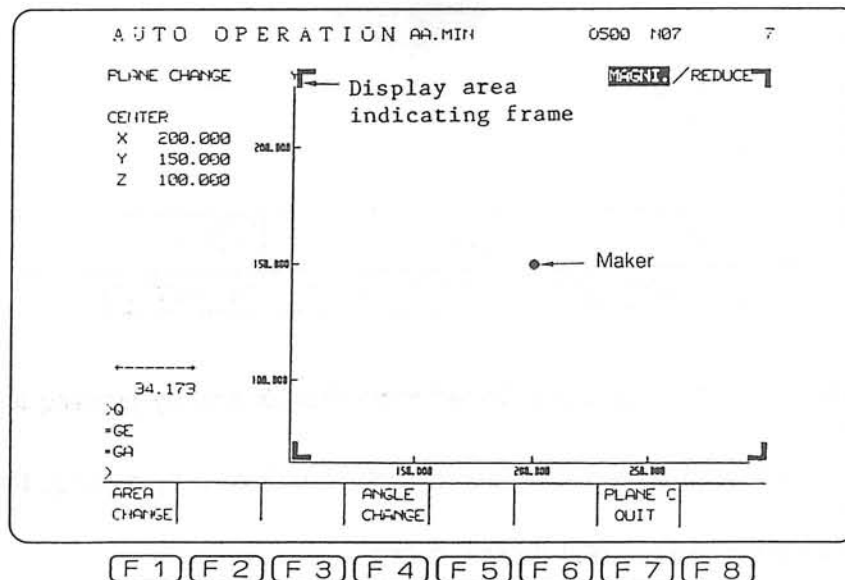
(1) Changing GRAPHIC ZERO Data

Operation Procedure

- ① Select any of the following operation modes:
 - AUTO
 - MDI
 - MANUAL
- ② Press the function key [F8] (EXTEND) until the CRT displays the set of function key names shown at the right.



- ③ Press the function key [F1] (GRAPHIC).
- ④ Press the function key [F3] (PLANE CHANGE).



- ⑤ Locate the marker at the point where the graphic zero is to be established. Use the cursor keys [↑], [↓], [←], [→] for moving the marker.

⑥ After locating the marker at the desired point, press the function key [F7] (PLANE C QUIT).

(2) Changing GRAPHIC AREA Data

Follow the steps ① through ④ in (1).

Operation Procedure:

This operation is effective only when the 3-D display mode is selected.

⑤) Locate the display area indicating frames at the required display area.

Use the page keys [P ↓], [P ↑] for this operation.

⑥) Press the function key [F7] (PLANE C QUIT).

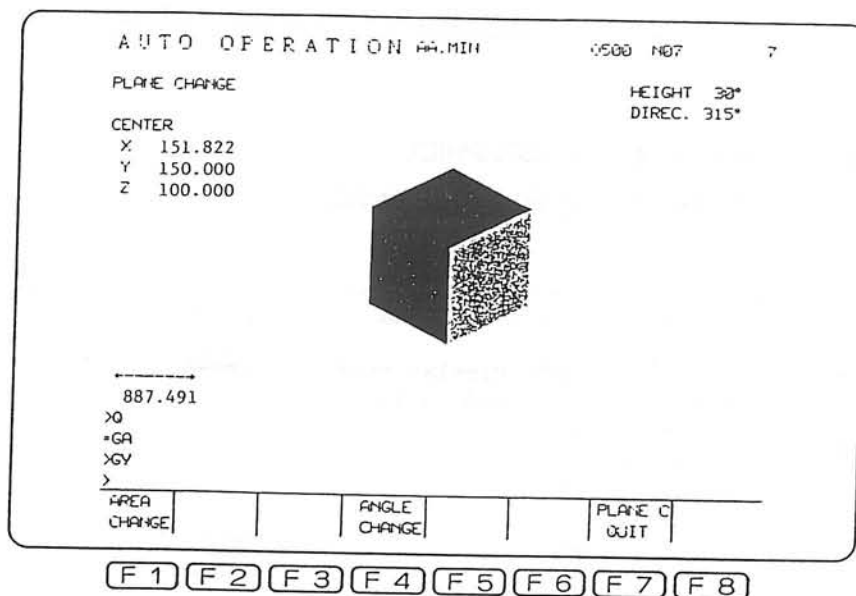
(3) Changing V ANGLE Data

Follow the steps ① through ④ in (1).

Operation Procedure:

This operation is effective only when the 3-D display mode is selected.

⑤ Press the function key [F4] (ANGLE CHANGE).



⑥ Rotate the angle cube to the desired angle (from X-axis) by pressing the cursor keys [←], [→].

⑦ Rotate the angle cube to the desired angle (from plane) by pressing the cursor keys [↑], [↓].

⑧ Press the function key [F7] (PLANE C QUIT).

3. Tool Path Drawing

3-1. Operations

To draw the programmed tool paths on the CRT, follow the procedure indicated below:

- (1) Select the AUTO mode.
- (2) Select the program for which tool paths are to be drawn.
- (3) Press the function key [F8] (EXTEND) three times.
- (4) Press the function key [F1] (GRAPHIC).
- (5) To erase the tool paths already drawn on the CRT, press the function key [F6] (GRAPHIC ERASE).
- (6) Press the **CYCLE START** button. The tool paths are drawn on the CRT in synchronization with the execution of the program.

Note 1: If the operation is attempted in the MACHINE LOCK mode, the tool paths will be drawn while actual axis movements do not occur.

Note 2: If "0 (Not draw)" is set at parameter PLANE SELECT on the GRAPH DATA page, tool path drawing does not occur.

3-2. Contents of Display

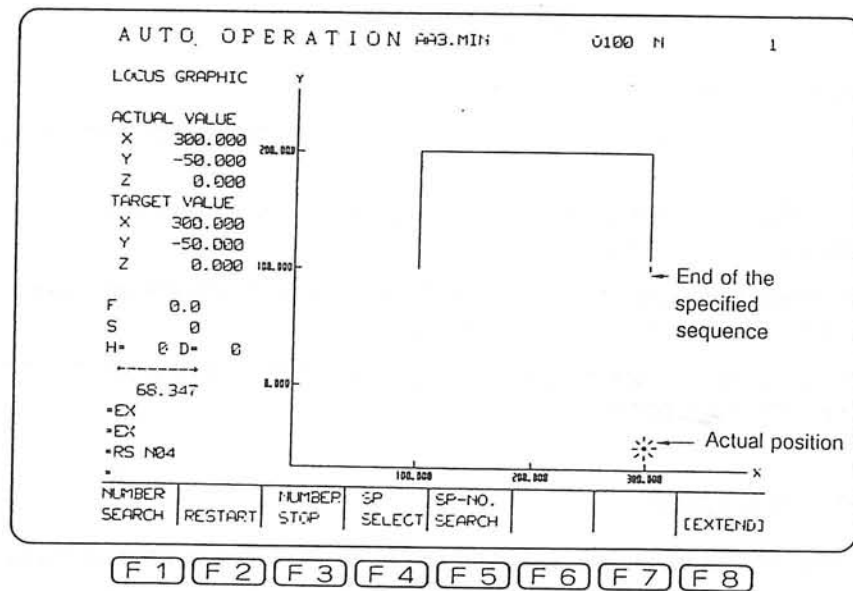
- (1) The programmed tool paths are differentiated by the types of lines as indicated below:

Rapid feed	broken lines	(- - - - -)
Cutting feed	solid lines	(———)
Jog feed	dots	(.....)
- (2) Even when the machining face is changed due to the indexing or rotation of the rotary axis, the tool paths are drawn assuming the same face. Therefore, it is recommended to erase the tool paths drawn for the previous face.
- (3) The tool paths are drawn taking the manual shift amount, work zero offset amount, and tool offset amount into account.

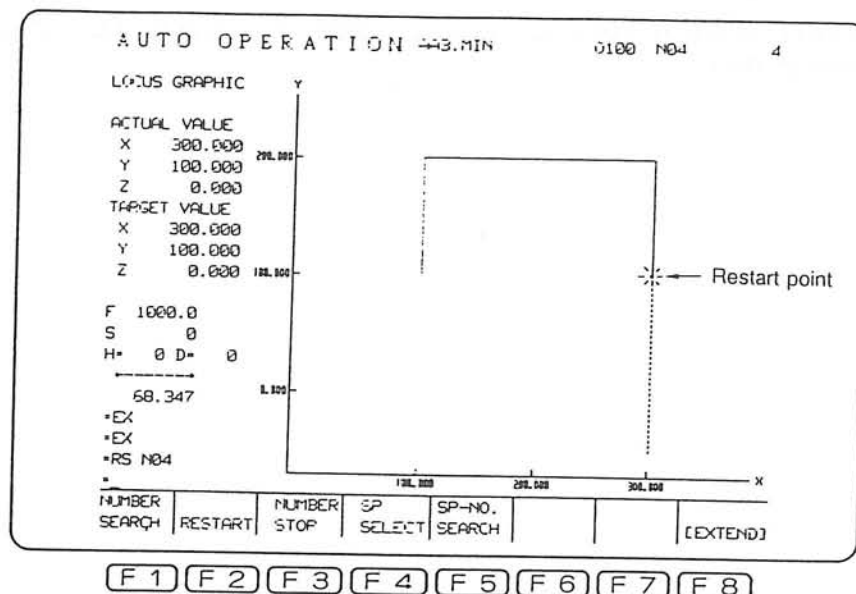
3-3. Restart and Sequence Restart Operations

- (1) The restart operation called by the pressing of the function key [F2] (RESTART) draws the tool paths at a high speed up to the specified block.

The point corresponding to the actual position will blink during this high-speed drawing.



- (2) When the **SEQUENCE RESTART** button is pressed, the axes are returned to the restart point at a manual cutting feedrate. The tool paths are drawn in dots. The blinking point is shifted from the actual position to the restart point.



- (3) Pressing the **CYCLE START** button executes the program from the specified sequence.

Note: Blinking point is cleared in the following cases:

- 1) NC is reset.
- 2) M02 (M30) is executed.
- 3) Tool path erase operation is executed.

4. Parameters

NC optional parameter (bit)

No. 33 bit 0 Effective/ineffective of graphic coordinate system

- 0: Graphic coordinate system is made ineffective when power supply is turned on or the control is reset.
- 1: Graphic coordinate system is made effective when power supply is turned on or the control is reset.

SECTION 6 NC OPERATION MONITOR

1. Overview

This function has two sub functions as NC HOUR METER and NC WORK COUNTER.

The NC HOUR METER function: Accumulates the following hours and displays them on the CRT screen.

POWER ON TIME
NC RUNNING TIME
SPINDLE REVOLUTION TIME
CUTTING TIME
EXTERNAL INPUT TIME

The NC WORK COUNTER function: Has four work counters and counter data of individual counters is displayed on the CRT screen. These four counters can be used as required.

In addition, data can be preset for each timer and counter. When the COUNT data exceeds the SET value, alarm signal is output.

2. NC Hour Meter

2.1. Contents Of Display

Press the function key [F6] (ITEM↑) or [F7] (ITEM↓) after selecting the PARAMETER SET mode, then the NC HOUR METER screen will be displayed.

PARAMETER SET			
NC HOUR METER			
	COUNT	SET	
1 POWER ON TIME	0:12:53	120: 0: 0	
2 NC RUNNING TIME	0: 0: 0	0: 0: 0	
3 SPINDLE REVOLUTION TIME	0: 2:31	0: 0: 0	
4 CUTTING TIME	0: 0: 0	0: 0: 0	
5 EXTERNAL INPUT TIME	0: 0: 0	0: 0: 0	

	X	Y	Z
ACT POSIT (WORK)	799.999	799.999	-1400.000

*EX
*EX
*S 120:0:0
*

SET	ADD		SEARCH		ITEM↑	ITEM↓	[EXTEND]
-----	-----	--	--------	--	-------	-------	----------

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

Details of the display contents are explained below:

The units of displayed data are "hours:minutes:seconds".

(1) POWER ON TIME

This accumulates duration of time in which power supply to the NC is on.

(2) NC RUNNING TIME

This accumulates duration of time in which NC is operating. Note that operation time in the machine lock mode is not accumulated.

(3) SPINDLE REVOLUTION TIME

This accumulates duration of time in which the spindle has been rotating. However, the time in which the control is placed in the machine lock mode is not accumulated since the spindle is not rotating in this mode.

(4) CUTTING TIME

This accumulates duration of time in which axes are fed in cutting feedrates. However, the time in which the control is placed in the machine lock mode is not accumulated.

(5) EXTERNAL INPUT TIME

This accumulates duration of time in which the external input signal is ON.

2-2. Count Data and Set Data

- (1) Setting of both the COUNT (accumulated) and SET (not accumulated) data is possible by locating the cursor at the required data position.
- (2) If the COUNT data exceeds the value set at SET, alarm signal is output.
- (3) When output of the alarm signal is not required, set "0:0:0" at the SET column.
- (4) The maximum setting values for both COUNT and SET are 99999:59:59.
- (5) Setting format is "hours:minutes:seconds" and omission is not allowed.

Example : S 0:28:59



Be sure to place a colon.

2-3. Alarm

If any one of the COUNT values exceeds the SET value, the following alarm occurs and cycle start of the NC is disabled.

ALARM-C 984 Running hour over X

Index : None

Character-string : None

Code : X=1..... COUNT data of POWER ON TIME exceeds the SET data.
 2..... COUNT data of NC RUNNING TIME exceeds the SET data.
 3..... COUNT data of SPINDLE REVOLUTION TIME exceeds the SET data.
 4..... COUNT data of CUTTING TIME exceeds the SET data.
 5..... COUNT data of EXTERNAL INPUT TIME exceeds the SET data.

To reset the alarm,

- (1) Set COUNT value smaller than SET value.
- (2) Set SET value larger than COUNT value.
- (3) Set SET value at 0:0:0.

Reset the NC after taking any of the above indicated measures.

Note that simple NC reset operation cannot reset this alarm.

Note: If measure (3) is taken, alarm check is not conducted.

3. NC Work Counter

3-1. Content of Display

- (1) Switching the display screens between NC HOUR METER and NC WORK COUNTER is made by pressing the **PAGE** key.

PARAMETER SET			
		NC WORK COUNTER	
		COUNT	SET
1 WORK COUNTER A	2		5
2 WORK COUNTER B	0		2
3 WORK COUNTER C	0		12
4 WORK COUNTER D	0		2
ACT POSIT (WORK)	X 799.999	Y 799.999	Z -1400.000
*EX			
*EX			
*EX			
*S 5			
SET	ADD	SEARCH	ITEM+ ITEM- (EXTEND)
F 1	F 2	F 3	F 4 F 5 F 6 F 7 F 8

- (2) The count data is displayed at the COUNT column.
- (a) The units of indication are pieces.
 - (b) Work counters A, B, C and D is incremented each time M02 or M30 is executed. This counts the number of workpieces which have been machined.
 - (c) Count up condition of the work counters are identical to all of these counters. Counting does not occur during machine lock mode of operation.
 - (d) Users can use these four counters for individual purposes.

3-2. Count Data and Set Data

- (1) Setting of both the COUNT (accumulated) and SET (not accumulated) data is possible by locating the cursor at the required data position.
- (2) If the COUNT data exceeds the value set at SET, alarm signal is output.
- (3) When output of the alarm signal is not required, set "0" at SET column.
- (4) The maximum setting values for both COUNT and SET are 99999999.

3-3. Alarm

If any one of the COUNT values exceeds the SET value, the following alarm occurs and cycle start of the NC is disabled.

ALARM-C 985 Work counter over X

Index : None

Character-string : None

Code : X=1..... COUNT data of WORK COUNTER A exceeds the SET data.
2..... COUNT data of WORK COUNTER B exceeds the SET data.
3..... COUNT data of WORK COUNTER C exceeds the SET data.
4..... COUNT data of WORK COUNTER D exceeds the SET data.

To reset the alarm,

- (1) Set COUNT value smaller than SET value.
- (2) Set SET value larger than COUNT value.
- (3) Set SET value at 0.

Reset the NC after taking any of the above indicated measures.

Note that simple NC reset operation cannot reset this alarm.

Note: If measure (3) is taken, alarm check is not conducted.

SECTION 7 Hi² - NC FUNCTION (High-speed NC)

1. Overview

- (1) The Hi²-NC function consists of the following functions:
 - (a) High-speed NC interpolation function which makes high cutting feedrate for continuous minute motion blocks possible.
 - (b) Quick response, high-accuracy servo function and tolerance control function which ensure high machining accuracy on sculptured surface and edges.
- (2) The high-speed NC interpolation function allows high cutting feedrate for cutting sculptured surface.
- (3) The part program used to cut sculptured surface consists of continuous minute motion blocks which are created by dividing the sculptured surface into proper segments and arcs. The high-speed NC interpolation function has the capability to read these minute motion command blocks and carries out interpolation at a high speed to provide improved high cutting feedrate.
- (4) The quick response, high accuracy servo function and the tolerance control function greatly improve the machined shape accuracy on sculptured surface and edges. Especially, the tolerance control function controls axis feedrates so that the error on the machined shape is always limited within the designated tolerance while cutting sculptured surface and edges at a high speed. With this function, consistently high machining accuracy is ensured.

2. High-speed NC Interpolation Function

- (1) The high-speed NC interpolation function is developed by increasing the NC interpolation speed of the NC itself. This means that;
 - (a) high cutting feedrate for continuous minute motion blocks is achieved using the same program format as applied for conventional programs, and
 - (b) the same NC operations, such as the sequence restart, manual intervention, etc., as available with the conventional NC can be used.
- (2) The high-speed NC function reads more than 9 blocks of commands into the buffer automatically when minute motion blocks are continued in the part program so that the stable high-speed NC interpolation is possible.

3. Tolerance Control Function

- (1) The tolerance control function guarantees machining accuracy for any type of workpiece shape by the "automatic control of cutting feedrate meeting the shape being machined", the technology realized on the base of quick-response, high-accuracy servo function.
- (2) To obtain required accuracy, only the designation of allowable tolerance is necessary in the program. Modification of feedrates corresponding to the shape to be cut is not necessary any more.
- (3) By designating the upper limit of the cutting feedrate, which is determined according to cutting conditions (workpiece material, tool type, spindle speed, etc.), the maximum value of feedrate is clamped at this upper limit. Therefore, automatic feedrate control which meets the cutting conditions is enabled.
- (4) Furthermore, the tolerance control function "automatically determines the optimum servo control parameters best fitting to cutting" based on the upper limit of feedrate which is determined according to the cutting conditions. Therefore, high-speed, high-accuracy machining is always possible regardless of cutting conditions.
- (5) Because automatic cutting feedrate control in the tolerance control function is carried out while actual tool position is monitored, machining accuracy is consistently high. In addition, the consistently high accuracy machining is realized in high feedrates through the feed forward control which secures the machining accuracy without lowering feedrates excessively.

3-1. Designating Tolerance Control Mode

To turn on the tolerance control function, designate the "TOLERANCE CONTROL ON".

- (1) Set the following tolerance control parameters according to the type of machining:
 - (a) CONTROL AXIS
 - (b) HIGH-SPEED MODE
 - (c) MAXIMUM FEEDRATE
 - (d) WORK TOLERANCE
 - (e) FILTER VALUE
- (2) Designation of the tolerance control mode is made in the following two methods:
 - (a) Parameter setting
 - (b) Program command
- (3) The tolerance control is effective only to the cutting feed commands in the "feed per minutes" mode programmed in the tolerance control mode. In other words, the tolerance control is not effective to the rapid feed commands and the feed/rev. commands programmed in the tolerance control mode.
- (4) Concerning the axes, the tolerance control is effective only to the basic three axes (X, Y, Z) and their parallel axes (U, V, W). For the rotating axes (A, B, C), the tolerance control is not effective.

3-2. Tolerance Control Parameters

(1) CONTROL AXIS

- (a) This parameter selects the axes for which the tolerance control is made effective.
- (b) Selection of the axis names is possible between the basic axes (X, Y, Z) and linear additional axes (U, V, W).

That is, the axis names can be selected for each Cartesian coordinate system axis independently:

- X direction: X (basic) / U (additional)
- Y direction: Y (basic) / V (additional)
- Z direction: Z (basic) / W (additional)

(2) HIGH-SPEED MODE

- (a) The tolerance control function provides the following three control modes and it is possible to select any of these modes to carry out machining.
 - Normal mode
 - High-speed mode 1
 - High-speed mode 2
- (b) With the tolerance control function, feedrates are automatically controlled by the combination of the closed loop control, in which consistently high accuracy is secured for any workpiece shape, and the feed forward control, in which high accuracy is secured without lowering feedrates excessively by estimating machining error in advance.

The feed forward control, due to its characteristic that it estimates machining error in advance, an error greater than the preset tolerance might be generated if slide hold or other operation is attempted. (positioning error in this case)

- (c) Therefore, the tolerance control function permits the selection of control mode so that the control best fitting to user's requirements is selected between the normal mode, which does not include the feed forward control, and the high-speed mode, which includes the feed forward control to allow high-speed cutting.
- (d) The features of the high-speed mode are briefly stated below:

1) Cutting time

High-speed mode 2 cuts workpiece faster than high-speed mode 1.
The normal mode takes longer cutting time than high-speed mode 1.

2) Cutting accuracy

* During normal cutting

In the high-speed mode 1 and high-speed mode 2, workpiece is finished within the set tolerance as in the normal mode.

* Slide hold button is pressed during cutting

Positioning error as indicated below is generated when cutting is being carried out on curved surface with small curvature.

High-speed mode 1 Less than the set tolerance

High-speed mode 2 Less than 3 times the set tolerance("0" at the normal mode)

(3) MAXIMUM FEEDRATE

- (a) Feedrate upper limit sets the maximum value of feedrate which is applicable when cutting is carried out using the tolerance control.

Feedrate upper limit = Maximum value of feedrate command

- (b) Because the tolerance control function determines automatically the optimum servo control parameters using the feedrate upper limit value, consistently high accuracy with high speed is guaranteed for any type of machining. Therefore, if the maximum feedrate changes due to the change in the type of machining, it is recommended to change the setting for this parameter.

- (c) The maximum value of feedrate designated in "per minute" mode is limited by this value.

(4) WORK TOLERANCE

- (a) This parameter sets the allowable machining error when the workpiece is machined using the tolerance control function.

Tolerance = Allowable machining error (1)

By setting this parameter, the workpiece is finished within allowable error.

- (b) Because the tolerance control function controls cutting feedrate based on the set tolerance, it is recommended to set a large value within allowable error so that a workpiece is machined by high feedrates.

Due to the control characteristic that diameter reduction in arc cutting and dulling at corners will become greater as higher feedrate is used, although smaller tolerance reduces error, feedrate is lowered at the same elongating total cutting time.

When cutting free-formed curve, which is approximated with minute motion blocks of line and arc command (programmed shape):

- (c) In this case, actual cutting error is determined by the following factors:

- Program tolerance Error between the original surface and the surface approximated using line segments
 - Machining tolerance Error between programmed shape and tool paths
- Tool shape error

If the relationship between the program tolerance and machining tolerance is

Program tolerance < Machining tolerance (2)

actual cutting error is as indicated below.

Allowable machining error > Actual machining error = Machining tolerance
+ Tool shape error

If the tool shape error is small and can be neglected, designation of the machining tolerance as in expression (1), actual machining error is within allowable machining error.

However, if precise setting is necessary, the tolerance must be set as indicated below.

Tolerance (machining tolerance) = Allowable machining error - Tool shape error

If the relationship as indicated in expression (2) is not satisfied, i.e., if the program tolerance is greater than the machining tolerance, actual machining error is generally expressed with the following formula.

Allowable machining error > Actual machining error = Program tolerance + Tool shape error

From this, it will be understood that if the program tolerance is greater than the allowable machining error, actual machining error is always greater than the allowable machining error even if the machining error is set to a small value.

Therefore, to machine a workpiece within the allowable machining error, it is necessary to set a smaller value to the program tolerance than the allowable machining error. To obtain smooth surface, setting of further smaller program tolerance is necessary. From this point of view, the program tolerance should be set to meet the following.

$$\text{Program tolerance} < 1/2 \times (\text{Allowable machining error})$$

That is,

$$\text{Program tolerance} < 1/2 \times (\text{Machining tolerance})$$

(5) FILTER VALUE

- (a) This parameter sets the filtering amount of the filtering function in the tolerance control mode. A value smaller than 30 μm is effective.
- (b) Usually, the filtering function is activated automatically, setting should be:

$$\text{Filtering amount} = 0$$

- (c) Filtering function:

Since the tolerance control function controls cutting feedrates in response to the programmed shape, satisfactory effect cannot be expected if an error is included in the programmed shape. For example, the free-form curved surface proximate using line segments and arcs will include an error at each command point due to calculation or rounding off. For example, the command value at each command point includes a maximum of 10 μm error if the command value unit is 10 μm . This means that satisfactory machining accuracy will not be obtained even if the workpiece shape is commanded correctly.

Due to this reason, if an error inevitable at each command point is set as the filtering amount, the commanded shape can be evaluated by excluding the error at each command point, permitting the optimum tolerance control. This is the filtering function.

- (d) With the tolerance control, the filter function becomes effective automatically for the error due to rounding off of command values based on the filtering amount which is set for the programming unit system. However, if calculation error generated by the automatic programming software, etc. is greater than the error caused by rounding off of command values, set the calculation error for the filtering amount.

3-3. Tolerance Control Mode Designation

(1) Tolerance Control Mode Designation by Parameters

Operation:

- ① Select the parameter setting mode.
- ② Display the tolerance control parameter setting screen by pressing the function key [F6] (ITEM↑) or [F7] (ITEM↓).
- ③ Place the cursor at the required data column of the parameter for which the setting is to be changed by using the cursor control keys. ([↑], [↓])
- ④ Set the data for the parameter after pressing the function key [F1] (SET) or function key [F2] (ADD).

(a) Function key [F1] (SET)

After pressing [F1], input the required data.

(b) Function key [F2] (ADD)

After pressing [F2], input an increment value in reference to the currently set data.

The unit for setting conforms to the unit designated for data setting.

PARAMETER SET

* TOLERANCE CONTROL PARAMETER * 1mm

1 TOLERANCE CONTROL	0 1		1
2 CONTROL AXIS	(X/U)		0
	(Y/V)		0
	(Z/W)		0
3 HIGH-SPEED MODE			0
4 MAXIMUM FEEDRATE			6000.000
5 WORK TOLERANCE			0.020
6 FILTER VALUE			0.000

ACT POSIT (MC)	X 0.000	Y 0.000	Z 0.000	C -OVERFLOW
----------------	------------	------------	------------	----------------

SET
ADD

ITEM↑
ITEM↓
[EXTEND]

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

1. TOLERANCE CONTROL

[1] : Tolerance control mode ON

[2] : Tolerance control mode OFF

The data set below is effective when the tolerance control mode is on, that is setting for TOLERANCE CONTROL is "1".

2. CONTROL AXIS

Select the three axes for which the tolerance control function becomes effective.

[0] : Basic axis (X, Y, Z)

[1] : Additional linear axis (U, V, W)

For the axis, for which the additional linear axis specification is not supported, the cursor does not move to the additional axis name position. That is, selection of the additional linear axis is possible only when the additional linear axis specification is supported.

3. HIGH-SPEED MODE

Select the tolerance control mode.

[0] : Normal mode

[1] : High-speed mode 1

[2] : High-speed mode 2

4. MAXIMUM FEEDRATE

Set the upper limit of the feedrate which is applied in the tolerance control mode.

5. WORK TOLERANCE

Set the tolerance which is applied in the tolerance control mode.

Setting of a value smaller than 0.003 mm is not allowed.

6. FILTER VALUE

Set the filtering amount for the filter function which becomes effective in the tolerance control mode. For details of the filtering function, refer to "Filtering function" on page 263. Usually, the filtering function is activated automatically, therefore, setting should be:

FILTER VALUE = 0

Setting range of filtering amount: 0 - 0.03 mm

(2) Tolerance Control Mode Designation by Program

To conduct the tolerance control for only a required part in the program or to change the tolerance control parameter setting according to the part to be machined, the tolerance control mode designation in a program is convenient.

(a) To carry out or cancel the tolerance control mode, designate the following G codes.

G187 (I___J___K) (H___) F___E___ (D___)	Tolerance control mode ON
--	---------------------------

G186	Tolerance control mode OFF (Cancellation of G187)
------	--

Follow the program unit system for the unit of command

- (b) Designate the G187 and G186 blocks at the beginning and at the end of blocks for which the tolerance control mode is required. These G codes must be designated in individual blocks and other commands must not be written in the same block.
- (c) When the tolerance control mode called by the programmed G code is ON, the tolerance control mode designated by the setting of the parameter becomes all ineffective.
- (d) When the tolerance control mode called by the programmed G code is OFF, i.e., after the designation of G186 or resetting the control, the tolerance control mode ON/OFF status is determined by the setting of the parameter.
- (e) Designate the following address characters and data words following the G187 code. Although they can be designated in any order, both E and F commands must always be designated.

1) I, J, K (axis selection)

I: X (basic axis) / U (additional linear axis)

J: Y (basic axis) / V (additional linear axis)

K: Z (basic axis) / W (additional linear axis)

0: Basic axis

1: Additional linear axis

For the axis for which an address character is not used, or for the axis for which the linear additional axis specification is not supported, the basic axis is selected automatically.

If "1" is set for axis for which the additional linear axis specification is not supported, an alarm occurs and the following message is displayed on the CRT.

Alarm message: 461 Data word: 'spec code' 31

2) H (high-speed mode)

Select any of the normal, high-speed mode 1, and high-speed mode 2.

0: Normal mode

1: High-speed mode 1

2: High-speed mode 2

When setting is not made for "H", the normal mode is selected automatically.

If a value greater than "2" or a negative value is set, an alarm occurs and the following message is displayed on the CRT.

Alarm message: 444 Data word: 'H'

3) F (maximum feedrate)

Designate the upper limit feedrate applied in the tolerance control mode.

An F command in the G187 block does not specify a linear cutting feedrate.

Designate the actual feedrate in a block other than the G187 block.

If no F command is designated in the G187 block, an alarm occurs and the following message is displayed on the CRT.

Alarm message: 443 Data word: 'F'

4) E (work tolerance)

Designate the machining tolerance amount used in the tolerance control mode.

If no E command is designated in the G187 block, an alarm occurs and the following message is displayed on the CRT.

Alarm message: 611 Data word: 'E'

Designation of a value smaller than 0.003 mm for this parameter is ignored and is replaced with 0.003 mm automatically.

5) D (filter value)

Designate the filtering amount for the filter function which becomes effective in the tolerance control mode. For details of the filtering function, refer to "Filter function" on page 263.

Usually, the filtering function is activated automatically, setting should be:

FILTER VALUE = 0

Filtering amount range: 0 - 30 μ m

If a value greater than 0.03 mm is designated, it is replaced with 0.03 mm.

Designation of a negative value causes an alarm and the following message is displayed on the CRT.

Alarm message: 442 Data word: 'D'

3-4. Tolerance Control Guide

In the Check Data pages accessible in the automatic operation mode, the TOLERANCE CONTROL GUIDE page is contained.

Using this display page, the tolerance control setting and state can be monitored.

To display the TOLERANCE CONTROL GUIDE page, follow the any of the procedure indicated below:

- (1) After pressing the function key [F7] (CHECK DATA), press the **PAGE** key repeatedly until the TOLERANCE CONTROL GUIDE page is displayed.
- (2) Press the function key [F5] (SEARCH) and the **WRITE** key to display the CHECK DATA DIRECTORY page. Using this page, key in the number corresponding to the TOLERANCE CONTROL GUIDE page to directly display the required page.

AUTO OPERATION A.MIN				0	NA1	63
CHECK DATA		* TOLERANCE GUIDE *		PAGE 59	1mm	
TOLERANCE CONTROL				EXECUTE		
PROGRAM	PARAMETER			CONDITION		
G187	TOLERANCE CONTROL			EXISTXIST		
IJK	CONTROL AXIS			(X Y Z)		
H	HIGH-SPEED MODE			1		
F	MAXIMUM FEEDRATE			6000.000		
E	WORK TOLERANCE			0.020		
D	FILTER VALUE			0.001		
B-Mtd						
=PS A						
PROGRAM	ACTUAL	PART	BLOCK		CHECK	
SELECT	POSIT.	PROGRAM	DATA	SEARCH	DATA	[EXTEND]

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

1. TOLERANCE CONTROL

Indicates that the tolerance control is not effective.

Indicates that the tolerance control is effective.

2. PROGRAM, PARAMETER

Indicates which of the settings is effective to activate the tolerance control; currently used setting is indicated by the reverse display.

3. G187 TOLERANCE MODE

Indicates the current tolerance mode on/off state.

OFF The tolerance control mode is off.

ON The tolerance control mode is on.

The following data is effective only when the tolerance control mode is on.

4. IJK CONTROL AXIS

Indicates the three axes for which the tolerance control mode is effective.

5. H HIGH-SPEED MODE

Indicates the currently effective high-speed mode.

'0' Normal mode

'1' High speed No. 1 mode

'2' High speed No. 2 mode

6. F MAXIMUM FEEDRATE

Indicates the currently effective maximum feedrate.

7. E WORK TOLERANCE

Indicates the currently effective machining tolerance amount.

8. D FILTER VALUE)

Indicates the currently effective filtering amount.

3-5. Alarm

Alarm A

269 Tolerance control error

Tolerance control cannot be executed due to the generation of a command which makes axis motion instable. An occurrence of instable axis motion is checked before executing the command.

Note: This is not an operator's error.

- Index: None

- Character-string : None

- Code: 1 Writing to the GD buffer is faulty while the tolerance control module is executed with the setting of tolerance control mode ON and high-speed mode other than "0". Or, reading from the GD buffer is faulty while the interpolation module is executed.1

- Measures to Take: Correct the NC control software.

SECTION 8 SYNCHRONIZED TAPPING FUNCTION

1. Overview

This function carries out tapping by synchronizing axis feedrate and spindle speed using the high-precision VAC.

2. Commands

(1) Command Format

G	X	Y	Z	R	E	P	Q	F	S	M
---	---	---	---	---	---	---	---	---	---	---

G: Tapping cycle calling G code
G84, G284 Normal tapping cycle
G74, G274 Reverse tapping cycle

Note: The G84 and G74 codes are also used to call the tapping cycle using a floating taper. These G codes are, however, used to call the synchronized tapping cycle by changing the parameter setting.

X, Y: Tapping position

Z: Bottom level of tapping cycle

R: R-point level

E: Spindle start position at R-point level (angle designation)

P: Dwell period at the bottom level

Q: Dwell period at the R-point level in the return cycle

F: Feedrate

S: Spindle speed

(2) Details of Commands

(a) G code calling tapping cycle (G84, G284)

The G84 code calls either the conventional float tapping mode or synchronized tapping mode depending on the setting at bit 7 of optional parameter (bit) No. 17. If the synchronized tapping specification is not selected, the float tapping mode is called regardless of the parameter setting.

(b) G code calling reverse tapping cycle (G74, G274)

The tapping mode called by the G74 code is determined also by the setting at bit 7 at optional parameter (bit) No. 17. The G274 code is same as the G284.

	Float tapping	Synchronized tapping
G84, G74	○	○
G284, G274	×	○

(c) Tapping position (X, Y)

These coordinate values determine the tapping position.

If these are not designated, the X or Y coordinate value effective in the previous block becomes effective.

(d) Bottom level of tapping cycle (Z)

The bottom level is designated in the coordinate system in the G90 mode or as the distance from the R-point level in the G91 mode.

This command can be omitted. In this case, the general rule for fixed cycles applies. For general rule, refer to the OSP5020M Programming Manual (Pub. No. 3336-E).

(e) R-point level (R)

This designates the R-point level.

This command can be omitted. In this case, the general rule for fixed cycles applies.

(f) Spindle start position at R-point level (E)

This designates the tapping starting position (spindle index position - absolute position). This command is effective only in the synchronized tapping mode and is ignored in the float tapping mode (This does not cause an alarm.)

This command can be omitted. In this case, the general rule for hole machining data in the fixed cycle applies. That is, in the fixed cycle mode, this command is treated as the modal command. If this command is omitted, and no E command has been designated up to the previous block after the entry to the fixed cycle mode, the start position control is not carried out and the cutting begins from the actual position.

(g) Dwell period at the bottom level (P)

This designates the dwell period at the bottom level. Dwell period can be designated in the same manner as designated using the G04 code.

This command can be omitted. In this case, the general rule for fixed cycles applies.

(h) Dwell period at the R-point level in the return cycle (Q)

This designates the dwell period at the R-point level. It is designated in the same manner as a P command.

This command can be omitted. In this case, the general rule for fixed cycles applies.

(i) Feedrate (F)

This designates the feedrate of an axis for cutting feed during tapping cycle.

Designate so that Z-axis feed amount per revolution of the spindle is equivalent to thread pitch of the taper. That is, designation should be as indicated below in the G94 (feed per minute) mode.

$$F = P * S$$

P: Tapper thread pitch

S: Spindle speed

In the G95 (feed per revolution) mode

$$F = P$$

This command can be omitted. In this case, the general rule for fixed cycles applies. An F1-digit command causes an alarm.

(j) Spindle speed (S)

This designates the spindle speed during tapping.

This command can be omitted. In this case, the general rule for fixed cycles applies.

Gear range is automatically selected according to the S value. When the fixed cycle is canceled, the gear range for normal operation is selected automatically.

Note: During the synchronized tapping fixed cycle, M40 to M43 commands are ignored.

(k) Spindle gear selection (M)

During synchronized tapping, the spindle gear range which meets the designated spindle speed is automatically selected. If the selected gear range is not proper, select the spindle gear range using M codes.

M234 : The spindle gear range which meets the designated spindle speed is selected from all gear ranges available.

M235 : The 2nd gear range is selected for the spindle speed within the 1st gear range.

M236 : The 3rd gear range is selected for the spindle speed within the 1st or 2nd gear range.

M237 : The 4th gear range is selected for the spindle speed within the 1st, 2nd, or 3rd gear range.

Note: M40 through M43 designated in previous blocks are ineffective during synchronized tapping. These become effective after the synchronized tapping mode has been canceled.

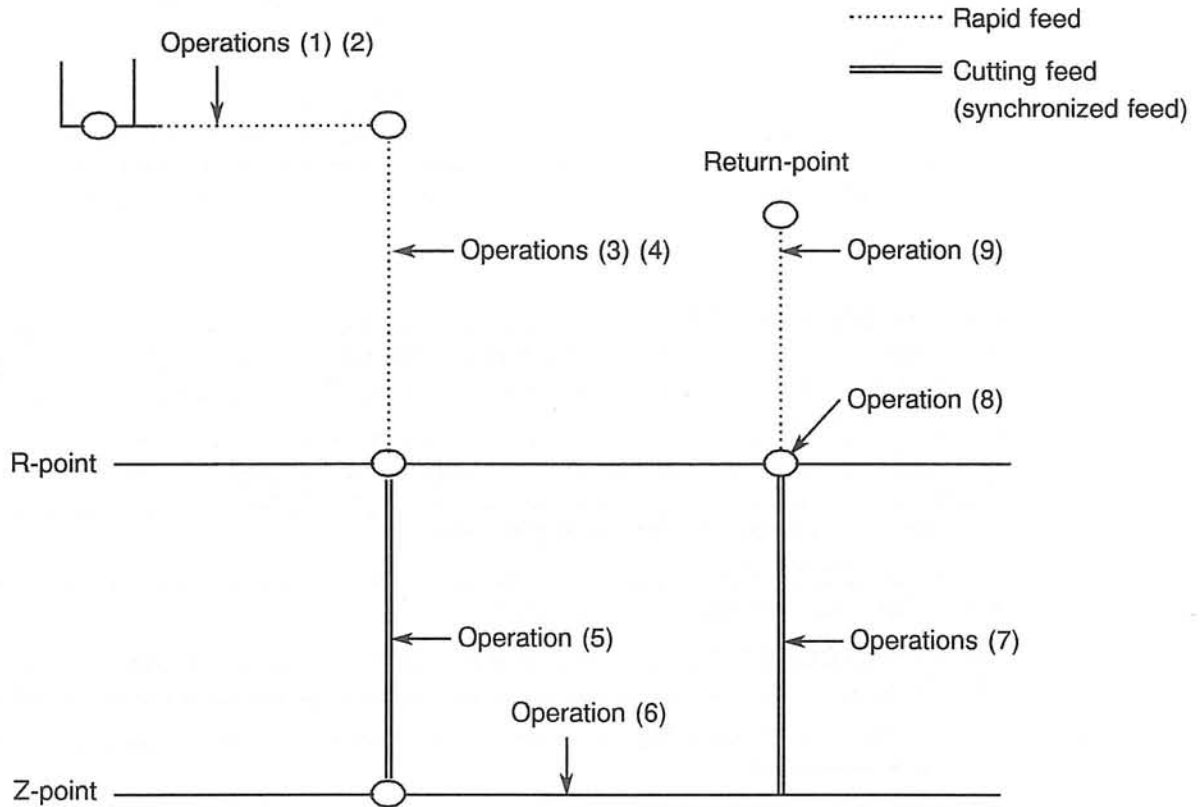
(3) How to Use G Codes

The G84 and G74 codes are provided so that the program prepared for a conventional tapping cycle which uses a floating taper can be used for synchronized tapping control without modification. Therefore, if the G84/G74 code is used in common to both tapping cycle modes, prepare a program for a floating taper.

If the synchronized tapping specification is not selected, the tapping cycle is always executed in the float tapping mode regardless of the setting for the parameter.

3. Tapping Cycle Operations

(1) Tapping Cycle Commands (G84, G284)



- ① Positioning of X and Y axes at the rapid feedrate, and at the same time.
- ② The spindle gear is selected according to the programmed S command, and the spindle is stopped. However, if an M code is designated in the same block, gear is selected after the completion of positioning and the designation of M code.
- ③ Positioning of Z-axis to the R-point level at the rapid feedrate, and at the same time
- ④ If an E command is designated, the spindle is positioned (angular position) at the programmed position in the spindle rotation direction for tapping.
- ⑤ Synchronized control of the spindle/Z-axis is carried out in the forward spindle rotation direction up to the Z-point level.
- ⑥ At the Z-point level, dwell is executed for P seconds if a P command is designated.
- ⑦ Synchronized control of the spindle/Z-axis is carried out in the reverse spindle rotation direction up to the R-point level.
- ⑧ At the R-point level, dwell is executed for Q seconds if a Q command is designated.
- ⑨ Positioning is carried out at the return point level at the rapid feedrate.

Note 1: In the cycles ⑤, ⑥, and ⑦, the setting of the feedrate and spindle speed override and "100%" setting is assumed.

Note 2: The dry run is ineffective while cycles ⑤, ⑥, and ⑦ are being executed.

(2) Reverse Tapping Cycle Commands (G74, G274)

Compared to the cycles explained in (1), the spindle rotating direction for the cycles ④, ⑤, and ⑦ is reversed. Other operations are completely the same as explained in (1).

Note 1: In the tapping cycle using the floating tapper, the spindle is rotating at the completion of the cycle. However, in the synchronized tapping cycle, the spindle stops at the completion of the cycle.

Note 2: If the control is reset during synchronized tapping cycle, the gear remains as selected for the synchronized tapping operation. However, the gear is selected according to the S command value when the spindle rotation command (M03, M04), spindle orientation command (M19, M118, M119), S command, or manual spindle operation is executed after that.

(3) Slide Hold

- (a) When the **SLIDE HOLD** button is pressed during the execution of step ⑤, the spindle stops immediately. The Z-axis is fed to the R-point level while being controlled in synchronization with spindle reverse rotation. When the Z-axis has reached the R-point level, it stops.
- (b) When the **SLIDE HOLD** button is pressed during the execution of step ⑤, the Z-axis is decelerated. However, the distance up to the R-point level is larger than the distance up to the Z-point level, the tapping cycle is continued while ignoring the slide hold command. The Z-axis stops when it has reached the R-point level.
- (c) When the **SLIDE HOLD** button is pressed during the execution of step ⑥ or ⑦, the Z-axis stops after it has reached the R-point level.
- (d) When the **CYCLE START** button is pressed while the Z-axis is temporarily stopped at the R-point level, synchronized control of the spindle/Z-axis is carried out up to the Z-point level.

*Note: The **MID AUTO MANUAL** key is not operative when the Z-axis is temporarily stopped at the R-point level.*

4. Parameters

(1) Tapping Mode Designating Parameter

This parameter sets whether the G84/G74 code designated in a program calls the float tapping mode or the synchronized tapping mode.

NC optional parameter (bit) No. 17, bit 7

- 0: Float tapping mode
- 1: Synchronized tapping mode

(2) Spindle Indexing Zero Point Parameter

This parameter sets the machine zero point for spindle indexing (E command).

NC optional parameter (long word) No. 15

Setting unit : Conforms to VAC command units (1/1000 deg. or 1/10000 deg.)

Setting range : 1/1000 deg 0 to 359,999
1/10000 deg 0 to 3,599,999

For conventional spindle indexing command (RS command), the encoder zero point is used to control spindle indexing.

5. Precautions

- (1) The G284 and G274 codes call the fixed cycle. The fixed cycle mode is canceled by designating any of G80, G00, G01, G02, and G03.
- (2) Before designating the G284 or G274 code after turning on the power, resetting the control, or canceling a fixed cycle, always designate an F command.

The fixed cycle mode is not canceled when other fixed cycle is designated.

- (3) Before designating the G284 or G274 code after turning on the power or resetting the control, always designate an S command.

Designate the S command in a block preceding the G284/G274 block.

Example: S320
:
:
G284

- (4) While spindle rotation and axis feed are synchronized, setting of feedrate override and spindle speed override are all ignored.
- (5) Whether or not the Z-axis stops at the R-point level in the single block mode is determined by the setting for the parameter.
NC optional parameter (bit) No. 34, bit 0
0: Does not stop
1: Stops
- (6) In the synchronized tapping mode, gear is changed before the mode enters to use the gear for synchronized tapping.
- (7) To carry out the sequence restart from the block in the synchronized tapping mode, pay attention so that the restart operation will not be associated with the synchronized feed. (There may be cases in which the gear is not changed correctly precluding synchronized feed.)
- (8) The mid-block sequence restart is not possible for the block which is governed under the synchronized axis feed mode. Stop is not possible until the axis reaches the R-point level.
- (9) Do not change the STM lock state during the synchronized tapping mode. If changed, gear change and spindle rotation control may not be carried out correctly.
- (10) The synchronized feedrate during the STM lock or machine lock state is the programmed feedrate (F command value). The control assumes that the spindle is rotating.

6. Torque Monitoring Function During Synchronized Tapping

(1) Overview

This functions monitors the spindle load torque during synchronized tapping, and generates an alarm of level B and suspends spindle rotation when the set torque limit value has been exceeded.

(2) Torque Monitoring ON/OFF Control

The following M codes are used to turn on/off the torque monitoring function.

M326 : Torque monitoring function during synchronized tapping OFF

M327 : Torque monitoring function during synchronized tapping ON

Note: M326 is effective when the power has been turned on or the control has been reset.

(3) Parameters

The torque to be monitored is set in units of kgf·m on the /tapping torque monitor parameter?/ screen in the parameter set mode. Since five sets of parameters are used, the parameter number used for torque monitoring must be designated using system variable VTMNO. An asterisk "*" is displayed for the parameter currently selected.

PARAMETER SET

* TAPPING TORQUE MONITOR PARAMETER *

NO.	MONITOR TORQUE[kgf*m]
* 1	100
2	15
3	0
4	51
5	127

	X	Y	Z
ACT POSIT (WORK)	0.000	0.000	0.000
	A-Mtd		

=IF
=IF
=IF
=

SET	ADD				ITEM↑	ITEM↓	[EXTEND]
-----	-----	--	--	--	-------	-------	----------

F1
F2
F3
F4
F5
F6
F7
F8

Set a torque value within the torque range recommended by tool manufacturers (torque range in which the tap can be used).

Note 1: To protect the tap, set a lower torque value. Note however this lowers cutting performance of the tap.

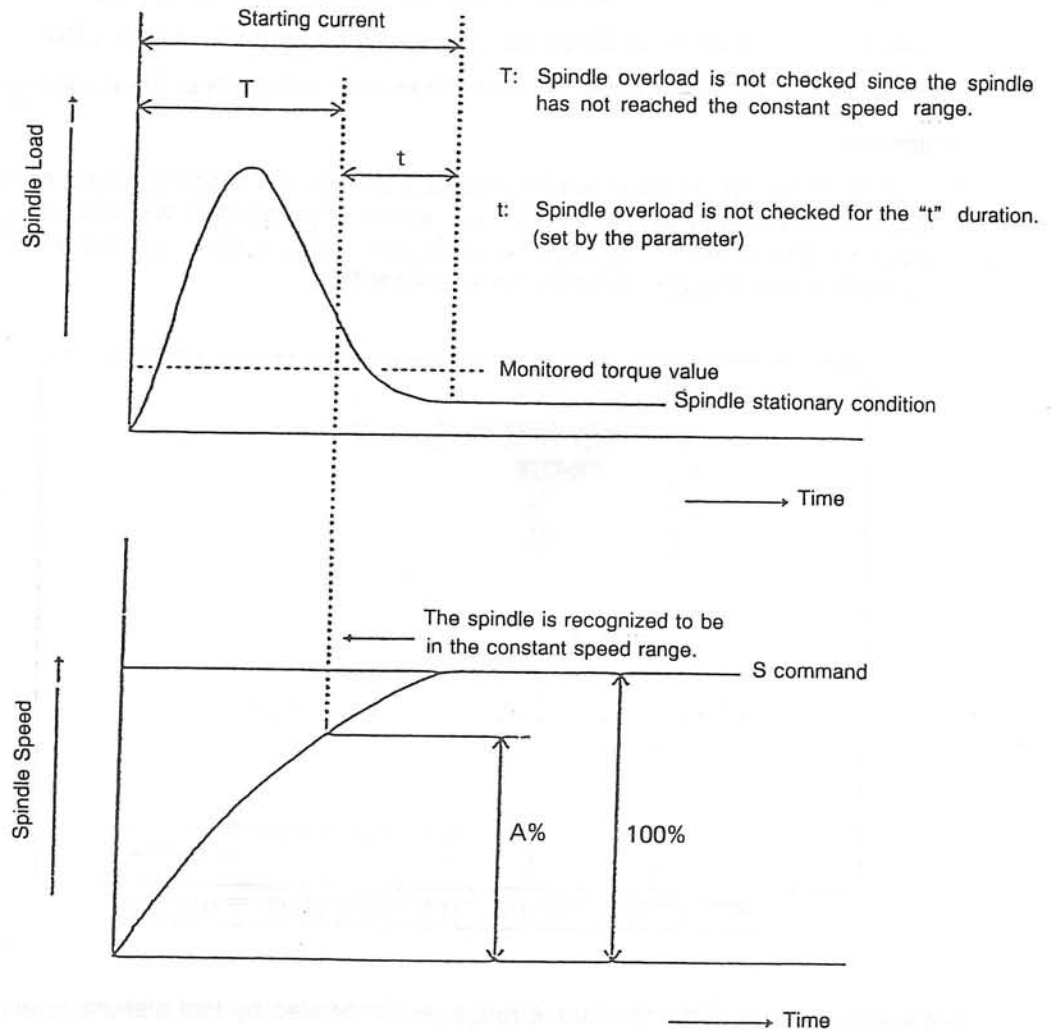
Note 2: The selected parameter number is not erased even when the power has been turned off.

Note 3: When the parameter whose torque value is "0" is selected, torque is not monitored.

(4) Ignoring of Spindle Motor Starting Current

When the spindle is started from a complete stop, starting current of the spindle motor flows. This might cause the maximum allowable load to be exceeded. This overload is prevented by the following two steps.

- ① Overload is ignored until the actual spindle speed reaches "A"% of the spindle speed designated by an S command.
- ② After the actual spindle speed has reached "A"% of the commanded spindle speed, the system waits for "t" (100 msec) until the spindle is put in the stationary condition. Then, torque monitoring is started.



Values for "A" and "t" are set at the NC optional parameter (word).

NC Optional Parameter (word) No.	Unit	Recommended Value
No. 61 Torque monitored spindle speed (A)	%	90
No. 62 Torque monitoring wait time (t)	100 msec	2 (= 200 msec)

(5) Torque Monitoring Method

If the spindle load torque exceeds the set value for $6.4 \times n$ (msec) continuously, the following alarm is displayed and the spindle stops immediately. The Z-axis is fed to the point-R level in the synchronization with spindle reverse rotation. When the Z-axis has reached the R-point level, it stops.

Alarm B 695 Synchronous tap's torque low

The torque is monitored until deceleration is started.

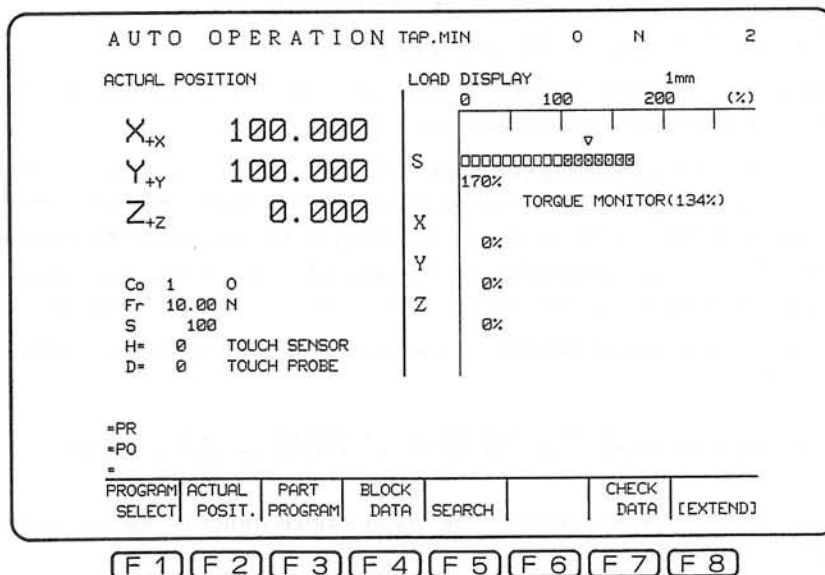
A value for "n" is set at NC optional parameter (word) No. 21.

NC optional parameter (word) No. 21 Allowable number (n) for torque over monitoring - recommended value: 4

Note: Torque monitoring is not carried out when "0" is set.

(6) Display

The torque monitoring process is displayed on the following three screens: 2nd page of the ACTUAL POSITION screen, the MAIN PROGRAM (execution) screen, and the MAIN PROGRAM (read) screen. A symbol "▽" is indicated above the LOAD DISPLAY bar graph. This is the maximum load torque.



2nd page of the ACTUAL POSITION screen

AUTO OPERATION TAP.MIN				0	N	2
PROGRAM * CURRENT MAIN PROGRAM *				1mm		
G00X0Y0Z0M327				DIS	X	0.000
+G2B4X100Y100Z-50R10F10G95S100P1Q1					Y	0.000
M02					Z	0.000
LOAD MAX				Co	1	
SPINDLE LOAD 00000000000000000000				O	Fr	10.00
TORQUE MONITOR(134%)				N	S	100
170%				H=	0	0.000
ACT POSIT (WORK)				D=	0	0.000
A-Mtd FCYCL				Z		0.000
=PR						
PROGRAM	ACTUAL	PART	BLOCK	SEARCH	CHECK	[EXTEND]
SELECT	POSIT.	PROGRAM	DATA		DATA	

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

MAIN PROGRAM (read) screen

(The MAIN PROGRAM (execution) looks as this screen.)

When torque monitoring is started, "TORQUE MONITOR (***)%" is displayed on the screen. ("**") represents the maximum torque load ratio.)

When the spindle torque ratio exceeds the maximum torque load ratio, the display color of "TORQUE MONITOR (***)%" is changed from white to red. (with the monochrome screen specification, the brightness is increased.) The maximum torque load ratio is a value which is obtained by converting the value set at the tapping torque parameter on the basis of the continuous rating of the spindle drive motor. For the continuous rating of the spindle drive motor, refer to the final specifications.

NC optional parameter (long word) No. 23 Continuous rating of spindle drive motor

Example:

When the spindle drive motor is a VAC 15/11 kW (20/15 hp) (30 min/cont.) motor, set "11000". (11 kW is 11000 W)

Note 1: When the continuous rating of the spindle drive motor is not set, torque monitoring is not carried out.

Note 2: Spindle overload monitoring is not carried out while torque monitoring is being executed for synchronized tapping. (This does not apply to the meter relay specification.) Attachment load monitoring is carried out.

(7) Parameters

(a) NC Optional Parameter (Word)

No. 21 Allowable number for torque over monitoring

Setting range : 0 to 32
Recommended value : 4
Setting unit : —
Initial setting : 0

No. 61 Torque monitored spindle rotation

Setting range : 1 to 100
Recommended value : 90 (%)
Setting unit : %
Initial setting : 0

No. 62 Torque monitored wait time

Setting range : 1 to 1000
Recommended value : 2 (= 200 msec)
Setting unit : 100 msec
Initial setting : 0

(b) NC Optional Parameter (long word)

No. 23 Continuous rating of spindle drive motor

Setting range : 110 to 99999999
(Refer to final specifications)
Setting unit : W
Initial setting : 0

(8) System Variables

(a) Tapping Torque Monitored Parameter No.

[VTMNO]

- Read and write operations are possible.
- Setting range : 1 to 5
- The value set at "VTMNO" is backed up. When a value is not set, the value previously set becomes effective. Initial setting is "1".

(b) Tapping Torque Monitored Parameter

[VTMDT (n)]

- "n" means parameter No. : 1 to 5
- Only read operation is possible.

LIST OF PUBLICATIONS

Publication No.	Date	Edition	
3294-E	September 1989	1st	A707 *
3294-E-R1	October 1991	3rd	A709 *
3294-E-R2	December 1991	4th	

This manual may be at variance with the actual product due to specification or design changes.

Please also note that specifications are subject to change without notice.

If you require clarification or further explanation of any point in this manual, please contact your OKUMA representative.