Cat. No. W210-E1-01

SYSMATE

Fuzzy Support Software

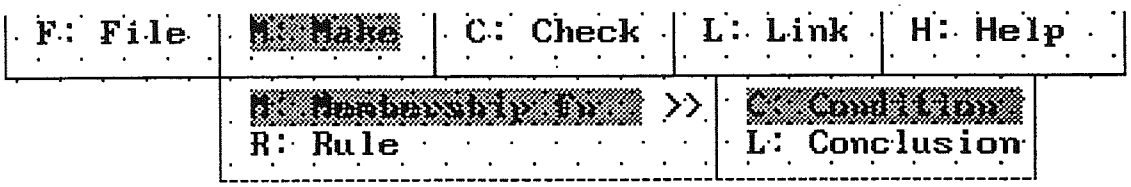
OPERATION MANUAL

OMRON

SYSMATE Fuzzy Support Software

Operation Manual

Produced April 1992



Notice:

OMRON products are manufactured for use according to proper procedures by a qualified operator and only for the purposes described in this manual.

The following conventions are used to indicate and classify warnings in this manual. Always heed the information provided with them.

Caution Indicates information that, if not heeded, could result in minor injury or damage to the product.

DANGER! Indicates information that, if not heeded, could result in loss of life or serious injury.

OMRON Product References

All OMRON products are capitalized in this manual. The word "Unit" is also capitalized when it refers to an OMRON product, regardless of whether or not it appears in the proper name of the product.

The abbreviation "Ch," which appears in some displays and on some OMRON products, often means "word" and is abbreviated "Wd" in documentation in this sense.

The abbreviation "PC" means Programmable Controller and is not used as an abbreviation for anything else.

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MS-DOS is a registered trademark of Microsoft Corporation.

Visual Aids

The following headings appear in the left column of the manual to help you locate different types of information.

Note Indicates information of particular interest for efficient and convenient operation of the product.

1, 2, 3... 1. Indicates lists of one sort or another, such as procedures, checklists, etc.

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About this Manual:

This manual describes the installation and operation of the Fuzzy Support Software and includes the sections described below. The Fuzzy Support Software supports the C200H-FZ001 and C500-FZ001 Fuzzy Logic Units.

Please read this manual completely and be sure you understand the information provide before attempting to install and operating the Fuzzy Support Software.

Section 1 provides an introduction to the Fuzzy Support Software and contains information relating to specifications, installation, and abbreviations used throughout this manual.

Section 2 provides an overview of FSS operations and the various software and functional configurations it operates in.

Section 3 provides connection requirements for the Fuzzy Logic Unit and peripheral units.

Section 4 provides information required before programming with the FSS. This includes keyboard and mouse operations as well as display configurations.

Section 5 provides startup and quitting procedures for FSS.

Section 6 provides details on File operations and pulldown menu items.

Section 7 provides details on Make operations as well as pulldown menu and related submenu items.

Section 8 provides details on Check operations and pulldown menu items.

Section 9 provides details on Link operations and pulldown menu items.

Section 10 provides details on Help operations.

Appendix A provides the error and warning messages for FSS.

Appendix B provides the fatal error messages for FSS.

SECTION 1
Introduction

This section provides an introduction to the Fuzzy Support Software and contains information relating to specifications, installation, and abbreviations used throughout this manual.

1-1 FSS Package

The C500-SU981-E Fuzzy Support Software (FSS) supports the C200H-FZ001 and C500-FZ001 Fuzzy Logic Units by enabling you to input the necessary knowledge and monitor the operation of the Unit with ease via the IBM-PC/AT-compatible computer (see Note). In addition to this operation manual, the package includes two 3.5" floppy disks (2 system disks). If the floppy disks are missing, please inform a local OMRON representative.

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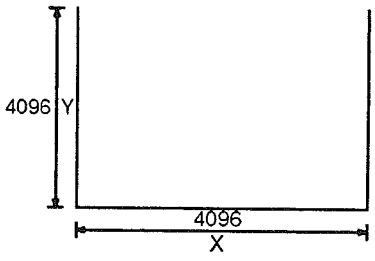
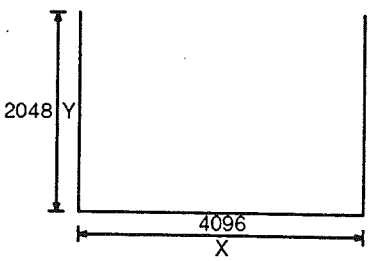
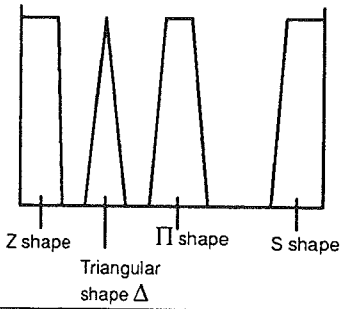
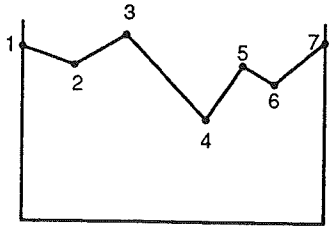
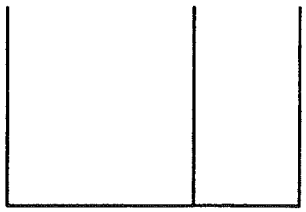
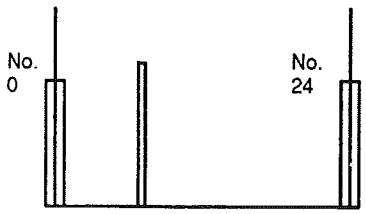
The following table lists the main specifications of the C200H-FZ001 and C500-FZ001 Fuzzy Logic Units. Familiarize yourself with the specifications before using either of these Units.

<table>
<tr><td colspan="3">Model</td><td>C200H-FZ001</td><td>C500-FZ001</td></tr>
<tr><td colspan="3">Input signals</td><td>8</td><td>8</td></tr>
<tr><td colspan="3">Output signals</td><td>4</td><td>2</td></tr>
<tr><td colspan="3">No. of labels set per signal (input or output)</td><td>7</td><td>7</td></tr>
<tr><td colspan="3">No. of characters used for signal name</td><td>5</td><td>5</td></tr>
<tr><td colspan="3">No. of characters used for label name</td><td>3</td><td>3</td></tr>
<tr><td rowspan="3">Rule</td><td colspan="2">No. of rules</td><td>128</td><td>128</td></tr>
<tr><td colspan="2">No. of condition parts</td><td>8</td><td>5</td></tr>
<tr><td colspan="2">No. of conclusion parts</td><td>2</td><td>2</td></tr>
<tr><td rowspan="2">Membership functions</td><td rowspan="2">Resolution</td><td>X (variable) direction
Y (adaptation) direction</td><td>4096
4096
  </td><td>4096
2048
  </td></tr>
<tr><td colspan="2">Condition membership function shape</td><td>Condition: 4 endpoints max.
Height at the endpoints must be either 0 or 4095.
  </td><td>Condition: Up to 7 different endpoints set horizontally anywhere including both edges.
Height can be freely set.
  </td></tr>
</table>

Conclusion membership function shape	Single line (no width) freely set horizontally. Height is fixed at 4095.  No width (Singleton)	Up to 25 bars set horizontally. Height can be freely set.  Up to 25 bars
Fuzzy logic method	MAX.-MIN. and LOGICAL PRODUCT	MAX.-MIN. and LOGICAL PRODUCT
Defuzzification method	Center of gravity method Left height precedence method Right height precedence method	Center of gravity method
Zero grade processing (If defuzzification is not possible because an output rule does not fit at all)	Holds previous logic value or outputs a value of 0 to 4095.	Outputs 4095
Knowledge to be downloaded to the Fuzzy Logic Unit	Fuzzy logic code, signal name, and other reference data (at the time of defuzzification, all data except the comment will be recovered).	Only fuzzy logic code (at the time of defuzzification, only the basic fuzzy logic data will be recovered).
Monitor data	I/O, fuzzy output, rule adaptation (for all rules).	I/O fuzzy output, rule adaptation (for the 1st to 5th rules).

Refer to the following table before building a fuzzy system.

Model	Function
C500-SU981-E Fuzzy Support Software	Makes it possible to download input knowledge to the Fuzzy Logic Unit and monitor the fuzzy operation.
C200H-FZ001/C500-FZ001 Fuzzy Logic Unit	For fuzzy logic operation.
SYSMAC	For control of the system and fuzzy logic processing.

Version and Serial Number Keep a record of the software's version and serial number for user support.

Compatibility

This software operates only with the following:

Item	Specifications
Personal computer	IBM-PC/AT and 100% compatibles (see Note 1)
Memory	525K bytes free for FSS. Data logging is possible with other free bytes.
Hard disk	It is possible to use this software without a hard disk. If the software is to be loaded on the hard disk, make sure that the disk has 1.1M bytes min. available.
Floppy disk	One 3.5" (720K bytes) or one 5.25"(1.2 M bytes)
Keyboard	IBM-PC/AT keyboard and 100% compatibles
Display	Color/Monochrome (16 shades of gray min.) EGA: 128K-bytes video memory required VGA: 128K-bytes video memory required; EGA mode
RS-232C	Two RS-232C ports required for the mouse.
DOS	MS-DOS 3.3 and above (see Note 2).
Mouse	Any Microsoft-compatible mouse with Microsoft mouse driver version 6.00 and above.
Printer	Any EPSON compatible 80-column and 132-column dot matrix printers.

Note

1. The following computers are recommended.
   PC/AT: DOS 3.30
   PS/2: DOS 4.01
   COMPAQ: DOS 4.01
2. MS-DOS is a registered trademark of Microsoft Corporation.

1-2 Installation

An installation program is provided to install the software to the system. The command file "FSS.EXE" for this software is on system disk 1. Make a backup copy of the software if you plan to use this software without loading it to the hard disk. The screen color will be the set default if you do not use the installation program.

Perform the following procedure to install the Fuzzy Support Software.

1, 2, 3...

1. Insert the installation disk "1" into the drive and type "install".
   The initial installation screen will appear. Press any key to continue or the Esc Key to quit the procedure. During the installation process, you can interrupt the installation by pressing the Esc Key.
2. You will be prompted to select the drive to install FSS. All available drives will be displayed. Select the drive using the Up and Down Keys, and press the Enter Key.
3. You will be prompted to indicate the directory to install the FSS. The default directory is "\FSS". You can change the install directory. Otherwise, the default directory will be automatically created if it does not exist.
4. You will be prompted to indicate the type of monitor you are using currently. Use the Up and Down Keys to select "color" or "monochrome" and press the Enter Key. If "monochrome" is selected, this procedure will automatically go to the next step number.

or If "color" is selected, the default colors used by FSS will be displayed as follows:

Foreground color: White
Background color: Blue

Line color: Light cyan
Error message color: Light magenta
Highlight color: Light red

Press any key to continue. The prompt to ask if you wish to change the default colors will be displayed. Select "Yes" or "No" using the Up and Down Keys and press the Enter Key. If "No" is selected, this procedure will automatically go to the next step number.

or If "Yes" is selected, you will be prompted to select the color combination of the software as follows:

a) Select the foreground color for FSS.
Available options are:

(i) White
(ii) Light Green
(iii) Light Cyan
(iv) Light Magenta

Select using the Up and Down Keys and press the Enter Key.

b) Select the background color for FSS.
Available options are:

(i) Blue
(ii) Brown
(iii) Black
(iv) Green
(v) Cyan

Select using the Up and Down Keys and press the Enter Key.

c) Select the line color for FSS.
Available options are:

(i) Light Cyan
(ii) White
(iii) Light Green
(iv) Light Magenta

Select using the Up and Down Keys and press the Enter Key.

d) Select the error message color for FSS.
Available options are:

(i) Light Magenta
(ii) White
(iii) Light Green
(iv) Light Cyan

Select using the Up and Down Keys and press the Enter Key.

e) Select the highlight color for FSS.
Available options are:

(i) Light Red
(ii) Red
(iii) Magenta
(iv) Yellow

Select using the Up and Down Keys and press the Enter Key.

5. Installation will now proceed and the following files will be copied into your directory:

FSS.EXE
FZYSST.MSG
FZYERR.MSG

Then you will be prompted to inserted installation disk "2". Insert the disk and the following files will be copied into your directory:

RULEPS.RUP
OTMFPS.DP2
OTMFPS.DP5
INMFPS.CP2
INMFPS.CP5
FSS.HP2
FSS.HP5
FSS.OPT
SAMPLE.KF2
SAMPLEKG5
TAB_CV.EXE

6. You will be prompted for permission to allow the installation program to modify/create your AUTOEXEC.BAT file. If you type "Y", your AUTOEXEC.BAT file will be copied to AUTOEXEC.OLD. Your AUTOEXEC.BAT file will be updated to include the path for FSS. If you type "N", the installation program will tell you the changes necessary for AUTOEXEC.BAT. Note these changes and change accordingly. If your AUTOEXEC.BAT file requires no modifications, you will be informed. Press any key to continue.

7. You will be prompted for permission to allow the installation program to modify/create your CONFIG.SYS file. If you type "Y", your CONFIG.SYS file will be copied to CONFIG.OLD. Your CONFIG.SYS file will be updated to change the buffer and files necessary for FSS. If you type "N", the installation program will tell you the changes necessary for CONFIG.SYS. Note these changes and change accordingly. If your CONFIG.SYS file requires no modifications, you will be informed. Press any key to continue.

8. When installation is completed, press any key to return to DOS.

1-3 Abbreviations

This manual uses the following abbreviations.

Item	Abbreviation
Fuzzy Support Software	The software or FSS
Fuzzy Logic Unit	The Unit
Membership function	MF
General term for created rule information	Rule data
General term for created membership function information	Membership function data (MF data)
General term for inference data, such as rule data, membership function data.	Knowledge
General term for knowledge and start/stop status of Fuzzy Logic Unit	Setting data
Press and release the mouse's left button	Left click
Press and release the mouse right button	Right click
Select one item from main menu, pulldown menu, function menu with mouse or key.	Select "F: File .." Select "F1: Execute .."
While pressing one key, press other key (e.g. Ctrl Key and F)	Ctrl+F

SECTION 2
Overview

This section provides an overview of FSS operations and the various software and functional configurations it operates in.

2-1 Software Operations

C500-SU981-E Fuzzy Support Software runs on the IBM-PC/AT and can do the following:

- Create and edit knowledge
- Save knowledge in a file
- Print out knowledge
- Download knowledge to the C200H-FZ001 or C500-FZ001 Fuzzy Logic Unit
- Upload knowledge from the C200H-FZ001 or C500-FZ001 Fuzzy Logic Unit
- Monitor inference process of the C200H-FZ001 or C500-FZ001 Fuzzy Logic Unit
- Log data that can be viewed using Lotus 1-2-3 or Excel
- General help function

Note
1. The software operates on a hard disk or floppy disk.
2. Data exchange between the Unit and C200H/C500 PC is performed by the C200H/C500 PC user program.

2-2 Operating Environment

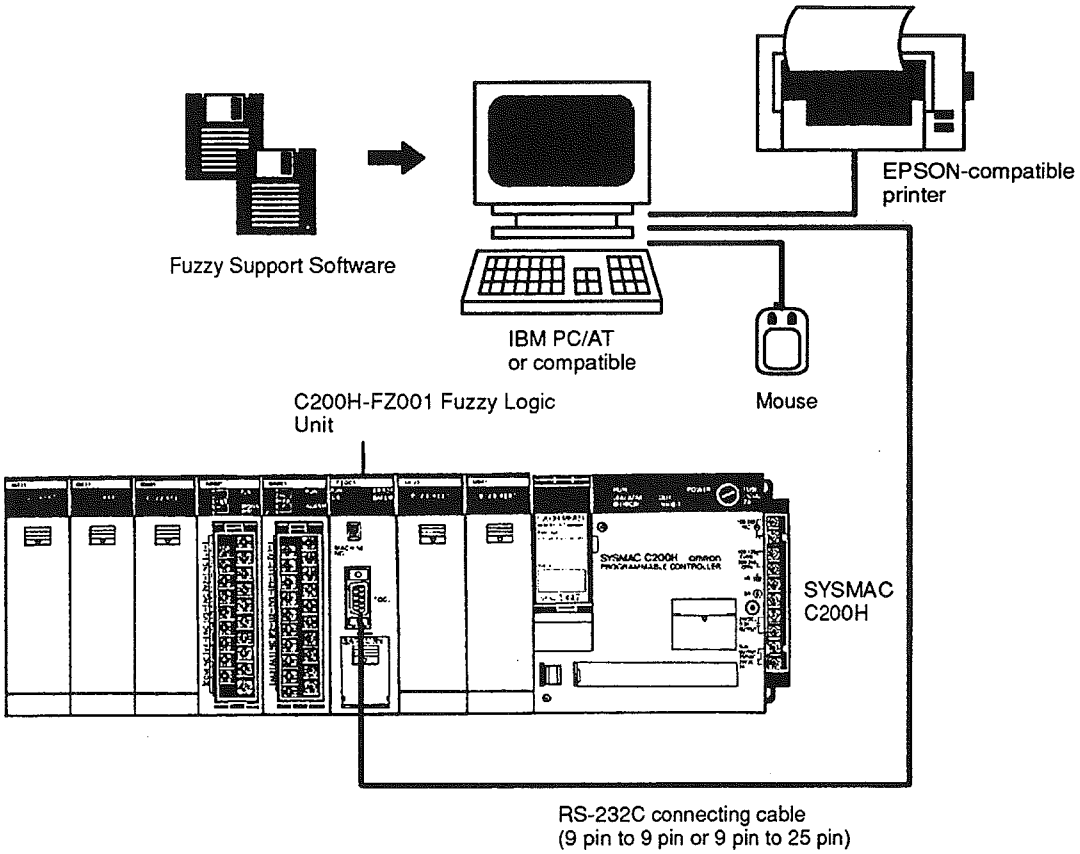
The following table shows the operating environment of the system.

Item			Model/Type	Comment
Hardware	Personal computer		IBM-PC/AT	EGA/VGA monitor. Necessary for software operation.
	Mouse		Microsoft-compatible mouse	Necessary for mouse operation.
	Printer		EPSON-compatible printer (80-column or 132-column)	Output is a monochrome image.
Software	System configuration file		CONFIG.SYS	May be modified during installation if permission is given. Necessary for software operation.
	System setting file		AUTOEXEC.BAT	
	Device driver	Video	EGA/VGA	Necessary for operation of this software.
		Mouse	Microsoft mouse driver	Necessary for mouse support and special function support.

The following table shows Fuzzy Logic Units and Programmable Controllers (PC) which correspond to FSS.

Name	Machine type
Fuzzy Logic Unit	C200H-FZ001, C500-FZ001
RS-232C cable	Only connector attached to C200H-FZ001/C500-FZ001.
PC	For C200H-FZ001: C200H SYSMAC C-series PC's For C500-FZ001: C500 SYSMAC C-series PC's C1000H SYSMAC C-series PC's C2000 SYSMAC C-series PC's C2000H SYSMAC C-series PC's CV500 SYSMAC CV-series PC's CV1000 SYSMAC CV-series PC's
Support tools	SYSMAC C-series Ladder Support Software (LSS)

System Configuration Sample



2-3 Software Configuration

The following table shows the contents of the system disks.

Disk no.	File	Description
1	FSS.EXE*	Command file for FSS.EXE
	FZYSST.MSG*	System message file for FSS.EXE.
	FZYERR.MSG*	Error/Guidance file for FSS.EXE.
	INSTALL.EXE	Installation file for FSS.EXE.
	INSTALL.DAT	Data file for INSTALL.EXE.
	DISK.ID	Disk identification file for INSTALL.EXE.
2	RULES.RUP* (rule part file)	FSS saves the following data in a single file: Rule, condition MF, and conclusion MF. Use the Part File function to save the data types to individual files. 2 to 7 function labels for MF data are created in the part files.
	INMFPS.CP2* (condition MF part file for C200H-FZ001) INMFPS.CP5* (condition MF part file for C500-FZ001)	
	OTMFPS.DP2* (conclusion MF part file for C200H-FZ001) OTMFPS.DP5* (conclusion MF part file for C500-FZ001)	
	FSS.HP2* FSS.HP5*	Help message file for FSS.EXE.
	SAMPLE.KG2* (C200H-FZ001) SAMPLE.KG5* (C500-FZ001)	For training purposes.

Disk no.	File	Description
	TAB_CV.EXE*	Changes a tab between data entry of the logging data file into a comma.
	DISK.ID	Disk identification file for INSTALL.EXE.

Note This mark, *, indicates files created by the software installation process.

The following table shows the type of files generated when operating the software.

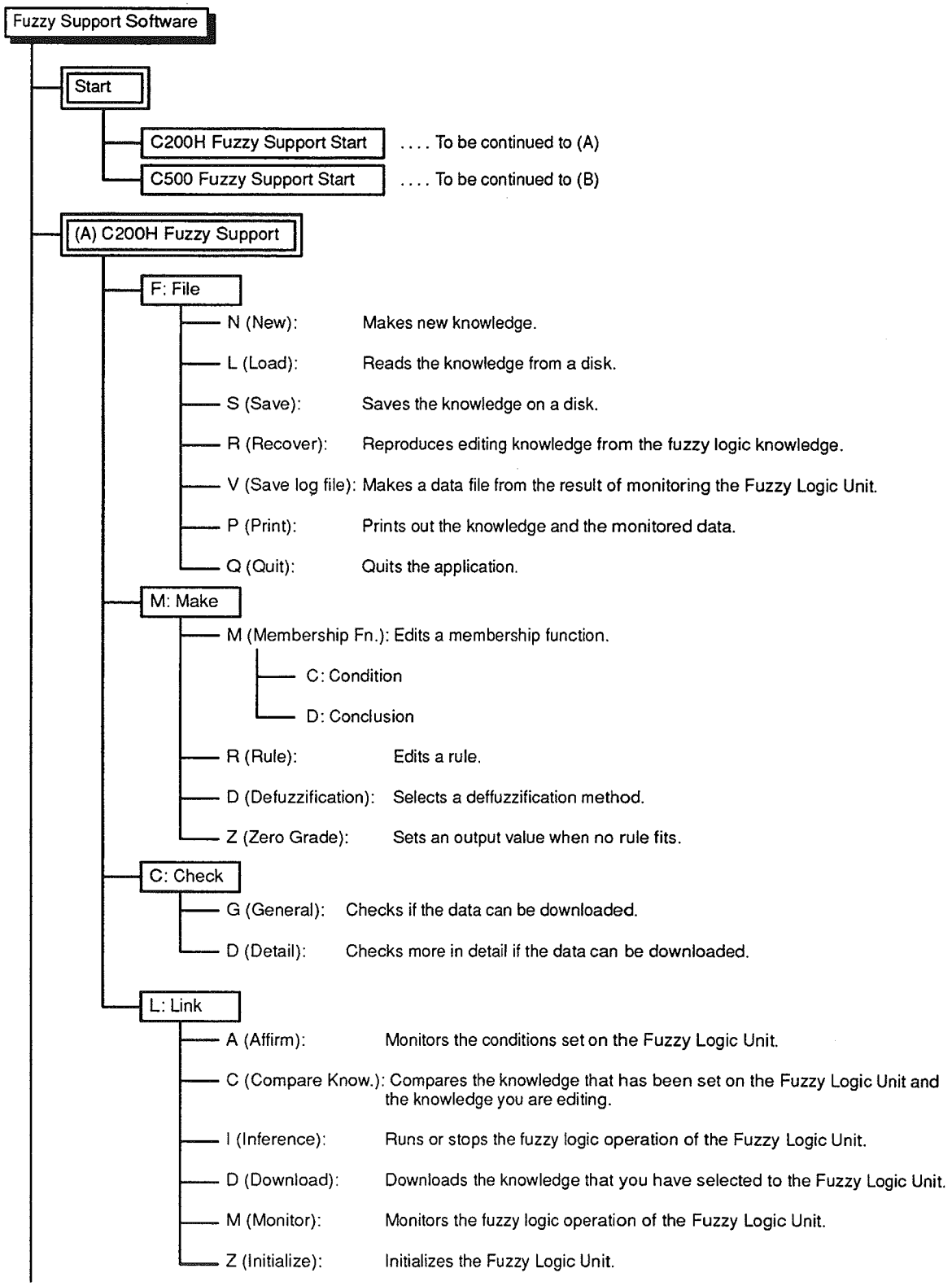
File	Description
Knowledge file: ********.KG2 for C200H ********.KG5 for C500 Each file is about 23.6K bytes in size.	Knowledge data to be edited (rule data, condition MF data, and conclusion MF data) are saved as one data set in this file.
Logging data file: ********.IO2 for C200H I/O data ********.GR2 for C200H rule grade ********.IO5 for C500 I/O data ********.GR5 for C500 rule grade	This file will be created when Save Log Data in the menu is selected.

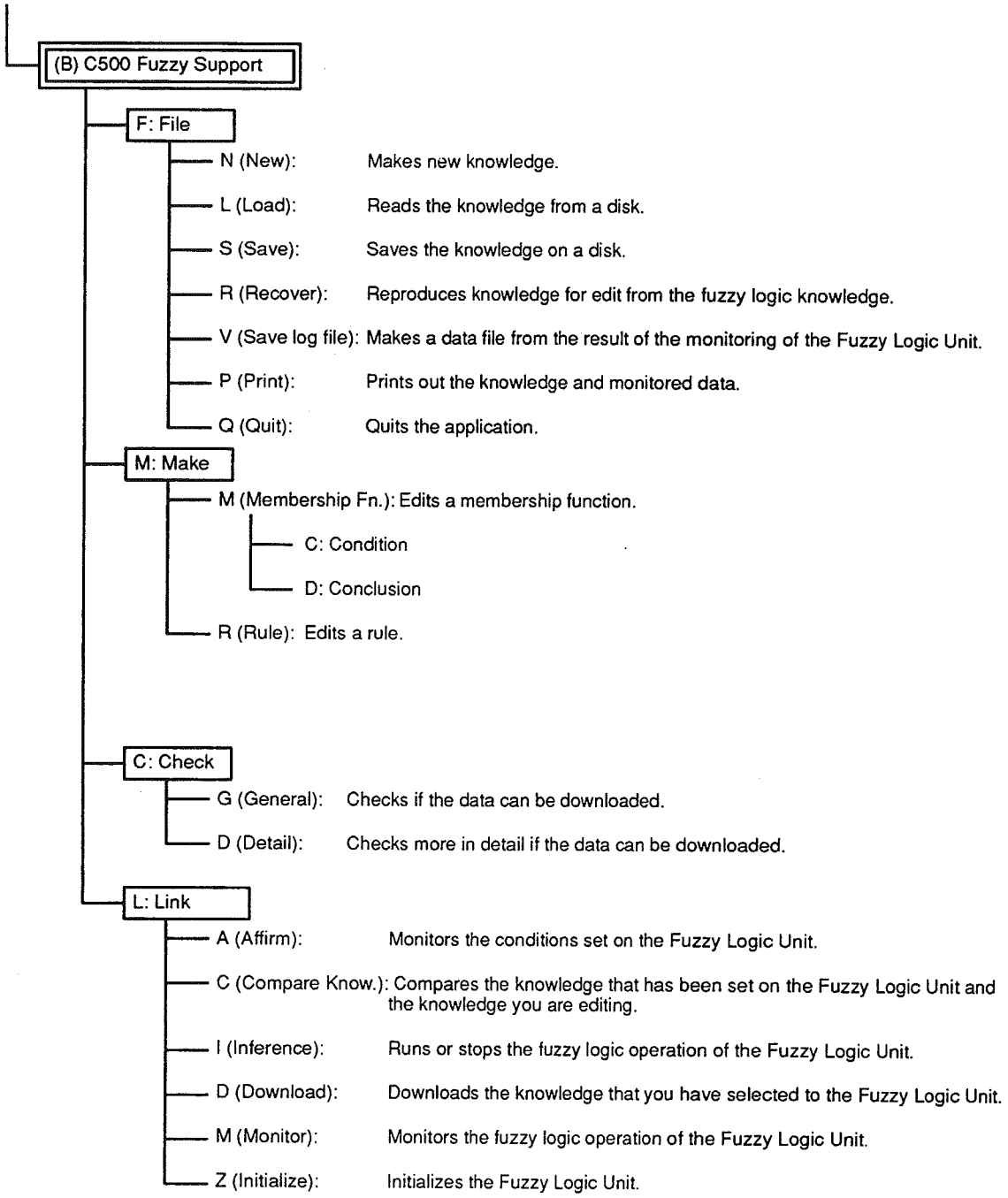
The following table shows the type of files generated when installing the software.

File	Description
FSS.OPT	Color data for FSS.EXE.

2-4 Functional Configuration

The C500-SU981-E Fuzzy Support Software has a pull-down menu, the main configuration of which is listed hereunder.




(B) C500 Fuzzy Support
F: File
N (New): Makes new knowledge.
L (Load): Reads the knowledge from a disk.
S (Save): Saves the knowledge on a disk.
R (Recover): Reproduces knowledge for edit from the fuzzy logic knowledge.
V (Save log file): Makes a data file from the result of the monitoring of the Fuzzy Logic Unit.
P (Print): Prints out the knowledge and monitored data.
Q (Quit): Quits the application.
M: Make
M (Membership Fn.): Edits a membership function.
C: Condition
D: Conclusion
R (Rule): Edits a rule.
C: Check
G (General): Checks if the data can be downloaded.
D (Detail): Checks more in detail if the data can be downloaded.
L: Link
A (Affirm): Monitors the conditions set on the Fuzzy Logic Unit.
C (Compare Know.): Compares the knowledge that has been set on the Fuzzy Logic Unit and the knowledge you are editing.
I (Inference): Runs or stops the fuzzy logic operation of the Fuzzy Logic Unit.
D (Download): Downloads the knowledge that you have selected to the Fuzzy Logic Unit.
M (Monitor): Monitors the fuzzy logic operation of the Fuzzy Logic Unit.
Z (Initialize): Initializes the Fuzzy Logic Unit.

SECTION 3
Connections

This section provides connection requirements for the Fuzzy Logic Unit and peripheral units.

3-1 Connecting the Fuzzy Logic Unit

The Fuzzy Logic Unit and PC send and receive data through the RS-232C. These two Units must be connected when executing the pulldown menu operations under the "L: Link" main menu item of the software.

3-1-1 Communications Settings

Set communications parameters and the communications unit number using the DIP switch on the back of the Fuzzy Logic Unit. Refer to the *Fuzzy Logic Unit Operation Manuals* for details on the setting method and set the parameters as follows:

Parameter	Settings
Baud rate	9600 bps
Character length	7 bits
Stop bit	2 bits
Parity	Even

Note The software must be set to these parameters only.

When installing two or more Units to the SYSMAC, be sure to set the communications unit numbers to different values.

3-1-2 RS-232C Connector

The C200H-FZ001 provides a 9-pin RS-232C connector and the C500-FZ001 provides a 25-pin RS-232C connector. Connect the RS-232C cable to serial port 1 on the computer running FSS and then to the RS-232C connector on the Fuzzy Logic Unit.

3-2 Connecting Peripheral Devices

3-2-1 Connecting a Mouse

When connecting a mouse, observe the following:

- When using the device driver `MOUSE.SYS`, connect the mouse before turning on the PC.
- When using the device driver `MOUSE.COM`, connect the mouse before entering the mouse command.
- Connect the mouse to serial port 2 on the personal computer.

3-2-2 Connecting a Printer

A printer must be connected when executing the pulldown menu operations under the "P: Printer" main menu item of the software.

This software supports EPSON-compatible 80-column and 132-column printers. The printer cable is a personal computer accessory. Refer to the printer manual for connection requirements.

SECTION 4
Before Programming

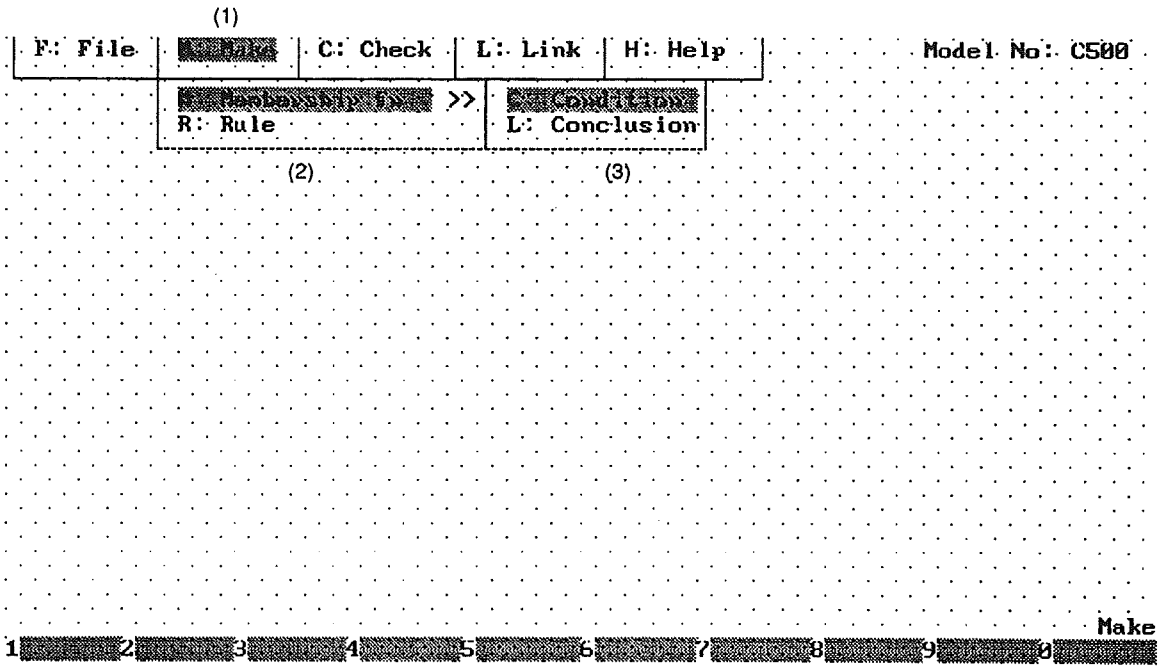
This section provides information required before programming with the FSS. This includes keyboard and mouse operations as well as display configurations.

4-1 Display

Components

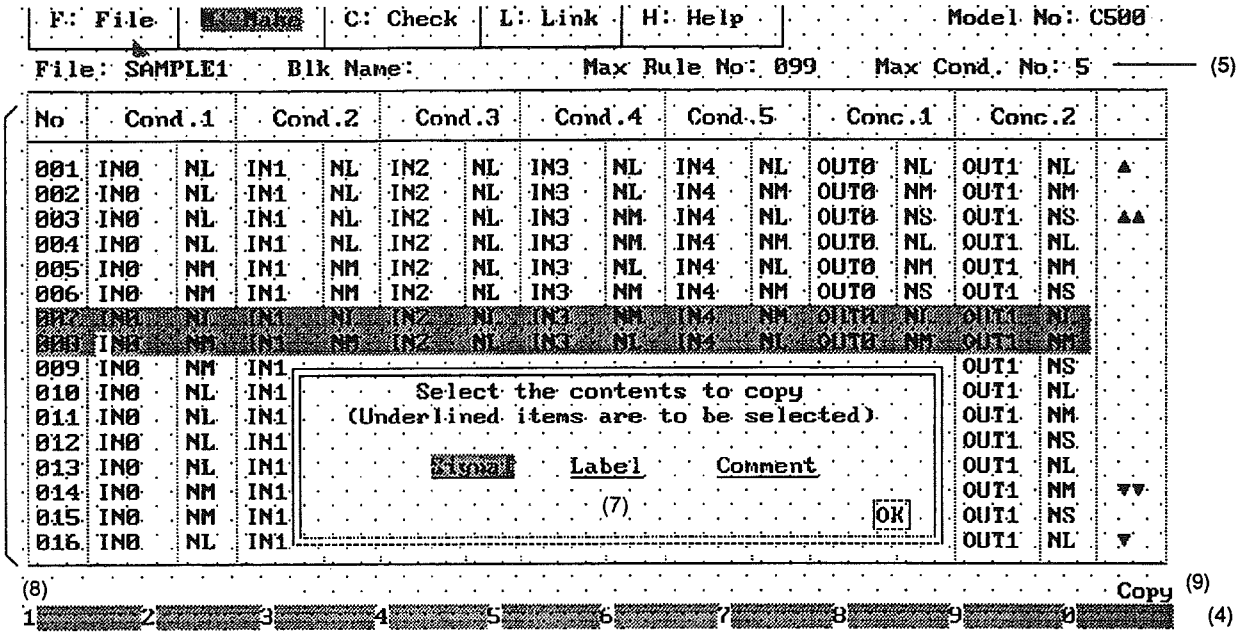
In order to operate the software, it is necessary to understand the display configurations and components. The numbers preceding the component name correspond to the numbers in the displays preceding the tables.

Menus



No.	Name	Operation
1	Main menu	Used to select a functional division of the software.
2	Pulldown menu	Used to select a function under the main menu.
3	Submenu	Used to select a function under the pulldown menu.

Display Areas



No.	Name	Operation
4	Function menu	Used to select a function operation.
5	General information display	Displays general information such as file names and block names.
6	Data setting area	Displays input data.
7	Window	Displays messages of confirmation, selection, or extended processing.
8	Operation guide/Error display	Displays instructions during normal operations and error messages.
9	Current operation display	Displays a selection menu or function.

4-2 Keyboard and Mouse Operation

FSS can be operated using either the keyboard or mouse.

4-2-1 Main Menu

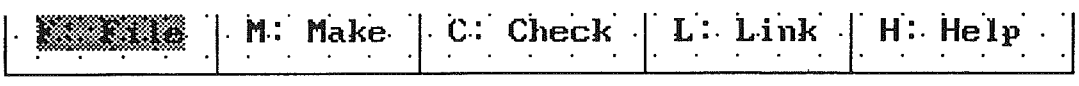
Main menu item selection can be performed using either the keyboard or mouse.

Keyboard Operation

To select an item from the main menu using the keyboard, type the key of the upper-case letter appearing before the desired item. To move from one item to another, use the Left and Right Keys and press the Enter Key to make the selection. Pressing and holding down the Alt Key and the appropriate letter key (Alt+*letter* Keys) will also select the desired item. To deselect an item, press the Esc Key.

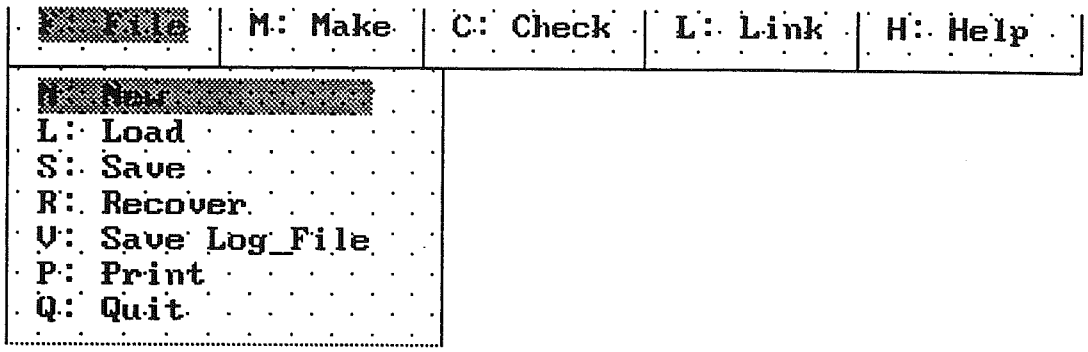
Mouse Operation

Place the cursor on the item to be selected and left click. Right click to deselect. The following shows the initial main menu.



The blocked item will be selected when the Enter Key is pressed or upon the left click of the mouse.

The pulldown menu appears after selecting "F: File" as seen in the following example.



The following is a table of main menu items with the corresponding pulldown menu items.

Main menu	Pulldown menu	Comment
File	New	Can be selected at any time.
	Load	
	Save	Can be selected only if there is editing knowledge.
	Save-Log-File	Can be selected only after data has been logged.
	Recovery	Can be selected only after unit data is uploaded from the Fuzzy Logic Unit.
	Print	Can be selected only if there is data to print.
	Quit	Can be selected at any time.
Make	Membership function	Can be selected only after loading a file or invoking "New" under "File".
	Rule	
	Defuzzification	These menus are only for C200H-FZ001 and can be selected only after loading a file on invoking "New" under "File".
	Zero grade	
Check	General	Can be selected only if editing knowledge is present.
	Detail	
Link	Affirm	Can be selected at any time.
	Compare	Can be selected only after "Affirm" is successful.
	Inference	
	Download	
	Monitor	Can be selected only after "Affirm" and when inference status is active.
	Initialize	Can be selected at any time.
Help	C200H	Can be selected at any time.
	C500	

4-2-2 Pulldown Menus

Pulldown menu item selection can be performed using either the keyboard or mouse.

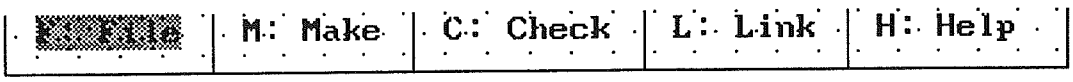
Keyboard Operation

Use the same procedure as used for the main menu. To select an item from the pulldown menu using the keyboard, type the key of the upper-case letter ap-

pearing before the desired item. To move from one item to another, use the Left and Right Keys and press the Enter Key to make the selection. Pressing and holding down the Alt Key and the appropriate letter key (Alt+*letter* Keys) will also select the desired item. To deselect an item, press the Esc Key.

Mouse Operation

Use the same procedure as used for the main menu. Place the cursor on the item to be selected and left click. Right click to deselect. The following shows the initial main menu.



Note Keyboard and mouse operation are the same for all other menus. Exceptions for submenus, function menus, and window items are noted in the following subsections.

4-2-3 Submenus, Function Menus and Window Items

Follow the previously described selection procedures for submenus, function menus and window items with the following exceptions:

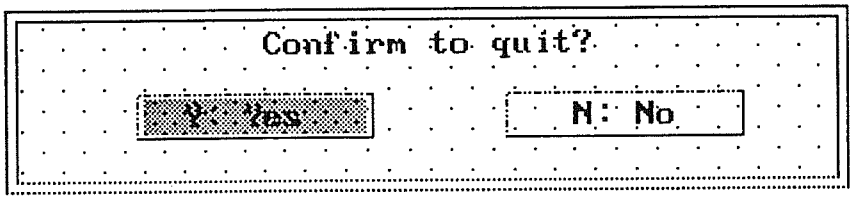
Function Menus

Use the Left and Right Keys to select an item and press the Enter Key, or alternately, press the corresponding function key (F1 Key, F2 Key, F3 Key, etc.) to select an item.

Window Items

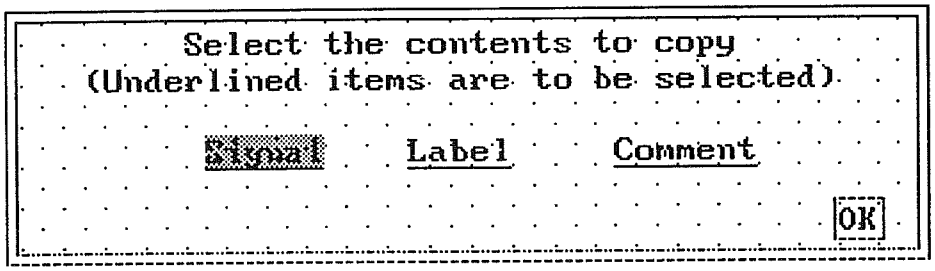
Yes/No Select Type

Press "Y" for a Yes selection and "N" for a No selection, or with the mouse cursor on the item to be selected, use a left click to select or a right click to deselect.



Item Select Type

From the keyboard, press the corresponding function keys, or alternately, a left click with the mouse cursor on the items in reverse-video (shaded) within the window will select the item.



4-2-4 Returning to Main Menu from Function Level

When a main menu item cannot be selected from a pulldown or function menu selection, pressing the F10 Key or Alt+*letter* or a right click with the mouse will return the procedure to the main menu display.

4-2-5 Returning from an Error Condition

When an error occurs while making a selection in the main or pulldown menus, an error message will be displayed in the operation guide area. Making a selec-

tion will still be possible. The error display will disappear when any key is pressed or a left click is made.

4-3 Knowledge Data Configuration

The following summarizes knowledge data configuration for whole knowledge, rules, and membership function (MF) conditions and conclusions.

4-3-1 Whole Knowledge (WK) Data

Whole knowledge data consists of a data file name, a date/time of data creation, and a comment block. Whole knowledge data specifications are as follows:

Item	Characteristics	Comments
Data (file) name*	Allowable number of characters for a file name is 8.	File extension is .KG2 for the C200H Fuzzy Logic Unit and .KG5 for the C500 Fuzzy Logic Unit.
Date and time of data creation	Year/Month/Day/Hour/Minute/Second	Set automatically by FSS.
Comments	30 characters max.	—

Note The items marked with * must be set.

4-3-2 Rule Data

Enter rule data using the following parameters:

Rule Blocks

Rule block names must have 8 characters maximum. Rule block comments must have 30 alphabetic characters maximum. When saved into a part file, a rule block name and comment become a part name and part comment respectively.

Rules

A maximum of 128 rules can be used. Each rule can consist of a maximum of eight conditions and two conclusions. Rule specifications are as follows:

Item			Characteristics
Rule	Condition*	Signal	5 upper-case letters max.
		Label	3 upper-case letters max.
	Conclusion*	Signal	5 upper-case letters max.
		Label	3 upper-case letters max.
	Comment		30 characters max.

Note The items marked with * must be set.

When editing rules, there is no upper limit for a signal and label setting. Also, there is no error check. When downloading to the Unit, the condition and conclusions for the C200H signals are within eight and four and those for the C500 are within five and two. Each label can have 7 signals. This is necessary in order to conform to MF data.

4-3-3 MF Data of Condition

Enter MF data of condition using the following parameters:

Condition Blocks

Condition block names must have 8 characters maximum. Condition block comments must have 30 alphabetic characters maximum. When saved into a part file, a condition block name and comment become a part name and part comment respectively.

MF Conditions

A maximum of 8 conditions and 7 MFs can be used. Condition specifications are as follows:

Item			Characteristics	Comments
MF condition	Signal		5 upper-case letters max.	When downloading to the Unit, the signal must be converted to rule data.
	MF range	Lower limit	0 to 4094 (integer)	Lower limit must not equal upper limit and the lower limit must be lower than the upper limit. Default: Lower limit = 0 Upper limit = 4095
		Upper limit	1 to 4095 (integer)	
	Reference range	Setting 1	Six-figure number in the range of –9999 to 9999 including decimal point. Signs are not included for the "six-figure number".	When setting MF shape or monitoring with the Fuzzy Logic Unit, correspond setting 1 to MF range lower limit and setting 2 to MF range upper limit. The reference range may be displayed.
		Setting 2	Setting 1 must not equal setting 2.	
	Reference unit		6 letters max.	
	Comment		30 characters max.	—
	MF	Label	3 upper-case letters max.	When downloading to the Unit, the signal must correspond to rule data. Also, a shape data type for a label needs to be set.
		Shape	S, Z, Δ, Π (for C200H-FZ001) up to 7 different endpoints set horizontally anywhere including both edges. Endpoint is fixed (for the C500-FZ001.)	

Note The items marked with * must be set.

4-3-4 MF Data of Conclusion

Enter MF data of conclusion using the following configuration:

Conclusion Blocks

Conclusion block names must have 8 characters maximum. Conclusion block comments must have 30 alphabetic characters maximum. When saved into a part file, a conclusion block name and comment become a part name and part comment respectively.

MF Conclusions

A maximum of 4 conclusions for the C200H Fuzzy Logic Unit and 2 conclusions for the C500 Fuzzy Logic Unit can be used. In addition a maximum of 7 MFs can be used. Conclusion specifications are as follows:

Item			Characteristics	Comments
MF condition	Signal		5 upper-case letters max.	When downloading to the Unit, the signal must be converted to rule data.
	MF range	Lower limit	0 to 4094 (integer)	Lower limit must not equal upper limit and the lower limit must be lower than the upper limit.
		Upper limit	1 to 4095 (integer)	Default: Lower limit = 0 Upper limit = 4095
	Reference range	Setting 1	Six-figure number in the range of –9999 to 9999 including decimal point. Signs are not included for the "six-figure number".	When setting MF shape or monitoring with the Fuzzy Logic Unit, correspond setting 1 to MF range lower limit and setting 2 to MF range upper limit.
		Setting 2	Setting 1 must not equal setting 2.	The reference range may be displayed.
	Reference unit		6 letters max.	
	Comment		30 characters max.	—
	MF	Label	3 upper-case letters max.	When downloading to the Unit, the signal must correspond to rule data.
		Shape	Vertical line with no width (for C200H) 25 bars (for C500)	Also, a shape data type for a label needs to be set.

Note The items marked with * must be set.

4-3-5 Special Processing for the C200H

Special processing for the C200H Fuzzy Logic Unit consists of defuzzification and zero grade processing.

Outputs

Defuzzification and zero grade processing produce a maximum of four outputs. The specifications are as follows:

Item	Characteristics	Comments
Defuzzification	Select from center of gravity, left maxima, or right maxima.	Default is center of gravity.
Zero grade processing	Select from previous value or fixed value output. In case of fixed value output, select from 0 to 4095.	Default is the fixed value output 4095.

4-4 File Control by Directory

By changing a knowledge file name, the same knowledge can be stored in one directory. This way, the same knowledge file from one directory can be used in more than one application.

For each directory, one rule part file (shared by C200H and C500 Fuzzy Logic Units), one condition part file, and one conclusion part file for C200H, one condition part file and one conclusion part file for C500, and as many knowledge files as the system allows can be stored.

Methods for loading knowledge and part files, and for saving directories are as follows:

File	Operation	Method
Knowledge	Loading	Change a directory and load knowledge in the same directory as the selected item.
	Saving	Change a directory and save.
Part	Loading	Change a directory and if it is a directory with a part file, make it a target of loading or saving.
	Saving	

When creating and deleting a directory, deleting a knowledge file, and copying and deleting a part file, it is necessary to use MS-DOS commands.

SECTION 5
Startup and Quitting

This information provides startup and quitting procedures for FSS.

5-1 Startup Method

FSS starts up from the MS-DOS prompt.

MS-DOS Startup

Activate the mouse driver using MOUSE.COM.

or If the full path for the mouse driver does not exist in the variable PATH of AUTOEXE.BAT, switch to the drive where MOUSE.COM is located and activate it by the following procedure:

1, 2, 3...

1. Type `F:` and press the Enter Key to change the drive to F.
2. Type `CD` to change the directory to root and press the Enter Key.
3. Type `MOUSE` and press the Enter Key.

FSS Startup from DOS

To startup the Fuzzy Support Software (FSS), the files FSS.EXE, FZYSST.MSG (screen messages), and FZYERR.MSG (error messages) must be in the same directory. Changing the directory is unnecessary when the drive containing FSS.EXE is set in a PATH environment variable or the current directory after startup contains FSS.EXE, FZYSST.MSG and FZYERR.MSG. Otherwise, change to the drive which contains the software using the following procedure:

1, 2, 3...

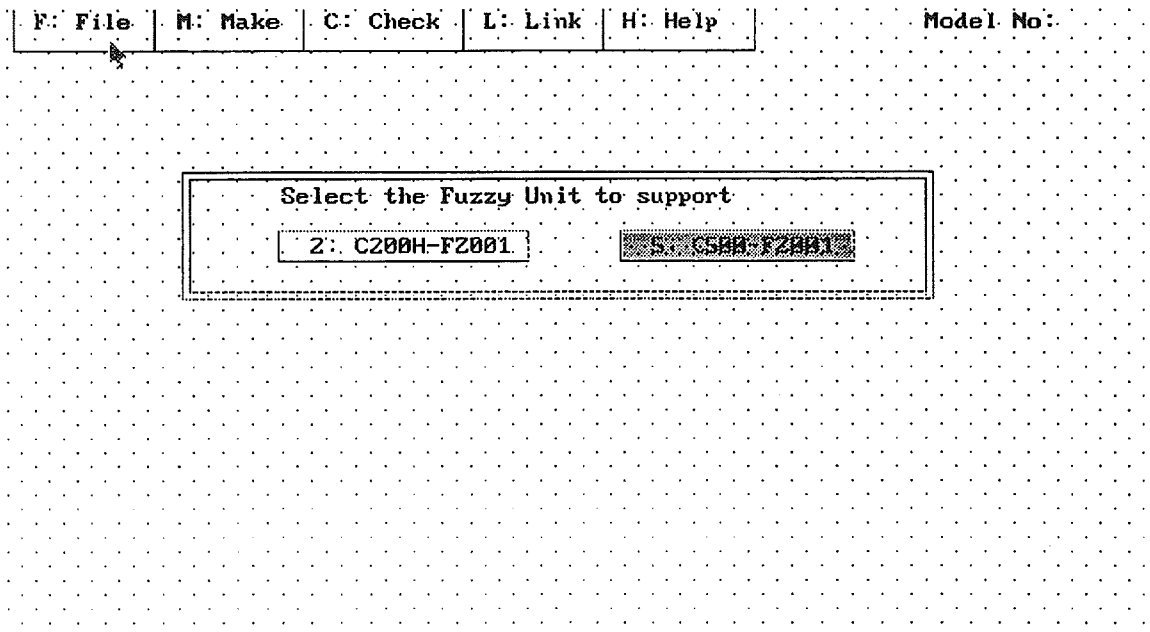
1. Type `G:` and press the Enter Key to change the drive to G.
2. Type `CD\FSS` and press the Enter Key to change to the FSS directory which contains FSS.EXE, FZYSST.MSG and FZYERR.MSG. A screen should appear similar to the following example.

```
E:\>F:

F:\>CD\
F:\>MOUSE
**********************************(mouse driver message)
**************************************************
**************************

F:\>G:

G:\>CD\FSS

G:\FSS>FSS
```

Unit Selection

The startup screen is displayed for three seconds followed by a control screen like that in the following example. The control screen displays the Unit selection window. To select the Unit using the mouse, move the cursor to the box containing the Unit name and left click only. To select using the keyboard, use the Left and Right Keys to toggle the Unit selection box and press the Enter Key, or press

the number for the Unit selection box; 2 for the C200H-FZ001 or 5 for the C500-FZ001.



Note The default Unit is the C200H.

After selecting the Unit, the selected item box will be highlighted and the Unit model number will appear on the top right corner of the display.

Mouse Selection

During startup the FSS checks if a mouse can be used. The mouse will be disabled in the following cases.

When using MOUSE.SYS:

- The mouse is not connected to the personal computer.
- The mouse is not connected when the Unit is set up.
- The mouse driver, MOUSE.SYS, is not installed in the CONFIG.SYS file.

When using MOUSE.COM:

- The mouse is not connected to the personal computer.
- The mouse is not connected when MOUSE.COM is activated.
- MOUSE.COM is not in the drive or directory that is active.

5-2 Selecting from the Menus

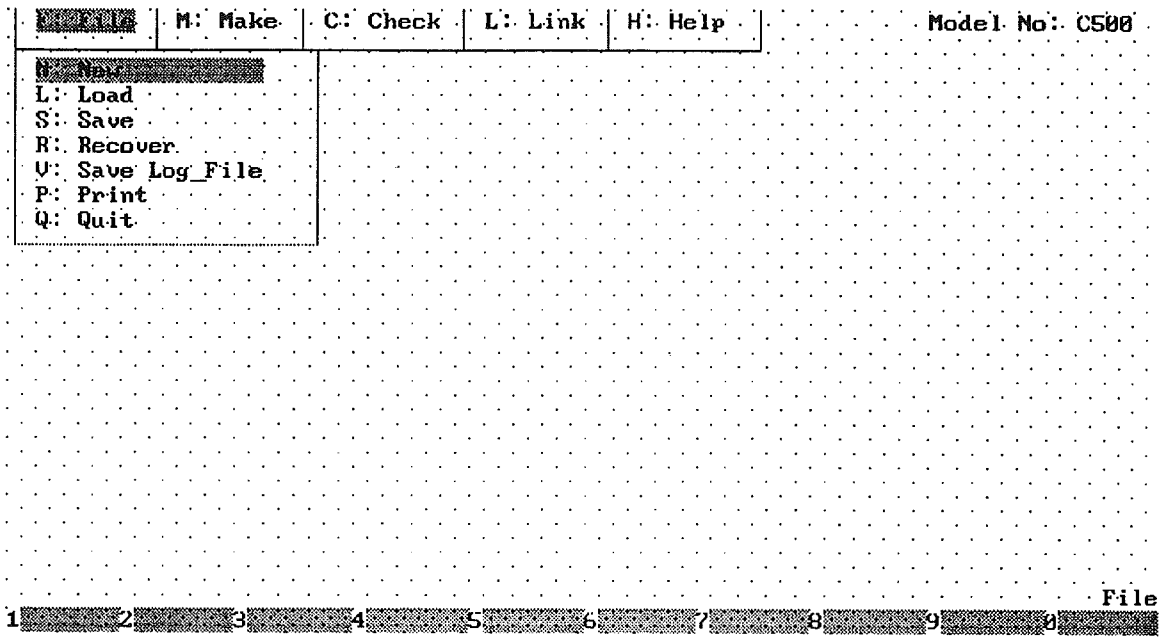
5-2-1 Main Menu

After selecting the Unit, the cursor will appear at "F: File" in the upper left of the main menu. The message "Select main menu" will be displayed at the bottom left corner of the screen.

When using the mouse, move the cursor to the desired main menu item and left click.

or When selecting with the keyboard, use the Left and Right Keys to move the cursor to the desired main menu item and press the Enter Key or type the letter which precedes the desired main menu selection.

After making a main menu selection, a pulldown menu will appear. Each pulldown menu item will be preceded by an upper-case letter. The pulldown menu under "F:File" is illustrated in the following example.



5-2-2 Pulldown and Submenus

When selecting any main menu item, hold down the left button of the mouse and drag the cursor down the pulldown menu and release the button.

or The Up and Down Keys can be used to move the highlight bar in the pulldown menus.

To close a pulldown menu, right click the mouse. Selecting another main menu item while the pulldown menu is displayed may be done by selecting another main menu item by using either of the methods described above. Doing so will close the previous pulldown menu and display the pulldown menu under the newly selected main menu item.

Use the selection method described previously to make selections in submenus. Pressing the Left Key will return the display to the pulldown menu.

5-2-3 Operating from a Floppy Disk

The software divides operations by each main menu item and loads them to memory. When replacing data disks, reset the system disk before selecting the main menu.

5-3 Quitting FSS

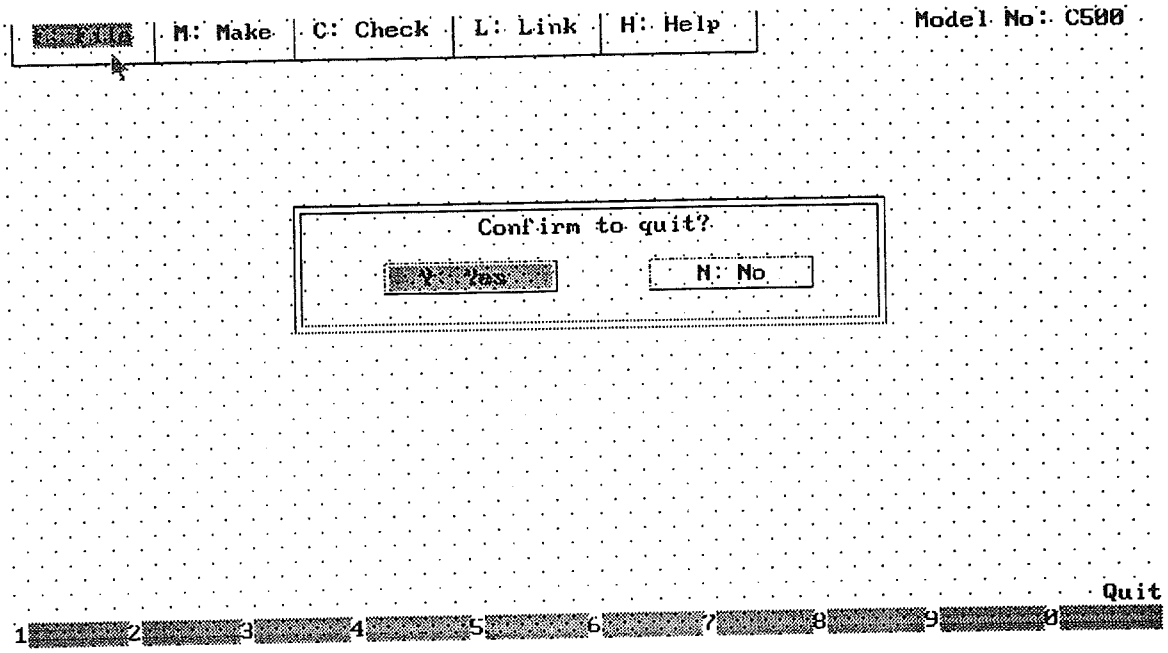
To quit the program, use the following procedure.

1, 2, 3...

1. Select "Q:Quit" under the main menu "F: File".
2. A window to confirm quit is displayed. Selecting "Y: Yes" will exit the program and return the MS-DOS prompt.

or Selecting "N: No" or a right click on the mouse will return you to the previous display.

The operation is illustrated in the following example:



If editing knowledge has not been saved to a file before the quit confirmation window, a Save Knowledge confirmation display will appear. Save to a desired file. For details on saving data, refer to *6-4 Save*.

If a data log file has not been saved before the quit confirmation window, a Save-log-file confirmation window will be displayed.

Caution After exiting the program, unsaved unit knowledge or logged data resident in the system is deleted.

SECTION 6
File Operations

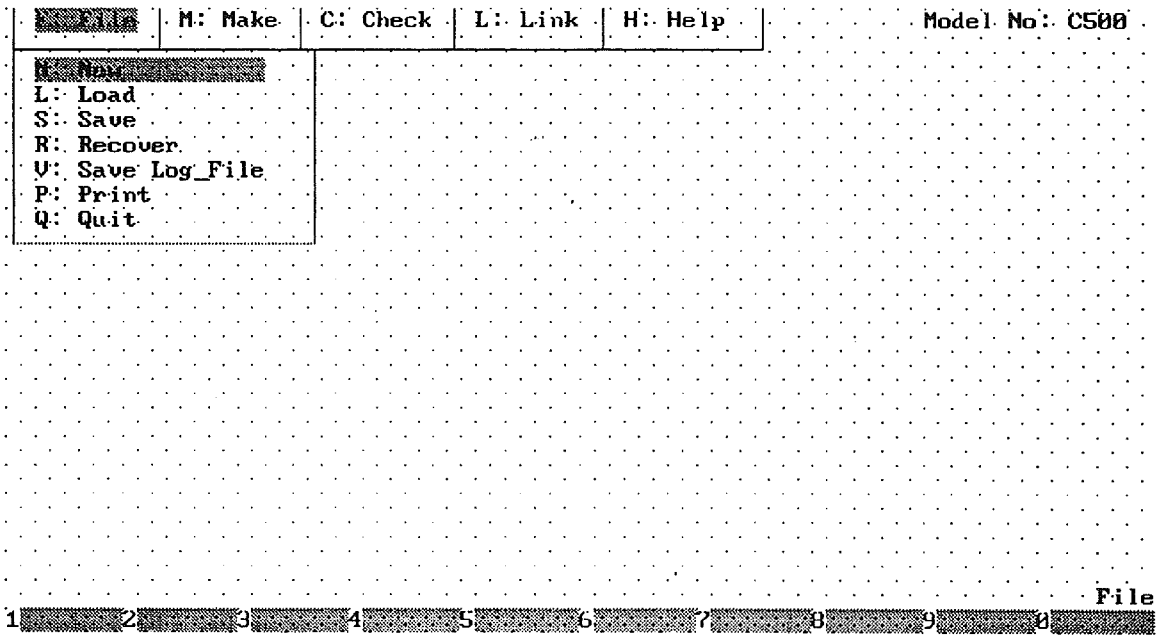
This section provides details on File operations and pulldown menu items.

6-1 File Menu Operations

"F: File" contains the following operations in its pulldown menu.

Operation	Function
N: New	Clears editing knowledge and creates a new file.
L: Load	Loads knowledge from a data disk.
S: Save	Saves knowledge to a data disk.
R: Recover	Recovers editing knowledge uploaded from the Fuzzy Logic Unit.
V: Save Log_File	Saves data captured from monitoring.
P: Print	Prints out editing knowledge, the Unit settings, and inference conditions.
Q: Quit	Exits from the FSS program and returns to MS-DOS.

When loading or saving a knowledge file, the working directory is the current directory at startup. After a directory has been changed by a load or save operation, the current directory becomes the next loading or saving directory. The following display shows the "F: File" pulldown menu.

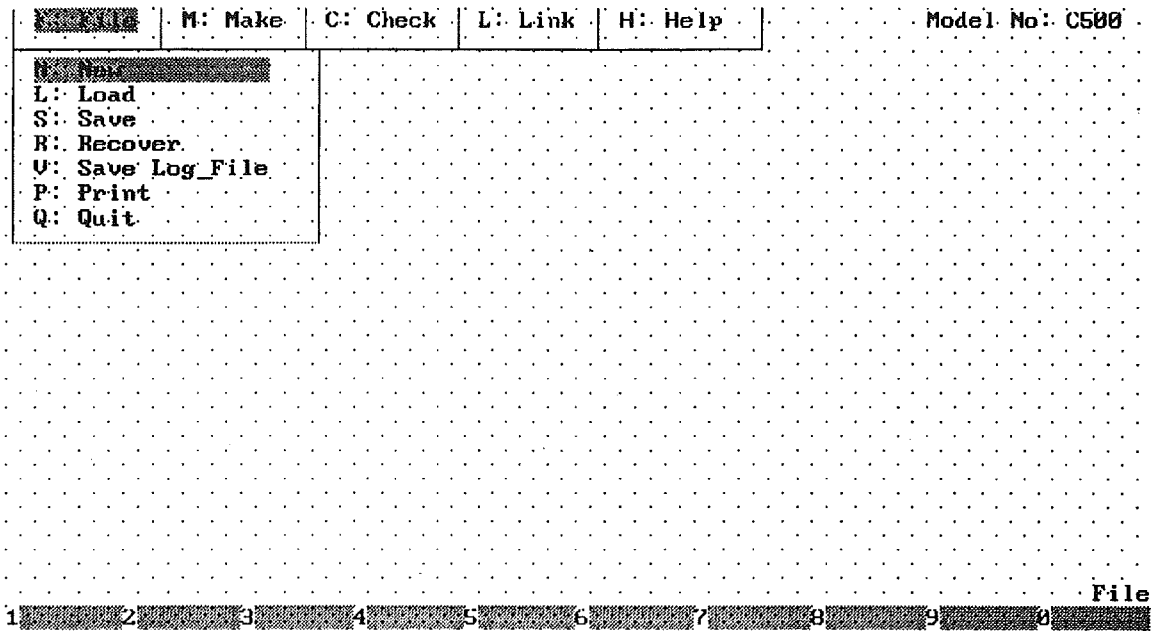


6-2 New

The following procedure is for the "N: New" operation of the "F: File" pulldown menu.

1, 2, 3... 1. Select "F: File" in the main menu. The pulldown menu will be displayed.

2. Select "N: New" from the pulldown menu.



This function clears editing knowledge and makes new knowledge. When "N: New" is selected, and previous editing knowledge not saved to a file remains, the display to prompt saving knowledge will appear. Save this to a file if desired, otherwise unsaved knowledge will be lost. Refer to *6-4 Save* for details about saving data.

6-3 Load

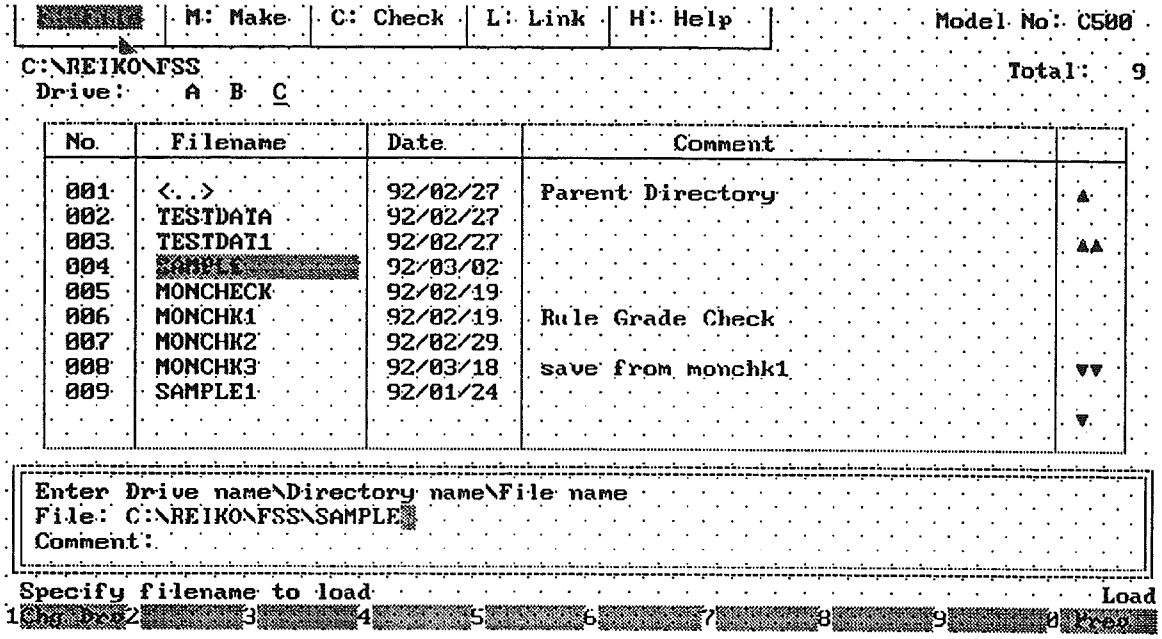
The following procedure is for the "L: Load" operation of the "F: File" pulldown menu.

1, 2, 3...

1. Select "F: File" in the main menu. The pulldown menu will be displayed.
2. Select "L: Load" from the pulldown menu.

Before the list of knowledge files is displayed, the "Creating data list" display appears. A list of existing knowledge files and the sub-directories of the specified

knowledge directory is displayed and an input area for file names or directories appears underneath. The following example shows the listing.



File Selection The knowledge file names are highlighted. To select a file, move the cursor using the Up and Down Keys and press the Enter Key. When using the mouse, left click on the single up ▲ or down arrows ▼ displayed in the rightmost column to move up and down the list, then right click to select the desired file.

Page Selection The directory displays a maximum of 10 files. To move to another page for more files, use the Page Up/Page Down Keys to go to the previous or next page. Alternately, when using the mouse, left click the double up ▲▲ or down arrows ▼▼ displayed in the rightmost column. The maximum number of files and directories which can be displayed is 280.

Changing Directories To change a directory, type in the directory name followed by a backslash "\" and press the Enter Key. An input path name exceeding 71 letters will be left truncated.

Changing the Working Drive To change the working drive, select "F1: Chg_Drv" from the function key menu and move the mouse cursor to the drive area or use the Left and Right Keys to move to the desired drive and press the Enter Key, or enter the drive letter, or left click to select the desired drive. Pressing the F10 Key will exit the display and retain the original drive.

Loading Knowledge After a confirmed knowledge file has been loaded, if edited knowledge has not been saved, a save confirmation window will be displayed. Save the file if desired. After saving, load the desired knowledge. During loading , the "Loading knowledge" window will be displayed. After loading is completed, the window will disappear and the display returns to the main menu. Selecting "F10: Prev" or a right click will also return you to the main menu.

Caution When loading a knowledge file, edited knowledge is replaced and previous knowledge is deleted.

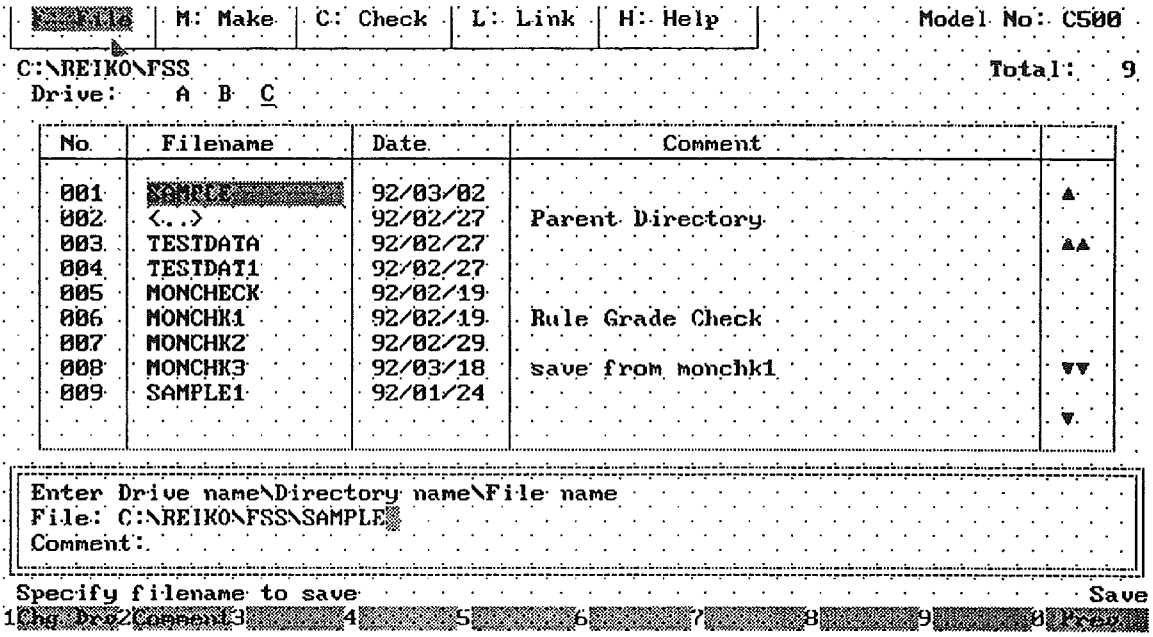
6-4 Save

The following procedure is for the "S: Save" operation of the "F: File" pulldown menu.

1, 2, 3... 1. Select "F: File" in the main menu. The pulldown menu will be displayed.

2. Select "S: Save" from the pulldown menu.

Before the list of knowledge files is displayed, the "Creating data list" display appears. A list of existing knowledge files and the sub-directories of the specified knowledge directory is displayed and an input area for file names or directories appears underneath. The following example shows the listing.



File Selection

The knowledge file names are highlighted. To select a file, move the cursor using the Up and Down Keys and press the Enter Key. When using the mouse, left click on the single up ▲ or down arrows ▼ displayed in the rightmost column to move up and down the list, then right click to select the desired file.

Page Selection

The directory displays a maximum of 10 files. To move to another page for more files, use the Page Up/Page Down Keys to go to the previous or next page. Alternately, when using the mouse, left click the double up ▲▲ or down arrows ▼▼ displayed in the rightmost column. The maximum number of files and directories which can be displayed is 280.

File Names

Type the file name to be saved and press the Enter Key. File names must be eight characters or less. When inputting the name of a knowledge which has been previously saved, a confirmation message to replace the file will appear. To replace, select "Y: Yes" and to cancel the operation, select "N: No".

Changing Comments

To change comments for the current knowledge file, select "F2: Comment", type in the comment and press the Enter Key. Comments are restricted to 30 characters or less. Select "F10: Prev" to cancel this operation.

Changing the Working Drive

To change the working drive, select "F1: Chg_Drv" from the function key menu and move the mouse cursor to the drive area or use the Left and Right Keys to move to the desired drive and press the Enter Key, or enter the drive letter, or left click to select the desired drive. Pressing the F10 Key will exit the display and retain the original drive.

Saving Knowledge

When saving a knowledge file, a "Saving knowledge" display will appear. After saving, the display reverts to the main menu. If "S: Save" is selected and no editing data exists, "No editing knowledge" will appear at the bottom left of the display.

6-5 Recover

The following procedure is for the "R: Recover" operation of the "F: File" pull-down menu.

1, 2, 3...

1. Select "F: File" in the main menu. The pulldown menu will be displayed.
2. Select "R: Recover" from the pulldown menu.

Editing knowledge will be recovered from the Fuzzy Logic Unit. During recovery, a "Recovering unit knowledge" window will be displayed. After recovery is completed, the message "Restoration of unit data completed" is displayed at the bottom left of the display.

After selecting "R: Recover", if editing knowledge is not saved to a file, the save confirmation window will be displayed. Save if desired at this time. After saving is completed, unit knowledge is recovered.

Note Because comments are not downloaded to the Unit, they cannot be recovered.

When unit knowledge is not loaded, the message "Select affirm settings" appears at the bottom left of the display. Load knowledge from the Unit by selecting "A: Affirm" under the main menu operation "L: Link".

For the C500:

After a knowledge file has been recovered, there will be several changes to it:

- All input names will have default names: input0 will have input name IN0, input1 will have input name IN1 and so on.
- All output names will have default names: output0 will have output name OUT0, output1 will have output name OUT1.
- All labels for a input or output signal will have default names.

The following table shows the complete list of default names used.

Label no.	Label name	Input no.	Input name	Output no.	Output name
0	NL	0	IN0	0	OUT0
1	NM	1	IN1	1	OUT1
2	NS	2	IN2	—	—
3	ZR	3	IN3	—	—
4	PS	4	IN4	—	—
5	PM	5	IN5	—	—
6	PL	6	IN6	—	—
—	—	7	IN7	—	—

Input names with labels which do not have a MF definition will not be recovered. Output signals and labels in conclusions will not be recovered if they are not used in rules.

6-6 Save Log_File

After selecting the item "Save log data" under "L: Link" and "M: Monitor", the data consisting of inputs, outputs and rule grades is logged during the monitoring process. "V: Save Log_File" saves this data into a permanent file. C200H log data files end with the extensions .IO2 and .GR2 for I/O and rule grade respectively. C500 log data files end with the extensions .IO5 and .GR5 for I/O and rule grade.

The file format for the C200H Fuzzy Logic Unit log file is as follows. The first row of the file shows the headings of items logged. "NO" is the number of counts logged. Maximum value is 512.

For I/O log (*.IO2):

"NO"	"IN1"	"IN2"	"IN3"	"IN4"	"OUTO"
1	1027	1027	0	0	0
2	1027	1027	0	0	0
3	1040	1027	0	0	0

For rule grade log (*.GR2):

" "	"RL"	"RL"	"RL"	"RL"	"RL"
"NO"	1	2	3	4	5
1	1027	1027	0	0	0
2	1040	1027	0	0	0
3	1027	0	1040	0	0

The file format for the C500 Fuzzy Logic Unit log file is as follows. In the I/O log, the first row of the file shows the headings of items logged. "NO" is the number of counts logged in both I/O and rule grade logs. Maximum value is 512.

For I/O log (*.IO5):

"NO"	"IN1"	"IN2"	"IN3"	"IN4"	"OUTO"
1	512	0	3072	0	0
2	512	0	3072	0	0

For rule grade log (*.GR5):

"No:1"					
"Rule No:"	3	4	10	11	17
"Grade "	2047	2047	2047	2047	0
"No:2"					
"Rule No:"	3	4	10	11	17
"Grade "	2047	2047	2047	2047	0

The saved log file can be viewed later using a text editor or be loaded into a spreadsheet (eg. Lotus 1-2-3). If this file has more than 63 rules logged and is to be loaded into Lotus 1-2-3, the tabs in the log file must be converted to commas before loading. This can be done using the program TAB_CV.EXE. Type `TAB_CV log-file.GR2` at command-line to perform the conversion. The converted file is log–file.4R@. The following shows the differences between the two:

log-file.GR2	log-file.GR@
" "<TAB>"RL"<TAB>"RL"<TAB>"RL"<TAB>	" ","RL","RL","RL",
"NO"<TAB>1<TAB>2<TAB>3<TAB>	"NO",1,2,3,
1<TAB>0<TAB>0<TAB>0<TAB>	1,0,0,0,
2<TAB>384<TAB>192<TAB>0<TAB>	2,384,192,0,

6-7 Print

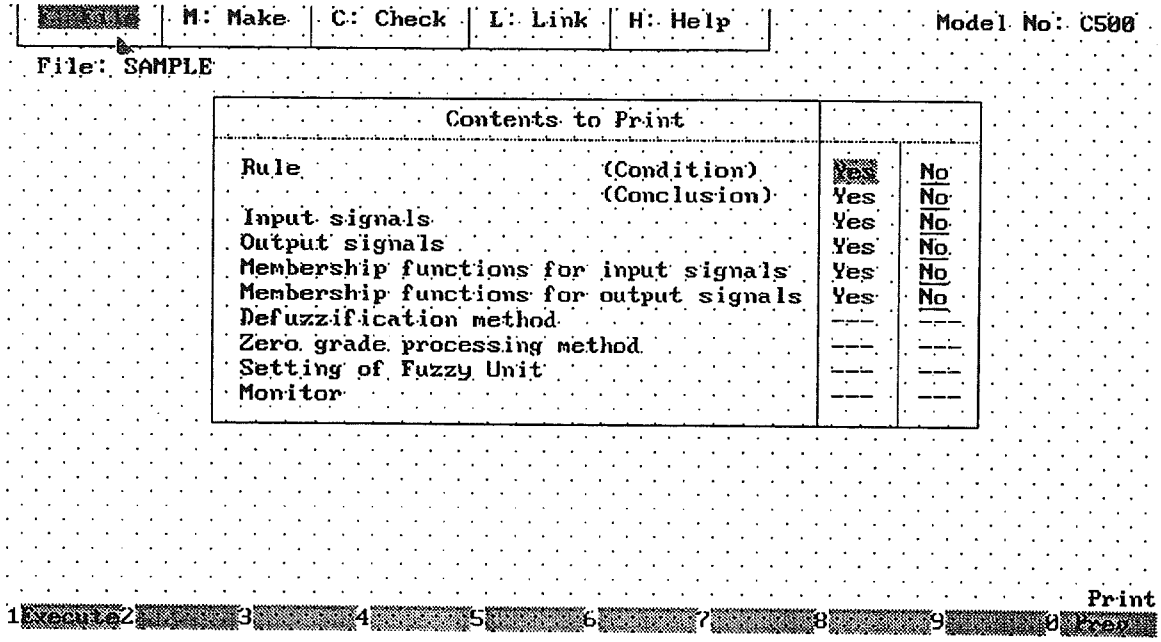
The following procedure is for the "P: Print" operation of the "F: File" pulldown menu.

1, 2, 3...

1. Select "F: File" in the main menu. The pulldown menu will be displayed.
2. Select "P: Print" from the pulldown menu.

The "CONTENTS TO PRINT" display will be appear. To select an item for printing, move the cursor to the item and select "YES" in the PRINT column and press

the Enter Key or left click. More than one item can be selected as seen in the graphic below.



During monitoring, the current display before selecting "P: Print" will be printed. If a communications error occurs during monitoring, the monitored display cannot be printed.

After selecting an item to print, select "F1: Print" and to begin printing. To quit printing, select "F10: Prev" or right click. Printing will stop and the main menu display will return. However, if the printing data has already been sent to the printer, printing will continue.

When no knowledge or unit knowledge exists and "P: Print" is selected, the message "No data to print out" will be displayed.

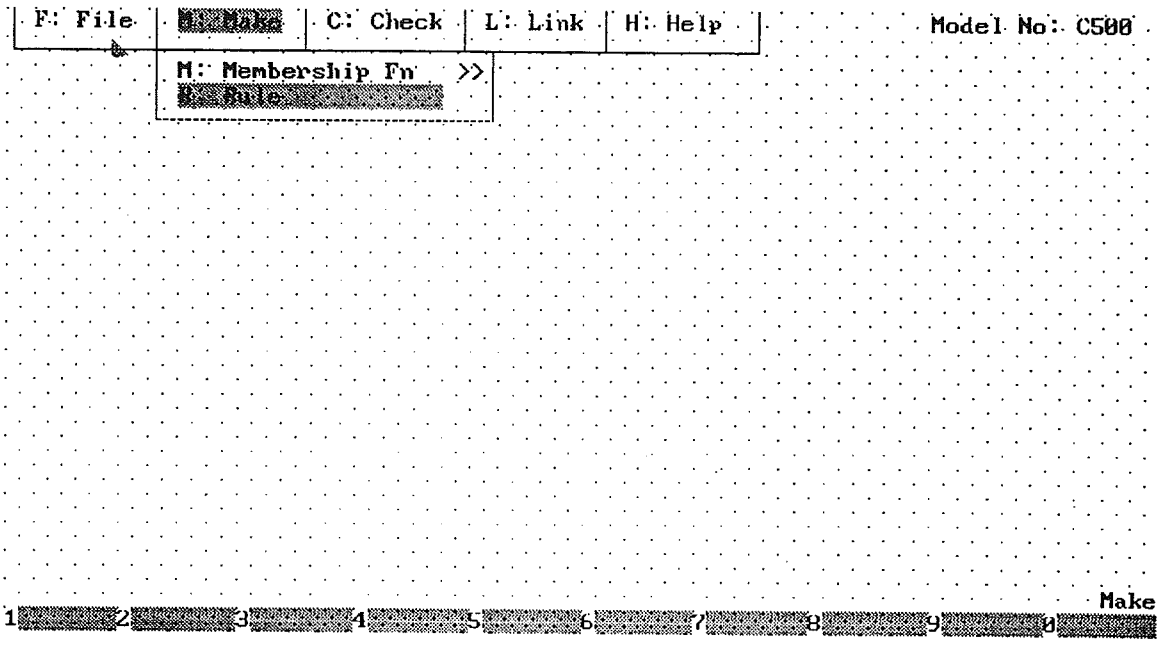
SECTION 7
Make Operations

This section provides details on Make operations as well as pulldown menu and related submenu items.

7-1 Make Menu Operations

"M: Make" contains the following operations in its pulldown menu.

Operation	Function
M: Membership Function	Edit MF data under either C: Condition or L: Conclusion.
R: Rule	Edit rule data.
D: Defuzzification	Select defuzzification method for the C200H Unit.
Z: Zero Grade	Selects the zero grade processing method to be used when starting up the C200H.



Note Defuzzification and zero grade processing are not necessary for the C500 Unit.

During loading or saving operations the current directory is used and if changed during loading or saving, the new directory then becomes the default directory. If "M: Make" is selected after starting up FSS, the message "No editing knowledge" will appear in the operation guide/error display area.

7-2 Rule Data

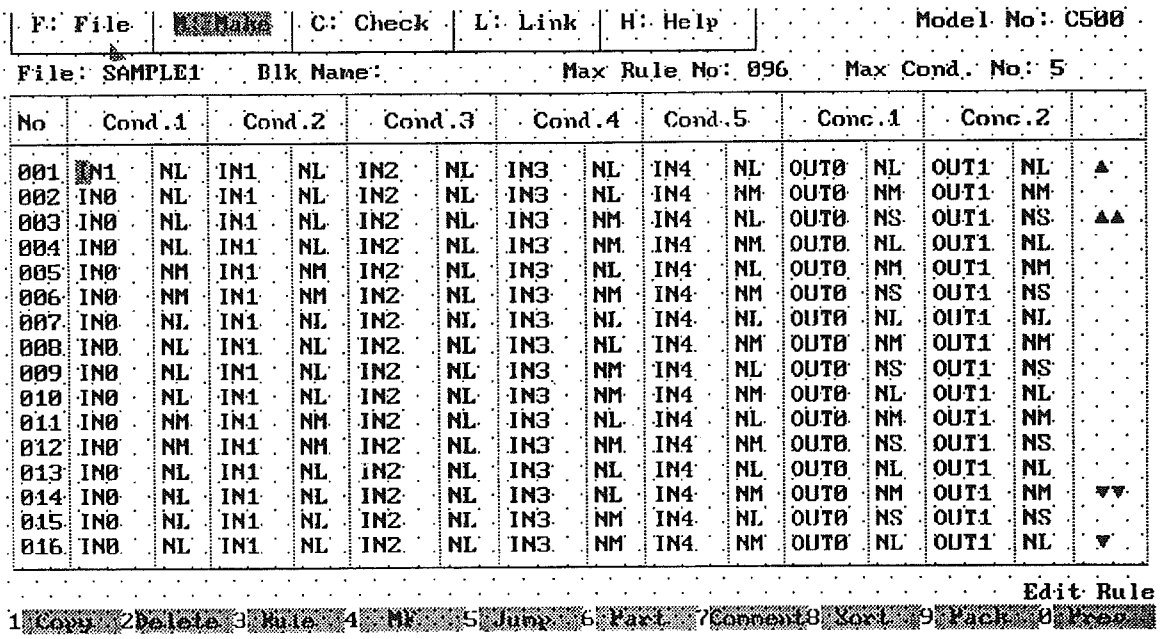
The following procedure is for the "R: Rule" operation of the "M: Make" pulldown menu. The operation "R: Rule" is used to perform all necessary operations on rule data information.

7-2-1 Function List and Shift

Operations are performed on rule data using the function key menu.

1, 2, 3... 1. Select "M: Make" in the main menu. The pulldown menu will be displayed.

2. Select "R: Rule" from the pulldown menu. The following display will appear.



The following table describes the functions keys available for "R: Rule".

Operation	Key	Function
Copy	F1	Copy rule(s) by overwriting or inserting to a specified position
Delete	F2	Delete rule(s) at a specified position.
Rule	F3	Edit rule.
MF	F4	Edit MF.
Jump	F5	Move the cursor to a specified rule position.
Part	F6	Load/Refer/Save/Delete a rule part from a part file.
Comment	F7	Make comments for each rule and rule block.
Sort	F8	Sort rule data by each input.
Pack	F9	Pack rule data.
Previous	F10	Go to the previous display

7-2-2 Basic Input

For basic input, use the following procedure.

1, 2, 3... 1. Move the cursor to the desired position using the Left and Right Keys.

The maximum number of rules allowed is 128. A maximum of 16 rules are displayed on the display. The signal name and each label name can be set using up to 5 and 3 characters respectively. The signal and label names are changed to upper-case letters when they are input.

2. When the Enter Key is pressed, the input signal and label names will be confirmed.

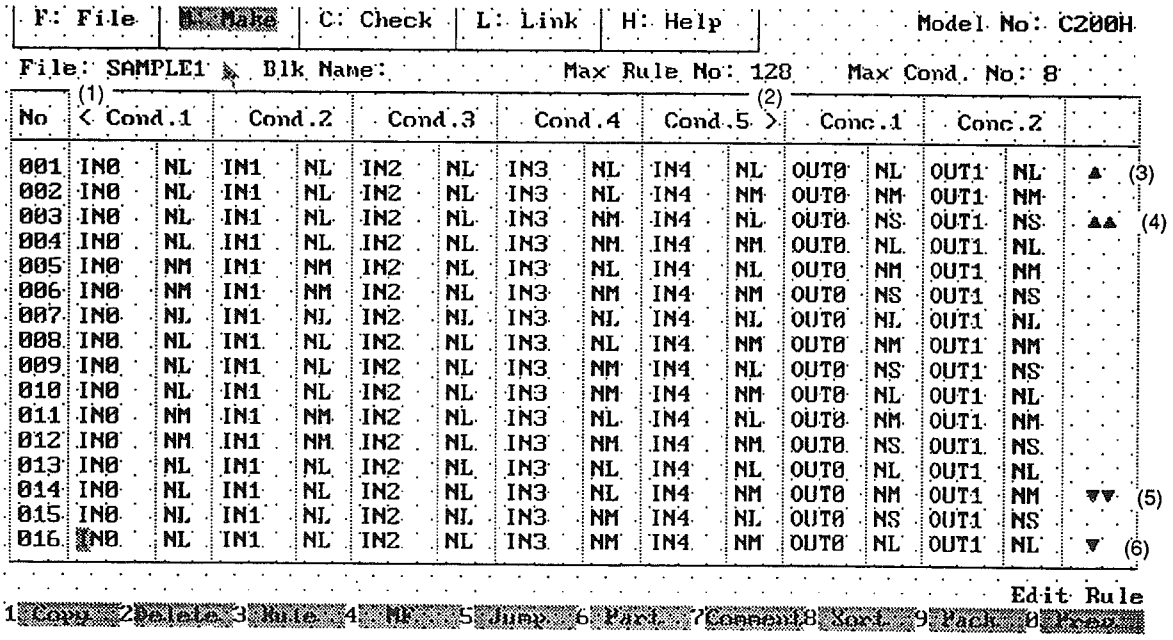
If the Home Key is pressed, all characters in the input column containing the cursor are deleted. For each rule, the contents of 5 conditions are displayed. The C200H has a maximum of 8 conditions per rule. To display more conditions, use Shift+Left Keys or Shift+Right Keys. The maximum number of conditions for the C500 is 5. The maximum numbers of conclusions for both

Units is 2. Pressing the Insert Key will place a space at the current cursor position.

Input Methods

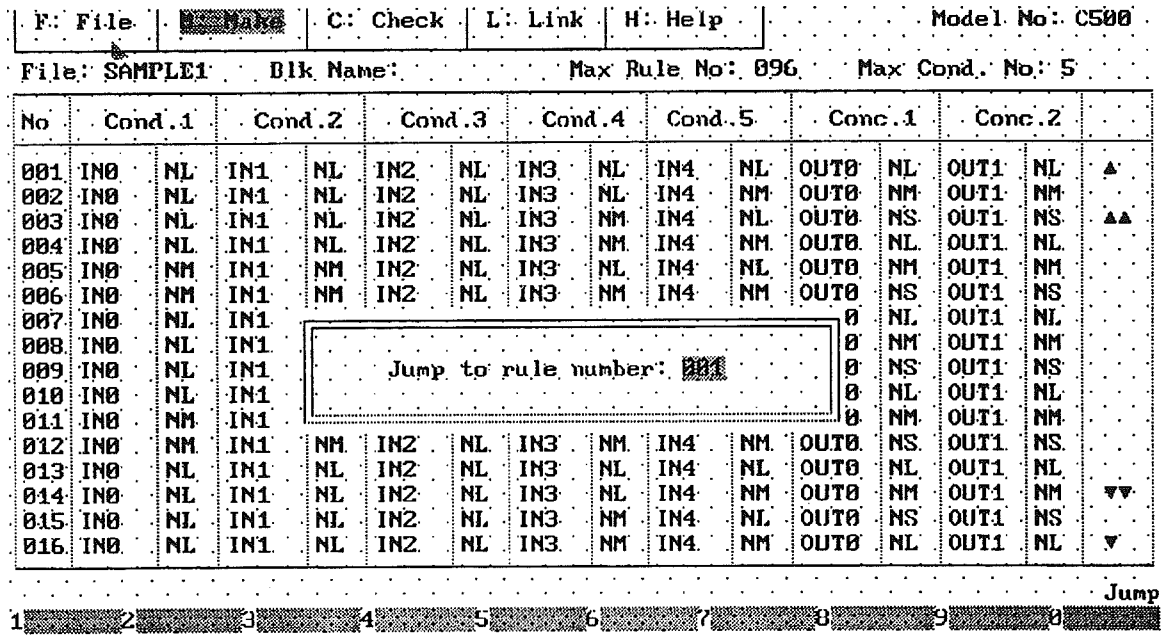
The following table and display summarizes the various ways to input rule and knowledge data.

Keyboard	Mouse click position	Explanation
Shift+Left Keys (for C200H only)	Position (1) on display	Shifts by one condition to the left.
Shift+Right Keys (for C200H only)	Position (2) on display	Shifts by one condition to the right.
—	Position (3) on display	Moves up to display previous rule.
Page Up Key	Position (4) on display	Displays the next 16 rules before the current rule.
Page Down Key	Position (5) on display	Displays the next 16 rules after the current rule.
—	Position (6) on display	Moves down to the next rule.
Up Key	—	The cursor moves one rule up the input field.
Down Key	—	The cursor moves one rule down the input field.
Left Key	—	The cursor moves left to the next input field.
Right Key	—	The cursor moves right to the next input field.
Enter Key	To input, place cursor on data to be input and left click.	The cursor moves to the right adjoining input field.



Jump

Jumping to a specified rule during editing, copying or deleting is performed using the F5 Key. For instance, during basic input, select "F5: Jump". An input window like the one in the following display will appear.



The current rule number at the cursor position is displayed inside the window on the rule editing display. Type in the rule number to be jumped to and press the Enter Key or left click.

A rule with a specified number will be displayed inside the rule editing display. If the input number is under 128 but exceeds the number of the last rule, the current rule data with the highest rule number will be displayed in the center of the display.

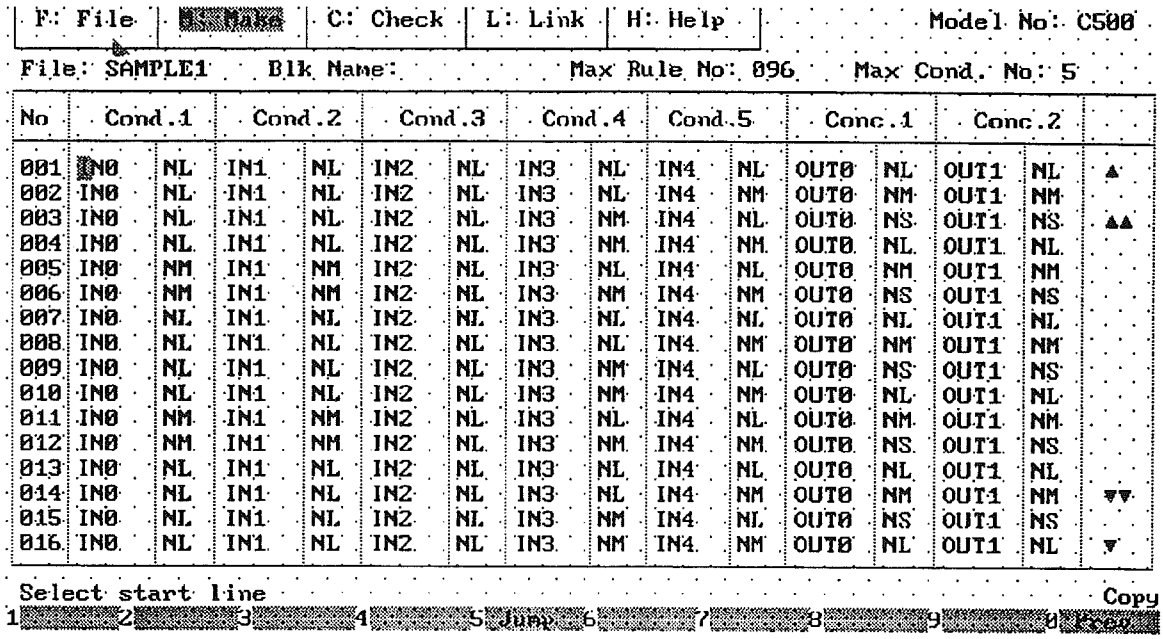
7-2-3 Copying

For copying, use the following procedure.

1, 2, 3...

1. Move the cursor to the starting point of the rule to be copied.
2. Select "F1: Copy" at the rule input editing display. The function menu display at the bottom of the display will change.

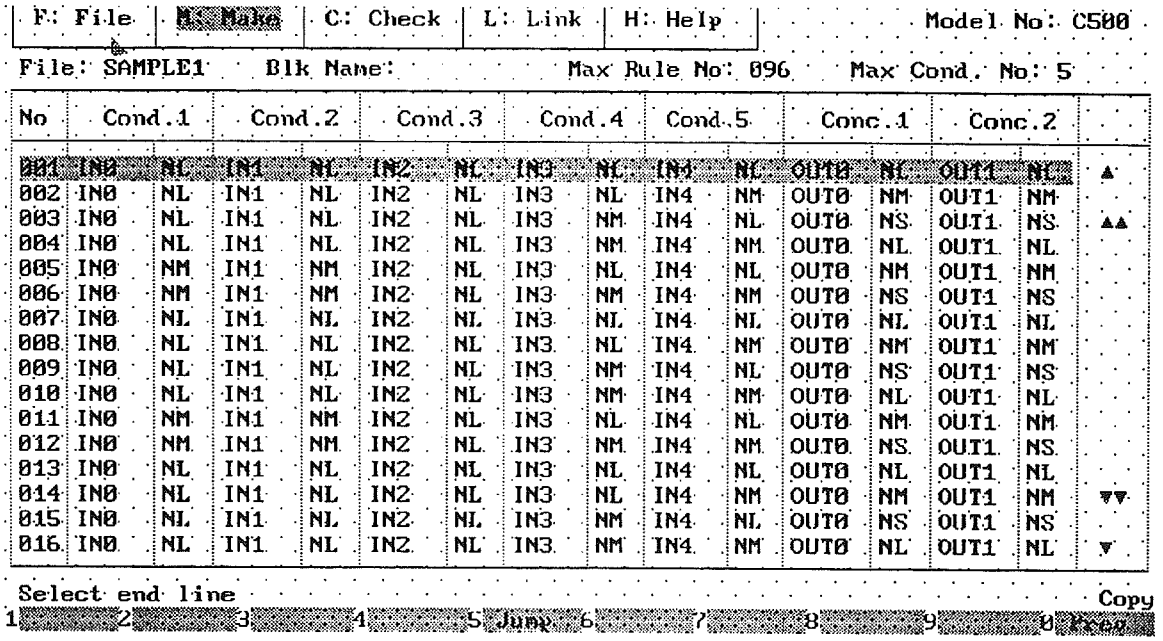
3. The user will be prompted to enter the number of the first line to be copied.



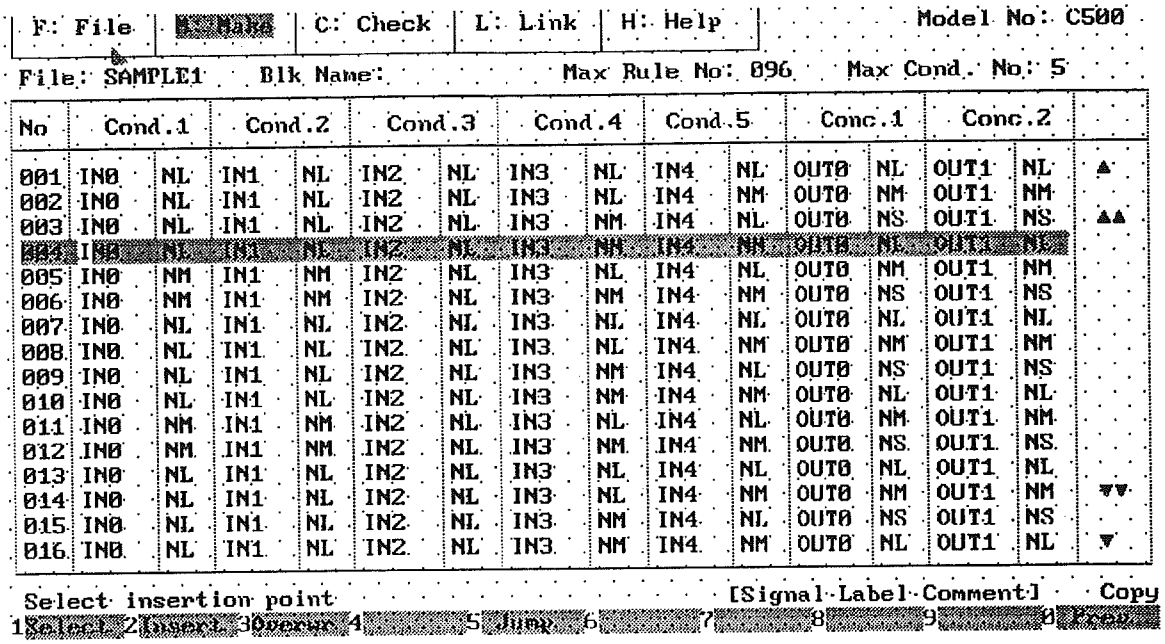
After the initial rule number has been input, guide messages will prompt for the ending rule number and the insertion/overwrite position.

4. Make the final selection by pressing the Enter Key or using a left click.

For the ending rule number:



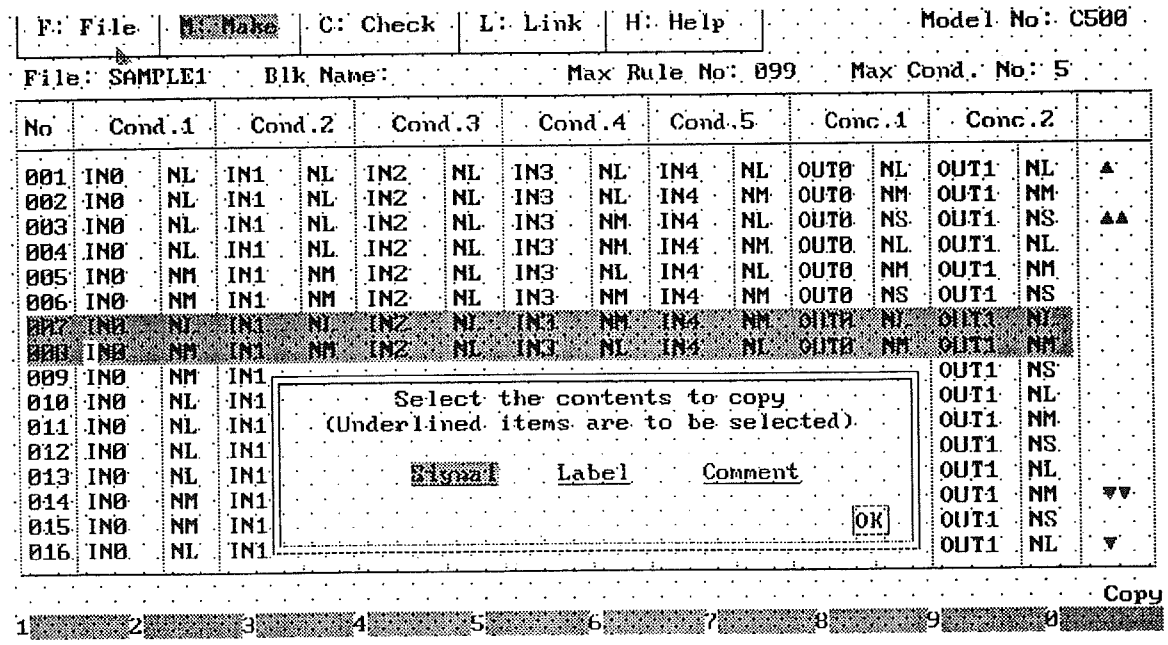
For the insertion/overwrite position:



5. After selecting the start and end lines, the rules that are to be copied are highlighted.

   The following selections can now be made.

   - F1 Key: To select the contents to copy.
   - F2 Key: To select the insertion mode. This is the default mode as seen in the following display.
   - F3 Key: To select overwrite mode.
   - F5 Key: To jump to a specified rule number.



Copied rules cannot be inserted into their original locations. Also, when copying while in the insert mode and the rule data exceeds 128 rules after copying has been completed, the operation will be stopped. In both cases, the message "Improper working position," will appear at the bottom left of the display.

6. After the rule data to be copied have been chosen and the mode designated, a confirmation window will appear. At this point the operation can be confirmed or cancelled.

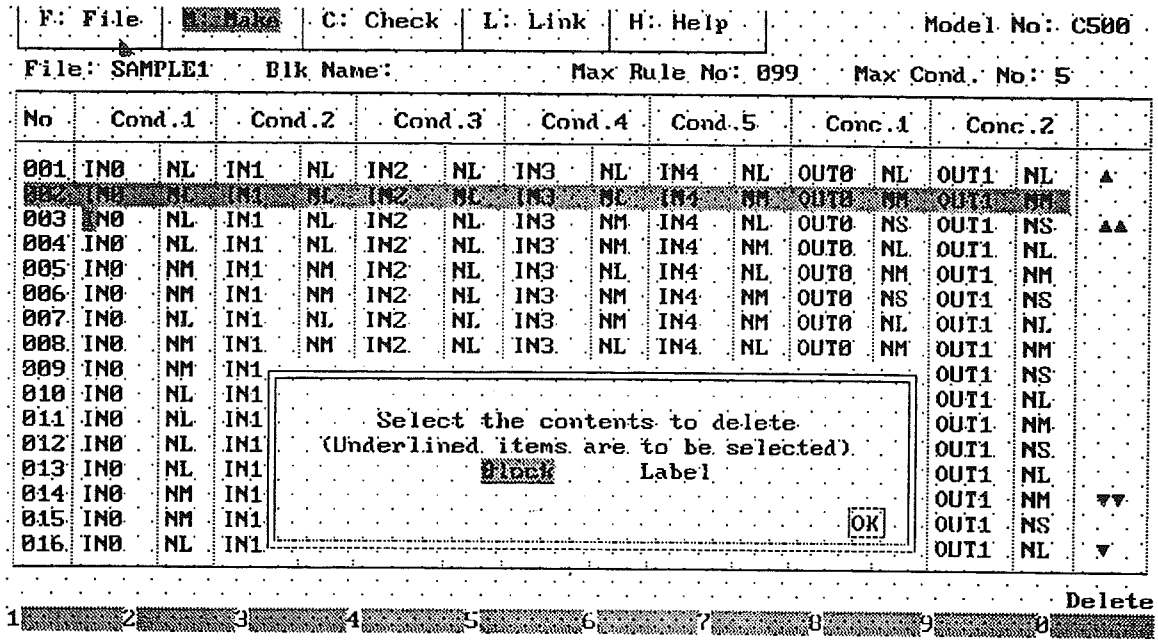
7-2-4 Deleting

To delete a rule or block of rules, use the following function keys and procedure:

F1: Select, F5: Jump, and F2: Delete.

1, 2, 3...

1. Select "D: Delete" under the main menu item "M: Make".
2. Select the starting line to be deleted. Use the function keys, F1, F5, and F2 to select the rule(s) to be deleted.
3. After the selection is made, a confirmation window will appear as seen in the following display.



Either the entire rule block or a specified label within a rule block can now be deleted.

7-2-5 Rule Data Based and MF Data Based Editing

To edit based on rule or MF data, use the following function keys and procedure:

When editing rules based on rule data, select "F3: Rule" on the rule input display.

If "F3: Rule" is selected, the set signal names and set label names by all rules are displayed on the lower half of the display as a signal/label list. When there are more than 8 input signals, 4 (2 for C500) output signals, and 7 labels in the rule data, the first 8 input signals, 4 (2 for C500) output signals, and 7 label signals which are checked in order from the rule 001 are displayed inside the signal/label list.

When editing based on MF data, select "F4: MF" on the rule input display.

If a rule data is edited based on MF data, unconformity with the MF data does not occur. In light of this, this mode of editing is recommended. The rule editing display becomes the editing display which displays data of three rules moved from the cursor position to the center of the rule editing display.

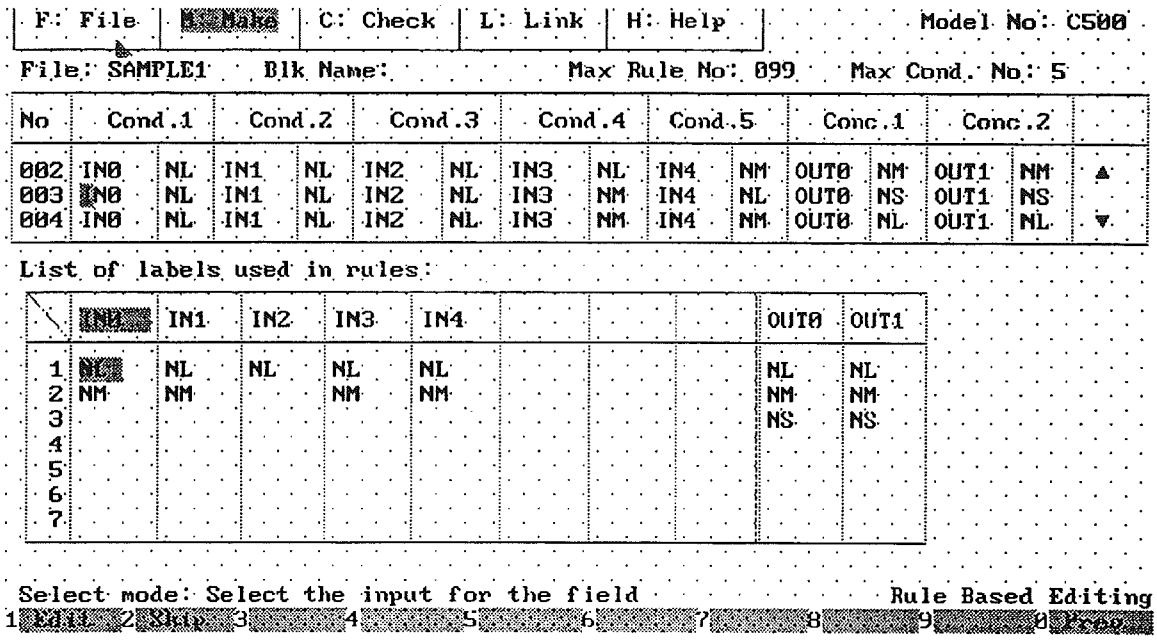
If "F4: MF" is selected, the set I/O signal names and set label names in MF editing are displayed on the lower half of the display as a signal/label list.

Use the following procedure when editing based on rule or MF data:

1, 2, 3...

1. Inside the signal and label list, the signal column of the left side and the label below it are blocked. Right after selecting "F3: Rule" of "F4: MF", "Select the

input for the field" is displayed on the bottom left of the display (seen in the following display) and it becomes possible to edit from the rule data at the cursor.



- Under the the select mode, if you press the Right and Left Keys, the cursor moves to the right and left inside the signal/label list.
- If you press the Up and Down Keys, the cursor moves up and down at the label column of the blocked signal names.
- The shift and display method of rule data by operating inside the rule editing display, besides Page Up Key and Page Down Key, is the same as that for the rule input display.

2. Under the select mode, select the signal and label to be specified from the signal/label list on the lower half of the display and press the Enter Key. The signal and label specified at the condition or conclusion item(s) with the cursor inside the rule editing display, are set.
3. If you do not want to edit rule data at the current cursor position, select "F2: Skip". The cursor position moves to the next item of condition or conclusion.

or If you select "F1: Edit", you enter into edit mode. The ordinal rule edit is possible. When you want to switch to "Select" mode, select "F1: Select".

or If you press "F10: Prev" or right click, then the rule input display appears.

7-2-6 Sorting

For sorting, use the following procedure.

1, 2, 3...

1. Before sorting, select "C: Check" to ensure all rule data are correctly entered.

   When there are rule setting errors, they are displayed in lower-case letters after performing "C: Check". After sorting, rule setting errors cannot be displayed in lower-case letters. To display rule data in lower-case letters again, select "C: Check" again.
2. Select "F8: Sort" on the rule editing display. The same signal names will be aligned. If the message "Cannot sort" appears, check for the following conditions.
   - A signal name has no label name.
   - More than 9 input signal numbers are set for the C200H.

- More than 5 input signal numbers are set for the C500.
- The same signal name occurs more than once in the same rule number.

7-2-7 Packing

For packing, select "F9: Pack" from the function menu. All empty items between the condition and conclusion columns will be removed.

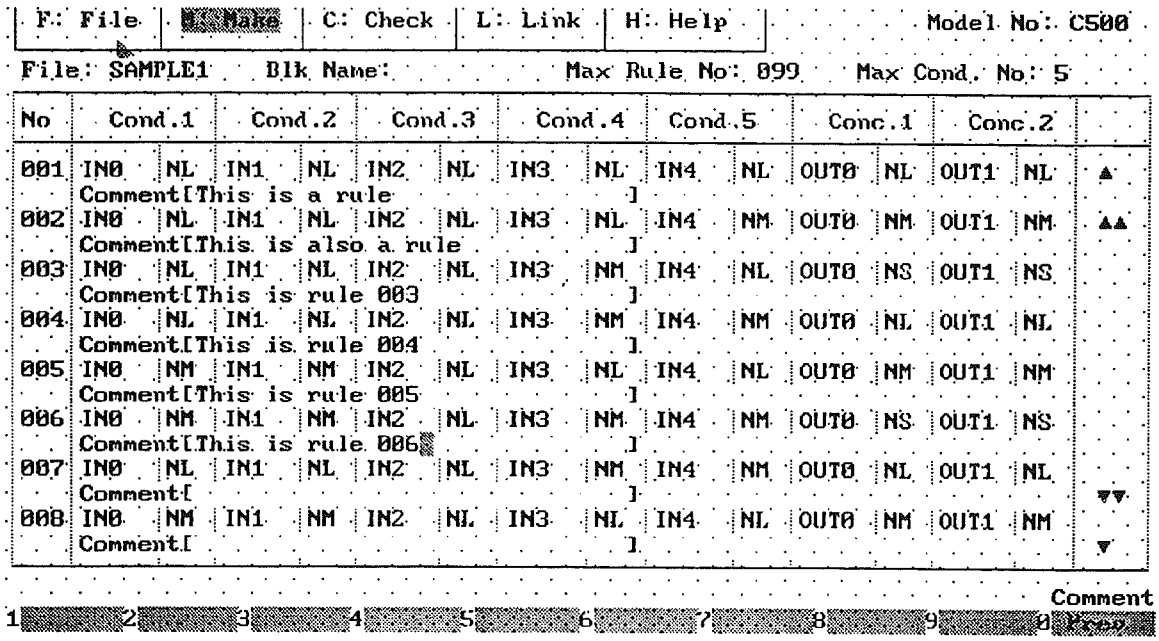
7-2-8 Comments

Comments can be made for rules and for rule block names. Use the following procedures.

Rules

1, 2, 3...

1. Select "F7: Comment". The message "Select one of the following to comment" will be displayed in the lower left of the display.
2. Select "F1: Rule". The rule comment display will be displayed. Up to 8 rules, rule data, and comment lines can be displayed.
3. Use the Left and Right Keys or move the mouse cursor to the desired rule comment and left click.



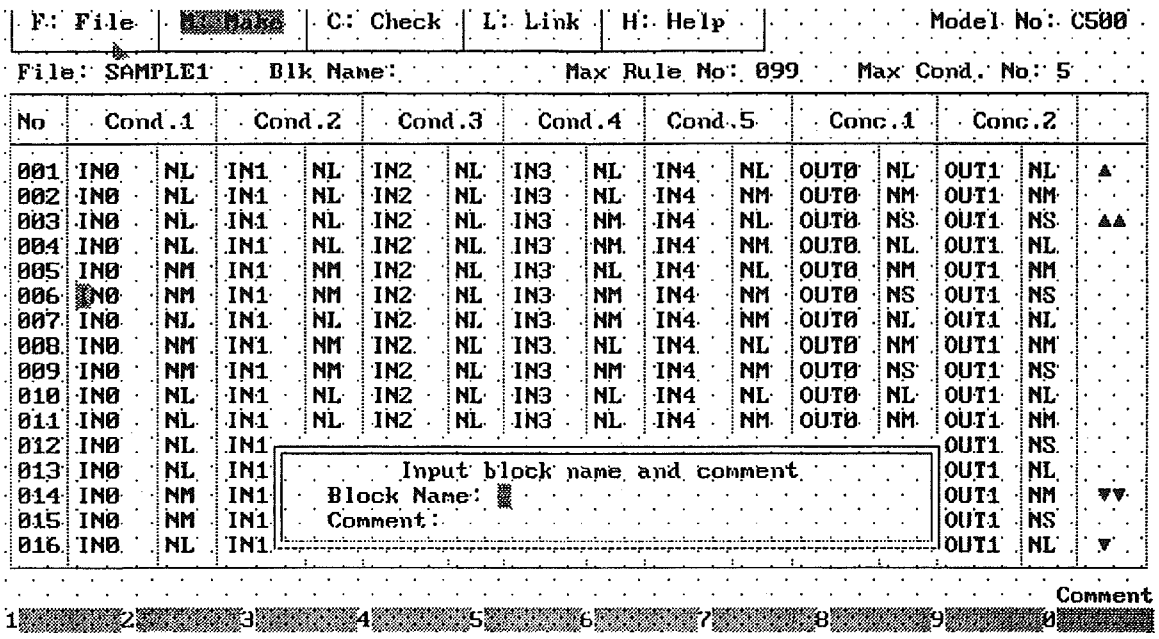
4. Enter comments and press the Enter Key. The input rule comments are confirmed and the cursor will move to the comment input column of the next rule below.
5. A right click or a press of the F10 Key will display the rule input display. The input rule comment will be confirmed and loaded into editing knowledge.

Rule Data Blocks

1, 2, 3...

1. Select "F7: Comment". The message "Select one of the following to comment" will be displayed in the lower left of the display.
2. Select "F2: Block". A block name and comment input window will be displayed. Block names are limited to 8 characters and comments to 30 characters.

3. Use the Up and Down Keys to move between block names and comments.



4. Input the block name and comment, and press the Enter Key. The input block name and comment will be confirmed.

or Right click the mouse or press the F10 Key for the input display. The input block name and comment, however, will not be confirmed.

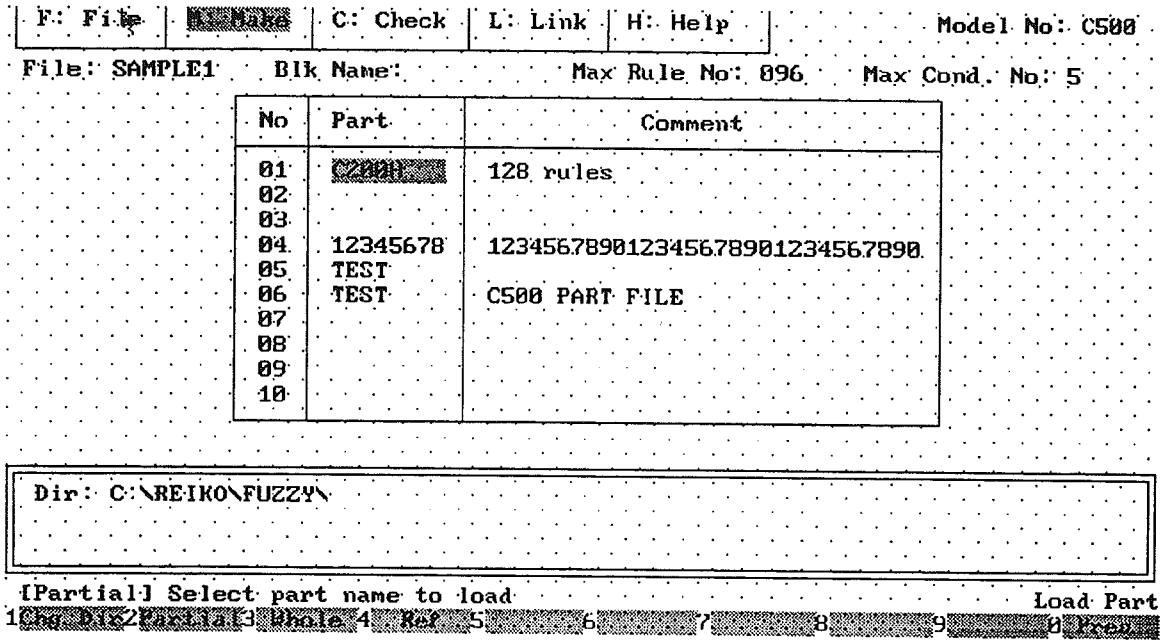
7-2-9 Part Data Files

Select "F6: Part". The following operations can be performed.

- Load part data, either partial or whole.
- Save part data.
- Delete part data.
- Reference part data.

Initial Loading Procedure Loading begins with the following procedure.

1, 2, 3... 1. Select "F1: Load". A list of rule part names will be displayed. A directory with the current part file will be displayed below it.



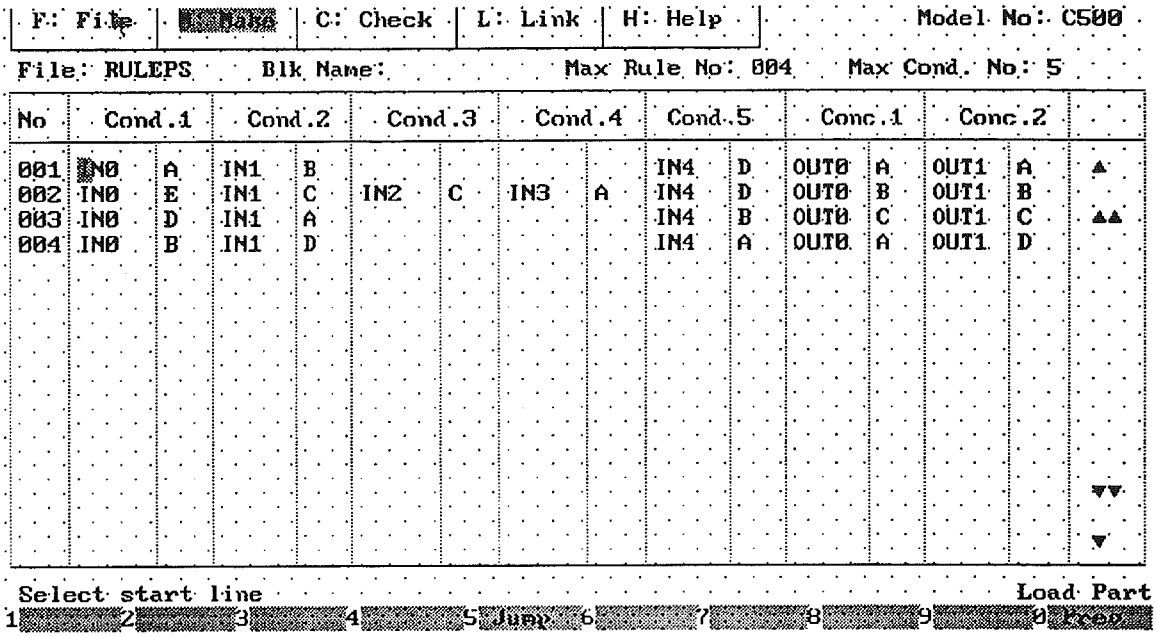
2. Select the loading mode. Partial loading is the default. To select whole loading, press the F3 Key. Pressing the F2 Key will return you to partial loading mode.
3. Move the cursor inside the list of rule part names using the Up and Down Keys.
4. To retrieve a part file from another directory, select "F1: Chg Dir". The parent directory, sub-directories, and any part files in the current directory will be displayed. Select the desired directory and part file from this display. Selecting "F1: Chg Dir" also changes the current drive.
5. Continue by using either the partial loading procedure or whole loading procedure which follow.

Note When loading parts for the C500 Unit, only 5 conditions per part rule are permitted.

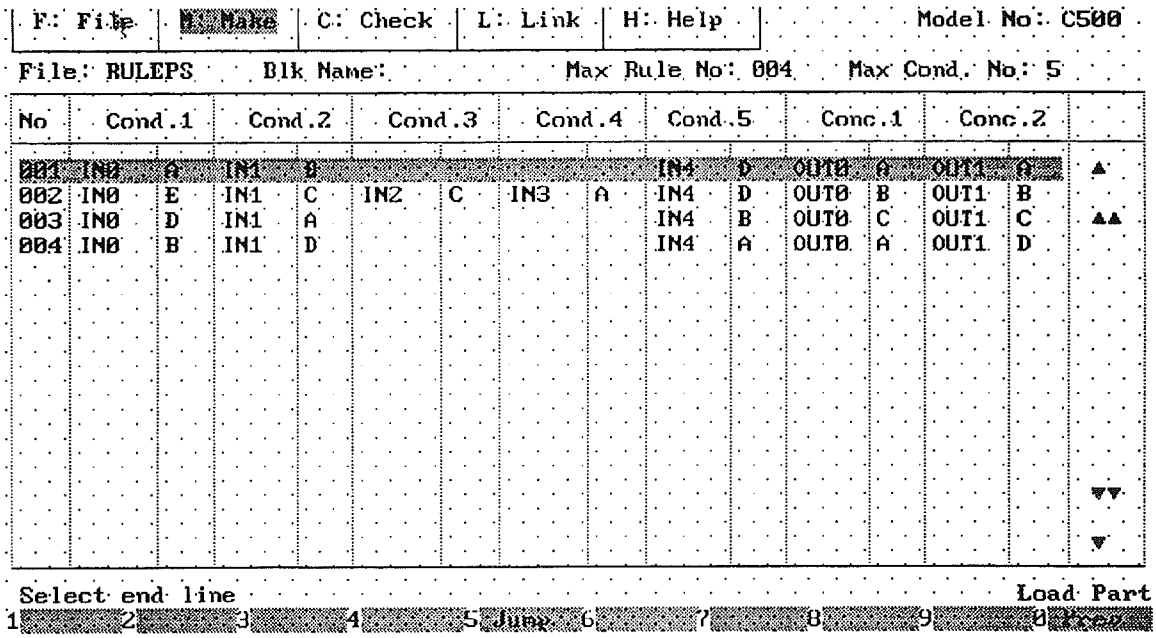
Partial Loading Use the following procedure to load part names and data.

1, 2, 3... 1. Move the cursor to the rule part name to be loaded and press the Enter Key or left click to select. After loading, the contents of the specified rule part will

be displayed and the message, "Select start line" will appear in the lower display.



2. Move the cursor to the line to be loaded. Press the Enter Key or left click the mouse.
3. Move the cursor to the last line to be loaded and press the Enter Key or right click the mouse. This selects the ending line.



The editing rule input display will be displayed and the message "Select insertion point," will appear.

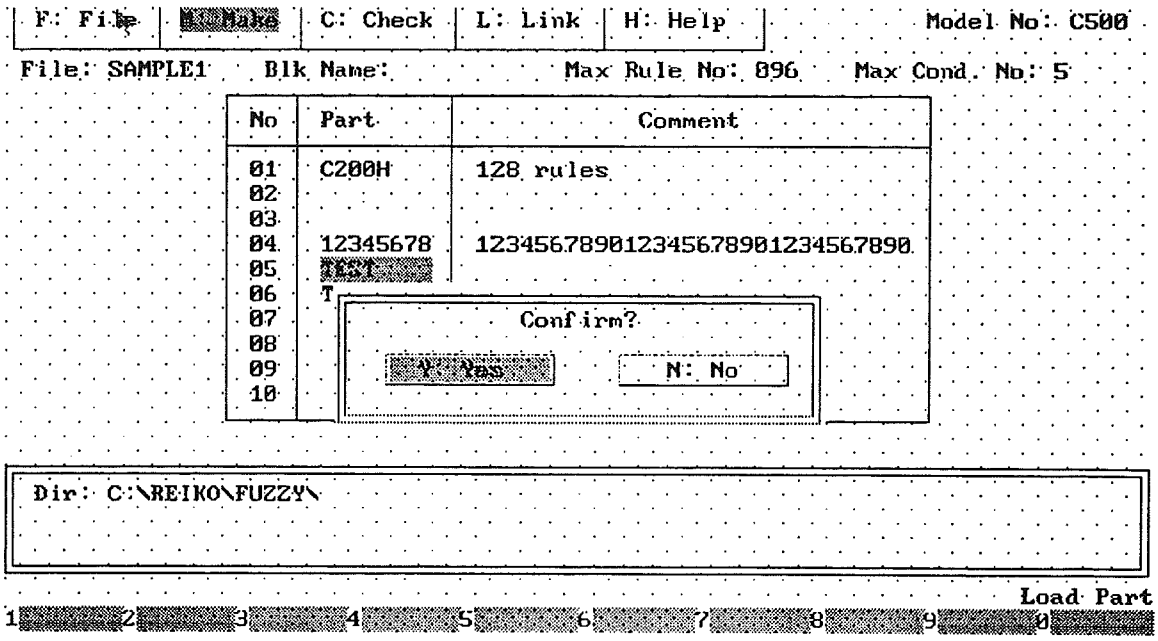
4. Use the Up and Down Keys to move to the position for inserting or rewriting and left click the mouse, or press the F5 Key (Jump).
5. A prompt to confirm partial loading will appear. Loading to the original loading area will display the message "Position inappropriate". Also, if the number of rules exceeds 128 after loading, the above message will appear on the display.

Whole Loading

Use the following procedure to whole load.

1, 2, 3...

1. Move the cursor to the rule part to be loaded and press the Enter Key or left click. The confirmation window for whole loading is displayed.



2. Select "Y: Yes" to whole load and "N: No" or right click to cancel the operation. Selecting "Y: Yes" will load the part into editing rule data and the rule input display will appear. After loading, the contents of the specified rule part will be displayed.

Note For the C500-FZ001 Fuzzy Logic Unit, parts with more than 5 conditions in a rule cannot be loaded.

Reference Part

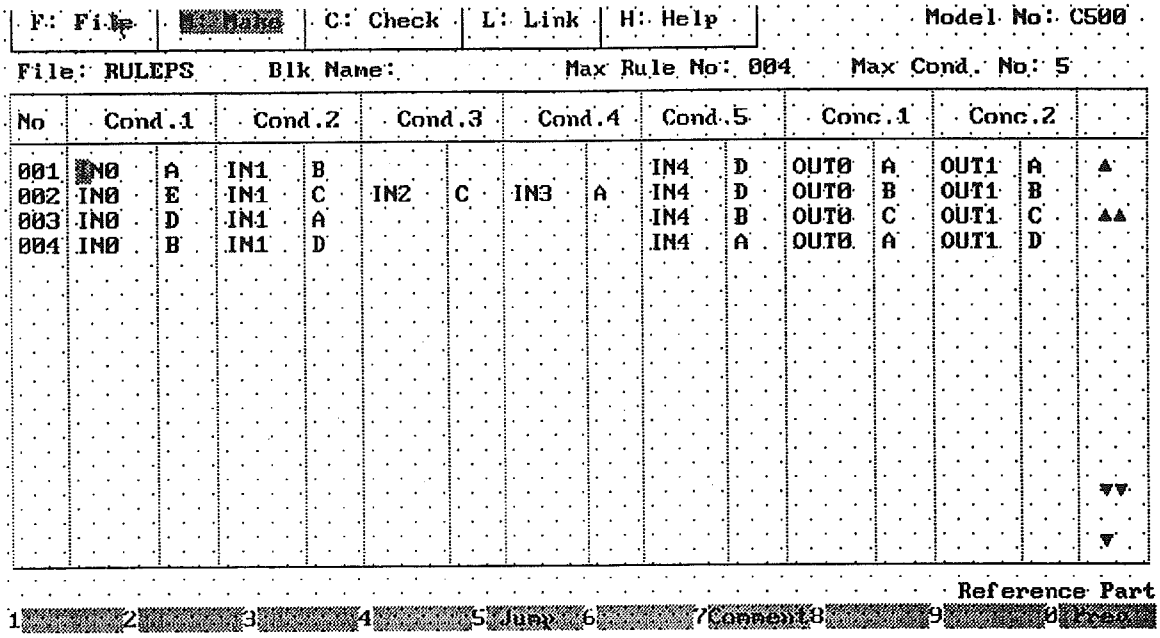
Use the following procedure to make references to rule parts.

1, 2, 3...

1. Move the cursor to the rule part.
2. Press the F4 Key (Reference). The rule part name list will display the "Loading a part file" message. When loading is finished, the contents of the specified rule part will be displayed.

   Note Rule data cannot be created here.

3. To move to a specified rule position, press the F5 Key (Jump). To view comments for each rule, press the F7 Key (Comment).



Note Moving a selected area of rule data can be accomplished with either the mouse or keyboard using the same procedures used when inputting data in the input display. Refer to *7-2-2 Basic Input* for details.

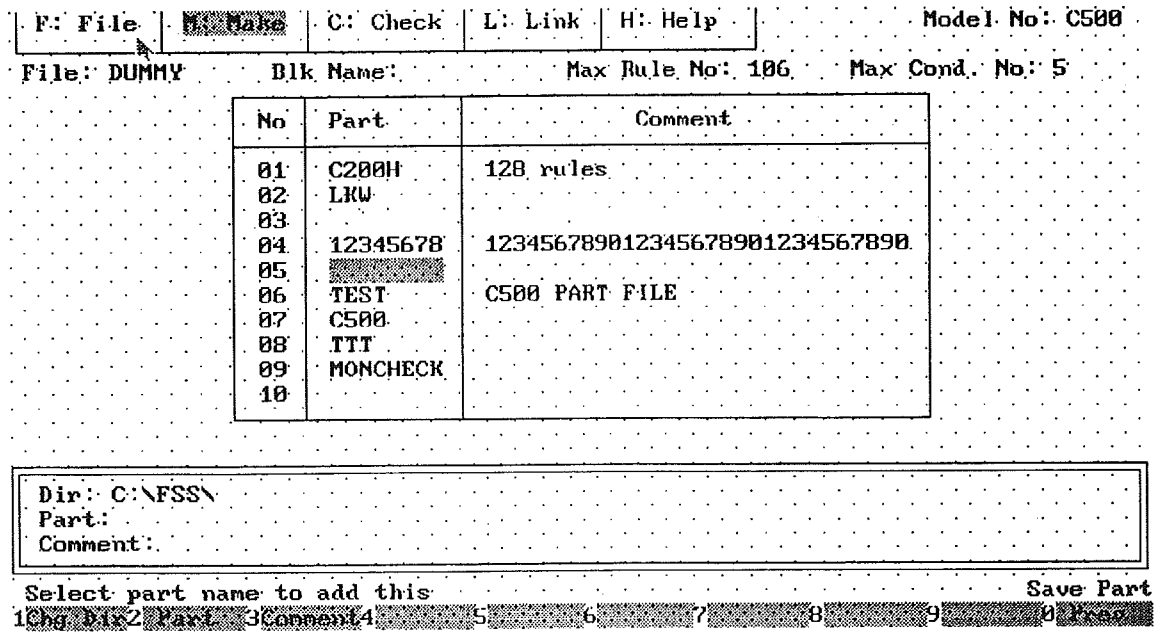
4. Press the "F10 Key (Prev) or right click for the rule part display.

Saving Rule Data to a Part File

Use the following procedure to save rule data to a part file.

1, 2, 3...

1. Select "F6: Part" on the rule editing display.
2. Select "F2: Save". A list of rule parts inside a part file will be displayed along with a part file directory name, a rule block name, and a rule block comment.



3. Use the Up and Down Keys to move the cursor inside the rule part list.
4. Select "F1: Chg Dir" to change the current directory. Input the name of the new directory and press the Enter Key.

or Select "F2: Part" to change a part name. Input the name and press the Enter Key. Changing a part name will not change the name of the rule block.

or Select "F3: Comment" to input a comment. Input the rule block comment and press the Enter Key. Pressing the Home Key will delete the comment. Changing a rule comment will not change a block comment.

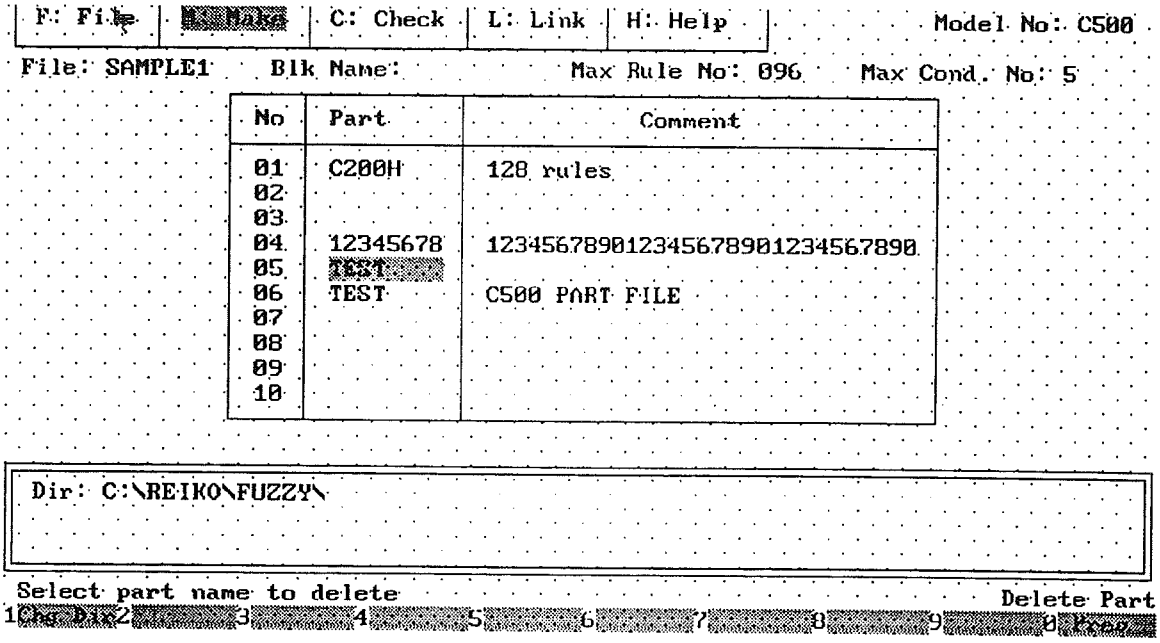
5. Move the cursor to the desired rule block and press the Enter Key or move the mouse cursor and left click to select. "Saving a part file" will be displayed. The rule input display will appear after saving is done.
6. Press the F10 Key (Prev) or right click to cancel the rule input operation and display the rule input display. The last rule input will not be saved.

Deleting Rule Data in a Part File

Use the following procedure to delete rule data from a part file.

1, 2, 3...

1. Select "F6: Part", on the rule editing display.
2. Select "F3: Delete". A list of rule parts inside a part file will be displayed along with a part file directory name, a rule block name, and a rule block comment.



3. Use the Up and Down Keys to move the cursor inside the rule part list.
4. Select "F1: Chg Dir", to change the current directory. Input the name of the new directory and press the Enter Key.
5. Move the cursor to the rule part to be deleted and press the Enter Key or move the mouse cursor to the rule part and left click. A delete confirmation window will be displayed. Select "Y: Yes" to delete or "N: No" to cancel. Selecting "Y: Yes" will delete the rule part at the cursor and the message "Deleting a part" will be displayed. After deleting, the rule input display will appear.
6. Press the "F10 Key" (Prev) or right click to cancel the rule deletion operation and display the rule input display. The rule part will be saved.

7-3 Membership Function (MF)

This section discusses the various operations which can be performed on Membership Functions.

7-3-1 Condition Input

Use the following procedure to input MF data of conditions.

1, 2, 3...

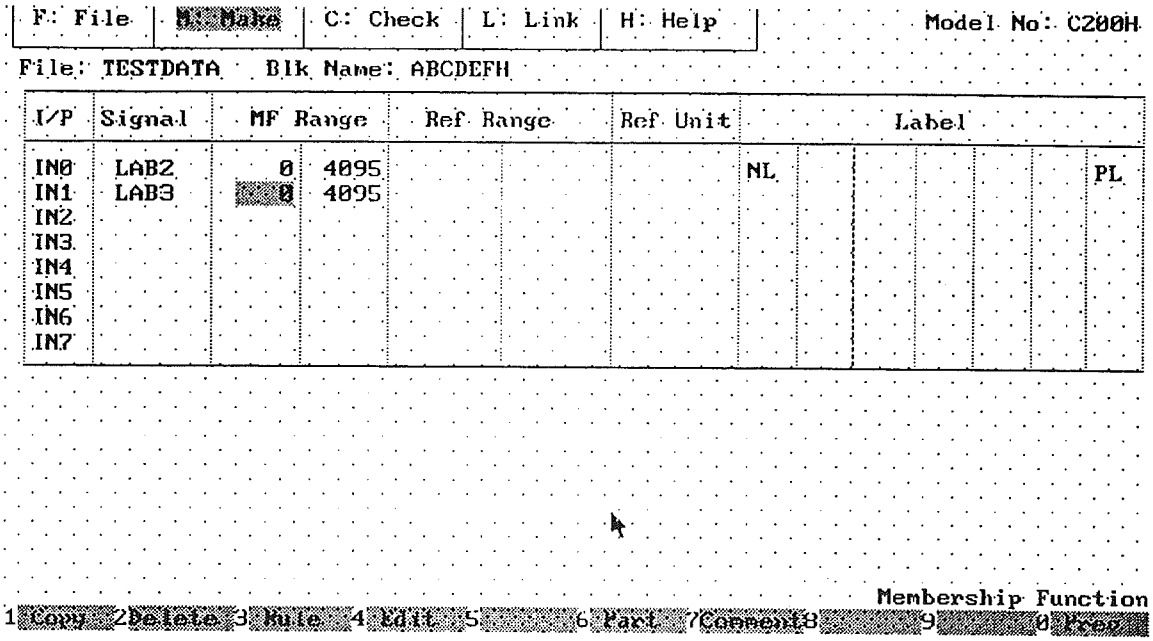
1. Select "M: Make". The pulldown menu will be displayed.
2. Select "M: Membership Function". The submenu will be displayed to the right of the pulldown menu.
3. Select "C: Condition" to display the condition input display and "L: Conclusion" to display the conclusion input display.

The following table summarizes the the function menu operations and their keys.

Function Menu	Key	Function
Copy	F1	MF data is overwritten or copied to a specified I/O signal.
Delete	F2	Deletes MF data from a specified signal.
Rule	F3	Makes MF data based on rule data.
Edit	F4	Makes MF.
Part	F6	Loads and refers to MF data from a part file, saves into a part file or deletes a part inside a part file.
Comment	F7	Makes and edits comments for each I/O signal or makes and edits a block name and block comment into MF data.
Prev	F10	Returns to the previous display.

Inputting MF Data

Move the cursor to the desired signal input, label name, range or reference unit input column. Move the cursor using the Left and Right Keys or use a left click at the desired signal input.



A maximum of 8 input signals can be set for both C200H and C500. 7 labels can be set per signal.

The following data parameters are given for each data type

Input	Explanation
Signal name	A maximum of 5 characters can be used (lower-case will be converted to upper-case.
MF range	Left column can be from 0 to 4094. Right column can be from 1 to 4095. The left column value must be less than the right column.
Reference range	A maximum of 6 characters can be used, including decimal points and minus signs. The left column value must be less than the right column value. The range can be from –9999 to 9999.
Reference unit	A maximum of 6 characters can be used.
Label name	A maximum of 3 characters can be used.

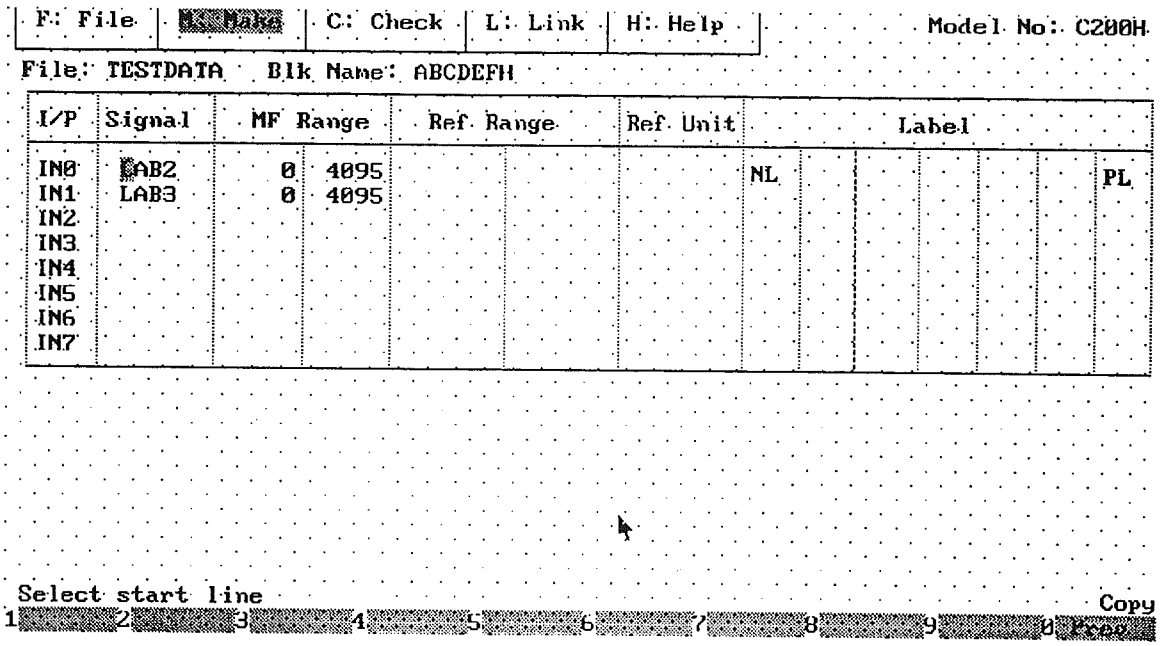
Entries will be confirmed when the cursor moves out of the column area or when the the Enter Key is pressed. Data entered in lower-case characters will be converted to upper-case characters. To delete characters inside an input column, press the Home Key.

Copying (Conditions)

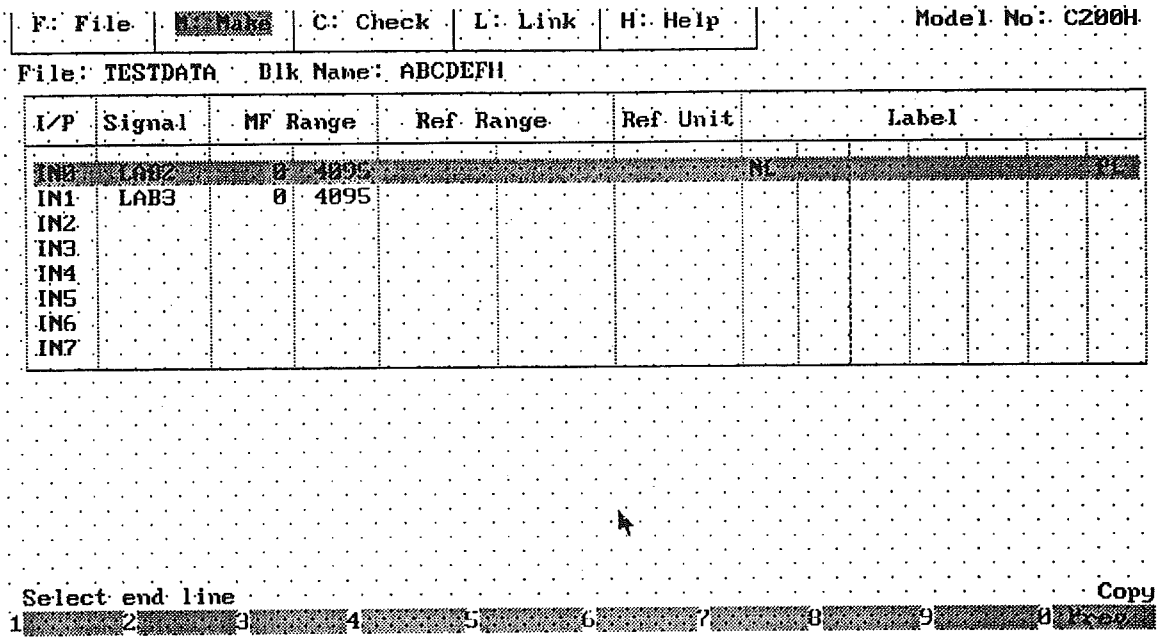
Use the following procedure to copy MF data.

1, 2, 3...

1. Select "F1: Copy". A prompt to specify the starting position will appear.
2. Move the cursor to the desired starting point and press the Enter Key or left click.



Next, a prompt for the ending location will appear.



3. Move the cursor to the desired ending location and press the Enter Key or left click. The function menu will change. Press the F10 Key (Prev) to return to the previous display or press the F1 Key. Select to set the contents to be copied. The prompt for the location to copy to will appear.
4. Move the cursor to the desired location and press the Enter Key or left click. Any previous data will be replaced. A confirmation window will appear.
5. "Y: Yes" can be selected by typing a "Y," left click with the cursor on the "Y: Yes" position, or using the Cursor Keys to move to "Y: Yes" and pressing the Enter Key. "N: No" can be chosen in the same way. Pressing the F10 Key or a right click will stop the copy.
6. An "Improper working position" message will appear when MF data is copied to the same location from which it was copied or when copying results in more than 8 condition signals.
7. To stop copying and return to the MF display, press the F10 Key or right click.

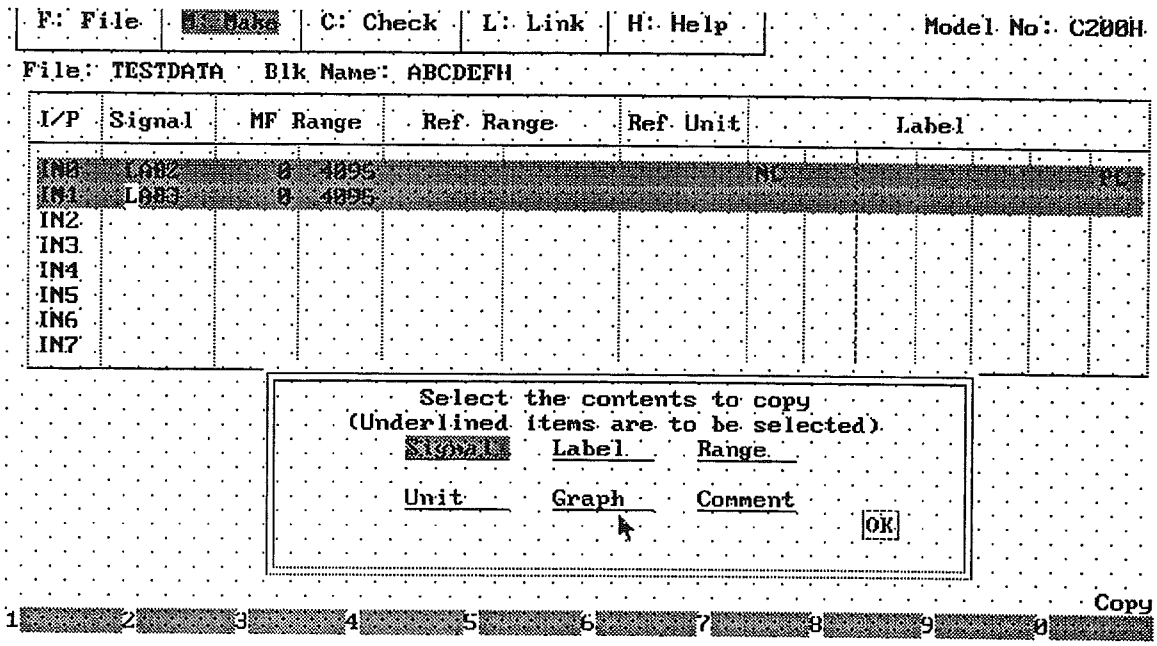
Setting Contents to be Copied

Complete the following procedure to copy contents.

1, 2, 3...

1. Select "F1: Content". The "Select Contents" window will appear and the operation will change to copying mode. The window contains the following: signal, label, range, unit, MF, and comment.
2. Items to be copied within the window will be underlined. To deselect items not to be copied, move the cursor to the content item using the Cursor Keys and press the Enter Key. A left click will also deselect the item. Pressing the Enter Key or left clicking will toggle the underline on and off.

3. After making selections, move the cursor to "OK" in the window and press the Enter Key or left click.



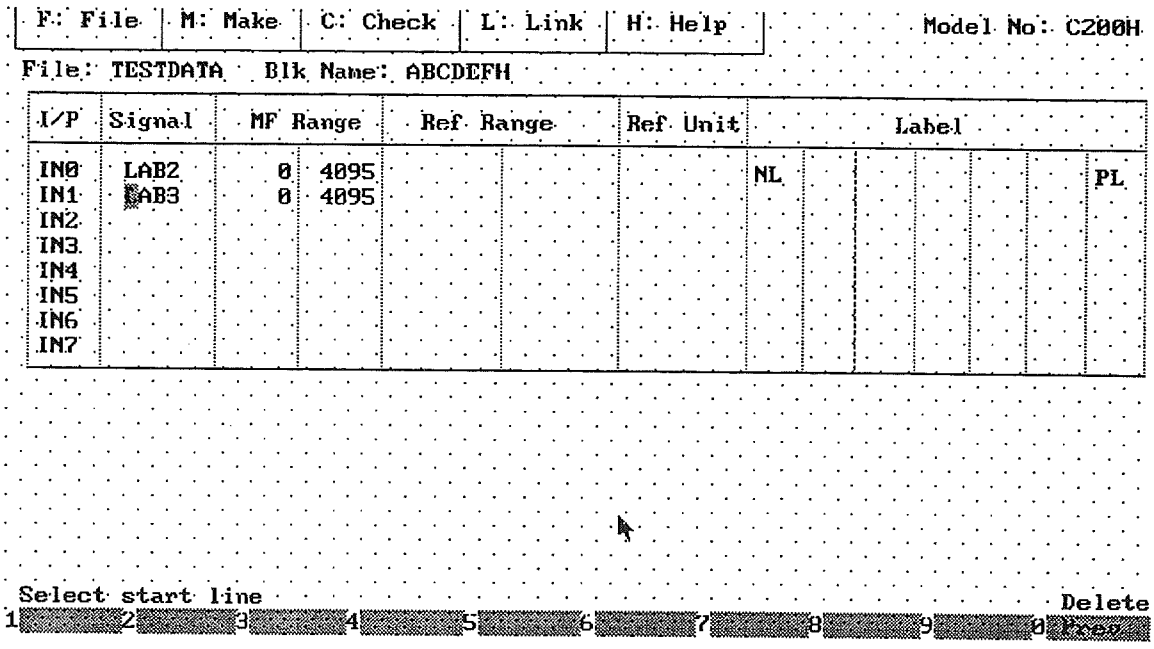
4. Comments will not be copied when all other items have not been selected to be copied.

Deleting (Conditions)

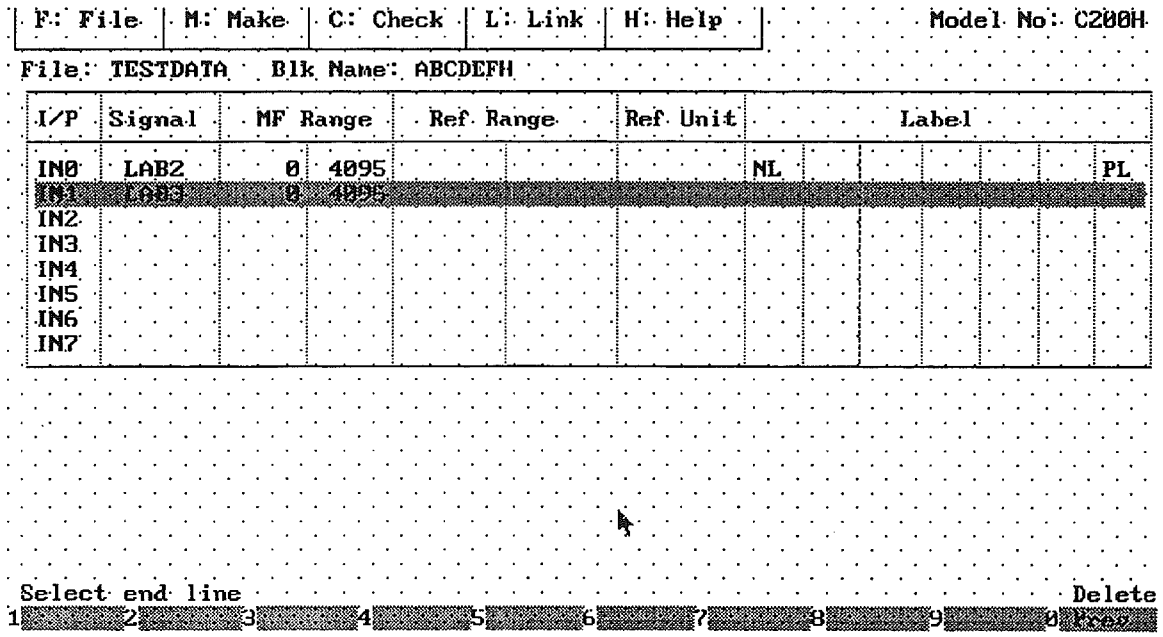
Complete the following procedure to delete contents.

1, 2, 3...

1. Select "F2: Delete" on the MF display. A prompt for the starting point will appear.
2. Move the cursor to the beginning of the I/O signal to be deleted. Press the Enter Key or left click to select.

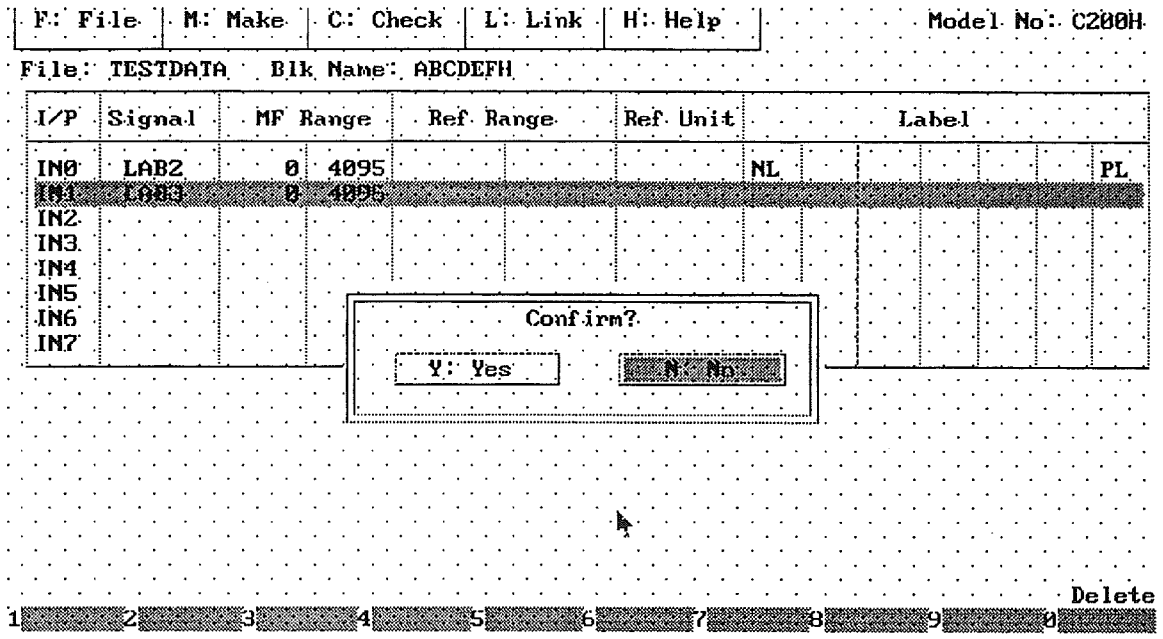


3. A prompt for the ending point will appear.



Using the Left and Right Keys, move the cursor to the end of the I/O point to be deleted and press the Enter Key or left click to select.

4. After completing the preceding steps, a delete confirmation window will appear. Select by typing "Y" for Yes and "N" for No, moving the cursor using the Cursor Keys and pressing the Enter Key, or left clicking on the desired choice.



5. To cancel the command, press the F10 Key or left click with the cursor on "F10" in the display. The
MF display of MF data will appear.

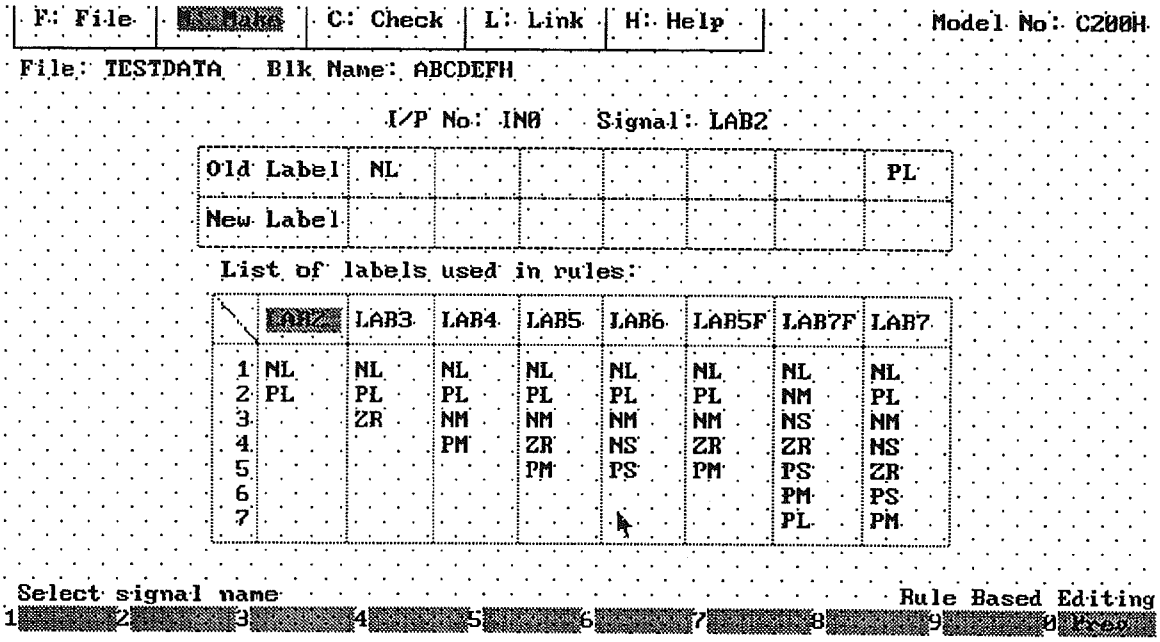
Rule-based Editing (Condition)

Rule data contained within an MF can be edited using the following procedure.

1, 2, 3... 1. Move the cursor to the I/O signal to be edited.

2. Select "F3: Rule" from the MF display. The label setting list and input signal/label list will be displayed in the upper half and the lower half of the display respectively.

   The upper part of the label setting list will display the selected I/O number and present I/O signal name. All signal and label names for all rules are displayed in the signal label list in the lower half of the display.



   After selecting a signal name, "Select label" will appear in the lower part of the display.

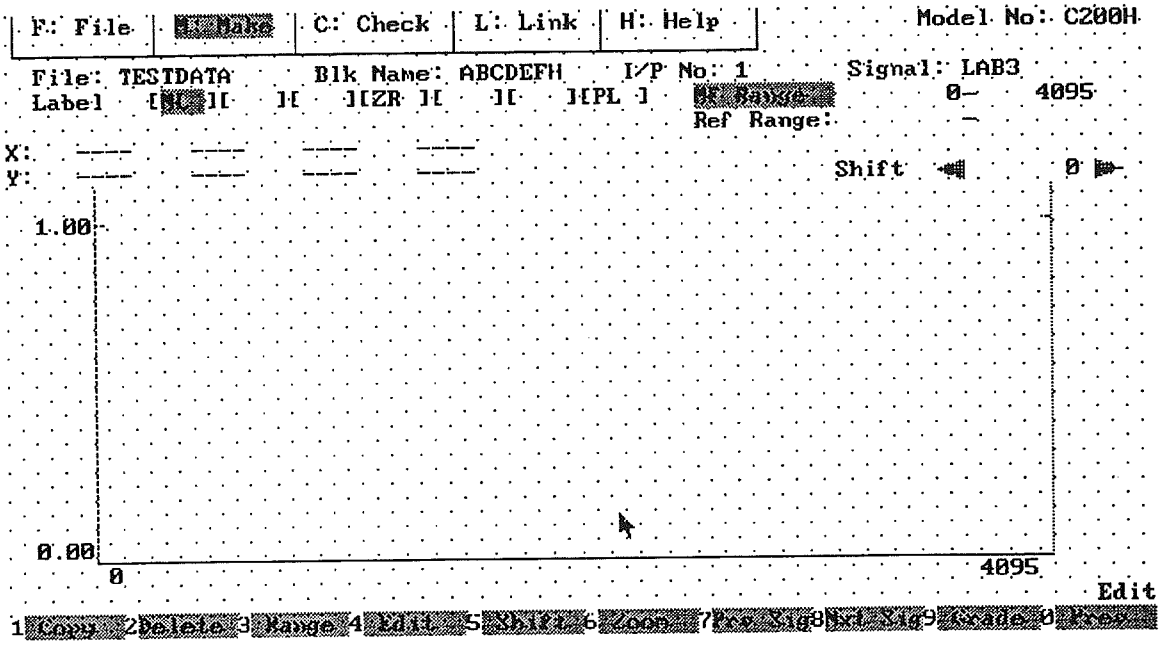
3. Use the Left and Right Keys to move between items in the signal/label list.
4. Move the cursor to the signal name to be edited. Press the Enter Key or left click to select.
5. Use the Cursor Keys to move between items in the label setting list.
6. Move the cursor to the label to be specified as the new label and press the Enter Key or move the cursor and left click to select. The label at the cursor will be set as the new label.
7. To return to the MF display, press the F10 Key (Prev). A right click will confirm the signal/label names which is followed by a return to the MF display.

Caution If the input column of a new label is empty, the existing label will be deleted.

Editing (Conditions)

Use the following procedure to edit MF condition shapes.

1, 2, 3... 1. Select "F4: Edit" in the MF display. The MF creation display will be displayed.

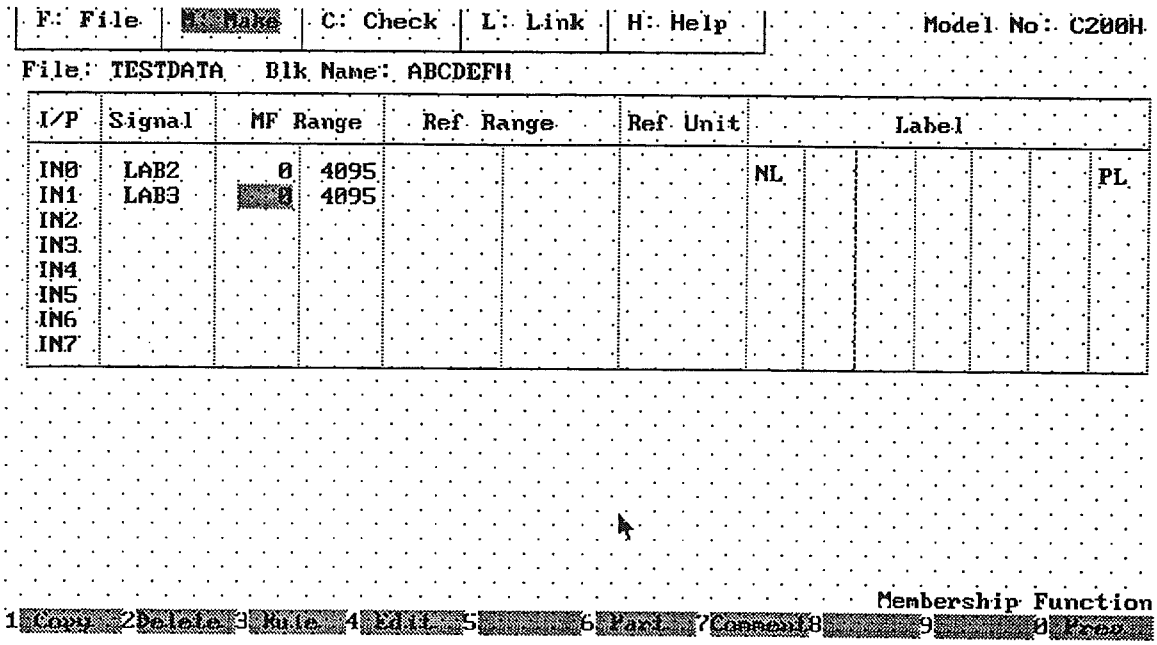


2. To edit the MF creation display select items from the function menu. A function menu item can be selected by pressing the corresponding key or by placing the cursor on the function menu display and left clicking.
3. To return to the MF display, press the F10 Key (Prev) or right click.
4. The following table summarizes the operations which can be performed using the function menu.

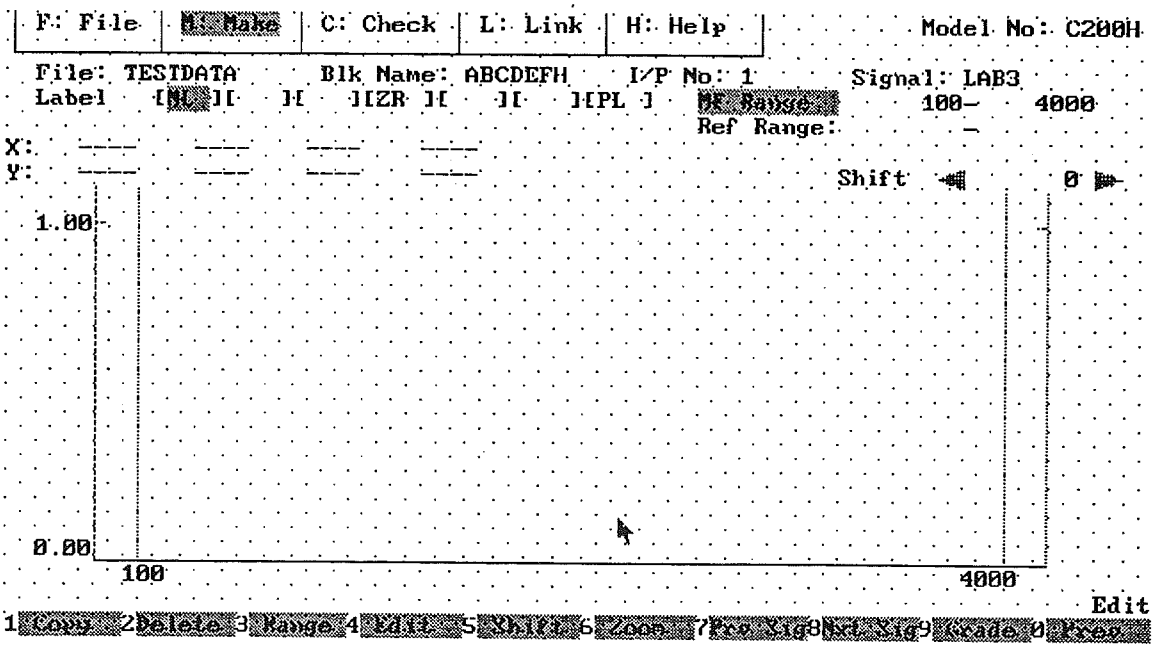
Operation	Key	Function
Copy	F1	Copies a specified MF.
Delete	F2	Deletes a specified MF.
Range	F3	Toggles display between MF range and reference range.
Edit	F4	Creates an MF.
Shift	F5	Shifts the MF. (Only for C200H conditions)
Zoom	F6	Enlarges the MF 2X, 4X or 8X. Displays the MF from a specified X coordinate.
Prv Sig	F7	Displays the prior MF creation display signal.
Nxt Sig	F8	Displays the next MF creation display signal.
Grade	F9	Changes the displayed MF grade from 0 to 1 and either 0 to 2047 (C500) or 0 to 4095 (C200H).
Prev	F10	Returns to the MF display.

Setting the Editing Area

Set the MF range between 0 and 4095 on the MF display.



The range will be shown as a vertical dotted line on the MF creation display. Editing can be done within the defined area.

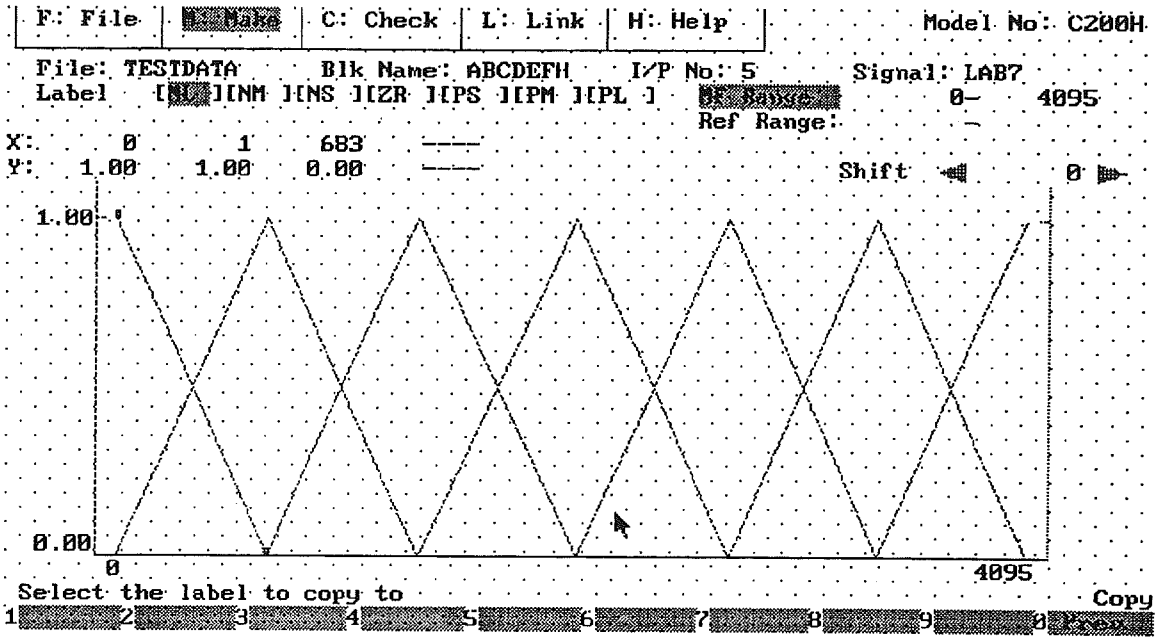


Copying MF Shape (Conditions)

The following procedure is used to copy MF from the MF creation display.

1, 2, 3... 1. Select "F1: Copy" on the MF creation display.

2. Move the cursor to the label to be copied and press the Enter Key or left click. The "Select the label to copy to" message will be displayed and an original copy of the MF coordinate will be displayed as a square mark.



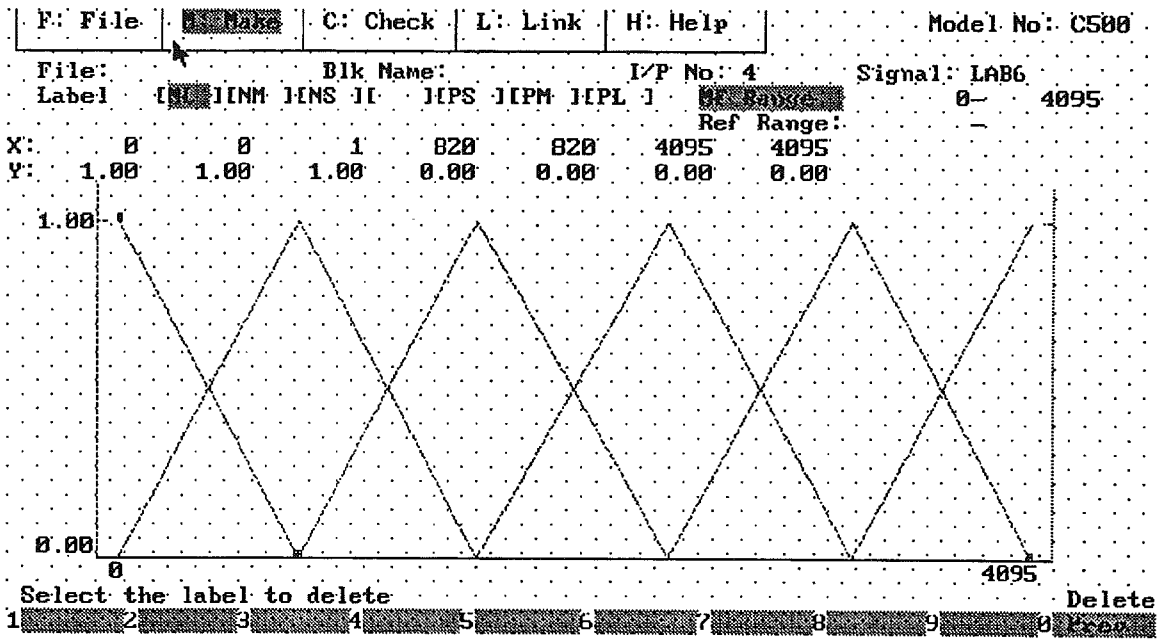
3. A window will be displayed to confirm the copy operation. Type "Y" for Yes and "N" for No to cancel the operation. This can also be done using the mouse or using the Left and Right Keys and pressing the Enter Key.
4. The MF of the original label and the MF of the copied label will be displayed overlapped.
5. If the label to be copied from has no MF definition, a "No MF definition" message will be displayed.

Deleting MF Shape (Conditions)

The following procedure is used to delete MF from the MF creation display.

1, 2, 3...

1. Move the cursor to the label to be deleted.
2. Select "F2: Delete" on the MF creation display. A prompt to select the label will be displayed.



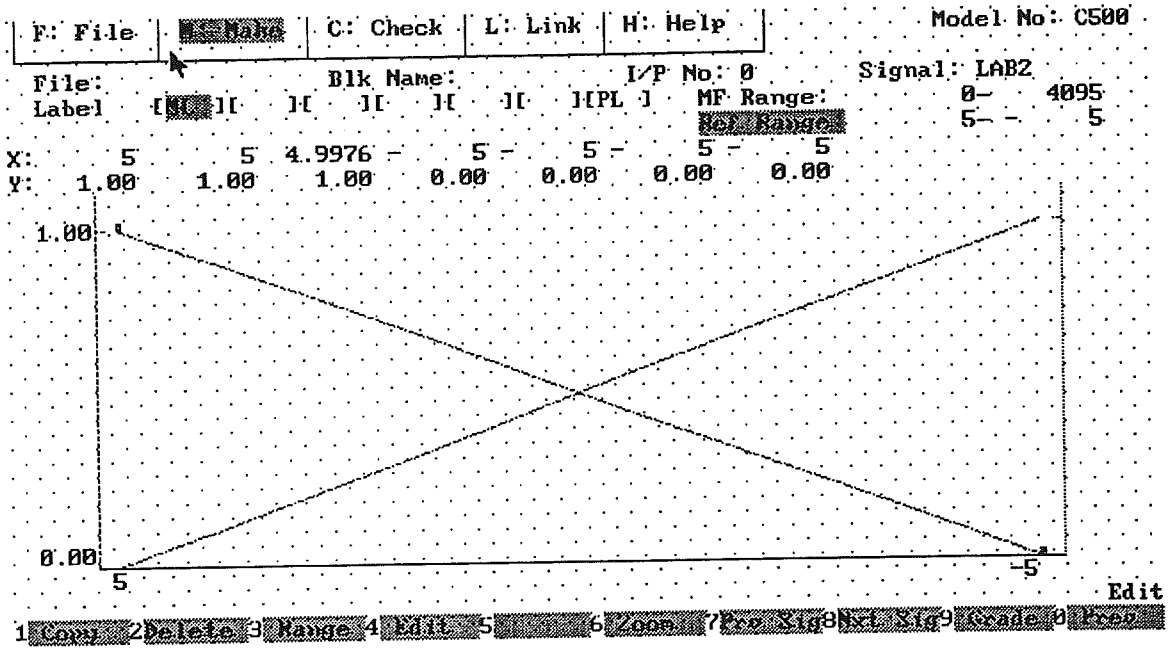
3. Select the label using the Left and Right Keys and press the Enter Key or move the mouse cursor to the desired label and left click. The coordinates of the MF label will be displayed as square marks and a display window will appear.
4. Press "Y" for Yes to delete the label and "N" for No to cancel the operation. This can also be done using the Left and Right Keys and pressing the Enter Key or by moving the mouse cursor to the desired choice and left clicking.
5. If the label to be deleted from has no MF definition, a "No MF definition" message will be displayed.

Toggle Range Display

To toggle between the MF range setting and the reference range setting, select "F3: Range" on the MF creation display.

The display will switch from the MF range setting to the reference range setting. If the reference range is not set on the MF data MF display, however, the display

of the MF range setting will not be changed. A "No reference range, press any key to continue." message will be displayed.



Editing MF (Conditions)

The following procedures are used to edit MF data of conditions.

1, 2, 3...

1. Select "F4: Edit", the message "Select label to edit" will be displayed. Select label to edit and press the Enter Key or move the cursor and left click.

   There are two ways to create MF:

   - by mouse
   - by keyboard

   Note If "F4:Edit" is selected by mouse, you can only create MF by using mouse. Keyboard input is ignored. If "F4:Edit" is selected by pressing the F4 Key, MF can only be created by using keyboard input.

2. Editing is only allowed within the specified region. i.e. MF Range
3. Select "F4: Edit", the message "Select label to edit" will be displayed. Use the Left and Right Keys to choose the label and press the Enter Key or move the cursor and left click.
4. If "F4: Edit" is selected using the keyboard, the mouse cursor will disappear. The message "Input coordinates" will be displayed.

or If "F4: Edit" is selected using the mouse, the message "Click coordinates" will be displayed.

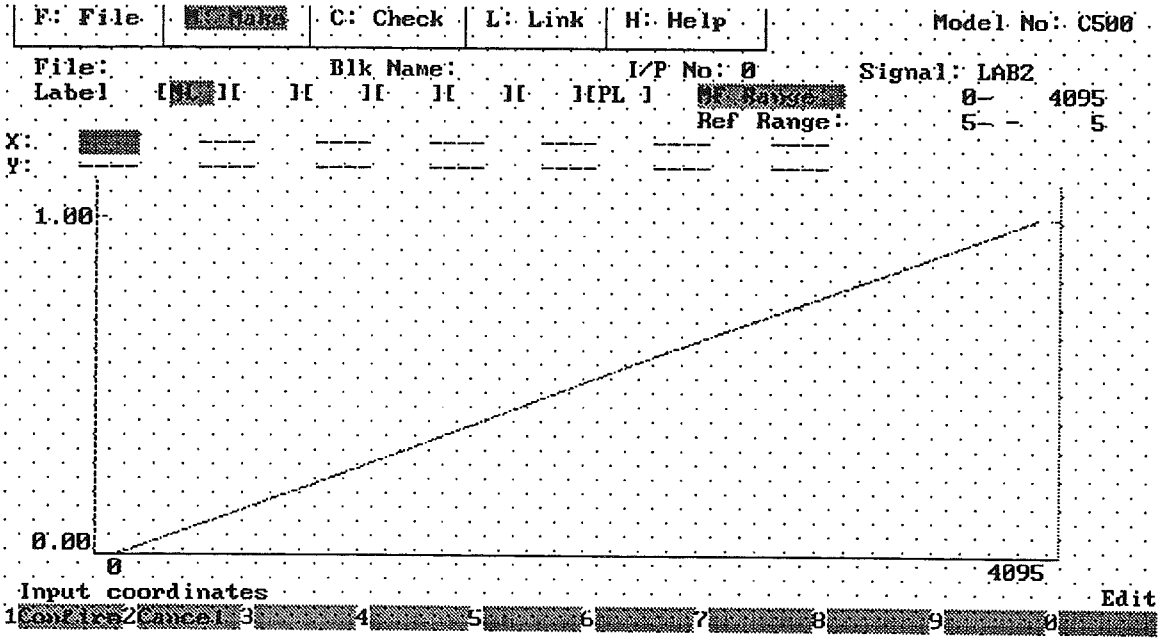
If the label selected has a MF, the existing MF will be displayed as dotted lines.

Creating MF by Key Input

If the X axis is displayed in terms of MF range, 0 to 9 are valid inputs for the coordinates. Other characters are ignored.

or If the X axis is displayed in terms of reference range, 0 to 9 are valid inputs. "–" sign and decimal points are allowed. Other characters are ignored.

1, 2, 3... 1. Use the Up and Down Keys to move between X and Y coordinates. After entering the values, press the Enter Key to confirm.



If you are entering the X coordinate, pressing the Enter Key will move the cursor down to the Y coordinate. However, if the value you entered is not permitted, the cursor will remain on the X coordinate until you enter a permitted value. If both the X value and Y value entered for a pair of coordinates are permitted, pressing the Enter Key after entering the Y coordinate will move the cursor to the next coordinate pair. To move to the previous coordinate pair, use the Left Key.

2. When confirmation is possible, i.e. the MF edited is considered done, the message "Confirm" will be displayed on the message line. The conditions that must be satisfied so that a point can be drawn or MF can be confirmed, will be discussed later.
3. Notice that "F1:Confirm" and "F2:Cancel" is displayed on the function menu. When confirmation is possible, pressing the F1 Key will confirm the MF drawn, remove the old MF (if any), and get you out of the editing routine. If you wish to get out of the editing routine at any time, press the F2 Key.

Creating MF by Mouse

1, 2, 3... 1. Move the mouse into the editing region. Notice that the mouse cursor changes from an arrow to a cross. When it moves out of the editing region, it becomes an arrow again.
2. If the mouse is left clicked at a permitted location, a point will be drawn. A rubber-band line will follow cursor movement within the editing region. Conditions to be satisfied before points can be drawn will be discussed later.

or Right click the mouse right button to undo previous points.

3. When confirmation is possible, the message "Confirm" will be displayed on the message line. Move the mouse cursor to left click at "F1" to confirm, or "F2" to cancel.

   When editing MF, you can left click mouse at "F2" anytime to get out of editing mode.

Conditions to be Satisfied when Drawing MF for C200H

A maximum of 4 points can be drawn for C200H. Assume the following:

Xmax = maximum value of MF range

Xmin = maximum value of MF range

Xn = X coordinate

Yn = Y coordinate

n = value 1 – 4

m = n – 1

For the first point of MF, if the first X coordinate is not equal to Xmin, then the first Y coordinate must be 0. If the first X coordinate is equal to Xmin, then the first Y coordinate can be 0 or 1.

Xn must always be greater or equal to Xm. If Xn is equal to Xm, Yn cannot be equal to Ym. If Xn is greater than Xm, Yn can be equal to Ym.

If the last X coordinate is not equal to Xmax, then the last Y coordinate must be 0. If the last X coordinate is equal to Xmax, then the last Y coordinate can be 0 or 1.

Conditions to be Satisfied when Drawing MF for C500

A maximum of 7 points can be drawn for a MF provided that the MF range is 0 to 4095. If MF is drawn under the Zoom mode or if the MF range is not 0 to 4095, only 5 points can be drawn for the MF. Assume the following:

Xmax = maximum value of MF range

Xmin = maximum value of MF range

Xn = X coordinate

Yn = Y coordinate

n = value 1 – 4

m = n – 1

If the MF range is 0 to 4095, the first X coordinate of MF must be zero. If MF range is not 0 to 4095, the first X coordinate can be equal to Xmin or greater than Xmin. If X coordinate is equal to Xmin, Y coordinate can be anywhere between 0.00 to 1.00 or 0 to 2047 depending on the grade of MF. If X coordinate is greater than Xmin, then Y coordinate must be 0.

Note Xn must always be greater than Xm.

To confirm at 4 points or less when only 5 points can be drawn, the last X coordinate must be 4095, and the last Y coordinate can be anywhere between 0.00 to 1.00 or 0 to 2047 depending on the grade of MF.

To confirm at 6 points or less when 7 points can be drawn, the last X coordinate must be 4095, the last Y coordinate can be anywhere between 0.00 to 1.00 or 0 to 2047 depending on the grade of MF.

When the MF range is not 0 to 4095, the first X coordinate of MF will be pushed back and automatically assigned to 0, and the other points will be also pushed backwards. The remaining points not drawn will take the last Y coordinate, and X coordinate will be 4095.

e.g.) If Xmin = 200, Xmax = 4000

X1 = 200, Y1 = 0.8, X2 = 1000, Y2 = 1.00, X3 = 4000, Y3 = 0.6

becomes

X1 = 0, Y1 = 0.8, X2 = 200, Y2 = 0.8, X3 = 1000, Y3 = 1.00, X4 = 4000, Y4 = 0.6, X5 = X6 = X7 = 4095, Y5 = Y6 = Y7 = 0.6

For other cases, if less than 7 points are drawn and if X1 is equal to 0, all the remaining points will take the coordinates of the last point drawn.

e.g.) Xmin = 0, Xmax = 4095

X1 = 0, Y1 = 0, X2 = 4095, Y2 = 0.8

becomes

X1 = 0, Y1 = 0, X2 = 4095, Y2 = 0.8, X3 = X4 = X5 = X6 = X7 = 4095

Y3 = Y4 = Y5 = Y6 = Y7 = 0.8

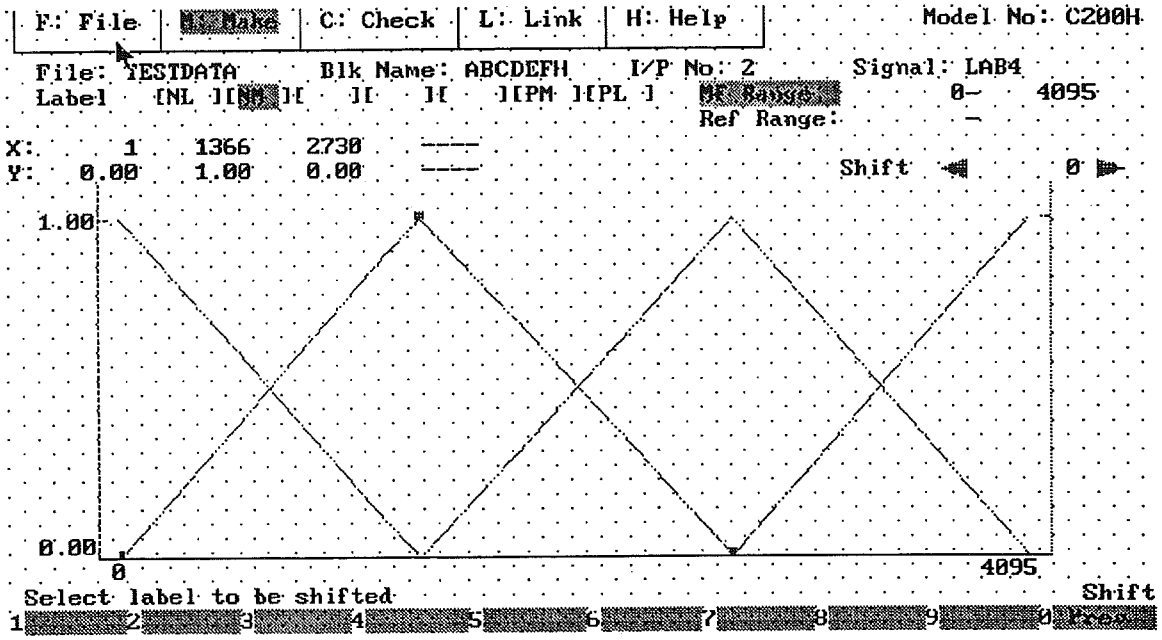
Note When editing MF using grade display of 0.00 to 1.00, if more than 4 decimal places are input for Y coordinates, they will be rounded to 2 decimal places. For 2 Y coordinates which look identical, the internal representation (in terms of 0 to 4095 or 0 to 2047) may be different. Hence, when grade is toggled to 0 to 4095 or 0 to 2047, value display is different. For instance, input 0.4954 and 0.5048. These will be both displayed as 0.50. However, when grade is toggled to 0 to 4095 or 0 to 2047, the values will be 1014 and 1033 respectively.

Shifting MF (C200H Conditions Only)

The following procedures are used to shift MF data of conditions for the C200H.

1, 2, 3...

1. Select "F5". You will be prompted to select the label to shift. The message "Select label to be shifted" will be displayed.

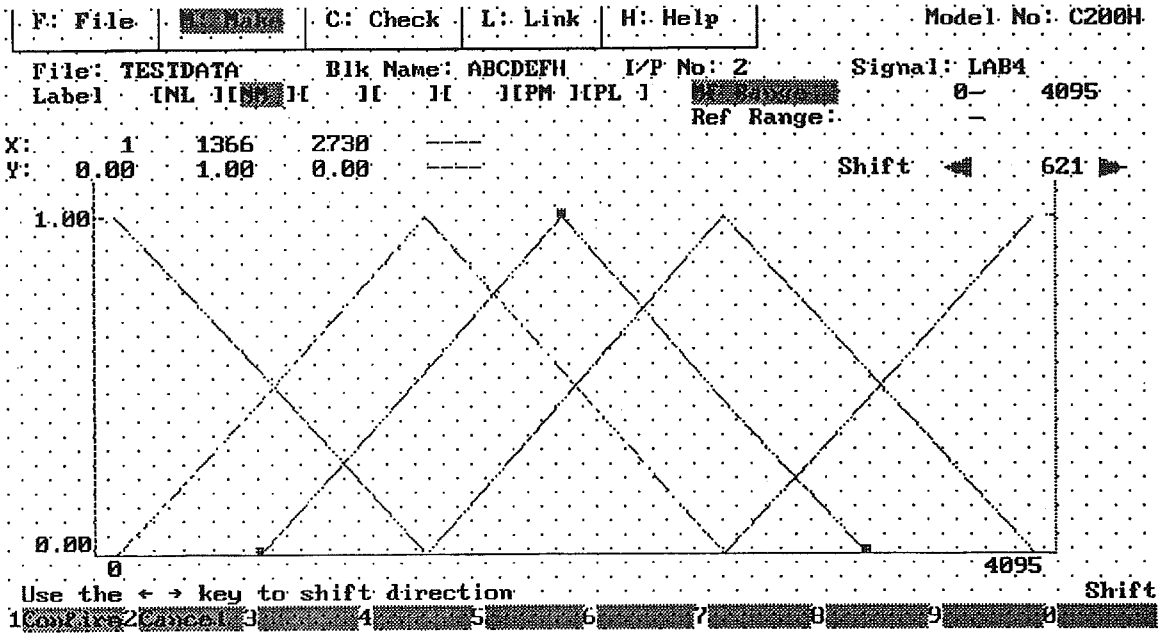


Move the cursor using the Left and Right Keys to the desired label and press the Enter Key to select, or move the mouse cursor to the label and left click the left button of the mouse to select. If the label selected has no MF, the error message "No MF definition" will be displayed.

or To exit out of the shift operation at this stage, press or left click at "F10" to return to MF creation display.

2. There are two ways to shift MF
   a) by mouse
   b) by keyboard

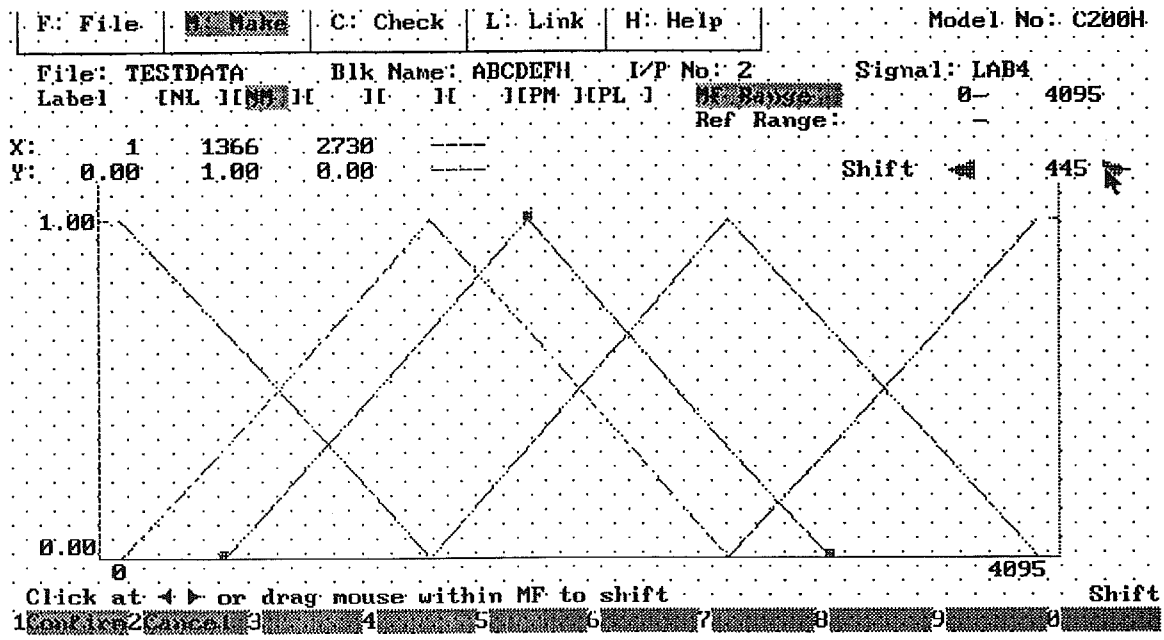
If F5 is selected by keyboard, you can only shift MF using the Left and Right Keys. The message "Use the ←→ Keys to shift direction" will be displayed.



If F5 is selected using the mouse, the message "Click at ◄ ►| " or drag mouse within the MF to shift will be displayed. You can shift MF by:

a) left clicking and holding the mouse left button on the ◄ ►| at the top right corner of the display, or,

b) moving the mouse cursor onto the MF to be shifted, left clicking, holding the mouse left button and dragging the MF toward the direction required to shift.



The old MF location is displayed in dotted line. The shift amount will be indicated at the top right corner of the display.

3. On the function menu, "F1:Confirm" and "F2:Cancel" are displayed. To confirm the shifted position, press the F1 Key (if you selected the shift function using the keyboard) or left click the mouse at "F1" (if you selected the shift

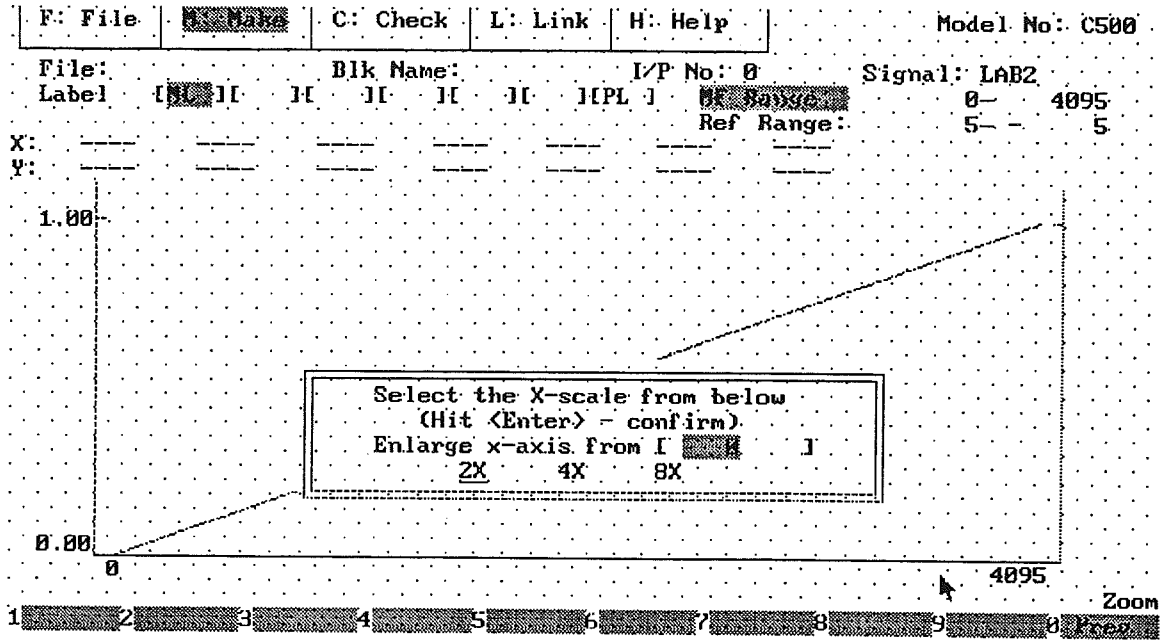
function using the mouse). The old MF position displayed in dotted line is removed. MF is redrawn at the new location.

4. To cancel the shift operation, press the F2 Key (if you selected the shift function using the keyboard) or left click the mouse at "F2" (if you selected the shift function using the mouse). The MF at the original location is redrawn.

Zoom (Conditions)

1, 2, 3...

1. Select "F6: Zoom" on the MF creation display. The window for the base X coordinate and to select zoom items are displayed.



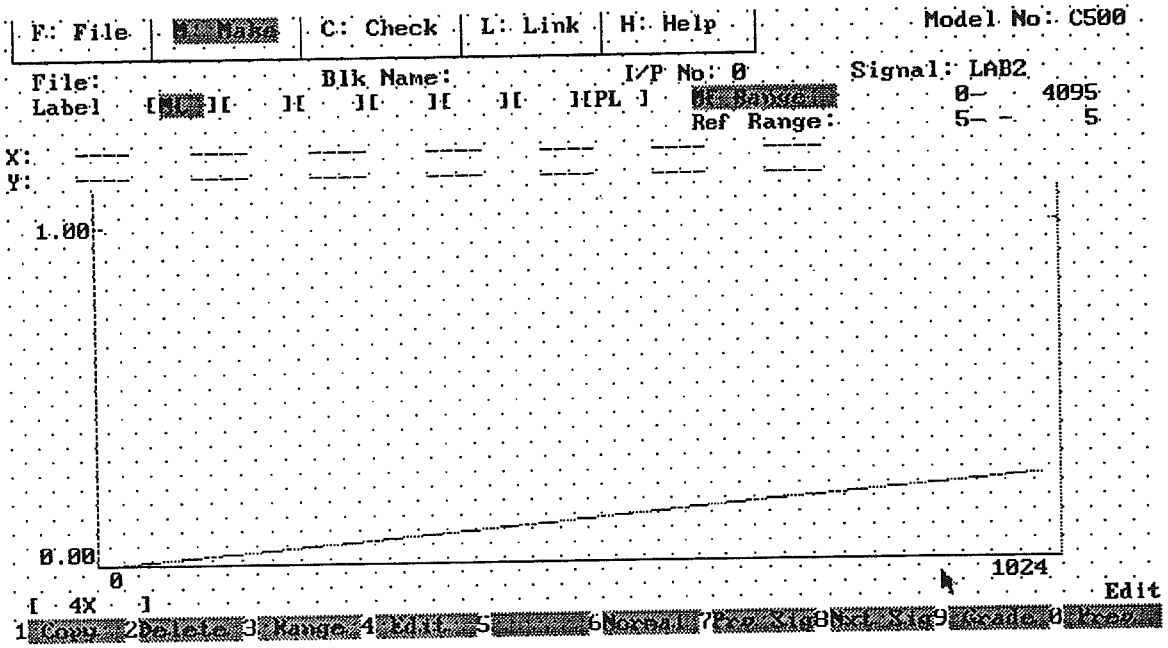
2. Enter the base X coordinate to zoom from.
3. Press the Down Key, move to the zoom items and select magnifications desired by pressing the Left and Right Keys.
4. If you press the Enter Key, MF is zoomed by the magnifications set from the base X coordinate. In the zoom display, the magnification shown is "2X" (when zoomed twice) at the bottom left of the display.

The resolution at the mouse position on the display by zoom items is as follows:

Zoom item	Resolution	Range display (see Note)
Normal	512	0 to 4095
2X	1024	0 to 2048
4X	2048	0 to 1024
8X	4096	0 to 512

5. Press the F10 Key or right click, and the MF I/O data display will appear.

When displayed in enlarged form, the F6 Key display of the function menu at the lower part of the display returns to normal and the present magnification is displayed at the bottom left of the display.



If you select "F6: Normal", the display of normal MF appears.

Go to Previous Condition Signal

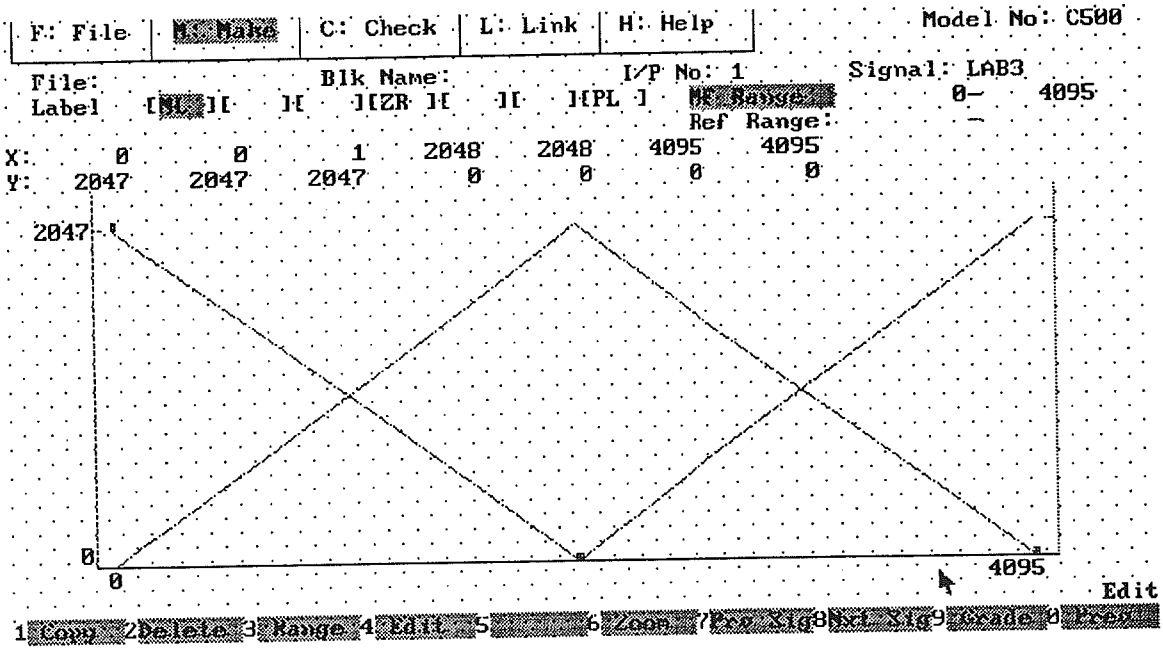
On the MF creation display, when the MF creation display of the previous signal appears, select "F7: Prv Sig". The MF creation display switches from a signal of the present display to the previous signal.

Go to Next Condition Signal

On the MF creation display, when the MF creation display of the next signal appears, select "F8: Nxt Sig". The MF creation display switches from a signal of the present display to the next signal.

Toggle Grade of MF (Conditions)

Select "F9: Grade" on the MF creation display. The grade of MF is toggled between 0 (0.00) and 4095 (1.00) for C200H or 0 (0.00) and 2047 (1.00) for C500.



Depending on the option of the grade display at the time of activating the software, the Y coordinate display of MF is different.

If the "–A" option is specified on the command line when invoking FSS, the grade display is 0 to 2047 for C500 or 0 to 4095 for C200H. Otherwise, the default grade display is 0 to 1.00.

Go to Previous Display

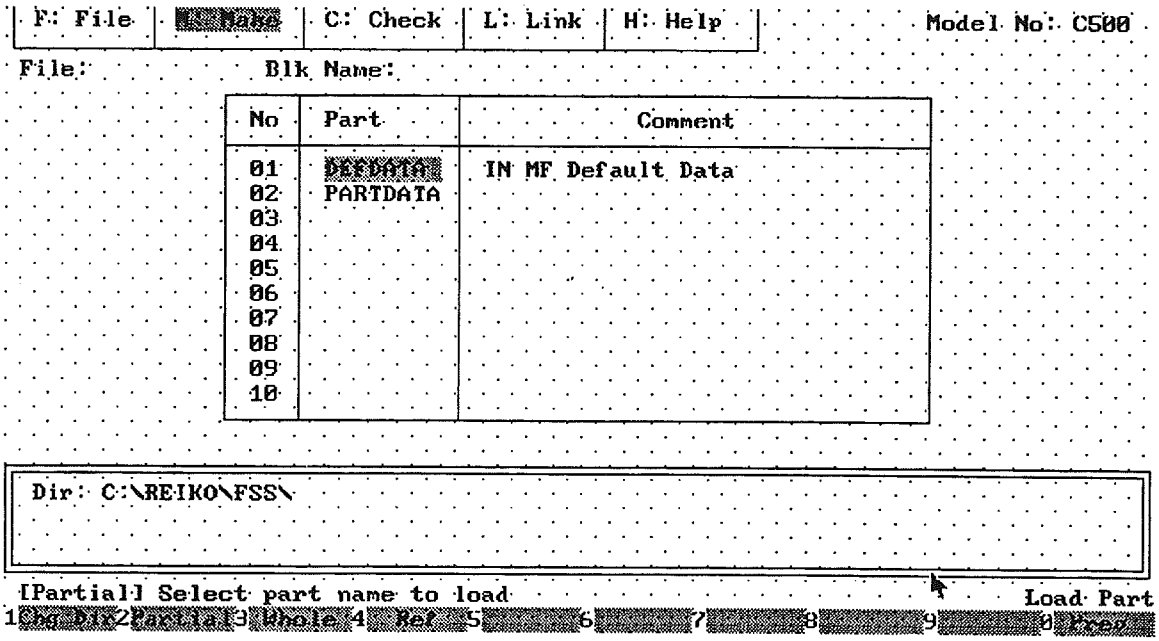
On the MF creation display, select "F10: Prev", or right click. The display returns from the MF creation display to the MF display data.

Part Data File

The following can be done to parts by selecting "F6: Part":

- Load (partial or whole)
- Save
- Delete
- Reference

Select "F1: Load". A list of condition part names is displayed. Under it, a directory which has the current part file is displayed.



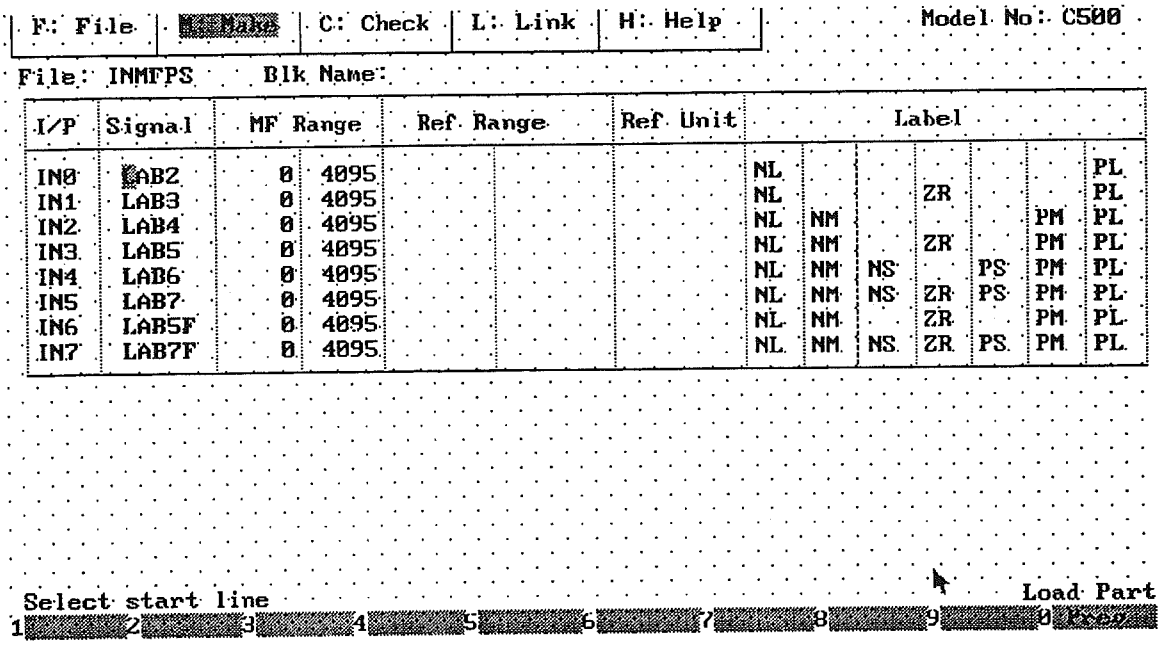
The default mode for loading is partial loading. You can change the loading mode to whole loading using the F3 Key. You can also choose the partial loading mode again by using the F2 Key. The mode chosen is indicated within the square brackets at the lower part of the display.

The cursor inside the list of the condition part names moves up and down by the Up and Down Keys.

When you want to retrieve a part file from another directory, select "F1: Chg Dir". Then, the parent directory, sub-directories, and the part file, if any, in the current directory are listed. You can change to the directory required and select the part file. You can also select "F1: Chg Drv" to switch to a different drive.

Partial Loading Mode

1, 2, 3... 1. Move the cursor to the condition part name for loading and press the Enter Key or left click the mouse in order to select. After loading, contents of a specified condition part are displayed.



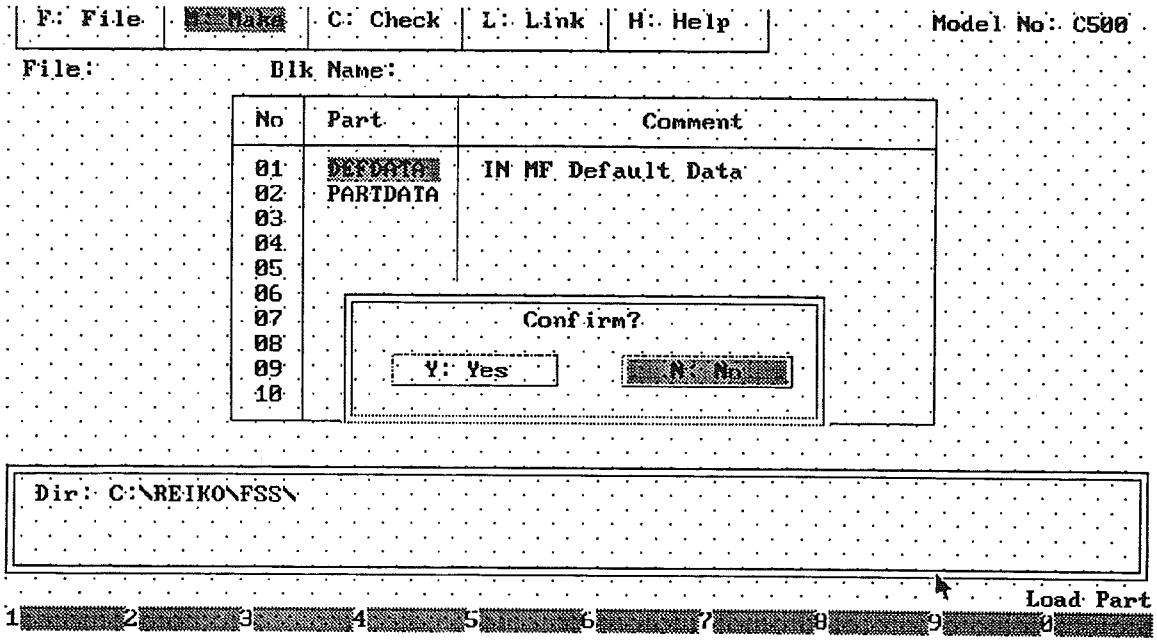
2. On the function menu display at the lower part of the display, the message "Select start line" is displayed.
   a) Specify the starting line for loading by using the cursor and press the Enter Key or left click.
   b) Specify the ending line for loading by using the cursor and press the Enter Key or left click.
3. The editing condition input display is displayed and the message "Select overwrite point" is displayed. You can move to the position where you want to rewrite by using the Up and Down Keys, or left clicking.

   You will be asked to confirm the partial loading.

   If you specify the loading destination in the original loading area, the message "Improper working position" is displayed at the bottom left of the display.

Whole Loading Mode

1, 2, 3... 1. Move the cursor to a condition part at the desired part name for loading and press the Enter Key or left click the mouse button. The confirmation window for whole loading is displayed.

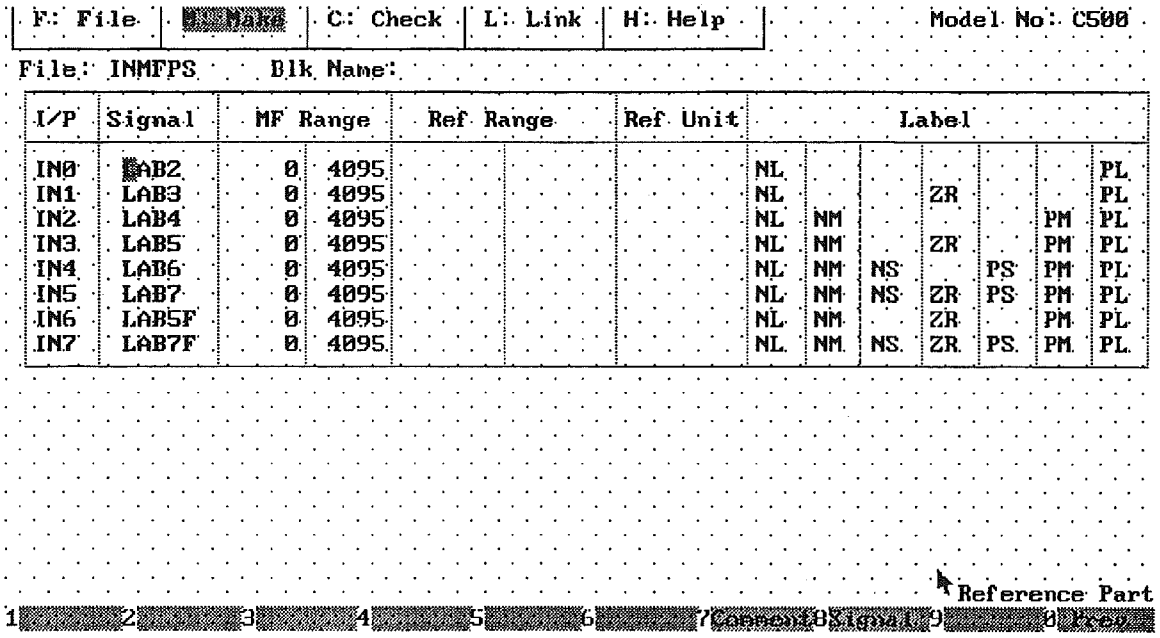


2. In the case of whole loading, select "Y: Yes", and for cancellation, select "N: No" or press the mouse right button. If you select "Y: Yes", a specified part is loaded into editing condition data and the condition input display appears.
   a) While loading, the window displays "Loading a part file".
   b) After loading, the window is deleted and contents of a specified condition part are displayed.

Reference Part

1, 2, 3...

1. Move the cursor to a condition part at the desired part to make reference with.
2. Select "F4: Ref" on the display of the condition part name list. While loading, the window displays "Loading a part file".
3. After loading, the window is deleted and contents of a specified condition part are displayed. Condition data cannot be created here.



4. The function menu selections possible at this step are as follows:

Function menu	Key	Function
Comment	F7	Refers to comments of each condition and condition block.
Signal	F8	Refers to the MF of labels.

- The way to move a displayed area of condition data by the key input is the same as the condition input display. (Refer to *7-2-2 Basic Input*)
- The way to move a displayed area of condition data at the mouse click point on the display is the same as the input display. (Refer to *7-2-2 Basic Input*)
- If "F8" is selected, MF of the labels of current signals are displayed. All the active functions are shown in the function menu. They are the same as in MF editing.

Function menu	Key	Function
Range	F3	Toggles range of MF between MF range and reference range.
Zoom	F6	Enlarges to 2X, 4X, or 8X.
Prv Sig	F7	Go to MF of previous signal.
Nxt Sig	F8	Go to MF of next signal.
Grade	F9	Toggle grade of MF between 0.00 to 1.00 and 0 to 4095 (for C200H) or 0 to 2047 (for C500).
Prev	F10	Returns to previous display.

5. By pressing the F10 Key or right clicking, the condition part list display appears.

Save Condition Data to a Part File

Select "F6: Part" on the condition editing display. Select "F2: Save". Under save, you can select "F1:Whole" to save the entire part or "F2:Signal" to save the signal only.

If "F1:Whole" is selected, a list of condition parts inside a part file is displayed as well as the following contents: the current directory, editing condition block name and condition block comment. The cursor inside the condition part list moves up and down by the Up and Down Keys.

If "F2:Signal" is selected, the signal under the current cursor location will be saved.

To save signals only:

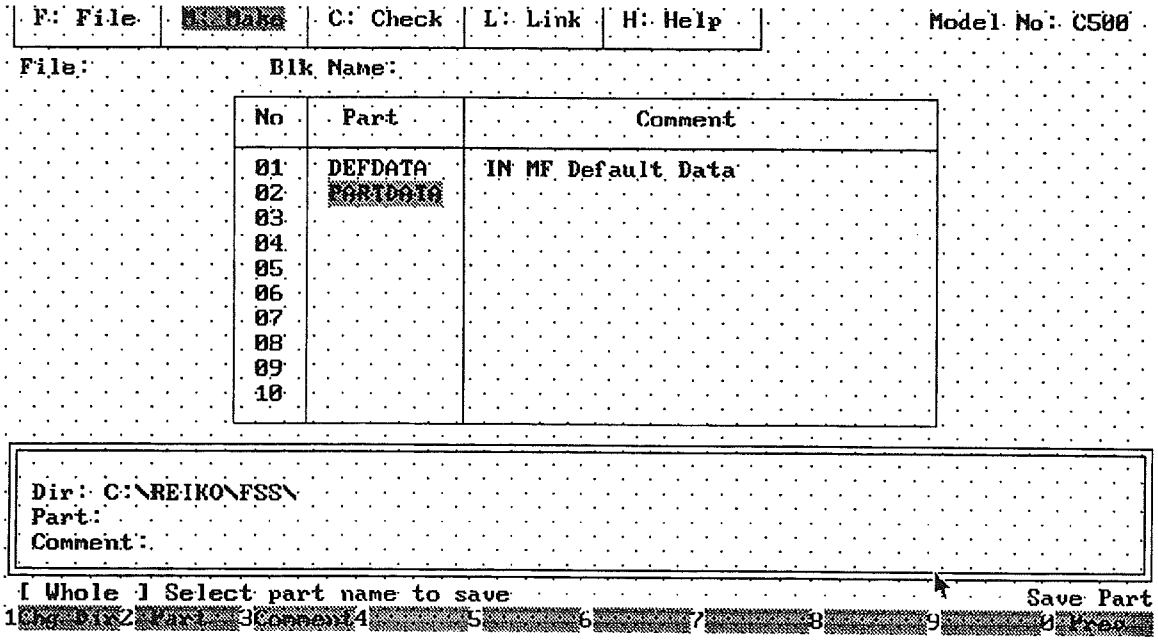
1, 2, 3...

1. If the current MF that you are editing has no block name, you have to enter the part name. To do so, press "F2:Part". Input a part name and press the Enter Key.

   Move the cursor to the desired condition part file in the condition part list using the Up and Down Keys, and move the cursor to the desired signal position in the signal list in the lower box using the Left and Right Keys.
2. Press the Enter Key when you have selected the part file and signal position.

To change a directory:

Select "F1: Chg Dir". Input the directory to be changed and press the Enter Key.



The following procedures are applicable only when saving a part using "F1: Whole".

To change a part name:

Select "F2: Part". Input a part name to be changed and press the Enter Key. Even if you change a part name, the block name of editing condition data will not be changed.

To change a block comment:

1, 2, 3...

1. Select "F3: Comment". Input the condition block comment to be changed and press the Enter Key. If you press the Home Key, the comment will be deleted. Even if you change a comment, the block comment of the current editing condition data will not be changed.

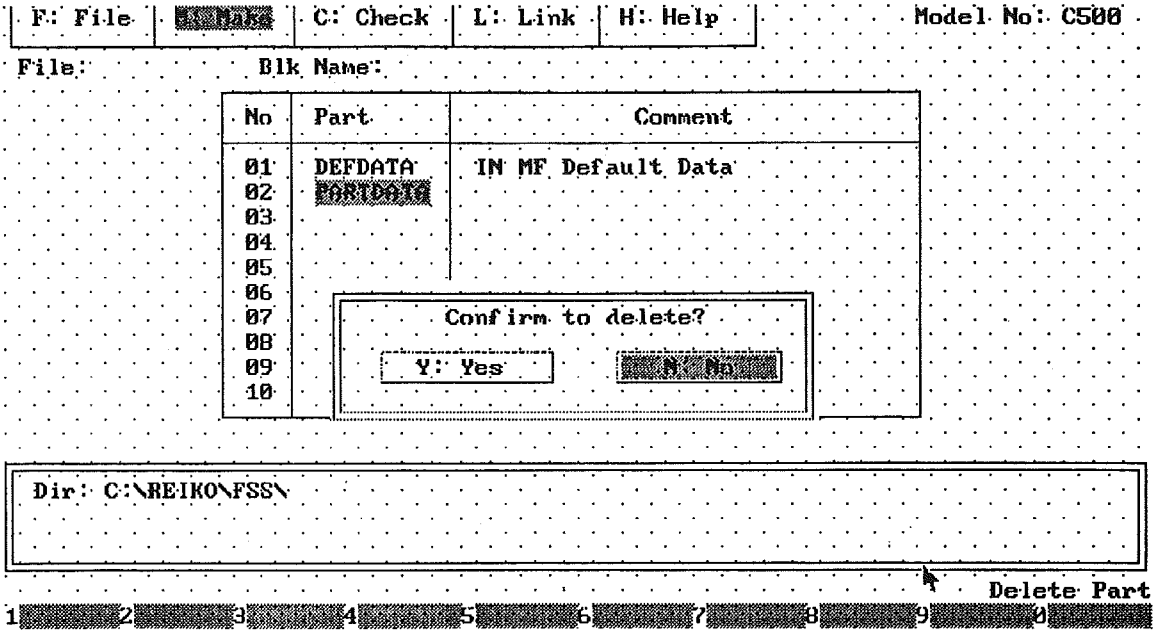
2. Move the cursor to the desired condition block and press the Enter Key, or move the mouse cursor and left click to select. While saving, the window "Saving part file" is displayed. After saving, the window is disappears and the condition input display appears.

or By pressing the F10 Key or right clicking, without saving the condition, the condition input display appears.

Delete Condition Data in a Part File

1, 2, 3...

1. Select "F6: Part" on the condition editing display.
2. Select "F3: Delete". A list of a condition part inside a part file is displayed.



The cursor inside the condition part list moves by using the Up and Down Keys.

3. In the case of changing a directory, select "F1:Chg Dir".
4. Input the directory to be changed and press the Enter Key.
5. Move the cursor to a condition part name to be deleted and press the Enter Key, or move the mouse cursor and left click to select. The confirmation window for deletion will be displayed.
6. For deletion, select "Y: Yes". For cancellation, select "N: No".

   If you select "Y: Yes", a part at the cursor inside the part list will be deleted. While deleting, a window "Deleting a part" is displayed.

   After deleting, the condition input display appears.

or If you press the F10 Key or right clicking, without deleting the condition part, the condition input display appears.

Note Default part files for C200H/C500 are created under the name "DEFDATA". These part files cannot be saved or deleted.

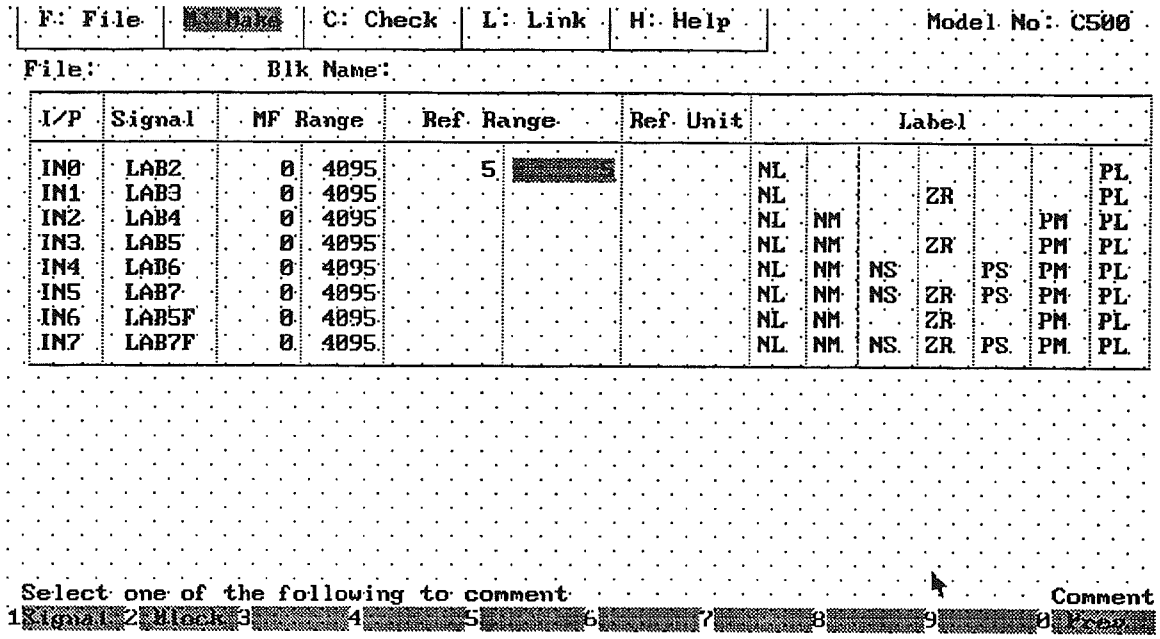
Comments

Signal

1, 2, 3...

1. Select "F7: Comment" on the MF display. The message "Select one of the followings to comment" is displayed at the function menu of MF data.
2. Select "F1: Signal". The display is switched to the MF comment display.
3. Move the cursor to the desired MF comment with the Up and Down Keys. The cursor can also be moved by moving the mouse cursor to a desired MF comment and left clicking.

Up to 30 characters can be input per comment.



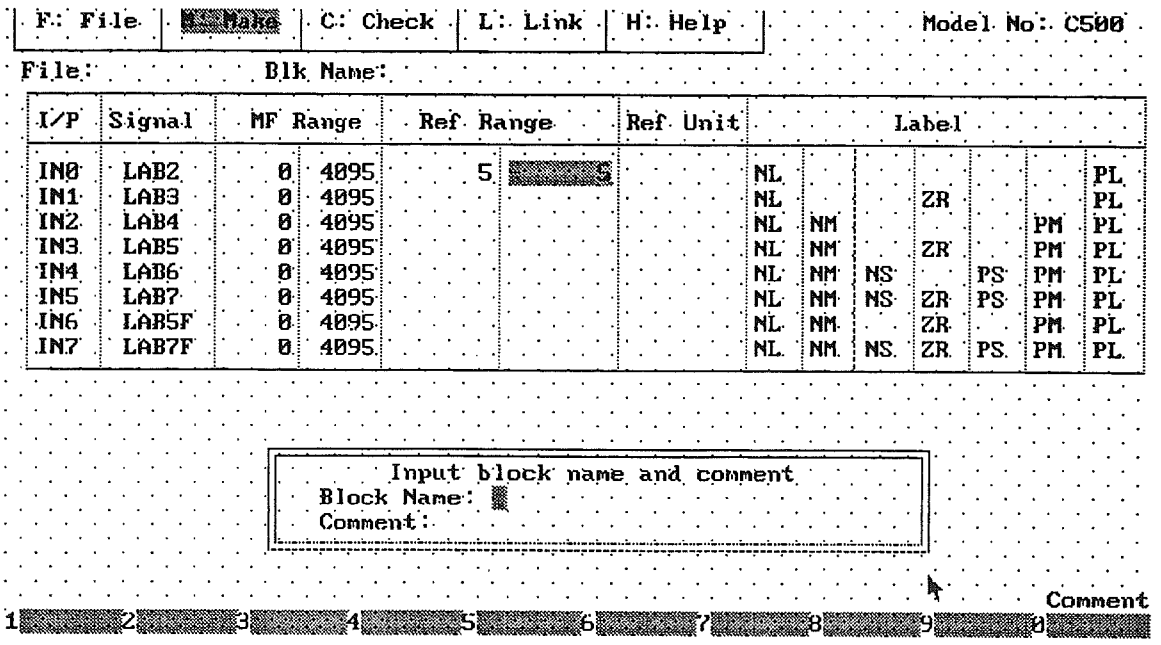
If you press the Home Key, I/O comment at the cursor is deleted.

4. Input comments and press the Enter Key.
5. By pressing the F10 Key or right clicking, the MF display is recovered. At this time, the input I/O comment is confirmed and loaded into editing data.

Block

1, 2, 3...

1. Select "F7: Comment" on the MF display. The message "Select one of the following to comment" is displayed at the function menu of the lower part of the display.
2. Select "F2: Block". A block name and comment input window are displayed.



A block name is limited to upper-case 8 characters. A comment is limited to 30 characters.

3. The cursor moves between a block name and comment with the Up and Down Keys.

   The block name and comment at the cursor are deleted by pressing the Home Key.

4. Input block name and comment, and press the Enter Key. The input block name and comment are confirmed.

or By right clicking, the MF data of condition data display appears. In this case, the input block name and comments are not confirmed.

Returning to Previous Display

"F10: Prev" will return you to the previous display.

7-3-2 ___Conclusion Input

Use the following procedure to input MF data of conclusions.

1, 2, 3...

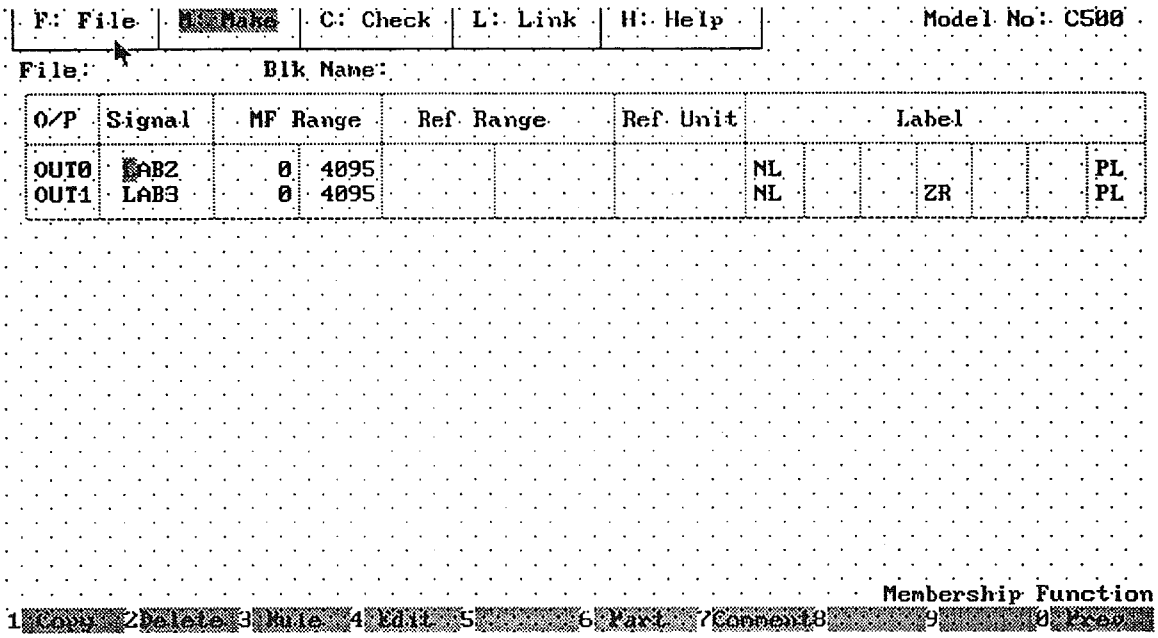
1. Select "M: Make". The pulldown menu will be displayed.
2. Select "M: Membership Function". The submenu will be displayed to the right of the pulldown menu.
3. Select "L: Conclusion" to display the conclusion input display.

The following table summarizes the the function menu operations and their keys.

Function Menu	Key	Function
Copy	F1	MF data is overwritten or copied to a specified output signal.
Delete	F2	Deletes MF data from a specified signal.
Rule	F3	Makes MF data based on rule data.
Edit	F4	Makes MF.
Part	F6	Loads and refers to MF data from a part file, saves into a part file or deletes a part inside a part file.
Comment	F7	Makes and edits comments for each I/O signal or makes and edits a block name and block comment into MF data.
Prev	F10	Returns to the previous display.

Inputting MF Data

Move the cursor to the desired input signal, label name, range or reference unit input column. Move the cursor using the Arrow Keys or use a left click at the desired signal input.



A maximum of 8 input signals can be set for both C200H and C500. 7 labels can be set per signal.

The following data parameters are given for each data type

Input	Explanation
Signal name	A maximum of 5 characters can be used (lower-case will be converted to upper-case.
MF range	Left column can be from 0 to 4094. Right column can be from 1 to 4095. The left column value must be less than the right column.
Reference range	A maximum of 6 characters can be used, including decimal points. (See note) The left column value must be less than the right column value. The range can be from –9999 to 9999.
Reference unit	A maximum of 6 characters can be used.
Label name	A maximum of 3 characters can be used.

Note Legal inputs include 123456, -654321 or 1234.5. Minus signs are not counted as characters in inference ranges.

Entries will be confirmed when the cursor moves out of the column area or when the Enter Key is pressed. Data entered in lower-case characters will be converted to upper-case characters. To delete characters inside an input column, press the Home Key.

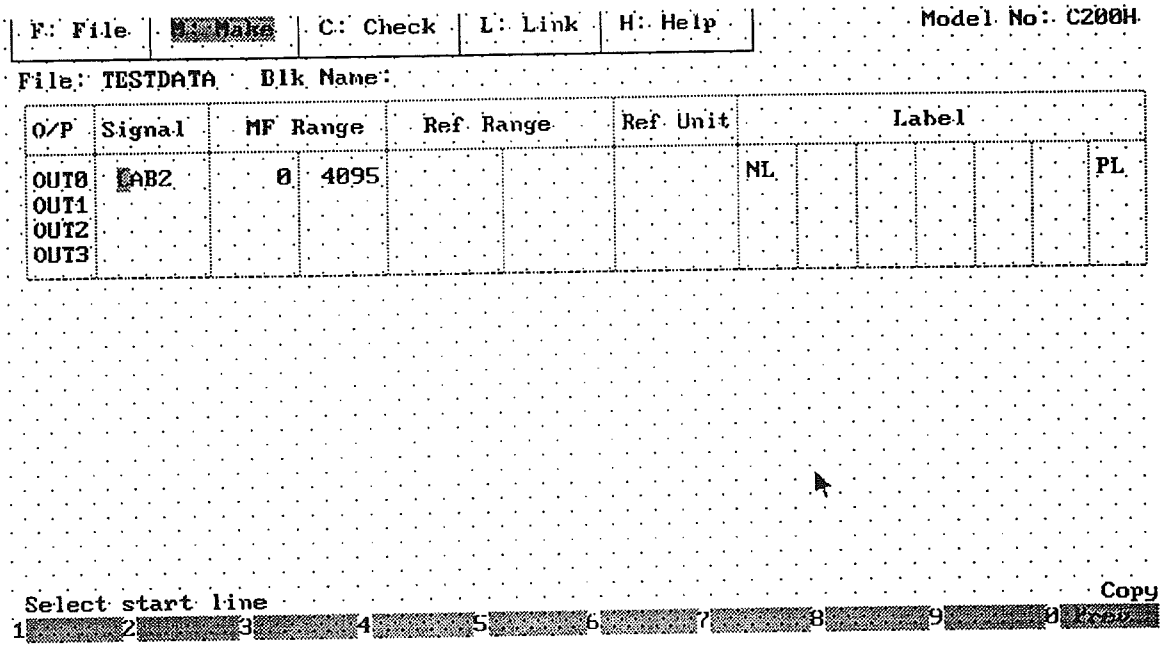
Copying (Conclusions)

For C200H

Use the following procedure to copy MF data.

1, 2, 3...

1. Select "F1: Copy". A prompt to specify the starting position will appear.
2. Move the cursor to the desired starting point and press the Enter Key or left click.



Next, a prompt for the ending location will appear.

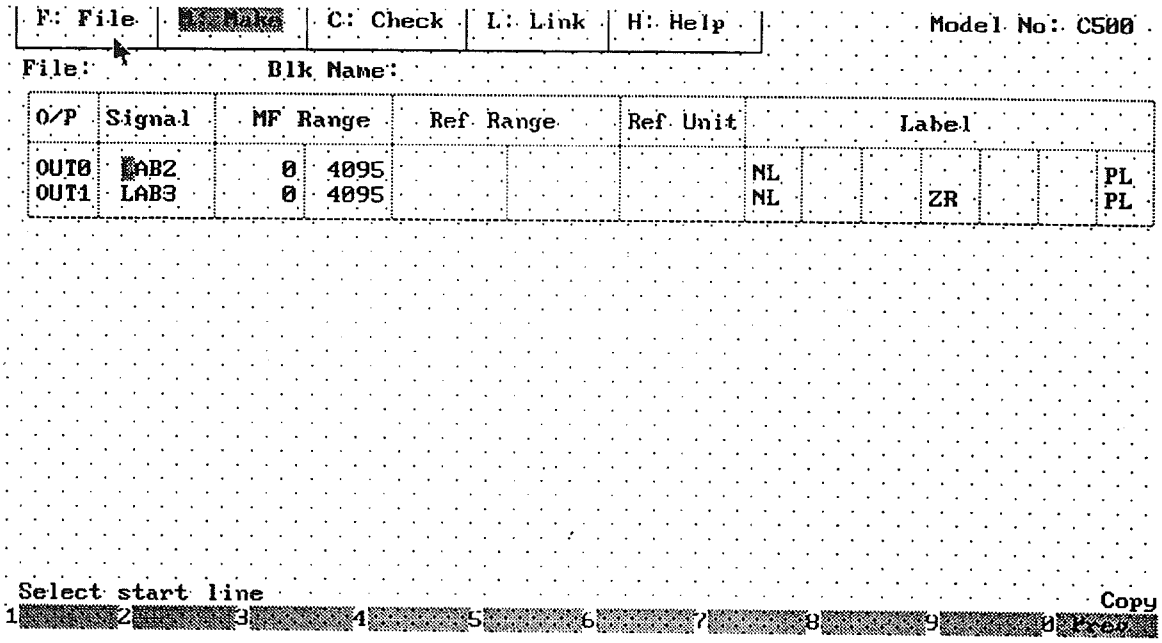
3. Move the cursor to the desired ending location and press the Enter Key or left click. The prompt for the location to copy to will appear and the function menu will change. Press the F10 Key (Prev) to cancel the copy operation or press the F1 Key. Select to set the contents to be copied. .
4. Move the cursor to the desired location and press the Enter Key or left click. Any previous data will be replaced. A confirmation window will appear.
5. "Y: Yes" can be selected by typing a "Y," left click with the cursor on the "Y: Yes" position, or using the Cursor Keys to move to "Y: Yes" and pressing the

Enter Key. "N: No" can be chosen in the same way. Pressing the F10 Key or a right click will stop the copy.

6. An "Improper working position" message will appear when MF data is copied to the same location from which it was copied or when copying results in more than 4 conclusion signals (for the C200H). Additionally, overwriting in highlighted output blocks (Out1, Out2, etc.) will result in an "Improper working position" message.
7. To cancel copying, press the F10 Key or right click.

For C500

It is similar to the copying procedure in C200H, except you will not be prompted for the end line. Once the start line is selected, it will be assumed to be the end line. You will be prompted for the overwrite point after you have selected the start line. The other operations remain the same as in C200H.



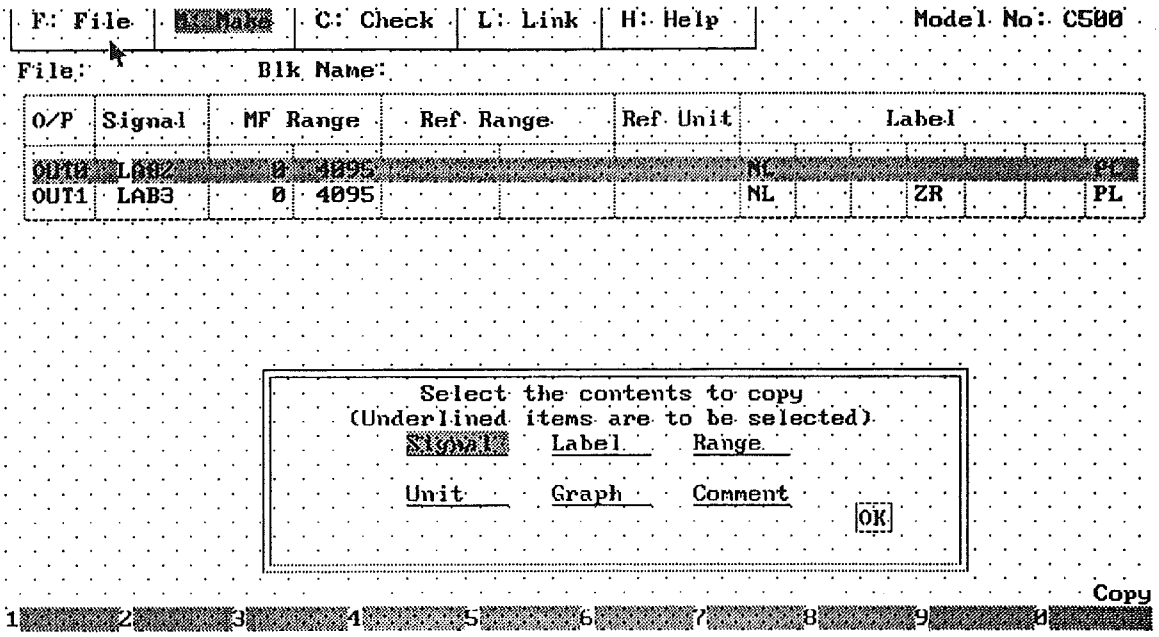
Setting Contents to be Copied

Complete the following procedure to copy contents.

1, 2, 3...

1. Select "F1: Select". The "Select Contents" window will appear. The window contains the following: signal, label, range, unit, MF, and comment.
2. Items to be copied within the window will be underlined. To deselect items not to be copied, move the cursor to the content item using the Cursor Keys and press the Enter Key. A left click will also deselect the item. Pressing the Enter Key or left clicking will toggle the underline on and off.

3. Comments will not be copied when all other items have not been selected to be copied.
4. After making selections, move the cursor to OK in the window and press the Enter Key or left click.

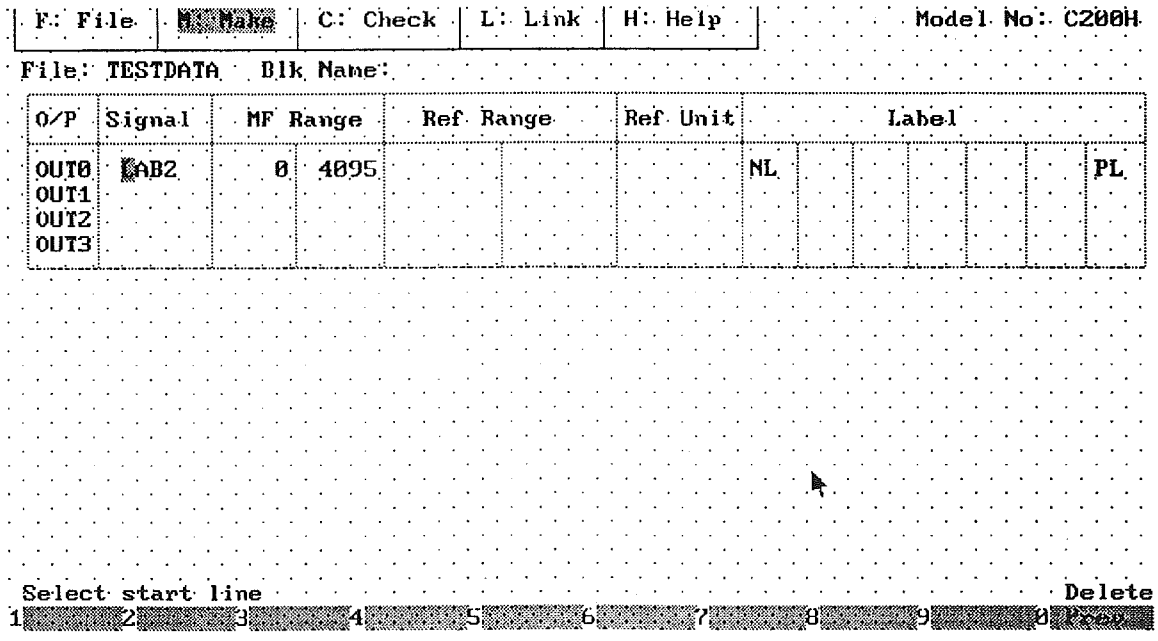


Deleting (Conclusions)

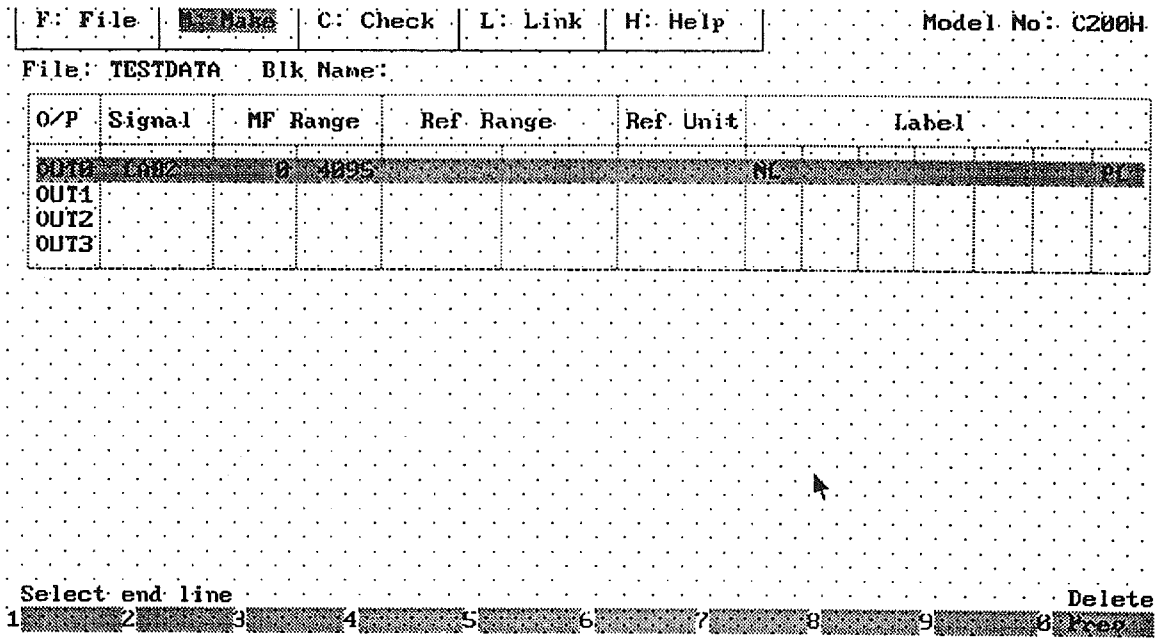
Complete the following procedure to delete contents.

1, 2, 3...

1. Select "F2: Delete" on the MF display. A prompt for the starting point will appear.
2. Move the cursor to the beginning to the output signal to be deleted. Press the Enter Key or left click to select.

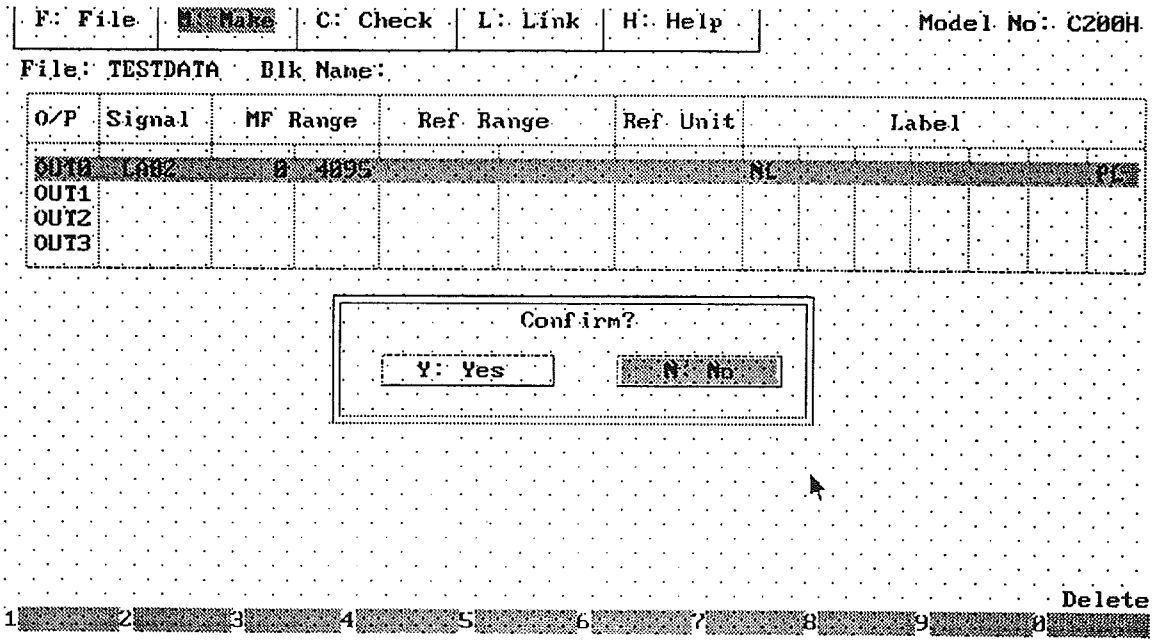


3. A prompt for the ending point will appear.



Using the Left and Right Keys, move the cursor to the end of the I/O point to be deleted and press the Enter Key or left click to select.

4. After completing the preceding steps, a delete confirmation window will appear. Select by typing "Y" for Yes and "N" for No, moving the cursor using the Cursor Keys and pressing the Enter Key, or left clicking on the desired choice.



5. To cancel the command, press the F10 Key or left click with the cursor on "F10" in the display. The MF display data will appear.

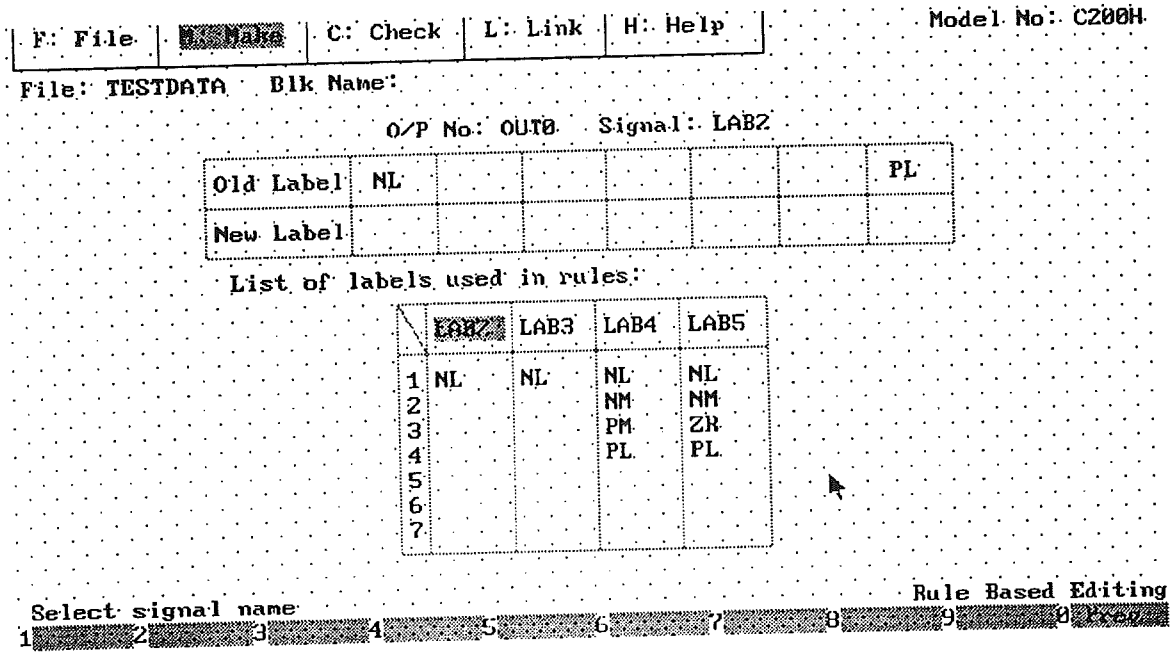
Rule-based Editing (Conclusion)

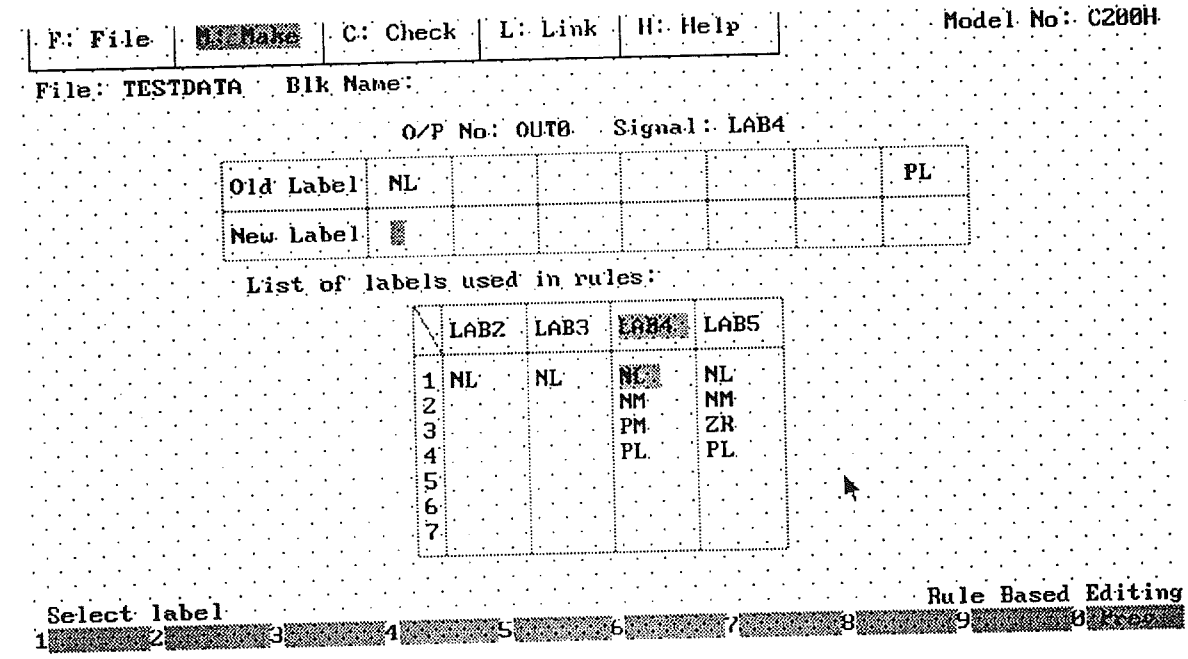
Rule data contained within an MF can be edited using the following procedure.

1, 2, 3...

1. Move the cursor to the I/O signal to be edited.
2. Select "F3: Rule" from the MF display.

The upper part of the label setting list will display the selected output number and present output signal name and present label names. All signal and label names used in rules are displayed in the signal label list in the lower half of the display.





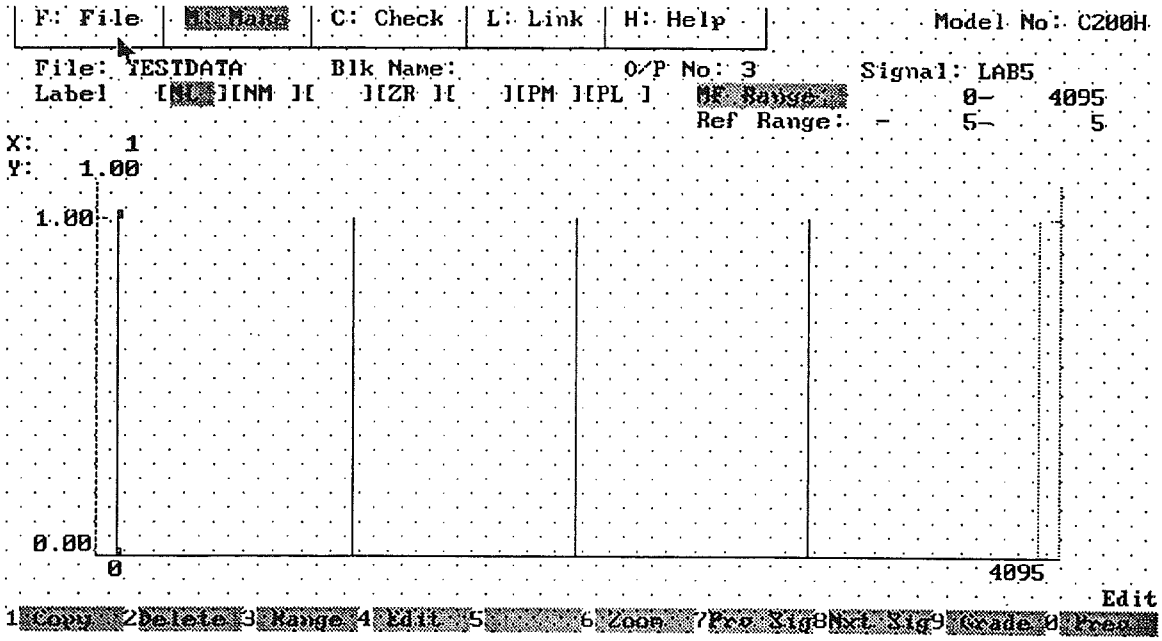
3. Use the Left and Right Keys to move between items in the signal/label list.
4. Move the cursor to the signal name to be selected. Press the Enter Key or left click to select. "Select label" will appear at the lower part of the display.
5. Use the Cursor Keys to move between items in the label setting list.
6. Move the cursor to the label to be specified as the new label and press the Enter Key or move the cursor and left click to select. The label at the cursor will be set as the new label.
7. To return to the MF, press the F10 Key (Prev) or a right click. This will confirm the signal/label names which is followed by a return to the MF display.

Caution If the input column of a new label is empty, the existing label will be deleted.

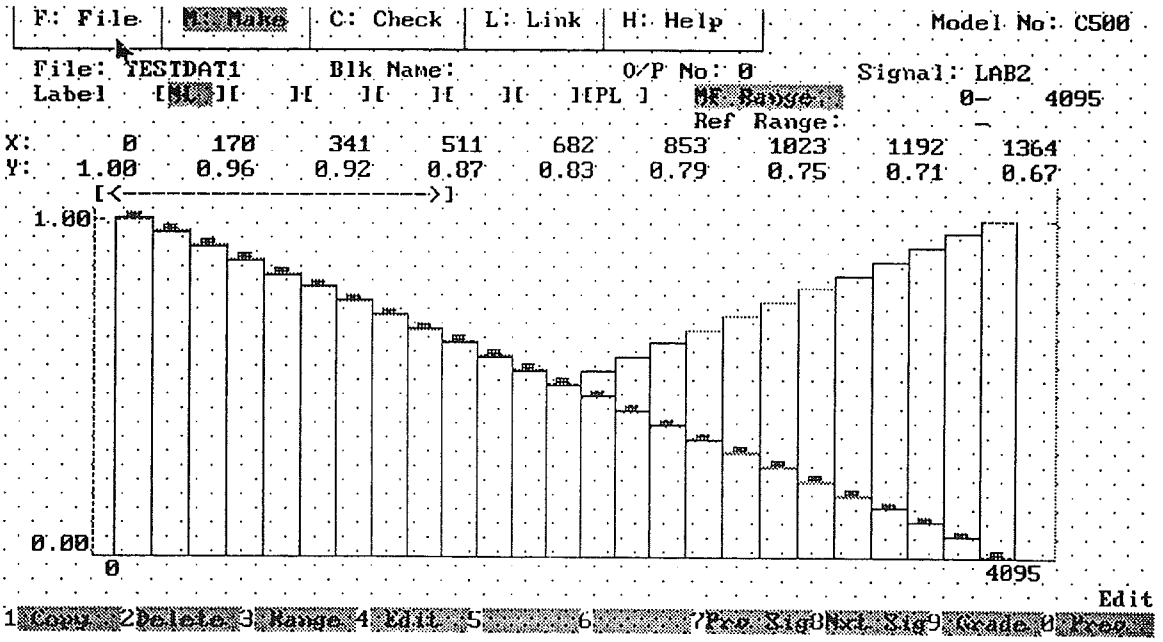
Editing (Conclusions)

Use the following procedure to edit conclusion shapes.

1, 2, 3... 1. Select "F4: Edit" in the MF display. The MF creation display will appear.



2. To edit the MF creation display select items from the function menu. A function menu item can be selected by pressing the corresponding key or by placing the cursor on the function menu display and left clicking.



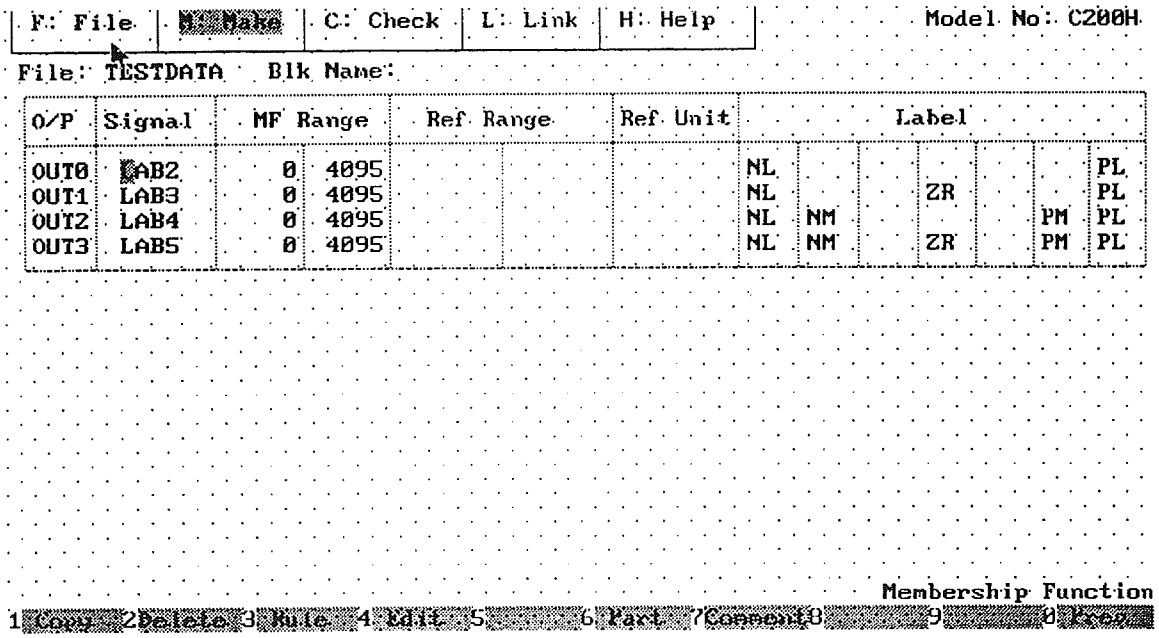
3. To return to the MF display, press the F10 Key (Prev) or right click.

4. The following table summarizes the operations which can be performed using the function menu.

Operation	Key	Function
Copy	F1	Copies a specified MF.
Delete	F2	Deletes a specified MF.
Range	F3	Toggles display between MF range and reference range.
Edit	F4	Creates an MF.
Zoom	F6	Enlarges the MF 2X, 4X or 8X. Displays the MF from a specified X coordinate.
Prv Sig	F7	Displays the prior MF creation display signal.
Nxt Sig	F8	Displays the next MF creation display signal.
Grade	F9	Changes the displayed MF grade from 0 to 1 and either 0 to 2047 (C500) or 0 to 4095 (C200H).
Prev	F10	Returns to the MF display.

Setting of Editing Area

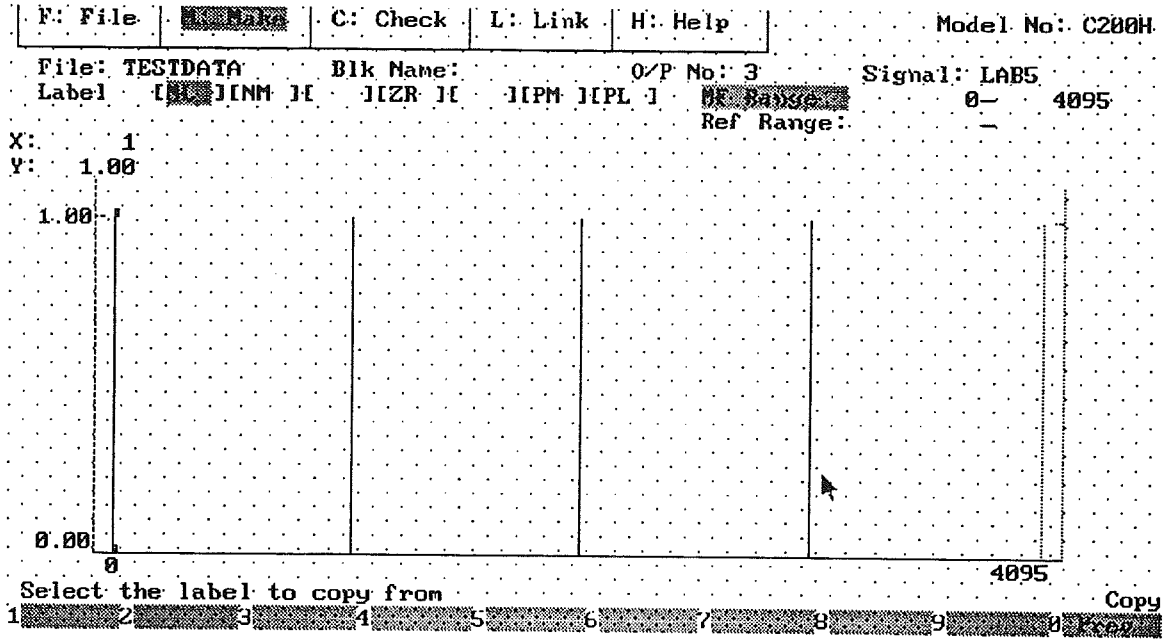
If the MF range is not set as 0 and 4095 on the display, the range will be shown as a vertical dotted line on the MF creation display. Editing can be done within the defined area.



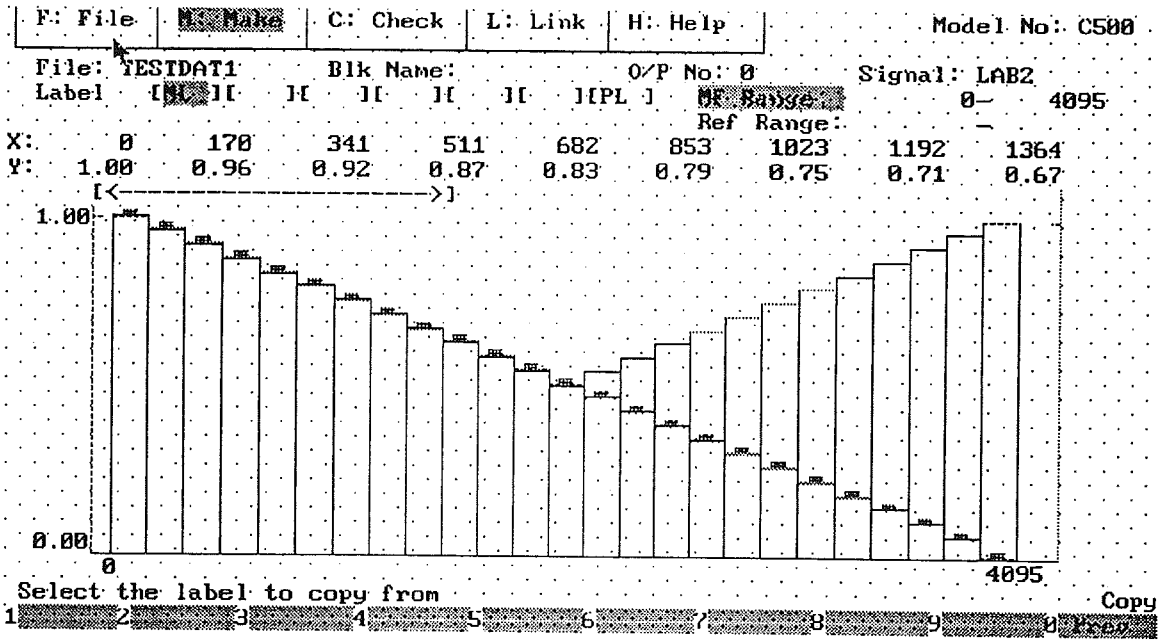
Copying MF Shape (Conclusions)

The following procedure is used to copy MF from the MF creation display.

1, 2, 3... 1. Select "F1: Copy" on the MF creation display.



2. Move the cursor to the label to be copied and press the Enter Key or left click.



The "Select the label to copy to" message will be displayed and each coordinate of the original copy of the MF will be highlighted by a small square.

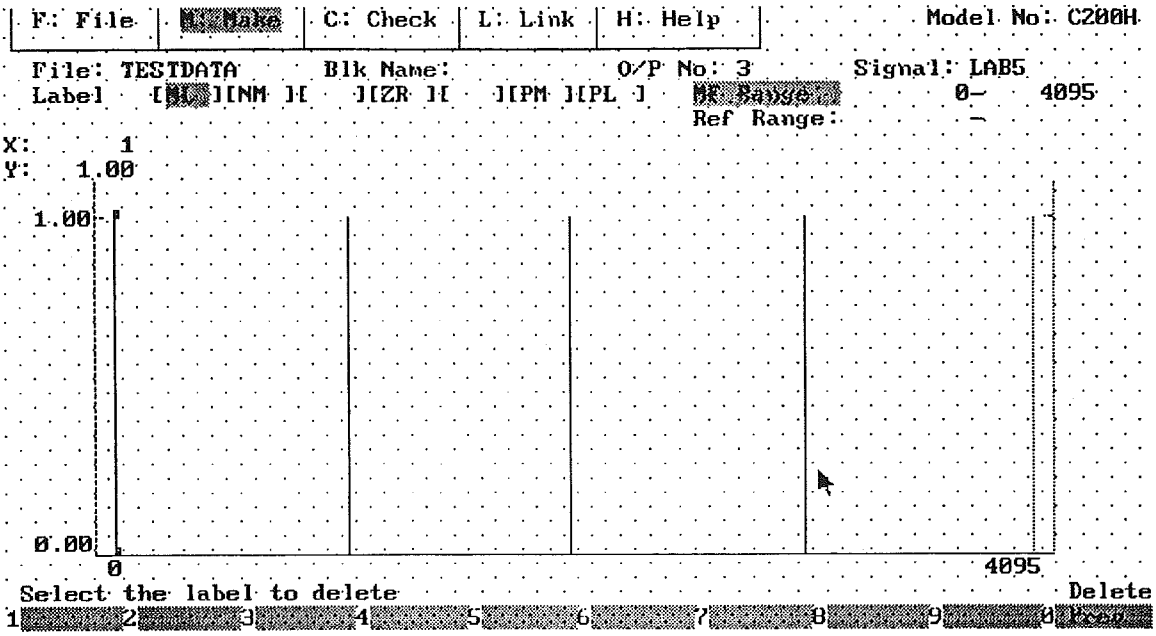
3. A window will be displayed to confirm the copy operation. Type "Y" for Yes and "N" for No to cancel the operation. This can also be done using the mouse or using the Left and Right Keys and pressing the Enter Key.
4. The MF of the original label and the MF of the copied label will be displayed overlapped.
5. If the label to be copied from has no MF definition, a "No MF definition" message will be displayed.

Deleting MF Shape (Conclusions)

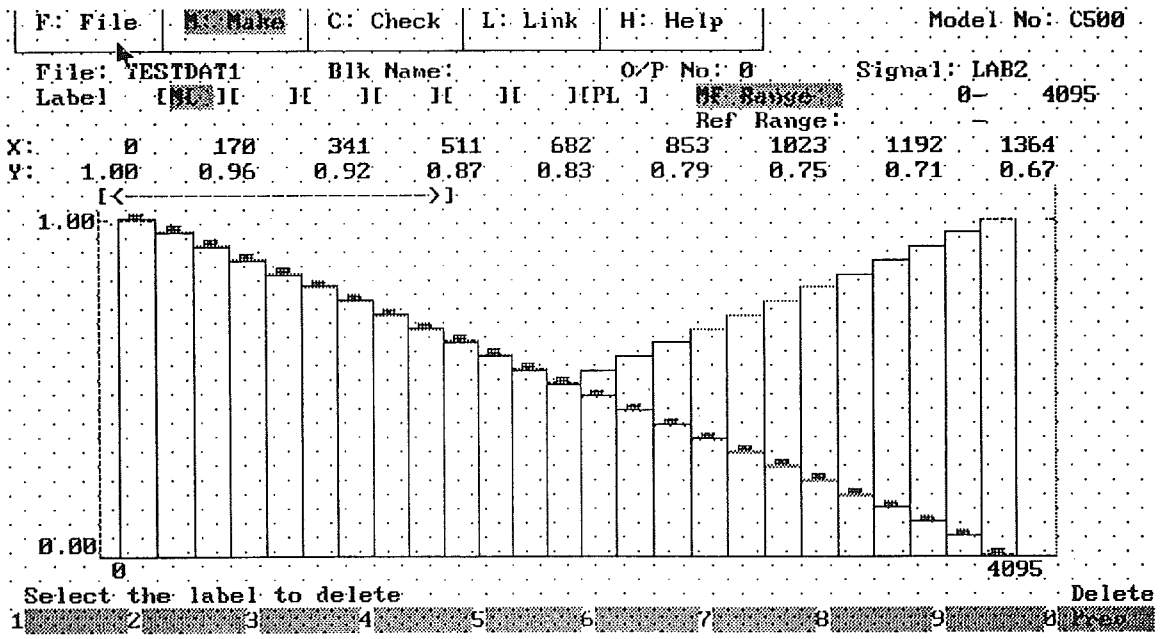
.The following procedure is used to delete MF from the MF creation display.

1, 2, 3...

1. Select "F2: Delete" on the MF creation display. A prompt to select the label will be displayed.



2. Select the label using the Left and Right Keys and press the Enter Key or move the mouse cursor to the desired label and left click. The coordinates of the MF label will be displayed as dots and a display window will appear.

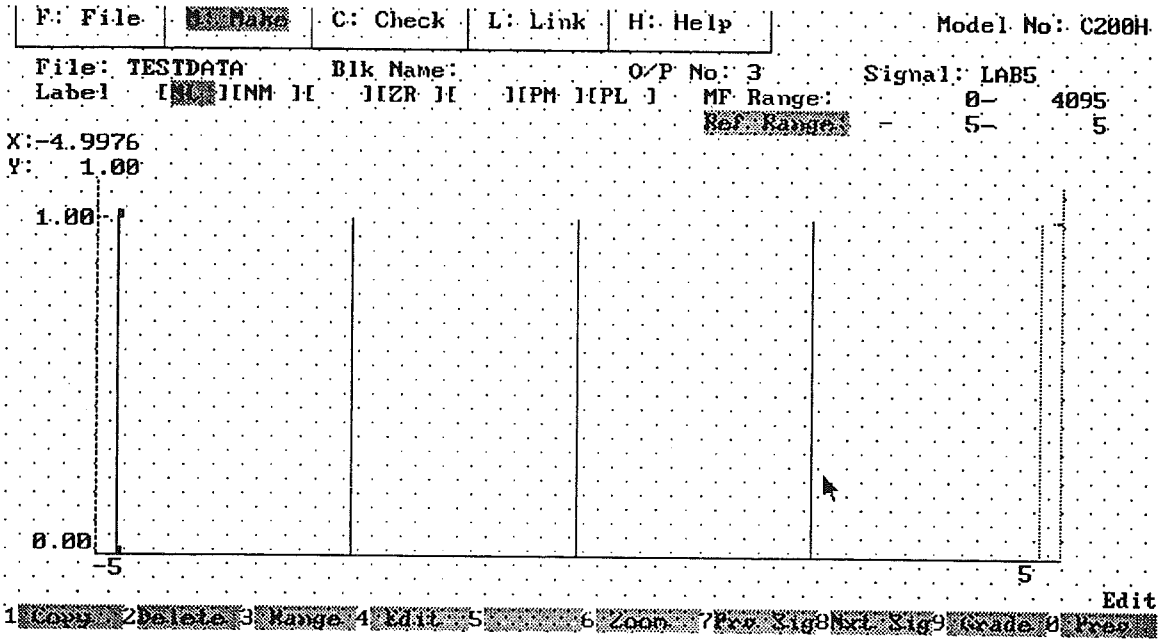


3. Press "Y" for Yes to delete the label and "N" for No to cancel the operation. This can also be done using the Left and Right Keys and pressing the Enter Key or by moving the mouse cursor to the desired choice and left clicking.
4. If the label to be deleted from has no MF definition, a "No MF definition" message will be displayed.

Toggle Range Display

To toggle between the MF range setting and the reference range setting, select "F3: Range" on the MF creation display.

The display will switch from the MF range setting to the reference range setting. If the reference range is not set (e.g. consists of only the minimum or maximum value) on the MF data I/O display, however, the display of the MF range setting will not be changed. A "No reference range, press any key to continue." message will be displayed.

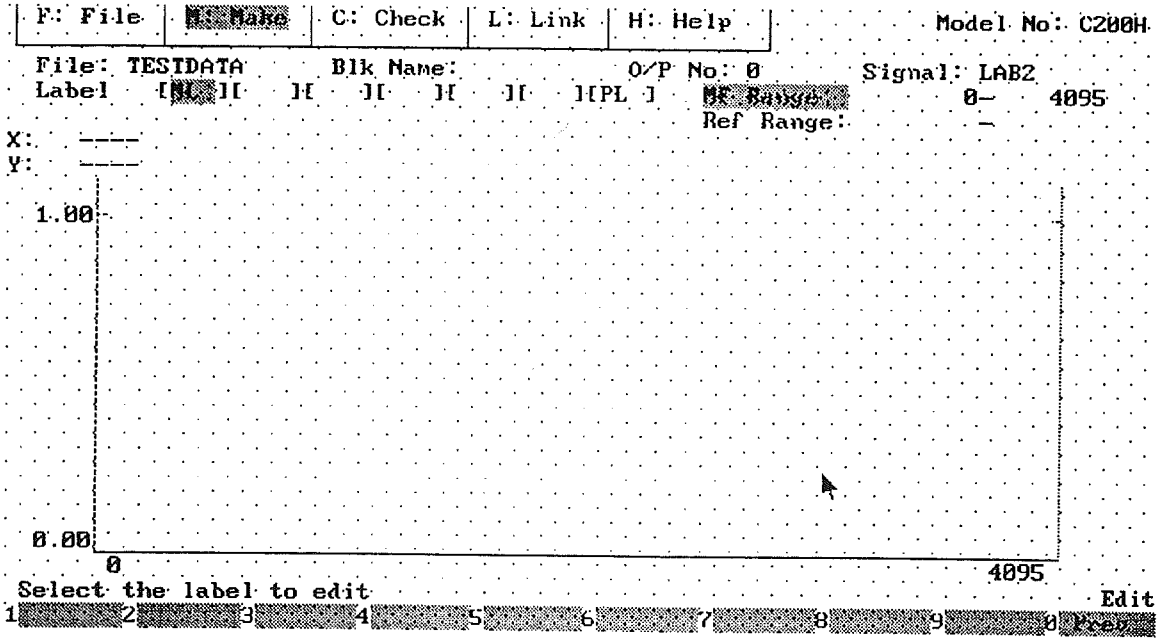


Editing MF Shape (Conclusion)

The following procedures are used to edit MF conclusions.

1, 2, 3...

1. Select "F4: Edit. The message "Select the label to edit" will be displayed. Select label to edit and press the Enter Key or move the cursor and left click.



There are two ways to create MF:

- by mouse
- by keyboard

Note If "F4:Edit" is selected by mouse, you can only create MF by using mouse. Keyboard input is ignored. If "F4:Edit" is selected by pressing the F4 Key, MF can only be created by using keyboard input.

2. Editing is only allowed within the specified region. i.e. MF Range

3. If "F4: Edit" is selected using the keyboard, the mouse cursor will disappear. The message "Input coordinates" will be displayed.

or If "F4: Edit" is selected using the mouse, the message "Click coordinates" will be displayed.

If the label selected has a MF, the existing MF will be displayed as dotted lines for the C200H or as small rectangles at the top of the bars for the C500.

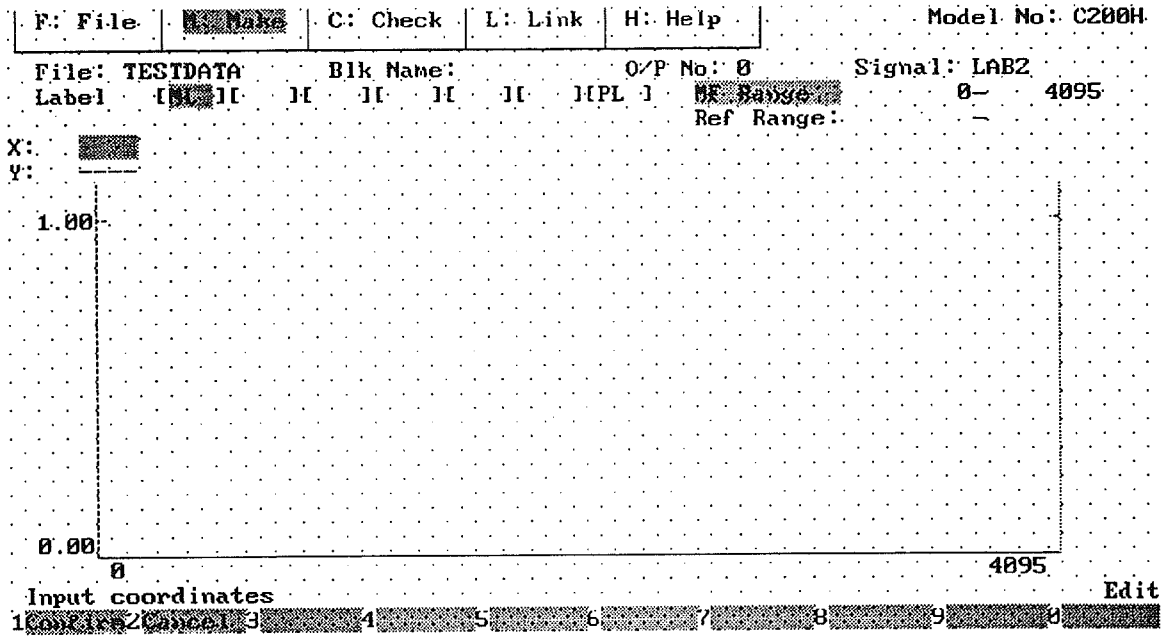
Creating MF by Key Input (For C200H)

If the X axis is displayed in terms of MF range, 0 to 9 are valid inputs for the coordinates. Other characters are ignored.

or If the X axis is displayed in terms of reference range, 0 to 9 are valid inputs. A "–" sign and decimal points are allowed. Other characters are ignored.

1, 2, 3...

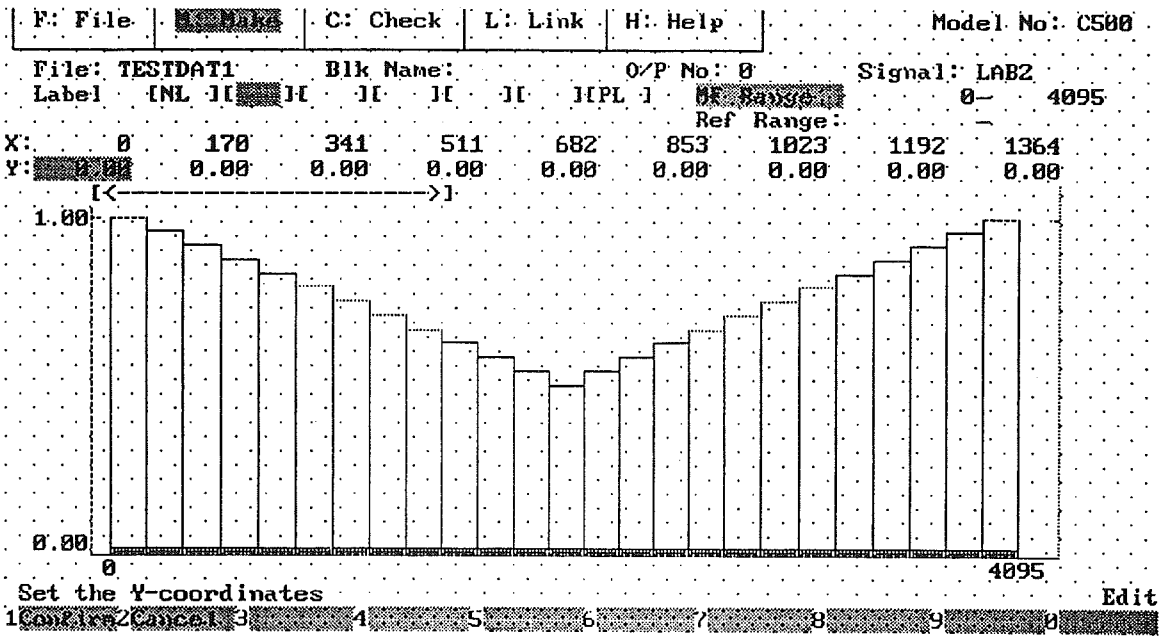
1. When confirmation is possible, i.e. the MF edited is considered done, the message "Confirm" will be displayed on the message line. The conclusions that must be satisfied so that a point can be drawn or MF can be confirmed, will be discussed later.



2. Notice that "F1:Confirm" and "F2:Cancel" is displayed on the function menu. When confirmation is possible, pressing the F1 Key will confirm the MF drawn, remove the old MF (if any), and get you out of the editing routine. If you wish to get out of the editing routine at any time, press the F2 Key.

Creating MF by Key Input (For C500)

After loading, X coordinates are fixed. You are required to enter only the Y coordinates. Input values 0 to 9 are valid for Y coordinates. If grade of MF is in terms of 0.00 to 1.00, decimal points are allowed. If grade of MF is in terms of 0 to 2047, decimal points are not allowed. A new bar height is indicated by a small square in the middle. An old bar height is indicated by 2 squares, one at each corner.



1, 2, 3...

1. The screen can only display 9 pairs of coordinates at any time. Press Shift+Left Keys to move to the next 9 pairs of coordinates or press Shift+Right Keys to move to the previous 9 pairs of coordinates.
2. The message "Confirm" is displayed on the message line. Pressing the F1 Key will confirm the MF drawn, remove the old MF (if any), and then exits the editing routine. If you wish to get out of the editing routine at anytime, press the F2 Key.

Creating MF by Mouse (For C200H)

1, 2, 3...

1. Move the mouse into the editing region. Notice that the mouse cursor changes from an arrow to a cross. When it moves out of the editing region, it becomes an arrow again.
2. If the mouse is clicked at a permitted location, a line will be drawn.
3. Click the mouse right button to undo the previous point.
4. When confirmation is possible, the "Confirm" message will be displayed on the message line. Move the mouse cursor to "F1" to confirm, or "F2" to cancel.

   When editing MF, you can left click the mouse at "F2" anytime to get out of editing mode.

Creating MF by Mouse (For C500)

1, 2, 3...

1. Move mouse into the editing region. The mouse cursor changes from an arrow to a cross. When it moves out of the editing region, it becomes an arrow again.
2. Only 9 bars can be edited at any time. There is an indicator on top of these bars. You can move the mouse to a particular bar below the indicator, left click, drag the height of the bar up and down, or simply left click at the desired height above the bar.

   To see or edit another 9 pairs of coordinates, left click the mouse at the indicator and drag.

Note When editing MF using grade display of 0.00 to 1.00, if more than 2 decimal places are input for Y coordinates, they will be rounded to 2 decimal places. For 2 Y coordinates which look identical, the internal representation (in terms of 0 to 4095 or 0 to 2047) may be different. Hence, when grade is toggled to 0 to 4095 or 0 to 2047, value display is different. For instance, input 0.4954 and 0.5048.

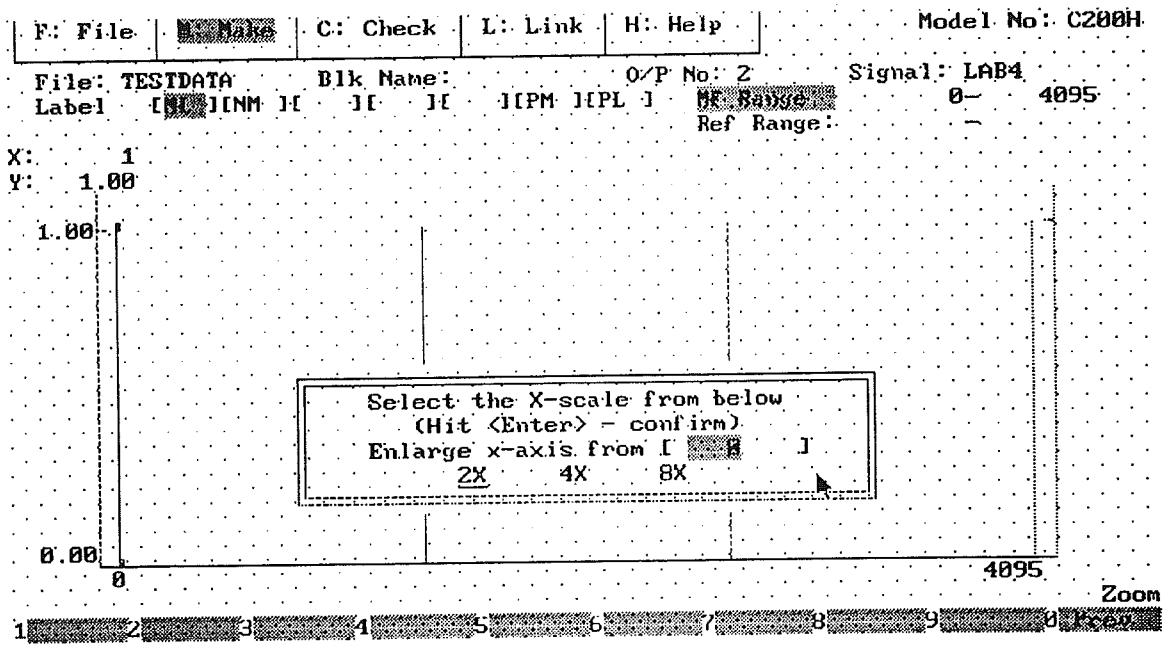
These will be both displayed as 0.50. However, when grade is toggled between 0 and 2047, the values will be 1014 and 1033 respectively.

When the MF range is not within 0 to 4095, all bars within the editing region (indicated by the vertical dotted line) can be edited, even though the bar may not be fully displayed. For example, if the MF range is 1108 to 4095, the bar with value 1023 can be edited.

Zooming (C200H only)

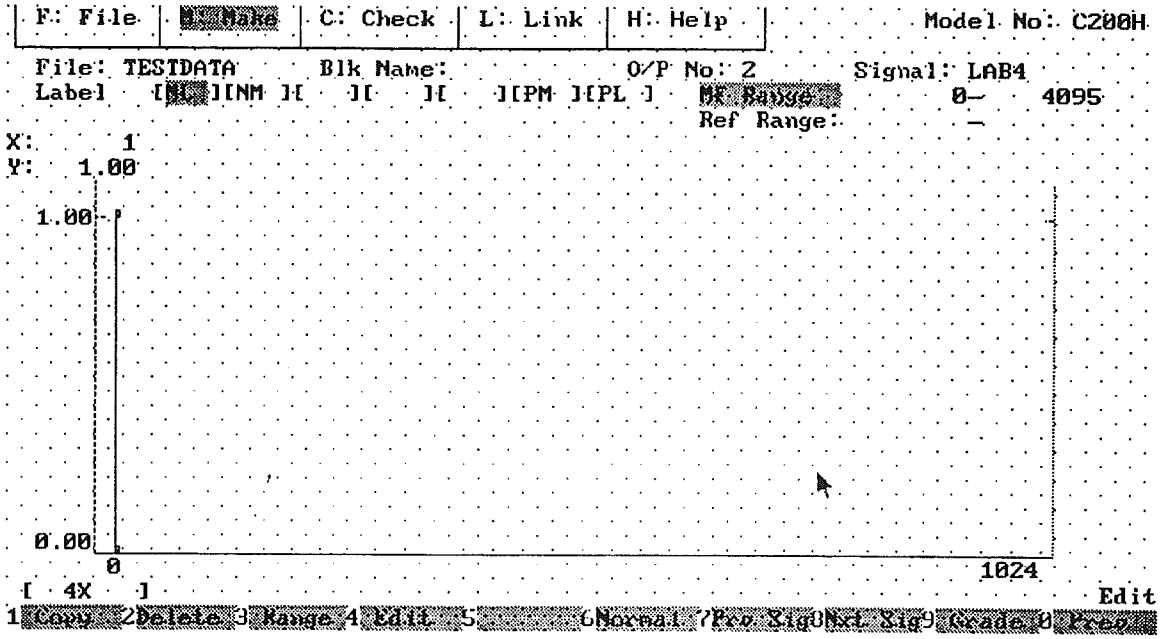
1, 2, 3...

1. Select "F6: Zoom" on the MF creation display. The window for the base X coordinate and to select zoom items are displayed.



2. Enter the base X coordinate to zoom from.
3. Press the Down Key, move to the zoom items and select magnifications desired by pressing the Left and Right Keys.

4. If you press the Enter Key, MF is zoomed by the magnifications set from the base X coordinate. In the zoom display, the magnification shown is "4X" (when zoomed three times) at the bottom left of the display.



The resolution at the mouse position on the display by zoom items is as follows:

Zoom item	Resolution	Range display
Normal	512	0 to 4095
2X	1024	0 to 2048
4X	2048	0 to 1024
8X	4096	0 to 512

5. Press the F10 Key or right click, and the MF display will appear.
   When displayed in enlarged form, the F6 Key display of the function menu at the lower part of the display becomes " Normal" and the present magnification is displayed at the bottom left of the display.
   If you select "F6: Normal", the display of normal MF appears.

Go to Previous (Conclusion) Signal

On the MF creation display, when you want to display the MF creation display of the previous signal, select "F7: Prv Sig". The MF creation display switches from a signal of the present display to the previous signal.

Go to Next (Conclusion) Signal

On the MF creation display, when you select "F8: Nxt Sig", the MF creation display switches from a signal of the present display to the next signal.

Toggle Grade of MF (Conclusions)

Select "F9: Grade" on the MF creation display. The grade of MF is toggled between 0 (0.00) and 4095 (1.00) for C200H or 0 (0.00) and 2047 (1.00) for C500.

Depending on the option of the grade display at the time of activating the software, the Y coordinate display of MF is different.

If the "–A" option is specified on the command line when invoking FSS, the grade display is 0 to 2047 for C500 or 0 to 4095 for C200H. Otherwise, the default grade display is 0 to 1.00.

Go to Previous Display

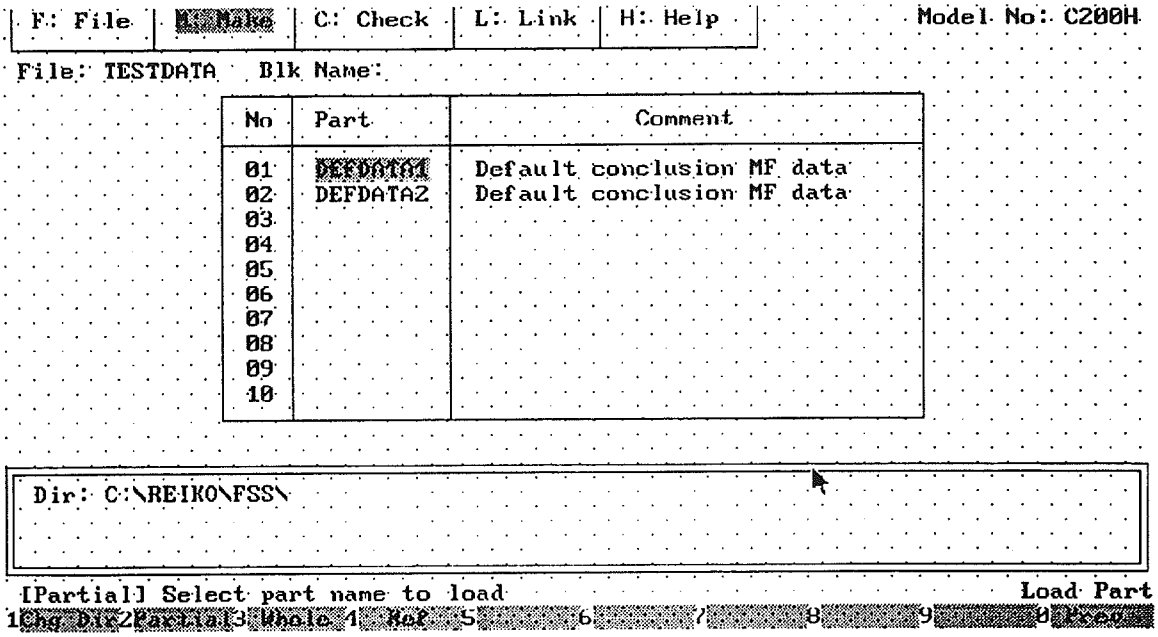
On the MF creation display, select "F10: Prev", or right click. The display returns from the MF creation display to the I/O display of MF data.

Part Data File

The following can be done to parts by selecting "F6: Part":

- Load (partial or whole)
- Save
- Delete
- Reference

Select "F1: Load". A list of conclusion part names is displayed. Under it, a directory which has the current part file is displayed.



The default mode for loading is partial loading. You can change the loading mode to whole loading using the F3 Key. You can also choose the partial loading mode again by using the F2 Key. The mode chosen is indicated in the square bracket at the lower part of the display.

The cursor inside the list of the conclusion part names moves up and down using the Up and Down Keys.

When you want to retrieve a part file from another directory, select "F1: Chg Dir". Then, the parent directory, sub-directories, and the part file, if any, in the current directory are listed. You can change to the directory required and select the part file. You can also select "F1: Chg Drv" to switch to a different drive.

Partial Loading Mode

1, 2, 3...

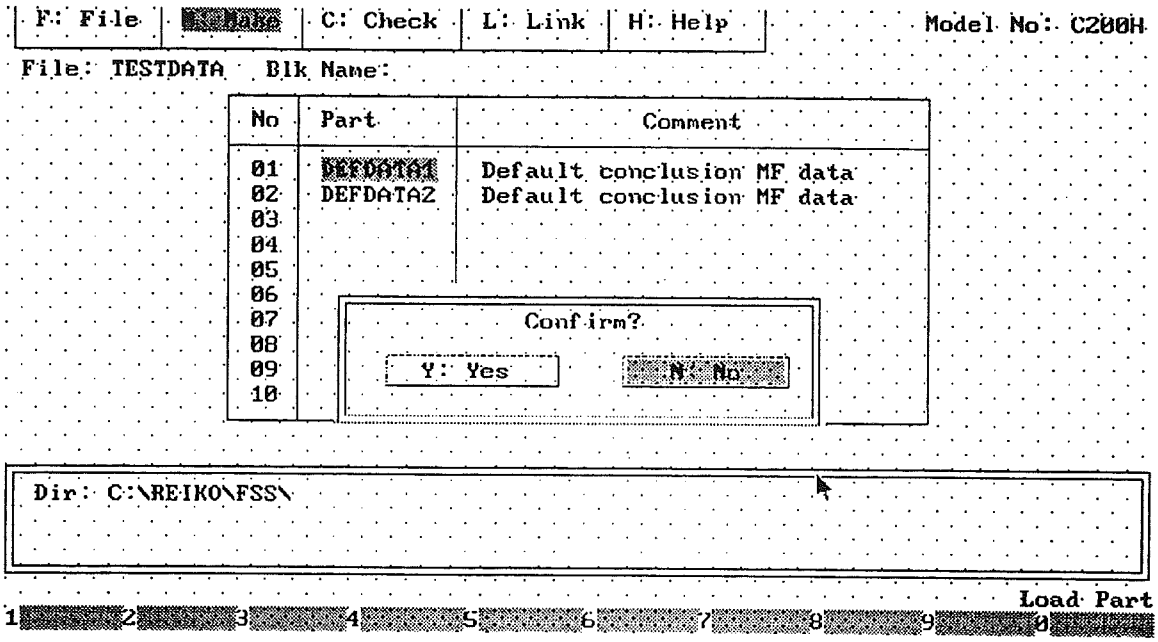
1. Move the cursor to the conclusion part name for loading and press the Enter Key or left click the mouse in order to select. After loading, contents of a specified conclusion part are displayed.
2. On the function menu display at the lower part of the display, the message "Select start line" is displayed.
   a) Specify the starting line for loading by using the cursor and press the Enter Key or left click.
   b) Specify the ending line for loading by using the cursor and press the Enter Key or left click.
3. The editing conclusion input display is displayed and the message "Select overwrite point" is displayed. You can move to the position where you want to rewrite by using the Up and Down Keys, or left clicking.

   You will be asked to confirm the partial loading.

   If you specify the loading destination at a location and after loading the total output signals exceed 4 for the C200H and 2 for the C500, the message "Improper Working Position" will appear.

Whole Loading Mode

1, 2, 3... 1. Move the cursor to a conclusion part at the desired part name for loading and press the Enter Key or left click. The confirmation window for whole loading is displayed.

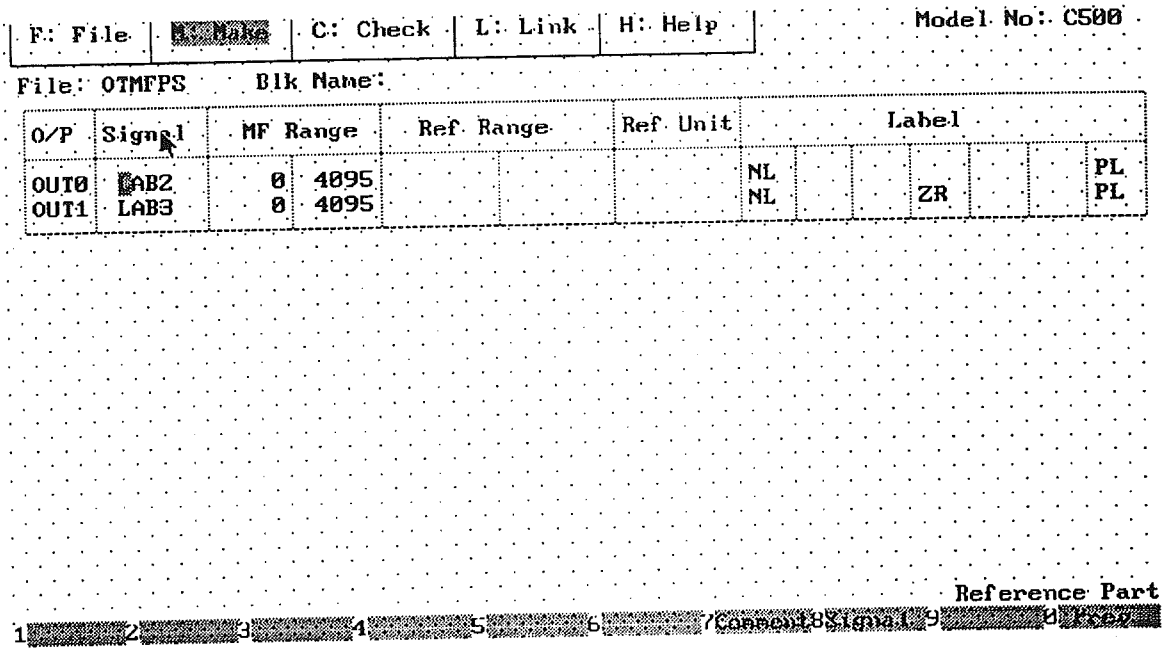


2. In the case of whole loading, select "Y: Yes", and for cancellation, select "N: No" or press the mouse right button. If you select "Y: Yes", a specified part is loaded into editing conclusion data and the conclusion input display appears.
   a) While loading, the window displays "Loading a part file".
   b) After loading, the window is deleted and contents of a specified conclusion part are displayed.

Reference Part

1, 2, 3...

1. Move the cursor to a conclusion part at the desired part to make reference with.
2. Select "F4: Ref" on the display of the conclusion part name list. While loading, the window displays "Loading a part file".
3. After loading, the window is deleted and contents of a specified conclusion part are displayed. Conclusion data cannot be created here.



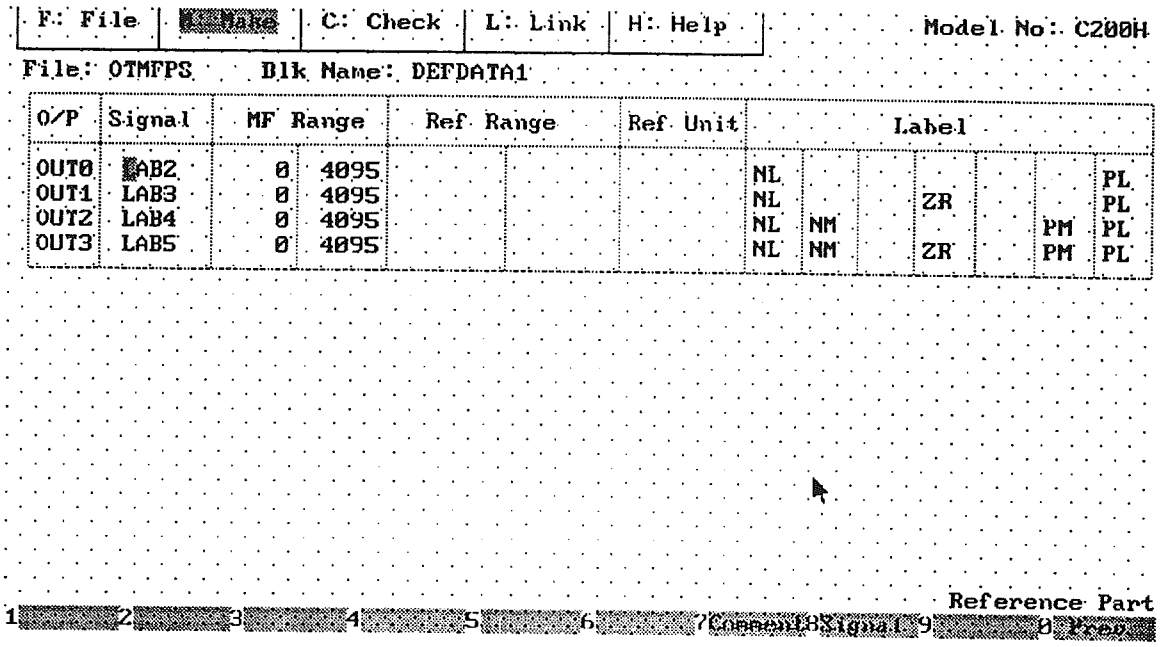
4. The function menu selections possible at this step are as follows:

Function menu	Key	Function
Comment	F7	Refers to comments of each conclusion and conclusion block.
Signal	F8	Refers to the MF of labels.

- The way to move within a displayed area of conclusion data using key input is the same as the conclusion input display. (Refer to *7-2-2 Basic Input*)
- The way to move within a displayed area of conclusion data using the mouse click point on the display is the same as the input display. (Refer to *7-2-2 Basic Input*)
- If "F8" is selected, MF of the labels of current signals are displayed. All the active functions are shown in the function menu. They are the same as in MF editing.

Function menu	Key	Function
Range	F3	Toggles range of MF between MF range and reference range.
Zoom	F6	Enlarges to 2X, 4X, or 8X.
Prv Sig	F7	Go to MF of previous signal.
Nxt Sig	F8	Go to MF of next signal.
Grade	F9	Toggle grade of MF between 0.00 to 1.00 and 0 to 4095 (for C200H) or 0 to 2047 (for C500).
Prev	F10	Returns to previous display.

5. By pressing the F10 Key or right clicking, the conclusion part list display appears.



Save Conclusion Data to a Part File

Select "F6: Part" on the conclusion editing display. Select "F2: Save". Under save, you can select "F1:Whole" to save the entire part or "F2:Signal" to save the signal only.

If "F1:Whole" is selected, a list of conclusion parts inside a part file is displayed as well as the following contents: the current directory, editing conclusion block name and conclusion block comment. The cursor inside the conclusion part list moves up and down by the Up and Down Keys.

If "F2:Signal" is selected, the signal under the current cursor location will be saved.

To save signals only:

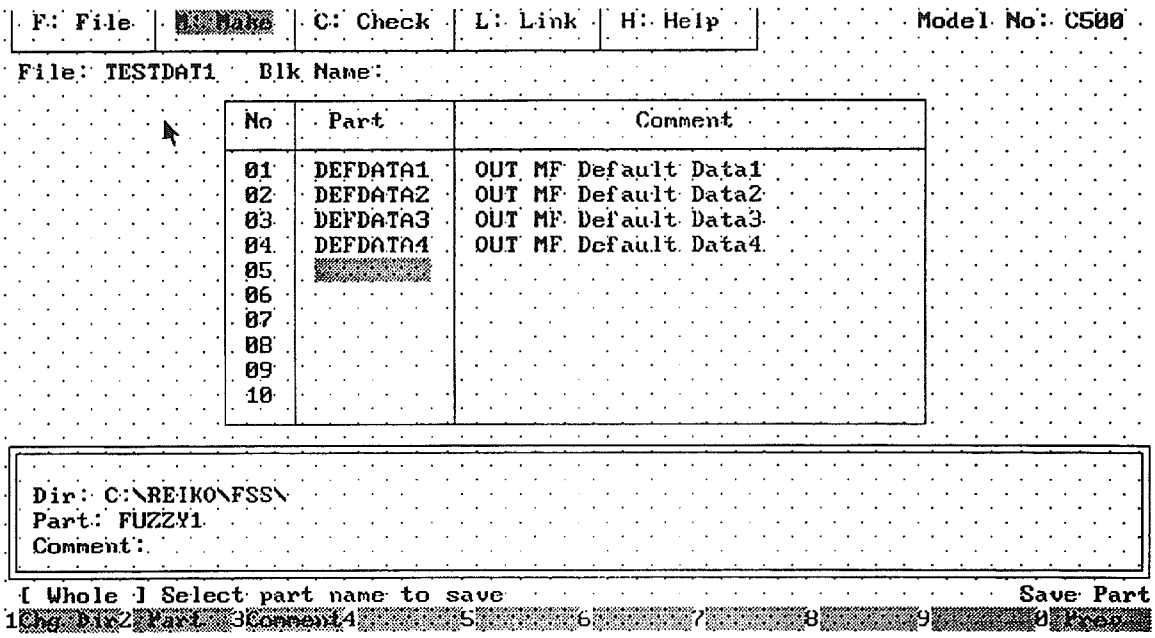
1, 2, 3...

1. If the current MF that you are editing has no block name, you have to enter the part name. To do so, press "F2:Part". Input a part name and press the Enter Key.

   Move the cursor to the desired conclusion part file in the conclusion part list using the Up and Down Keys, and move the cursor to the desired signal position in the signal list in the lower box using the Left and Right Keys.
2. Press the Enter Key when you have selected the part file and signal position.

To change a directory:

Select "F1: Chg Dir". Input the directory to be changed and press the Enter Key.



The following procedures are applicable only when saving a part using "F1: Whole".

To change a part name:

Select "F2: Part". Input a part name to be changed and press the Enter Key. Even if you change a part name, the block name of editing conclusion data will not be changed.

To change a block comment:

1, 2, 3...

1. Select "F3: Comment". Input the conclusion block comment to be changed and press the Enter Key. If you press the Home Key, the comment will be deleted. Even if you change a comment, the block comment of the current editing conclusion data will not be changed.
2. Move the cursor to the desired conclusion block and press the Enter Key, or move the mouse cursor and left click to select. While saving, the window "Saving part file" is displayed. After saving, the window is disappears and the conclusion input display appears.

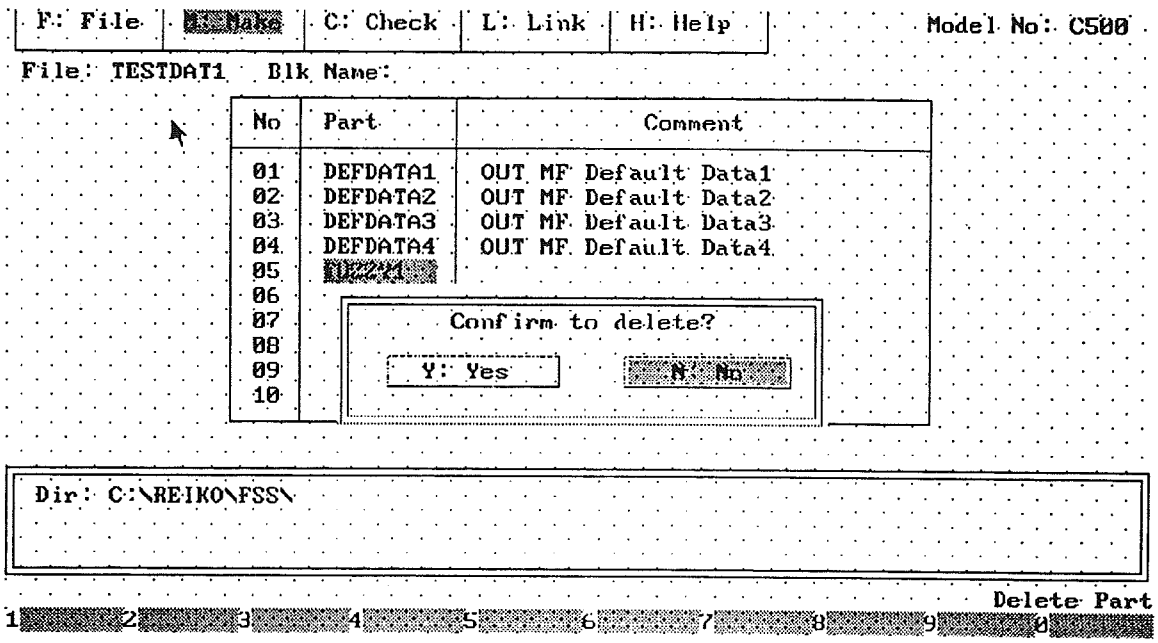
or By pressing the F10 Key or right clicking, without saving the conclusion, the conclusion input display appears.

Delete Conclusion Data in a Part File

1, 2, 3...

1. Select "F6: Part" on the conclusion editing display.

2. Select "F3: Delete". A list of a conclusion part inside a part file is displayed.



The cursor inside the conclusion part list moves by using the Up and Down Keys.

3. In the case of changing a directory, select "F1:Chg Dir".
4. Input the directory to be changed and press the Enter Key.
5. Move the cursor to a conclusion part name to be deleted and press the Enter Key, or move the mouse cursor and left click to select. The confirmation window for deletion will be displayed.
6. For deletion, select "Y: Yes". For cancellation, select "N: No".

   If you select "Y: Yes", a part at the cursor inside the part list will be deleted. While deleting, a window "Deleting a part" is displayed.

   After deleting, the conclusion input display appears.

or If you press the F10 Key or right click, without deleting the conclusion part, the conclusion input display appears.

Note Default part files for C200H/C500 are created under the name "DEFDATA". For C200H, there are 2 default part files created under the names "DEFDATA1" and "DEFDATA2". For C500, there are 4 default files created under the names "DEFDATA1", "DEFDATA2", "DEFDATA3", and "DEFDATA4". These part files cannot be saved or deleted.

Comments

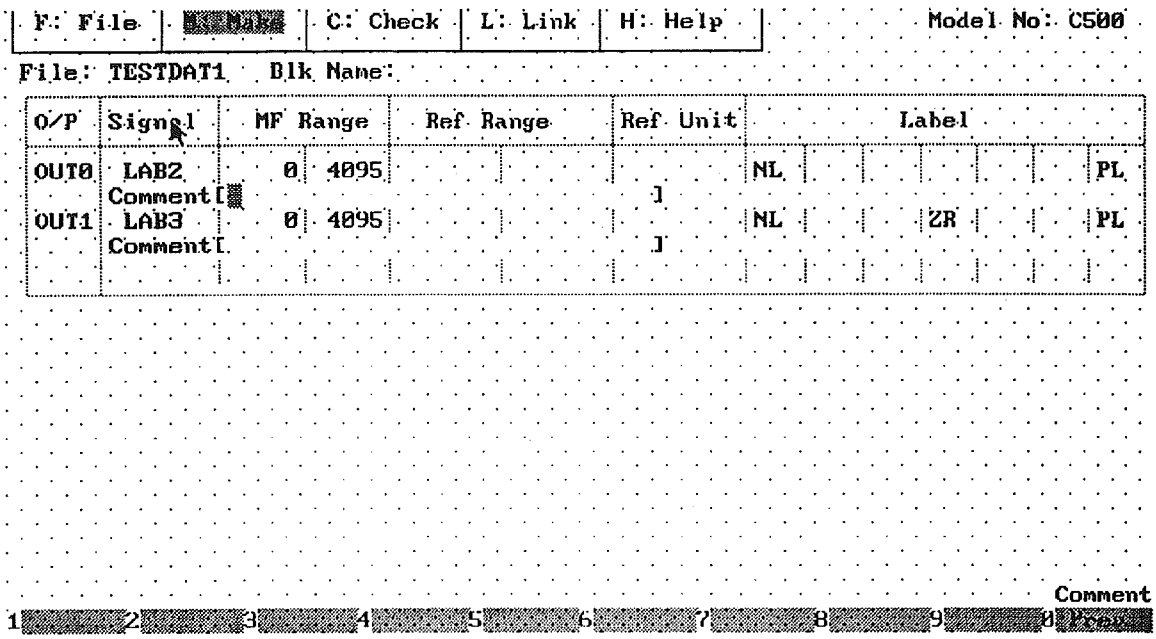
Signal

1, 2, 3...

1. Select "F7: Comment" on the MF display. The message "Select one of the following to comment" is displayed at the function menu of MF data.
2. Select "F1: Signal". The display is switched to the MF comment display.

3. Move the cursor to the desired MF comment with the Up and Down Keys. The cursor can also be moved by moving the mouse cursor to a desired MF comment and left clicking.

   Up to 30 characters can be input per comment.



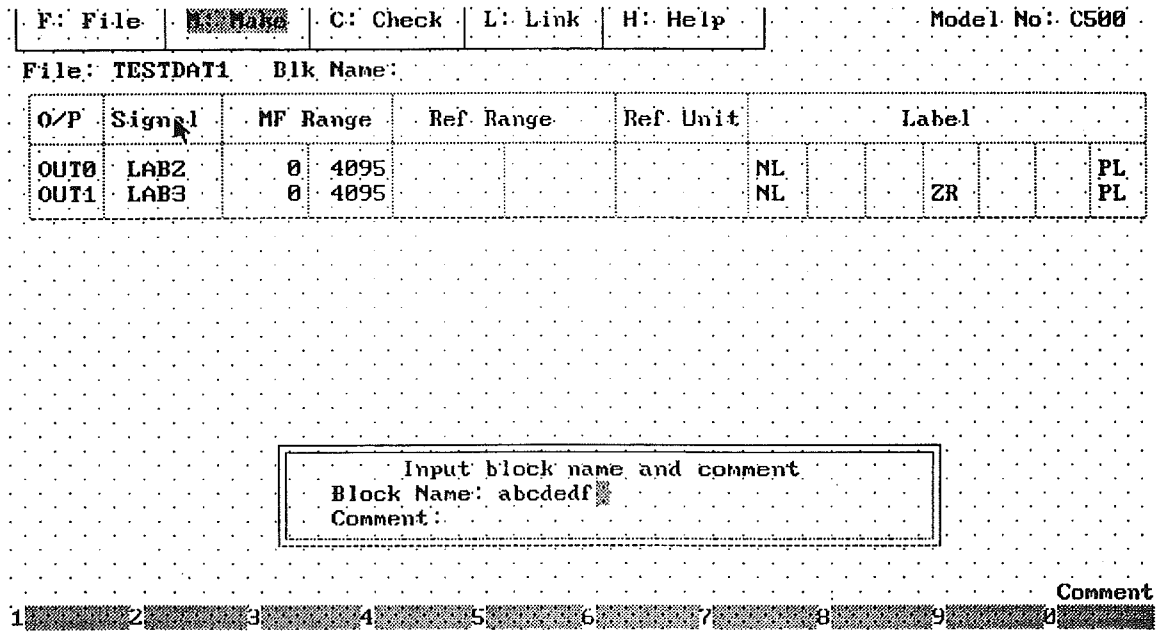
   If you press the Home Key, I/O comment at the cursor is deleted.

4. Input comments and press the Enter Key.
5. By pressing the F10 Key or right clicking, the MF display data is recovered. At this time, the input I/O comment is confirmed and loaded into editing data.

Block

1, 2, 3...

1. Select "F7: Comment" on the MF display. The message "Select one of the following to comment" is displayed at the function menu of the lower part of the display.
2. Select "F2: Block". A block name and comment input window are displayed.



A block name is limited to upper-case 8 characters. A comment is limited to 30 characters.

3. The cursor moves between a block name and comment with the Up and Down Keys.

   The block name and comment at the cursor are deleted by pressing the Home Key.

4. Input block name and comment, and press the Enter Key. The input block name and comment are confirmed.

or By right clicking, the MF conclusion data display appears. In this case, the input block name and comments are not confirmed.

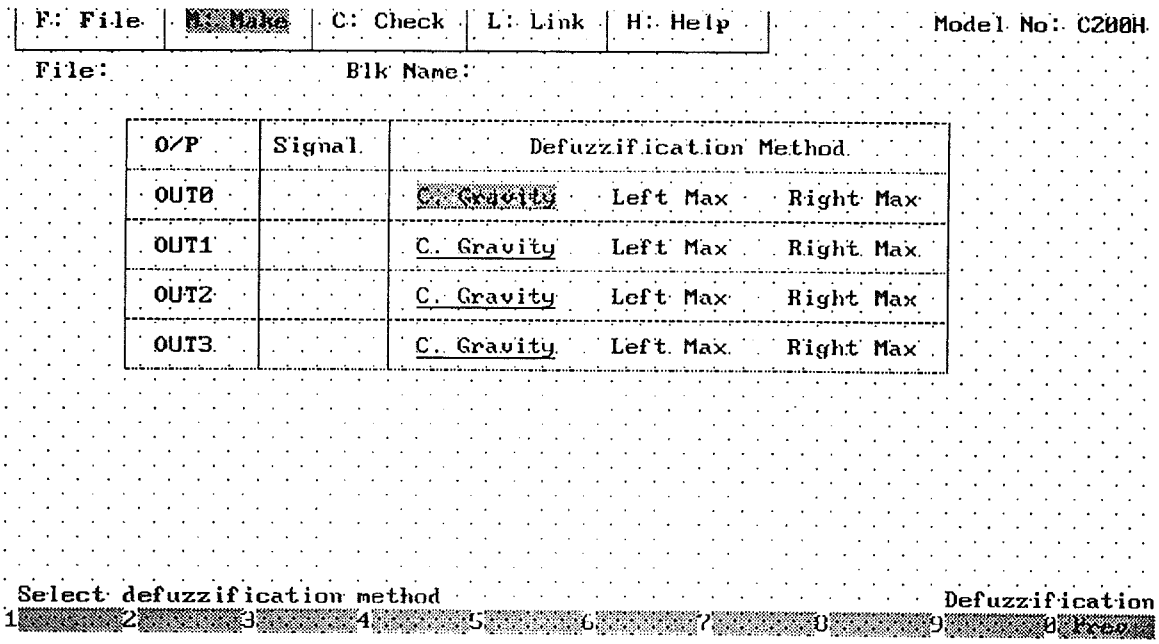
Returning to Previous Display

"F10: Prev" will return you to the previous display.

7-4 Defuzzification

For the C200H, the user is permitted to select the defuzzification method. For C500, the defuzzification method uses the center of gravity only. To select defuzzification use the following procedure.

1, 2, 3... 1. Select the main menu "M: Make". Display the pulldown menu under "M: Make". Then, select "D: Defuzzification".

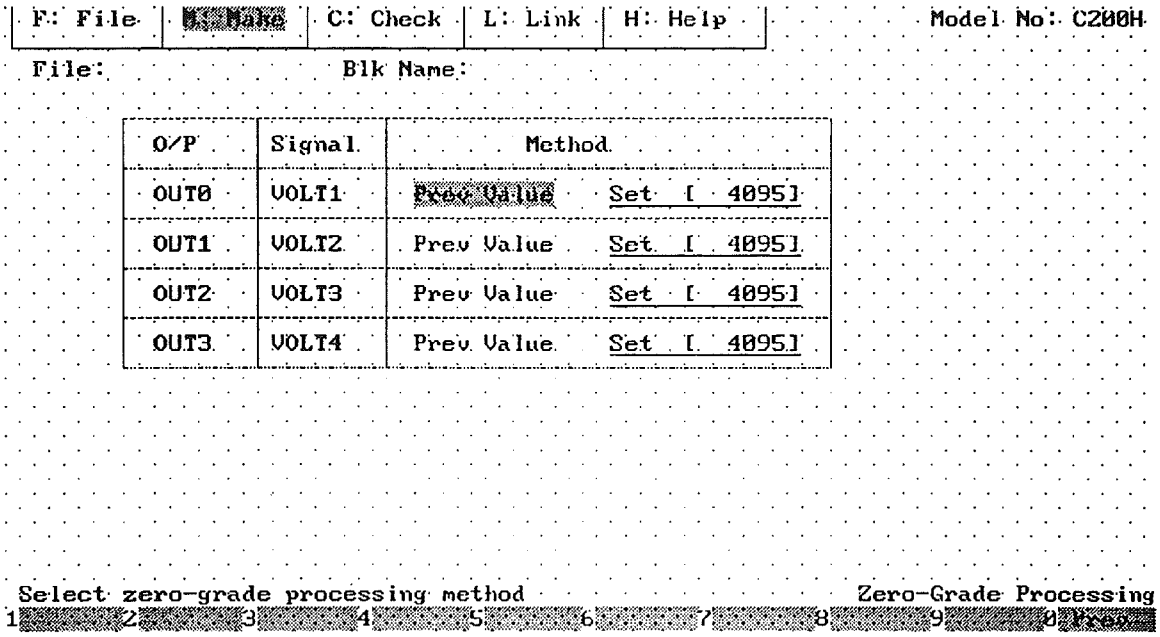


2. Use the Up and Down Keys to select the output signal. Then, the defuzzification method for that output signal can be selected by the Left and Right Keys.
3. When you wish to return to the main menu, press the Alt Key together with the key corresponding to the letter on the main menu or move the mouse cursor to the desired main menu item and left click.

7-5 Zero Grade Processing

To select the output method for zero grade processing use the following procedure

1, 2, 3... 1. Select the main menu "M: Make". Display the pulldown menu under "M: Make". Select "Z: Zero Grade".



2. Use the Up and Down Keys to select the output signal. You can choose to retain the previous value or set to a new fixed value (0 to 4095) for zero grade processing by using the Left and Right Keys.
3. When you wish to return to the main menu, press the Alt Key together with the key corresponding to the letter on the main menu or move the mouse cursor to the desired main menu item and left click.

SECTION 8
Check Operations

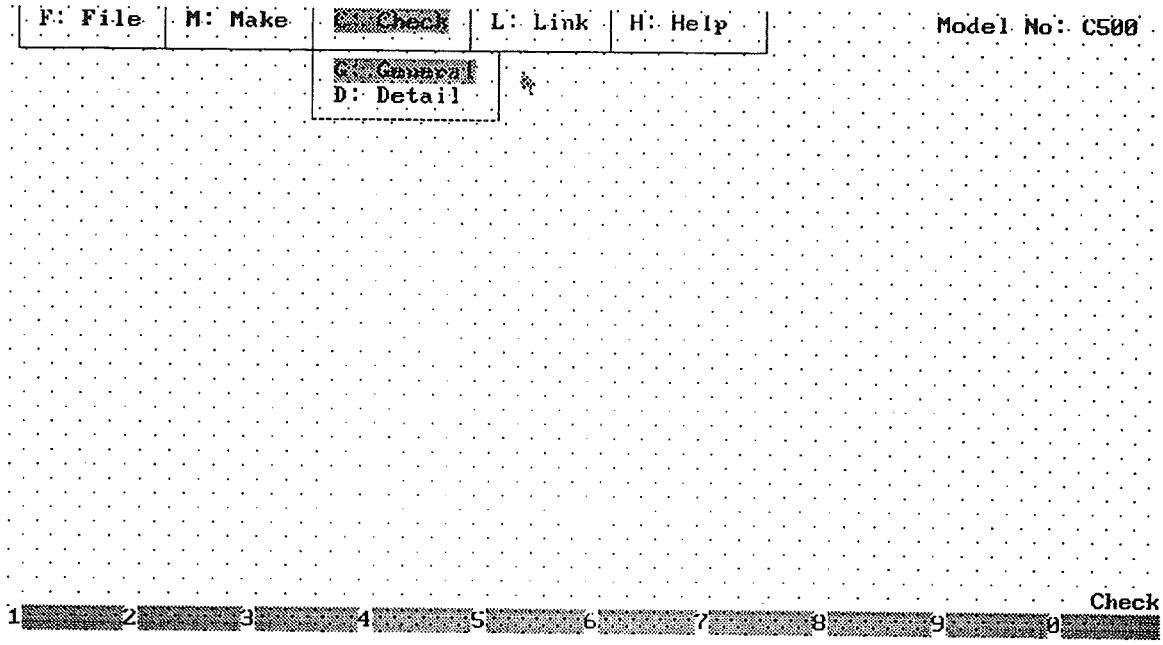
This section provides details on Check operations and pulldown menus items.

8-1 Pulldown Menu

For the main menu item "C: Check", the following operations can be made:

"G: General": Checks if the checking unit is in a form to infer knowledge.

"D: Detail": Checks if the editing unit is in a form to infer knowledge and redundancy.



After checking, any errors that have occurred appear on each display of the pulldown menus "M: Membership Function" and "R: Rule" of "M: Make".

8-2 Contents of Check Items

There are two types of check items, "G: General" and "D: Detail".

"General" checks whether the knowledge can be inferred by the unit and "Detail" checks redundancy of knowledge.

The following tables show check items for both types of checks.

General Check

The following table is for a "General" check. The numbers in the tables refer to the numbers that appear on the "General" check displays in *8-6 Improper Knowledge Definition and Display Method.*

Data type	No.	Check item
Rule	01	Label missing in a condition/conclusion.
	02	Signal missing in a condition/conclusion.
	03	Conclusion missing in a rule.
	04	Condition missing in a rule.
	05	More than 7 labels for a signal name used.
	06	More than 8 signal names in conditions used.
	07	More than 4 (2 for C500 only) signal names in conclusions used.
MF	13	Signal name used in rule is not identified.
	14	Label used in rule is not defined.
	15	MF of a label used in rule in not defined.
	16	Redefinition of signal name.
	17	Redefinition of label.

Detail Check

The following table is for a "Detail" check. The numbers in the tables refer to the numbers that appear on the "Detail" check displays in *8-6 Improper Knowledge Definition and Display Method.*

Data type	No.	Check item
Rule	01	Same as those for the "General" check.
	02	
	03	
	04	
	05	
	06	
	07	
	08	Duplicate signal name in conditions of a rule.
	09	Duplicate signal name in conclusions of a rule.
	10	Same condition but inclusive conclusions.
	11	Same conclusions but inclusive conditions.
	12	Same conditions but contradicting conclusions.
MF	13	Same as those for the "General" check.
	14	
	15	
	16	
	17	
	18	Label missing for a signal name.
	19	Signal name missing for a label.
	20	Membership function missing for a label.
	21	Label missing for a membership function.

8-3 Check During Knowledge Download

When downloading editing knowledge to the unit using "D: Download" in "L: Link", check the editing knowledge before downloading. At this time, even if "C: Check" is not selected, the check will be performed by "General Check". When there is no error in the knowledge, downloading knowledge to the unit is possible.

If errors are found by the check, a message "Verification error" is displayed above the function menu at the lower part of the display and knowledge downloading will not be performed.

8-4 Check Items for Knowledge Download

Before starting "C: Check", confirm that there is a rule data in editing knowledge. If rule data does not exist, a message "Editing knowledge not found" is seen at the bottom left of the display.

1, 2, 3...

1. Select the main menu item "C: Check".
2. Select the pulldown menu item "G: General", to check the knowledge produced by "M: Make".

   "General" check is the minimum necessary check at the time of downloading. When no error is found by "General" check, it is possible to download knowledge.

   After "General" check, a table of check results is displayed. (Refer to *8-6 Improper Knowledge Definition and Display Method.*)

In case of checking data which uses 128 rules, 8 conditions, 2 conclusions, and 7 labels, it takes 2 seconds before a table of check results is displayed.

8-5 Check Including Knowledge Redundancy

Before starting "C: Check", confirm that there is a rule data in editing knowledge. If rule data does not exist, a message "Editing knowledge not found" is seen at the bottom left of the display.

1, 2, 3...

1. Select the main menu item "C: Check". The pulldown menu is displayed under "C: Check".
2. Select the pulldown menu item "D: Detail" to check the knowledge file created by "M: Make".

   "Detail Check" performs a "General Check" first and then for redundancy of knowledge afterwards. As for check items of "Detail check", refer to *8-2 Contents of Check Items.*

   If there are errors items discovered during "General" check, "Detail" check cannot be performed. Even if there are errors items discovered during "Detail check", if there were no error items discovered during "General" check, downloading of knowledge is still possible.

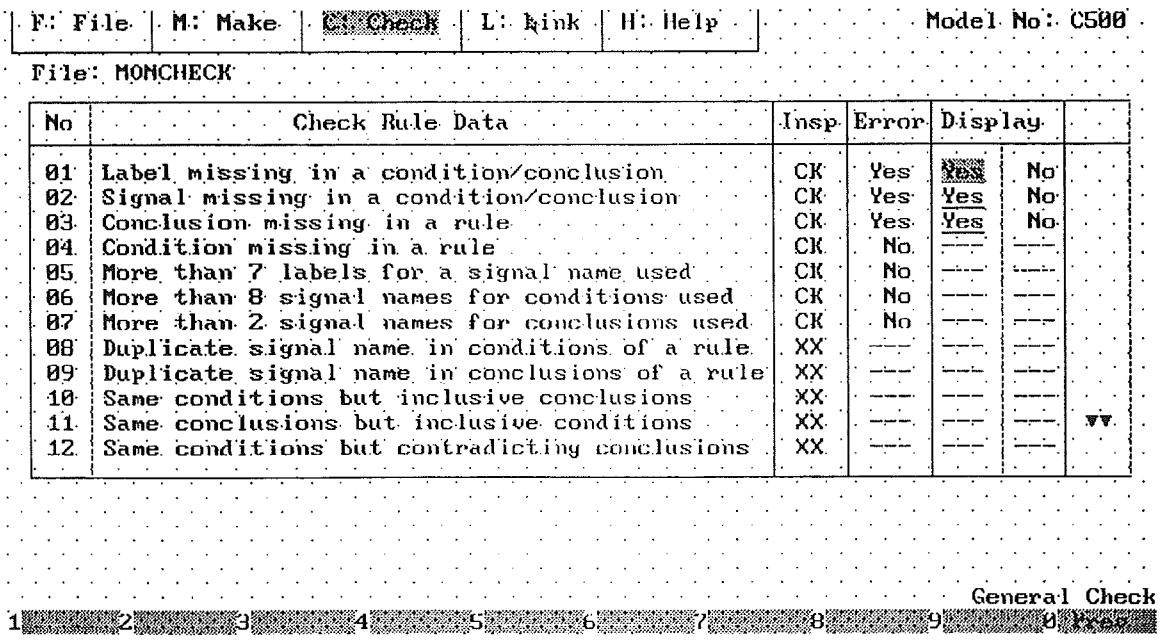
   After "Detail" check, a table of check results is displayed. (Refer to *8-6 Improper Knowledge Definition and Display Method.*)

   In case of checking data which uses 128 rules, 8 conditions, 2 conclusions, and 7 labels, it takes 6 seconds before a table of check results is displayed.

8-6 Improper Knowledge Definition and Display Method

After "General" check or "Detail" check, the results are displayed on the check result table. On the check result display, if you press the F10 Key, or move the mouse cursor to the desired main menu item and left click, it is possible to select the main menu item. In case of selecting the wrong main menu item, press the Esc Key or right click to return to the check result display.

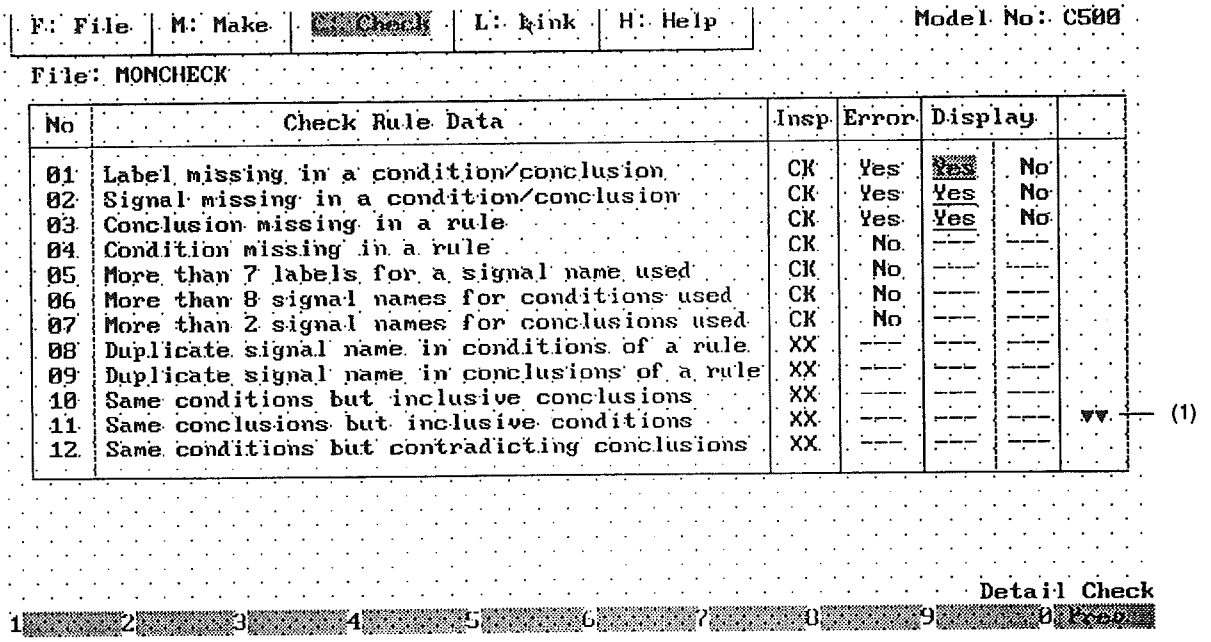
Inside the check result display table, items where "Error" column is indicated as "Yes" become "Yes" for "Display". Items under "Insp" column shown with "——" indicate that they are not checked.



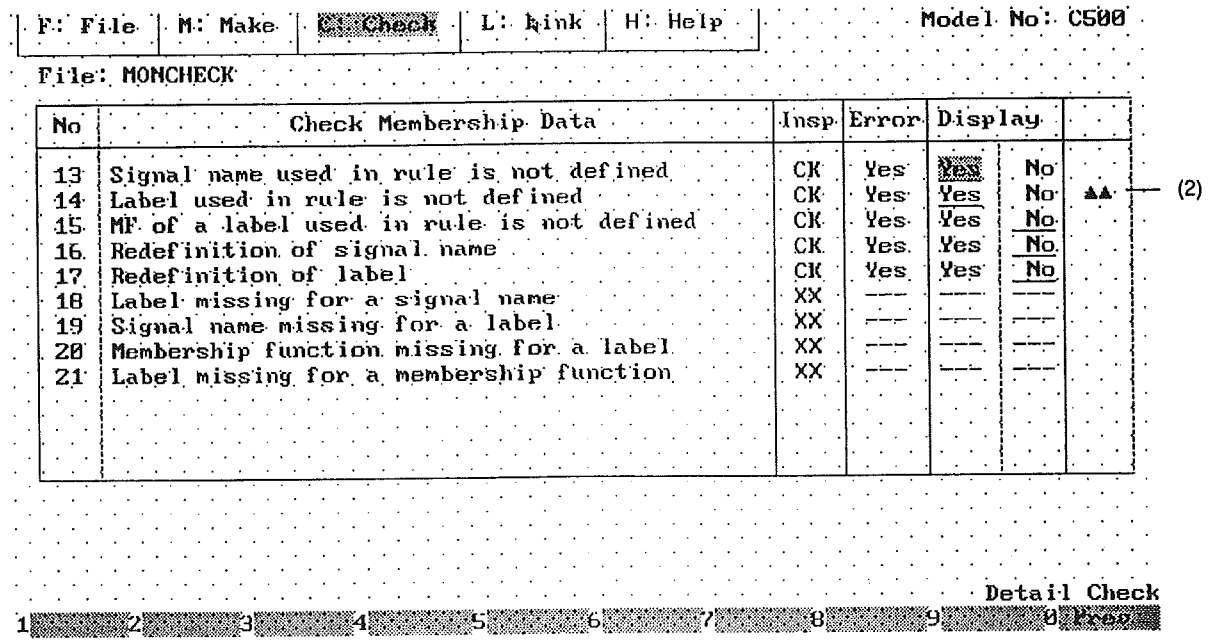
If you press the Up and Down Keys, the cursor moves up and down the items under the "Display" column.

Switch between "yes" and "no" items with the cursor under the "Display" column and confirm by pressing the Enter Key. When you switch a "Display" item using the mouse, move the mouse cursor and left click. The selected item in "Display" is underlined.

Inside the check result display table, if the Page Down Key is pressed or position (1) is left clicked (see the following), the check result of MF data is displayed.



If the Page Up Key is pressed or position (2) is left clicked (see the following), the check result of rule data is displayed.



Display of Error Data

If you set "Display" of errors as "Yes" on the check result table, error data is displayed in lower-case letters for "R: Rule" or "M: Membership Function" under "M: Make". The list of error data is seen in the following table.

No.	Error	Explanation
1	Check existence of label setting	If label is absent in a condition/conclusion, the corresponding signal name will be displayed in lower-case characters.
2	Check existence of signal name setting	If signal name is absent in a condition/conclusion, the corresponding signal name will be displayed in lower-case characters.
3	Check existence of conclusion	If conclusion is absent in a rule, the condition (signal, all labels) will be displayed in lower-case characters.
4	Check existence of condition	If condition is absent in a rule, the conclusion (signal, all labels) will be displayed in lower-case characters.
5	Check number of label	If more than 7 labels are used for a signal in a rule, the labels will be displayed in lower-case characters.
6	Check number of input signal	If more than 7 input signals are used, the signals will be displayed in lower-case characters (labels are also lower-case).
7	Check number of output signal	If more than 4 output signals are used, the signals will be displayed in lower-case characters (labels are also lower-case).
8	Same signal in a condition	If signal name is duplicated in a condition, the signal name and labels will be displayed in lower-case characters.
9	Same signal in a conclusion	If signal name is duplicated in a conclusion, the signal name and labels will be displayed in lower-case characters.
10	Multiple use of rules with same condition and conclusion	If more than one rule has the same conclusion and condition, all duplicate rules (condition, conclusion, signal label) will be displayed in lower-case characters.
11	Check inclusive relationship of rules	If the conclusion of a rule has inclusive relationship with that of other rules, all related rules will be displayed in lower-case characters.
12	Rules with the same condition and same output name, but different label name	If several rules have the same condition and output signal name but different label name, all related rules will be displayed in lower case characters.
13	Check signal names in rules	If signal name used in a rule is not defined in MF data, the signal will be displayed in lower-case characters (labels are also lower-case).
14	Check label names in rules	If label used in a rule is not defined, the label will be displayed in lower-case characters (signal names are also lower-case).
15	Check MF data in rules	If the MF of a label used in a rule is not defined, the label will displayed in lower-case characters (signal name is also lower-case)
16	Duplicate signal	If a signal name is redefined in MF data, the signal name in MF list display will be displayed in lower-case characters.
17	Duplicate label	If a label is redefined in MF data, the label in MF list display will be displayed in lower-case characters.
18	Check existence of label setting	If the label of a signal name is absent in MF data, the signal name in MF list display will be displayed in lower-case characters.
19	Check existence of signal setting	If the signal name of a label is absent in MF data, the label in MF list display will be displayed in lower-case characters.
20	Check existence of MF shape	If the MF shape of a label is absent in MF data, the label in MF list display will be displayed in lower-case characters.
21	Check existence of label setting for MF	If the label of a MF is absent, the signal name and all labels will be displayed in lower-case characters.

SECTION 9
Link Operations

This section provides details on Link operations and pulldown menu items.

9-1 Pulldown Menu

The main menu "L: Link" has the following operations:

Operation	Function
A: Affirm	Get the Unit setting data (knowledge, inference)
C: Compare Know	Compare acquired unit knowledge and editing knowledge.
I: Inference	Control the unit inference active/idle status.
D: Download	Download editing knowledge to the unit.
M: Monitor	Monitor the Unit inference condition.
Z: Initialize	Initialize the Unit.

For the pulldown menu of "L: Link", "A: Affirm" must be operated in the following cases:

- When "L: Link" is selected for the first time after starting up the software.
- When the error message "Communication error" or "Time out" is seen at the bottom left of the display.

When "Z: Initialize" is selected before "A: Affirm", control will be passed to invoke "A: Affirm" automatically.

If the unit is not inferencing, you cannot operate "M: Monitor".

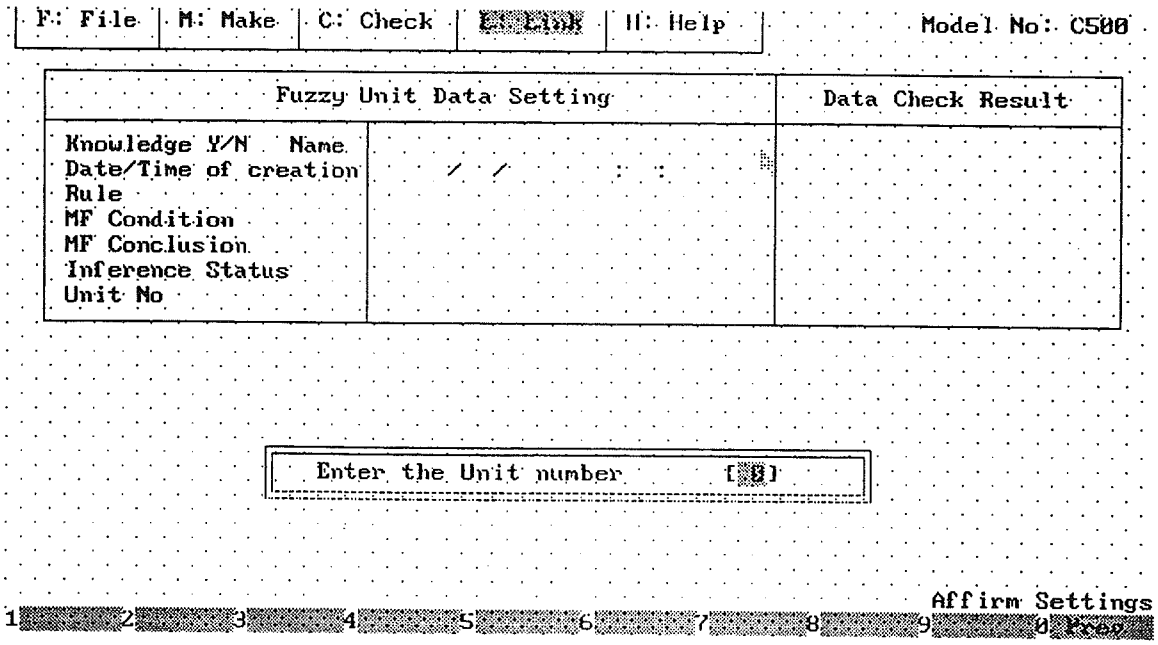
Caution There is no function in this software to obtain the setting data of the Unit automatically when the Unit is connected or when the Unit is changed. Make sure "A: Affirm" is operated.

9-2 Confirm Unit Setting

To confirm the Unit setting, use the following procedure.

1, 2, 3...

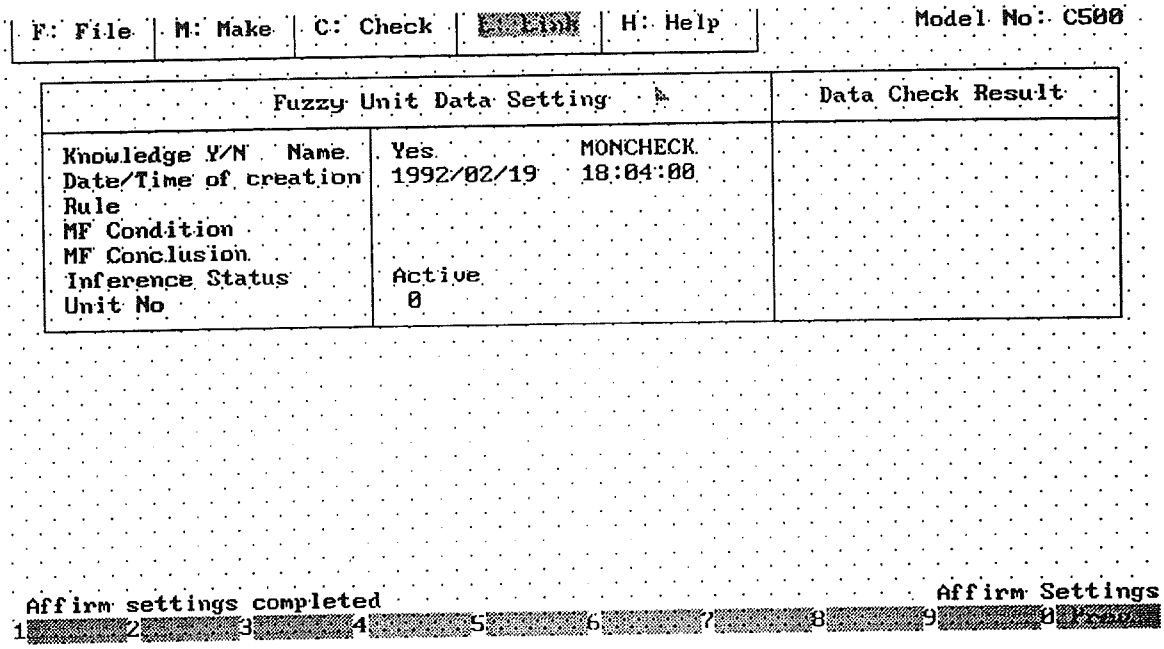
1. Select the main menu item "L: Link". The pulldown menu is displayed under "L: Link".
2. Select "A: Affirm" from the pulldown menu. The window to input the unit communications number is displayed.



The default Unit number after startup of the software is 0. If you set the Unit number afterwards, the set Unit number is displayed.

3. Input the Unit number and press the Enter Key. Then the setting data (knowledge, inference) is loaded. The Unit number is any value between 0 to 31.

   When you load the knowledge into the Fuzzy Logic Unit, "FUZZY UNIT SETTING DATA" will display the following information: presence of knowledge, knowledge data name (if knowledge is present), year/month/day/hour/second of knowledge created, rule/condition/conclusion MF block name (for C200H only), and inference status.



In order to look at the details of knowledge, recover to edited knowledge in "R: Recover" under "F: File". (Refer to *6-5 Recover*)

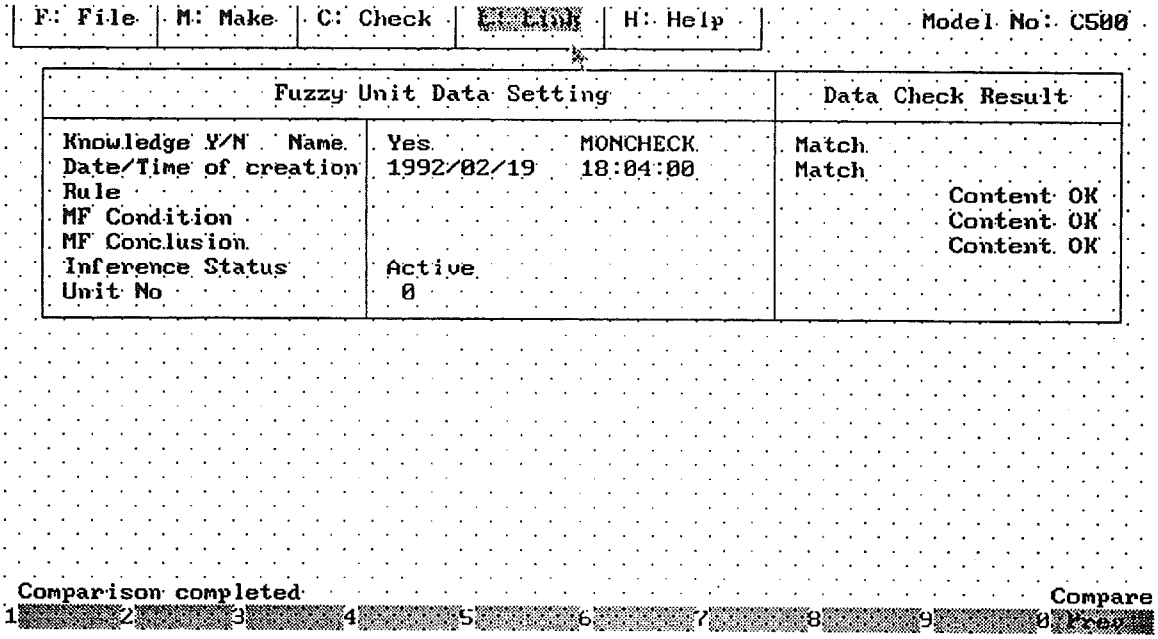
If there is no knowledge in the Unit, a message "No knowledge" is displayed at the bottom left of the display.

9-3 Compare Unit Knowledge and Editing Knowledge

To compare Unit knowledge and editing knowledge, use the following procedure.

1, 2, 3...

1. Select the main menu item "L: Link". The pull down menu is displayed under "L: Link".
2. Select "C: Compare". Compare Unit knowledge and editing knowledge.
   The result of comparison is displayed under "DATA CHECK RESULT" at the right side of the display.



If there is no knowledge in the Unit, a message "No data" is displayed at the bottom left of the display.

In the following cases, a message "Content NG" is displayed at the "DATA CHECK RESULT" column:

a) no editing knowledge

b) error data in editing knowledge

c) contents of editing knowledge and Unit knowledge do not match

3. If there is an error data in the editing knowledge, confirm knowledge by going to "C: Check". (Refer to *8-4 Check Items for Knowledge Download*)

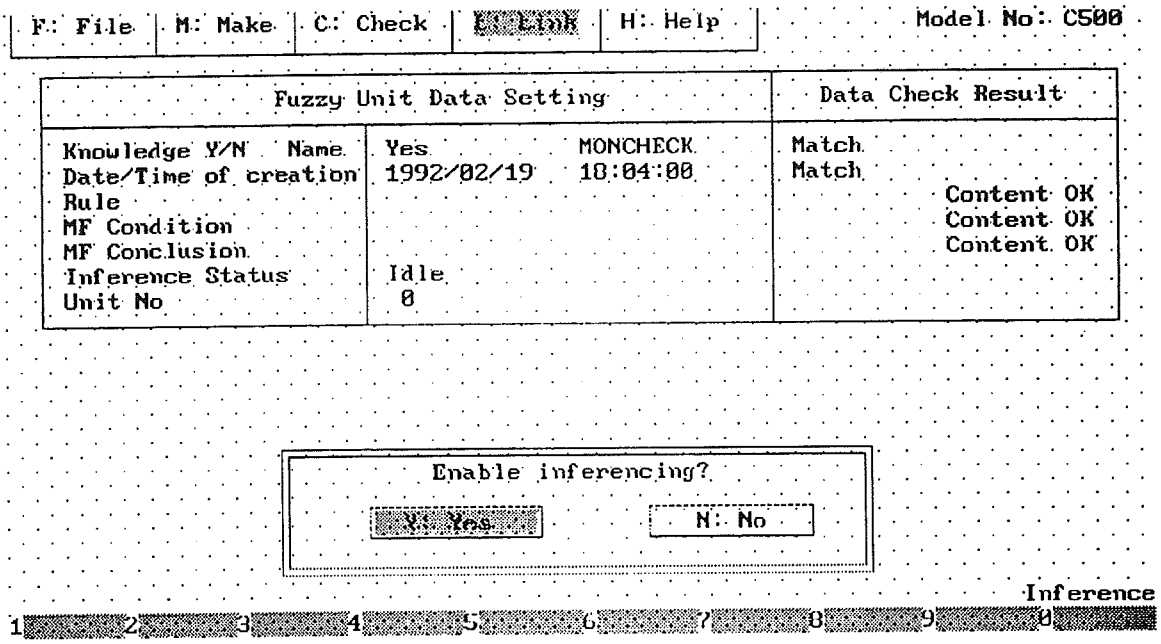
9-4 Control Unit Inference Active/Idle

To control Unit inference, use the following procedure.

1, 2, 3...

1. Select the main menu item "L: Link". The pull down menu is displayed under "L: Link".
2. Select the pulldown menu item "I: Inference".

   The confirmation window "Enable inferencing?" of Unit inference is displayed. If the current inference status is "Active", the confirmation window "Disable inferencing?" will be displayed. If the current inference status is "Idle" , the confirmation window "Enable inferencing?" will be displayed.



3. If the Unit is inferencing when you select "Y: Yes", the Unit condition is changed to "idle". If the Unit is not inferencing, the Unit condition is changed to "active".

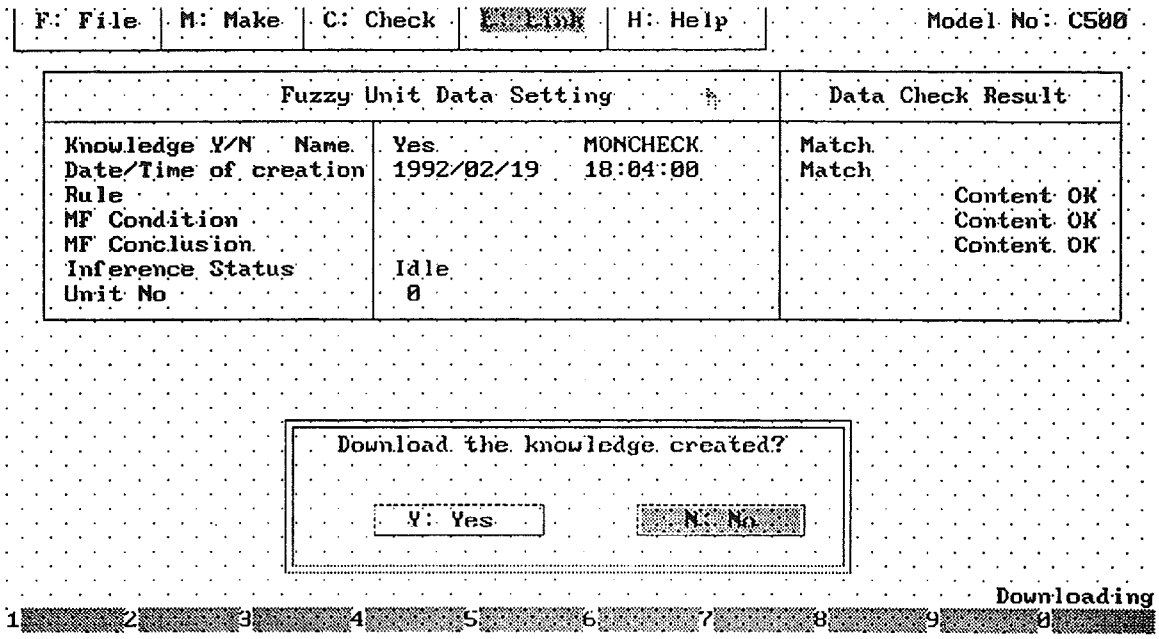
9-5 Download Editing Knowledge to Unit

To download editing knowledge to the Unit, use the following procedure.

1, 2, 3...

1. Select the main menu item "L: Link". The pulldown menu is displayed under "L: Link".
2. Select the pulldown menu item "D: Download".

When editing knowledge is downloaded, the confirmation window "Download the knowledge created?" is displayed.



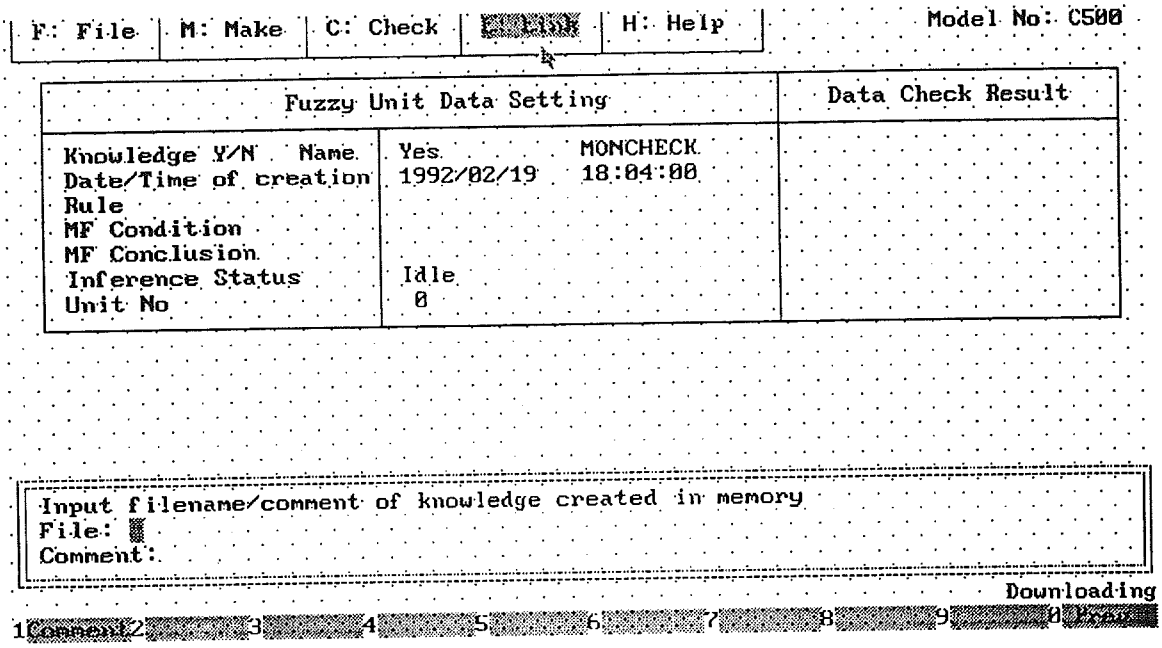
3. If the Unit condition is inferencing, a message "Inferencing is active now" will be displayed inside the window. When you download editing knowledge to the Unit, select "Y: Yes", and when you wish to cancel, select "N: No".
4. If you select "Y: Yes", editing knowledge is checked. (Refer to *8-3 Check During Knowledge Download*) If any errors are found by the check, a message "Verification error" is displayed at the bottom left of the display and downloading to the Unit cannot proceed. If "X: General" under "C: Check" has already been performed and there are no errors in editing knowledge, the general check is omitted.

   The window displays a message "Downloading knowledge to fuzzy unit" and editing knowledge will be downloaded to the Unit.

   When downloading is finished, the window displays a message "Uploading the knowledge from fuzzy unit for comparison" at the bottom left of the display and knowledge is loaded from the Unit. Then the loaded Unit knowledge and knowledge in the tool are compared.

   After the comparison, a message "Downloading completed" is displayed at the bottom left of the display. Also, the results of the comparison are displayed under the "DATA CHECK RESULT" column.

If editing knowledge is not saved as a file and does not have a data name/file name, a window message "Input data name/comment." appears at the lower part of the display.



5. When you input a comment, select "F1: Comment". Input a comment and press the Enter Key.
6. Input a data name of knowledge and press the Enter Key. After that, a confirmation window for downloading "Download the knowledge created?" is displayed.

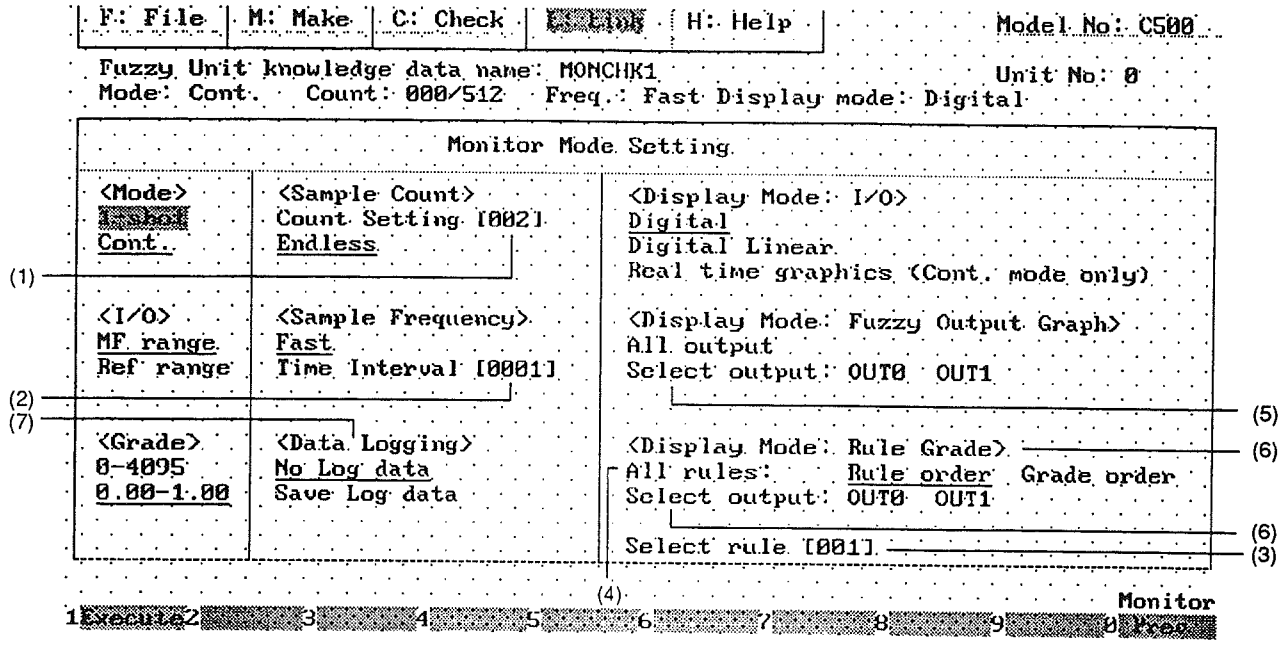
Caution In case of downloading editing knowledge, comments are not downloaded. Therefore, comments are not restored in "R: Restore" under "F: File". The Unit can store only one set of knowledge. If knowledge is downloaded, the previously stored knowledge will be overwritten.

9-6 Monitor Inferencing Condition of Unit

To monitor the inferencing condition of the Unit, use the following procedure.

1, 2, 3...

1. Select the main menu item "L: Link". The pulldown menu is displayed under "L: Link".
2. Select "M: Monitor". It shows a setting display to execute the monitoring process.
3. When you wish to return to the main menu, press the Alt Key together with the key corresponding to the letter on the main menu or move the mouse cursor to the desired main menu and left click.



The underlined item is the current setting.

4. The highlight bar moves up and down using the Up and Down Keys or it can move from column to column by using Tab Key to go forward and Shift+Tab Keys to go backwards. The highlight bar also moves by moving the mouse cursor to the item which you want to set and left-clicking the mouse button.

5. If you press the Enter Key or left click the mouse button, the item is displayed with an underline.

6. If you select one of positions (1), (2), or (3) (see following table and previous diagram), it is possible to input the numbers within the square brackets seen on the display.

Position	Item	Range of input no.
(1)	<Sample Count> count setting	002 to 512
(2)	<Sample Frequency> time interval	0001 to 3600
(3)	<Display Mode: Rule Grade> select rule	001 to 128

- If the time set by "Time Interval" cannot be maintained, after monitoring, it automatically becomes "fast".
- If the time set cannot be maintained, a message "Frequency cannot be maintained" is displayed at the bottom left of the display.
- When you select "Display Mode: Rule Grade", select either by "Rule Order" or "Grade Order".
- If you select either position (5) or (6), selection of signal name on the right side becomes possible. The cursor moves right and left using the Right and Left Keys.

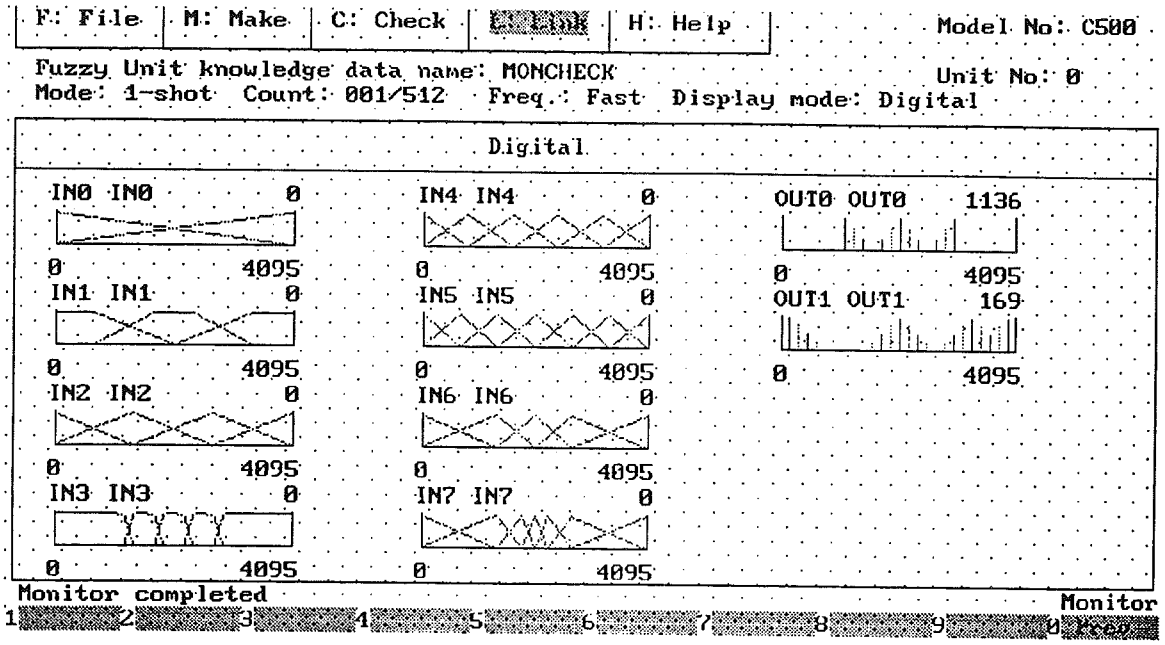
Position	Item	Selection method
(4)	—	—
(5)	<Fuzzy Output Graph> output signal selection	Select one output you want to display.
(6)	<Rule Grade> output signal selection	
(7)	<Data Logging>	Select this item to log monitor items: inputs, outputs, and rule grades to a log file. By default, system will log data until user stops monitoring. However, if not enough memory is available, a message will warn the user of the maximum number of counts that can be logged.(See Note below)

Note The maximum memory required to log one count is 280 bytes for the C200H and 30 bytes for the C500. If insufficient disk memory exits to store log data, data logging will be aborted and the message "Not enough disk space: Save log data aborted. Hit any key to continue." will be displayed. For the C200H, use the CHKDSK command to confirm available memory. The number of rules reduces free memory from 590 K-bytes to 512 K-bytes with 50 rules, to 436 K-bytes with 64 rules, and to 234 K-bytes with 128 rules.

7. Select "F1: Execute". Based on the set items, the monitor display is shown.
8. If a message "setting error" appears at the bottom left of the display, change the monitor setting. Setting monitor error occurs in the following cases:
   - "Real time graphic display" is selected with "1 shot".
   - When "Select output" is chosen and signal name is not selected.
   - When "Select rule" is selected under "rule grade display" and input rule no. exceeds maximum rule no. of Unit knowledge.

   In above cases, set the items again.
9. If there is a reference range data in Unit knowledge when "range" is specified in "reference", it is displayed in reference range. When there is no reference range data in Unit knowledge, even if "range" is specified to "reference", it is automatically displayed in the MF range. No reference range data occurs with the C500 model.
10. When the count reaches 512, it stops and will not increase.
11. On each monitor display, if you select "F10: Prev", the monitoring stops and the monitor setting display appears.
12. After monitoring, a message "Monitor completed" is displayed at the lower portion of the display.

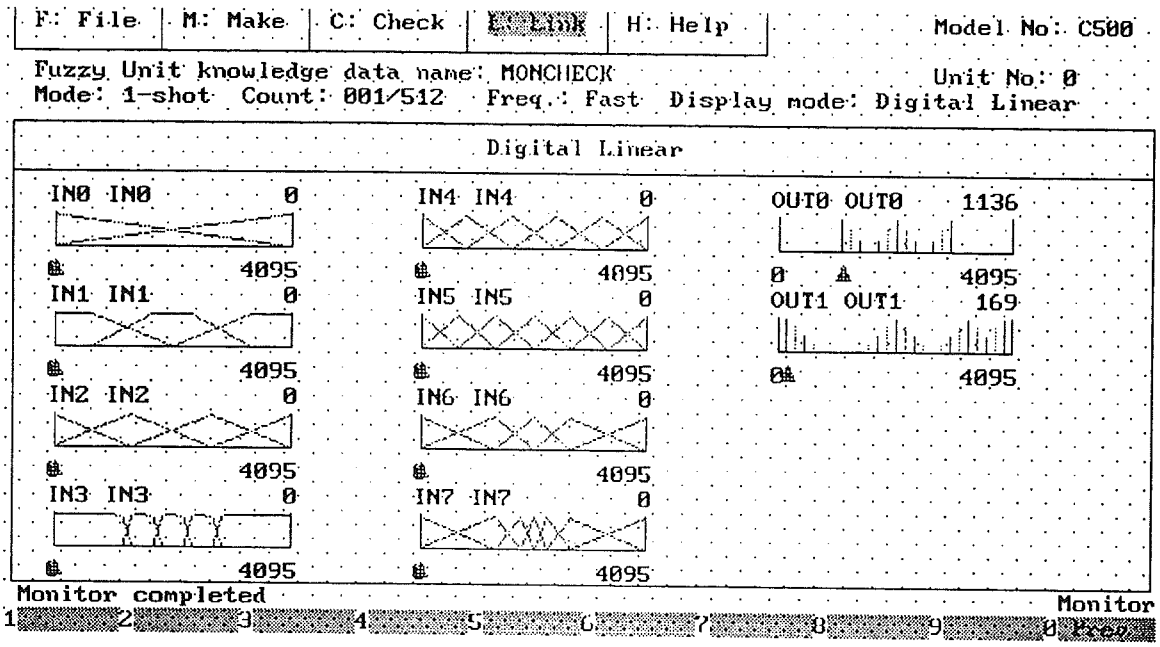
Input/Output Digital Display Monitor



Input value (IN0, IN1, IN5) and output value (OUT0) are displayed in the above example. A maximum of 5 input values (IN0 to IN4) and 2 output values (OUT0 to OUT1) can be displayed. I/O which is not used for inference is not displayed with a number. The displayed conclusion MF is a set shape and does not change according to input value.

In zero grade processing, the output values will be displayed in reverse.

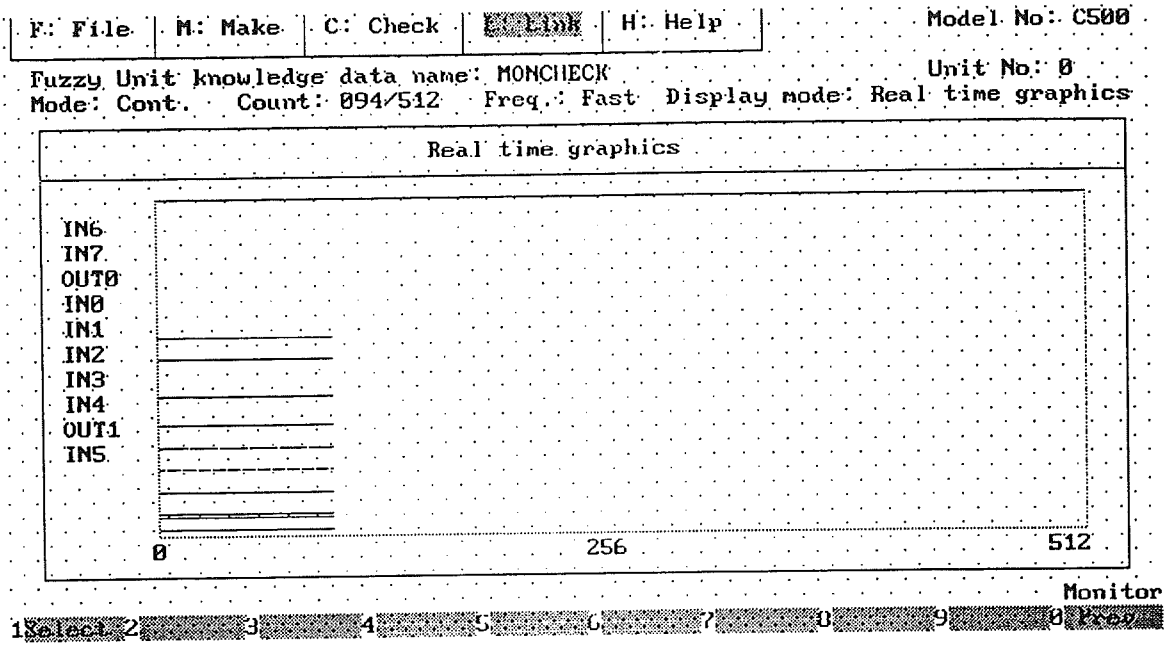
Input/Output Digital Linear Display Monitor



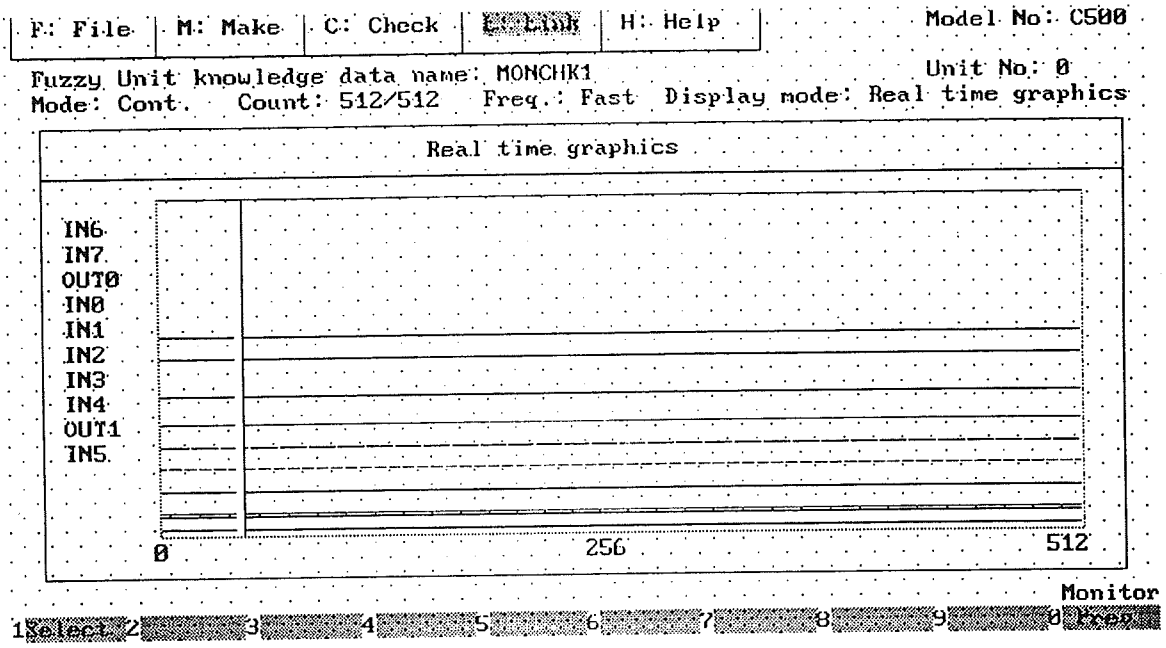
Input and output values are displayed by number and ▲. An I/O not used for inference is not displayed graphically. The displayed conclusion MF is a set shape and does not change according to input value.

In zero grade processing, the output values will be displayed in reverse.

Input/Output Real-time Graphical Display Monitor

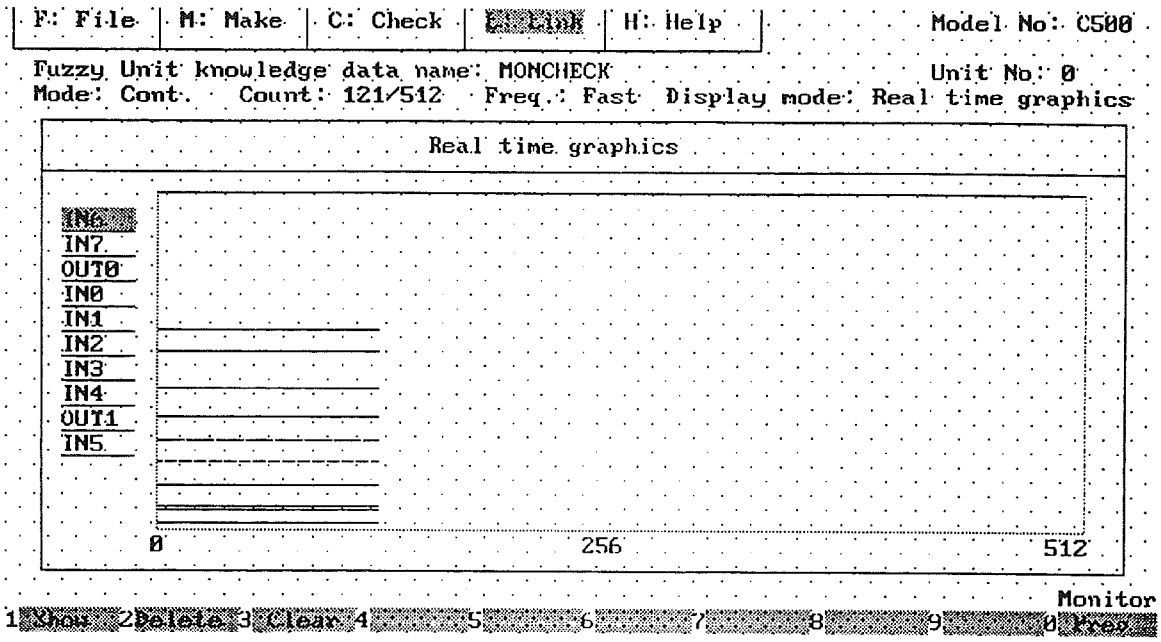


The displayed conclusion MF is a set shape and does not change according to input value. For the C200H, in cases of zero grade processing for an output signal, the signal name will appear in reverse. If the count reaches 512, a vertical line is drawn across the display.



1, 2, 3... 1. Select "F1: Select" when you view the graph display by each signal. The function menu display at the lower part of the display will be switched. Also,

each signal name is underlined and the top signal name is displayed by the cursor.



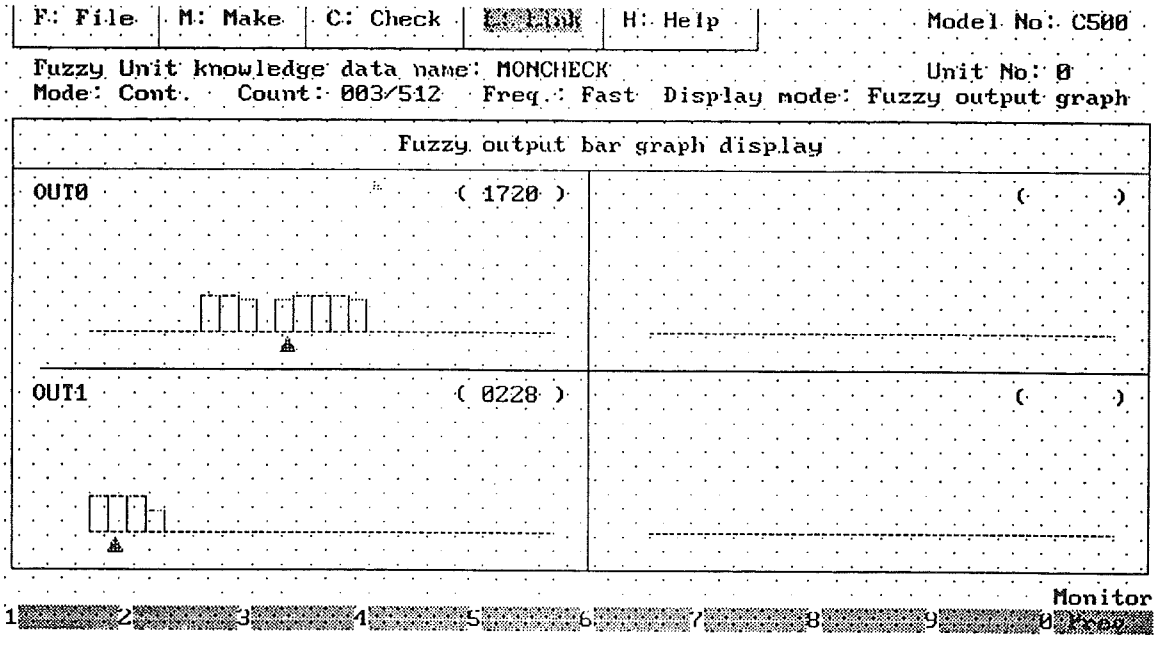
The cursor moves up and down by the Up and Down Keys. The cursor also moves by moving the mouse cursor to desired I/O signal name and left-clicking.

2. If you select "F2: Delete", the graph of input and output values of signal at the cursor can be deleted.

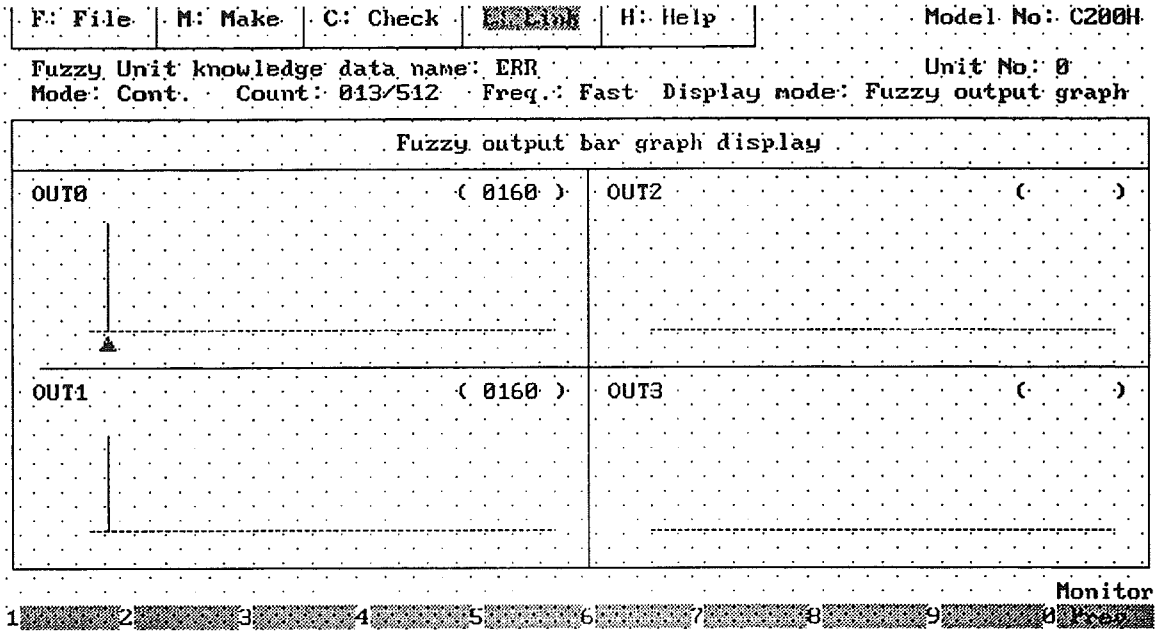
or If you select "F1: Display", the graph of input and output values of the signal at the cursor can be displayed.

or If you select "F3: Clear", the graph of input and output values of all signals can be deleted.

Fuzzy Output Bar Graph Display Monitor

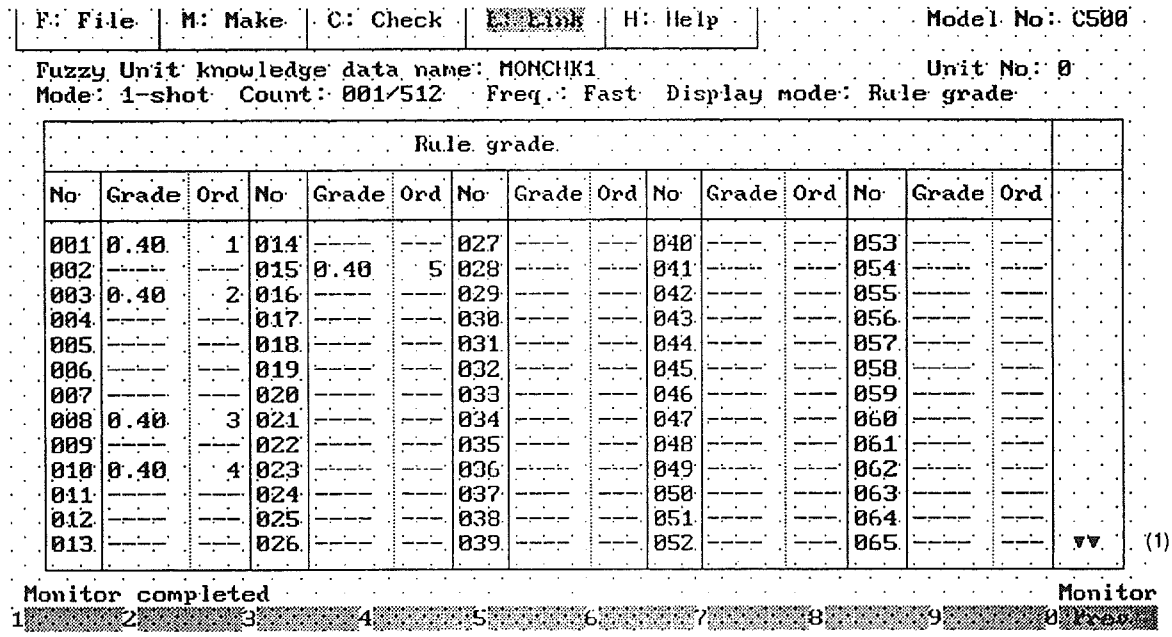


Output values (OUT0, OUT1) for C500 are displayed in the previous example.

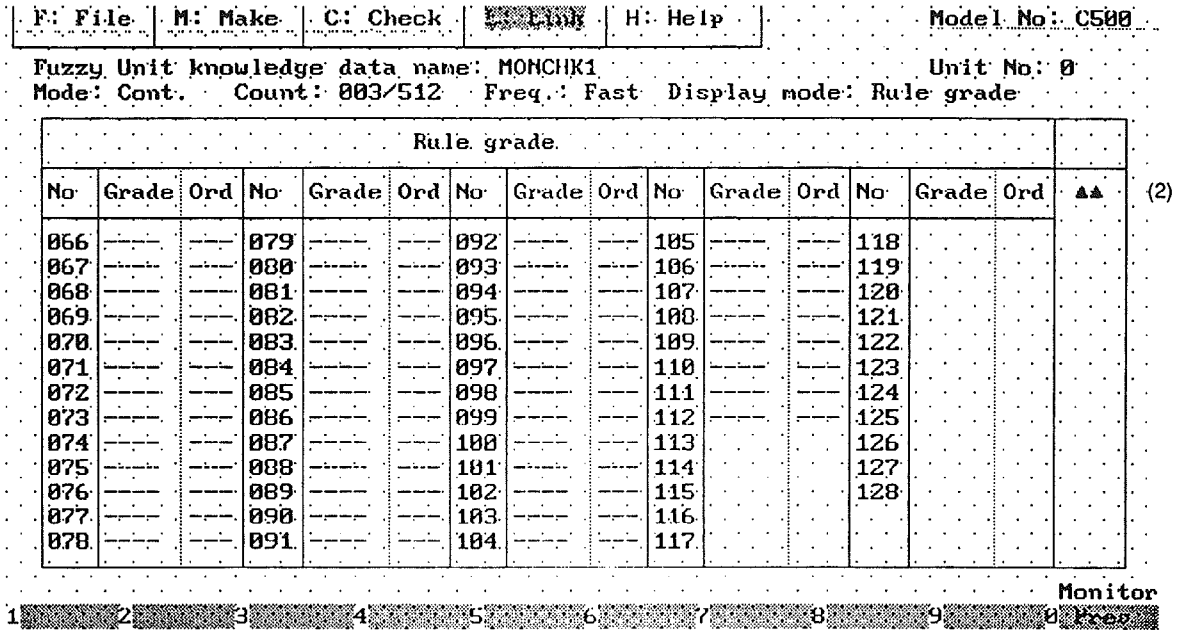


Output values (OUT0, OUT1, OUT2, OUT3) for C200H are displayed here. The displayed conclusion MF is a set shape and does not change according to input value. Bar graph shows each label grade. Output which is not used for inference is not displayed.

Rule Grade Digital Display I Monitor (All Output Display)



Grade of output value from all output signals to each rule is displayed by rule and order.



In case that rule number exceeds 65, it is necessary to see the next page in order to see the whole information. Refer to the displays in the previous two diagrams for mouse click positions (1) and (2).

Key input	Mouse click	Rule order	Grade order
Page Down Key	(1)	Next page (rule no. 066 to 128) of the currently displayed rule grade list is displayed.	Next page (63 rules) of the currently displayed rule grade list is displayed.
Page Up Key	(2)	Previous page (rule no. 001 to 065) of the currently displayed rule grade list is displayed.	Previous page (65 rules) of the currently displayed rule grade list is displayed.

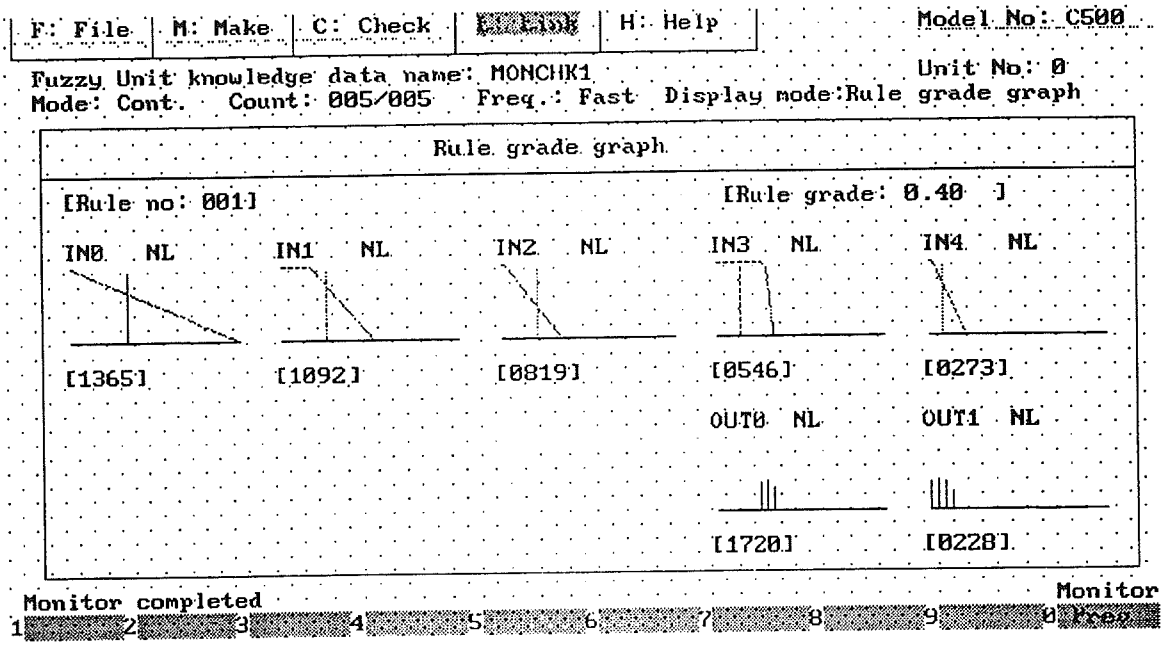
Rule Grade Digital Display II Monitor (Output Selection Display)

Grade of output value from selected output signals to each rule is displayed by rule and order.

In case that rule number exceeds 65, it is necessary to see the next page in order to see the whole information. A method to change pages is same as output display of rule grade number I, as follows: (Refer to "Rule Grade Digital Display I Monitor")

Key input	Mouse click	Rule order	Grade order
Page Down Key	(1)	Next page (rule no. 066 to 128) of the currently displayed rule grade list is displayed.	Next page (63 rules) of the currently displayed rule grade list are displayed.
Page Up Key	(2)	Previous page (rule no. 001 to 065) of the currently displayed rule grade list is displayed.	Previous page (65 rules) of the currently displayed rule grade list are displayed.

Rule Grade Graphical Display Monitor



Rule No. and rule grade value are displayed at the upper part of the rule grade graphical display.

Input and output values from the signal of each condition and conclusion are displayed. (IN0 to IN4/OUT0 to OUT1)

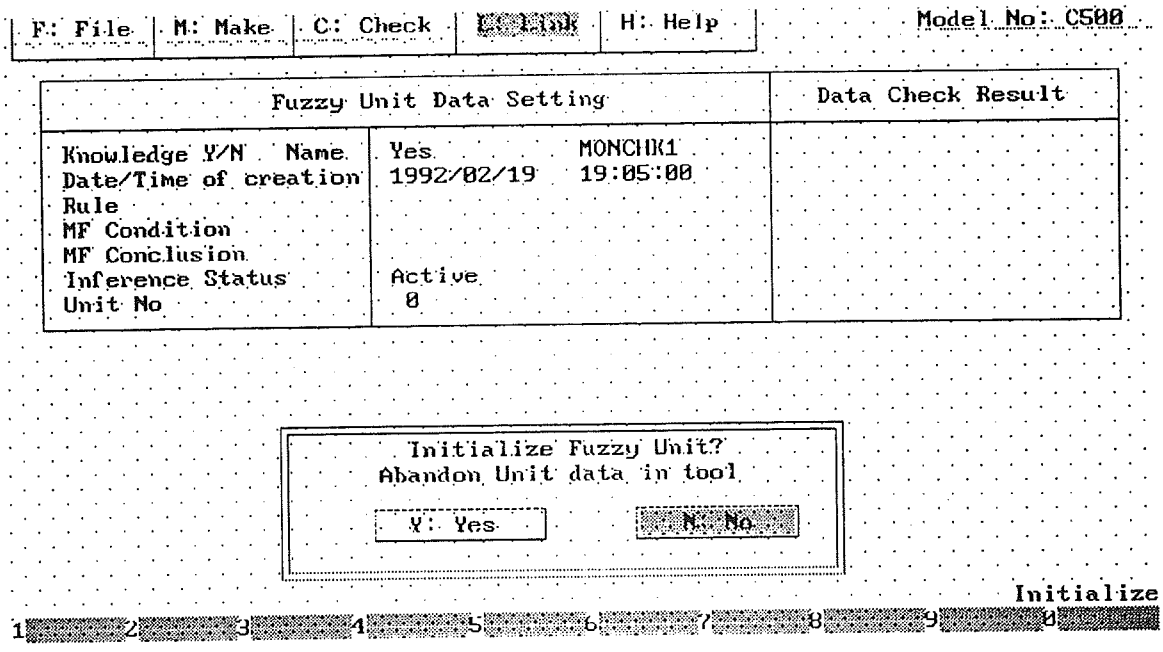
Conditions and conclusions that are not set are not displayed.

9-7 Initialize Unit

To initialize the Unit, use the following procedure.

1, 2, 3...

1. Select the main menu item "L: Link". The pulldown menu is displayed under "L: Link".
2. Select the pulldown menu item "I: Initialize". The confirmation window is displayed.



3. To initialize the Unit, select "Y: Yes", and to cancel, select "N: No". If you select "Y: Yes", the Unit is initialized.

Note If "I: Intialize" is selected before "A: Affirm", control will automatically pass to invoke the Affirm procedure before invoking the Initialize procedure.

9-8 Operation with SYSMAC in Monitor Mode

Before actual operation, check the operation of the knowledge that you have made, using the monitor function of the Fuzzy Support Software and the monitor mode of the SYSMAC Unit.

C200H-FZ001

1, 2, 3...

1. Make the necessary arrangements so that the SYSMAC C200H, CPU, Backplane, Memory Unit, Programming Console, and connecting cables are all set up and ready to operate.
2. Mount the Fuzzy Logic Unit as unit number 0 on the SYSMAC C200H.
3. Connect the Fuzzy Logic Unit to the IBM PC-compatible computer with the connecting cable.
4. Set the SYSMAC C200H to the program mode.
5. Input the ladder program as shown in the table below to the SYSMAC C200H. Follow the key sequence below.

Key operation	Mnemonic
CLEAR MONITOR CLEAR *Password*	—
LD NOT WRITE	LD NOT 0
FUN 2 1 WRITE	MOV(21)
# 8 0 0 8 WRITE	#8008
1 0 0 WRITE	Wd 100
FUN 2 1 WRITE	MOV(21)
# 0 WRITE	#0000
1 0 1 WRITE	Wd101
FUN 2 1 WRITE	MOV(21)
# 8 WRITE	#0008
1 0 2 WRITE	Wd 102
FUN 2 1 WRITE	MOV(21)
# 8 WRITE	#0008
1 0 3 WRITE	Wd 103
FUN 0 1 WRITE	END(01)

(Input: DM 0 to 7, output: DM 8 to 11, error code: DM 12 to 15)

6. Set the SYSMAC C200H to the monitor mode.
7. Download the knowledge to the Fuzzy Logic Unit.
8. Select to monitor the operation of the Fuzzy Support Software and the display mode from the menu.
9. Change the present value of the SYSMAC C200H and monitor the new value.

10. Input the following to the SYSMAC C200H in the monitor mode to change the data.

Key operation	Explanation
CLEAR	Clears the present data.
DM 2 CLEAR	Input 0 or 1 as the input number to read the present input value. The setting change will be displayed.
CHANGE DATA	Input a new value.
WRITE	Press WRITE to change the set value.

C500-FZ001

1, 2, 3...

1. Make the necessary arrangements so that the SYSMAC C500, CPU, Backplane, Memory Unit, Programming Console, and connecting cables are all set up and ready to operate.
2. Mount the Fuzzy Logic Unit as unit number 0 on the SYSMAC C500.
3. Connect the Fuzzy Logic Unit to the IBM PC-compatible computer with the connecting cable.
4. Set the SYSMAC C500 to the program mode.
5. Input the ladder program as shown in the table below to the SYSMAC C500. Follow the key sequence below.

Key operation	Mnemonic
CLEAR MONITOR CLEAR *Password*	—
LD 6 1 1 3 WRITE	LD 6113 (see Note 1) (Always ON)
FUN 8 7 WRITE	WRIT(87)
# 8 WRITE (see Note 2)	#0008
DM 0 WRITE	DM000
0 WRITE	Wd 00
FUN 8 8 WRITE	READ(88)
# 4 WRITE	#0004
1 WRITE	Wd 01
DM 8 WRITE	DM008
FUN 0 1 WRITE	END(01)

(Input: DM 0 to 7, output: DM 8 to 9, error code: DM 10 to 11)

Note a) This value is for the C500H. The value varies with the SYSMAC C500 model version.

b) No. of consequent parts used with the rules.

6. Set the SYSMAC C500 to the monitor mode.
7. Download the knowledge to the Fuzzy Logic Unit.
8. Select to monitor the operation of the Fuzzy Support Software and the display mode from the menu.
9. Change the present value of the SYSMAC C500 and monitor the new value.

10. Input the following to the SYSMAC C500 in the monitor mode to change the data.

Key operation	Explanation
CLEAR	Clears the present data.
DM 1 MONITOR	Input 0 to 7 as the input number to read the present input value.
CHANGE DATA	Input a new value.
WRITE	Press WRITE to change the set value.

SECTION 10
Help Operations

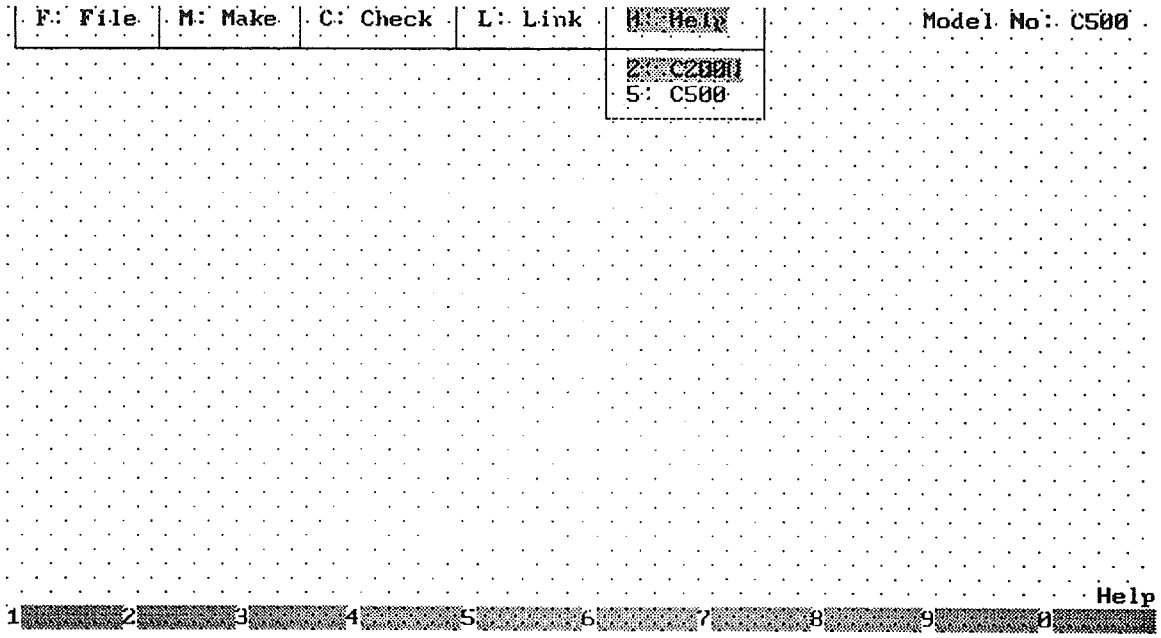
This section provides details on Help operations.

General

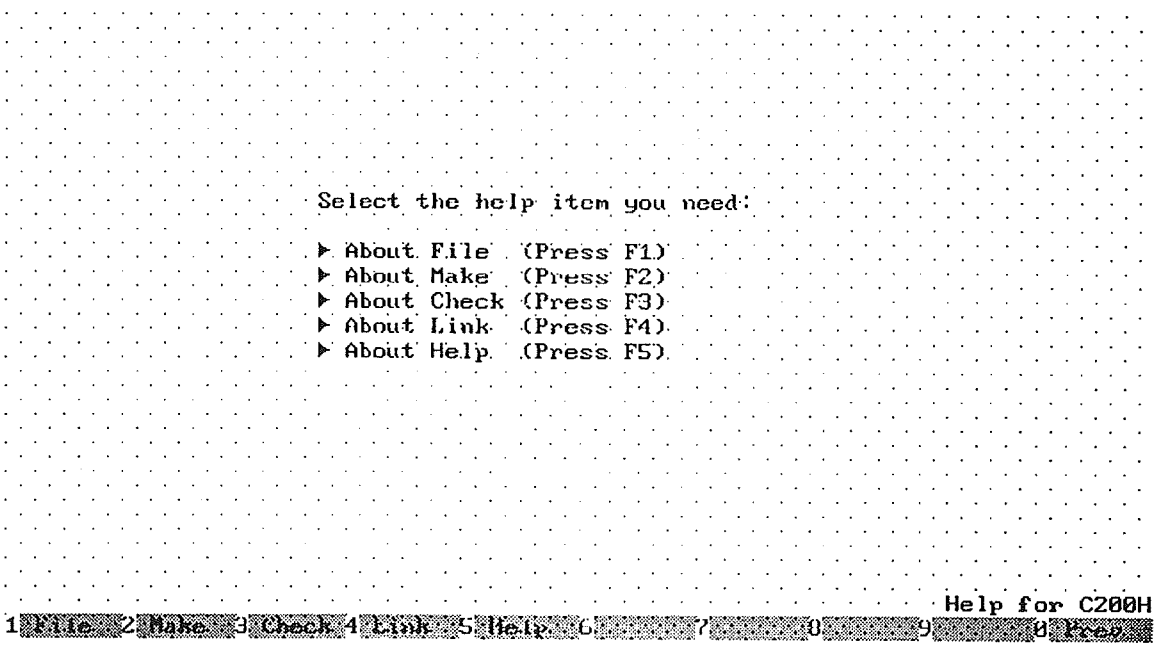
The objective of the Help operation is to provide the user with general information on all the available functions, namely File, Make, Check, Link, and Help.

1, 2, 3...

1. In the main menu "H: Help", there are two options, namely the help for "2: C200H" and "5: C500". The user can select using a mouse click at the appropriate number or by using the Cursor Keys. Confirm with the Enter Key.



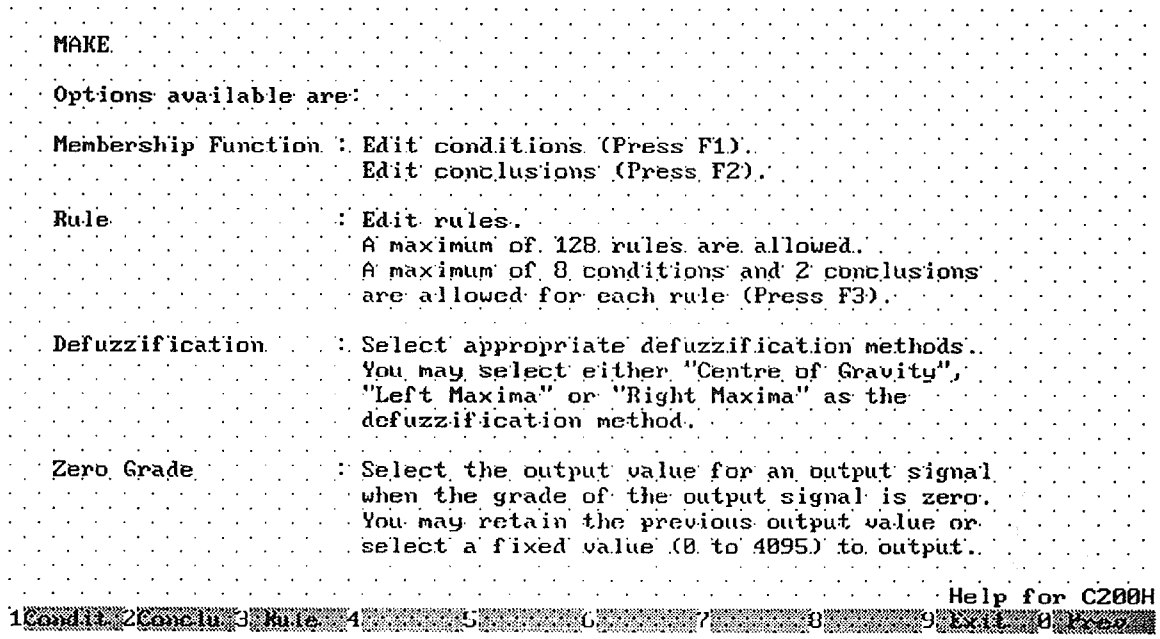
2. If you select "2: C200H" or "5: C500", the information for C200H or C500 will be displayed. After the Help operation is activated, its menu will be shown as follows:



3. Press the function key corresponding to the help information you require.

Help Display for Pulldown Menu Items

After making a main menu item selection from the previous procedure, select the desired submenu help item from the options available. The following is an example for "Make".

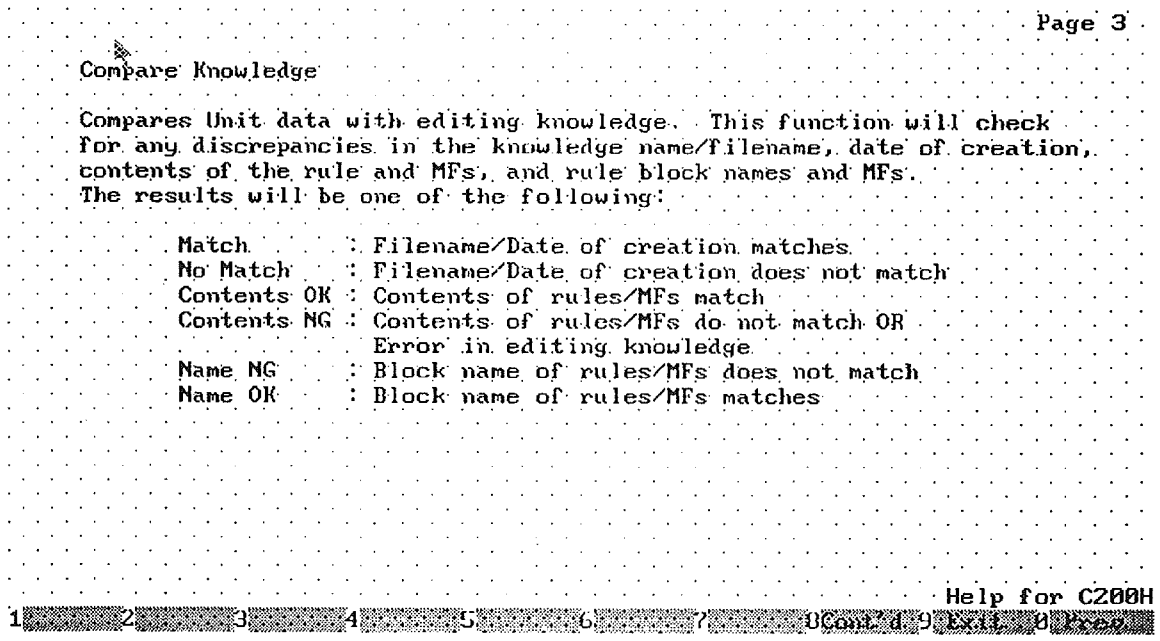


For example, under "Make", the basic key input will be:

Key	Operation
F1	Help for Condition
F2	Help for Conclusion
F3	Help for Rule

Help Display for Submenu Items

After the submenu help item is selected, help text will appear as seen in the example below.



While in any of the help items, the basic key input will be:

Key	Operation
F8 Key or Page Down Key	If there is more than one page for the help text, this will enable the user to scroll down the display to obtain the next page.
F9 Key	Exit from Help.
F10 Key or Page Up Key	This will scroll up the display to obtain the previous page.

Appendix A
Error/Warning Messages

When errors occur during the operation of the software, error messages appear at the top left or bottom left of the display. Places marked with (*) also refers to the hard disk and memory card.

Error	Possible cause	Solution
Cannot load file	Floppy disk is faulty. (*)	Change floppy disk.
Cannot load part	Floppy disk is faulty. (*)	Change floppy disk.
Cannot sort	Editing rule data does not have a signal setting for a label, there are 9 or more input signal settings, or same signal name is set twice or more in the same rule number.	Check error of editing knowledge by "C: Check".
Cannot shift MF	Start and end X coordinate of MF are at the minimum and maximum respectively.	Shift only the MF whose first and last coordinates are not at the minimum and maximum respectively.
Cannot write to file	Floppy disk is faulty. (*)	Change floppy disk. (*)
Cannot write to part	Floppy disk is faulty or not enough disk space. (*)	Change floppy disk. (*)
Communication error	Abnormality occurred during communication.	Check connection cable between Unit and PC.
Conclusion part filename is OTMFPS.DP2	Input filename is not system's default conclusion filename.	Input a valid conclusion part filename.
Conclusion part filename is OTMFPS.DP5	Input filename is not system's default conclusion filename.	Input a valid conclusion part filename.
Condition part filename is INMFPS.CP2	Input filename is not system's default condition filename.	Input a valid condition part filename.
Condition part filename is INMFPS.CP5	Input filename is not system's default condition filename.	Input a valid condition part filename.
Contents do not match	Editing knowledge and unit knowledge do not match after downloading to the Fuzzy Logic Unit.	According to requirements, check contents of Unit knowledge and editing knowledge using "M: Make".
Directory or filename not found in drive	There is no specified directory name, filename, or invalid directory name.	Input existing drive name, directory name, or file name.
Disk drive faulty	Floppy disk is not inserted in the drive, non-formatted disk used, or faulty disk is inserted.	Insert formatted floppy disk or change floppy disk.
Disk space is full	No free disk space for saving purposes.	Use a new disk.
Editing knowledge not found	No rule data or MF data of editing knowledge exists.	Load knowledge file using "L: Load" under "F: File" or recover Unit knowledge from the Fuzzy Logic Unit using "R: Recover" under "F: File".
File not found	There is no knowledge file or part file in specified drive or directory.	Change directory name to knowledge file or directory name which has a part file.
Improper working position	Copying destination for part-reading to copy or delete is wrongly specified.	Check position specification.
Invalid data name	Filename has more than 8 characters or characters of filename are inappropriate.	Specify correct filename or check the number of characters.
Invalid filename	Filename has more than 8 characters or characters of filename are inappropriate.	Specify correct filename or check the number of characters.

Error	Possible cause	Solution
Knowledge not found	When uploading knowledge from the Unit, no knowledge exists in the Unit.	Make knowledge using "M: Make" and download knowledge into the Unit using "D: Download".
Log data not found	No log data exists.	Generate log data from main menu "Monitor".
MF data not found	Trying to save part when there is no MF data.	Make MF data and save in part.
No data to print	Cannot print because there is no editing knowledge and Unit knowledge is not loaded.	Select "N: New" or "L: Load" to make condition editing possible or load Unit knowledge using "A: Affirm".
No MF definition	During copy, delete, or shift MF, specified label has no MF definition.	Choose label with MF definition.
No reference range, press any key to continue	Reference range is not set for the MF.	Check if reference range is set in MF table. If reference range is required but is not set, set it under the reference column in the MF table.
Out of paper	Printer has run out of paper during printing.	After setting paper in printer, select "F1: Execute" or refer to a printer guide.
Part not found	Attempt to save a signal at a location which has no part name.	Select another position with part name.
Part name not found; input part name	No name in part to be saved.	Load part which has a block name or set block name in part to be saved.
Printer is not ready	Power supply of printer is off, printer is not connected properly, or printer is offline, etc.	Turn on power supply, connect printer, switch on printer, etc. Then select "F1: Execute" again. If DIP switch setting is different, refer to a printer guide.
Put system disk in drive A	Selecting other main menu items without setting system disk in drive A. ("A" when starting up the software in drive A)	Set system disk in drive A.
Rule data not found	No rule data in editing knowledge.	Make rule data by using "R: Rule" under "M: Make".
Rule part filename is RULEPS.RUP	Input filename is not system's default part filename.	Input valid part filename.
Select affirm settings	After starting up the software, after error messages "comm error" and "time out", or after selecting "I: Initialize", trying to select pulldown menu without selecting "A: Affirm".	Select "A: Affirm" and load Unit knowledge.
Setting error	All print items in print setting are "no" or in monitor setting items, there is a setting which cannot be executed.	Set "more than one print item in print" setting as "yes" or check monitor setting.
Time out	No response while trying to communicate or improper Unit number.	Check connection cable, PC, or Unit number.
Unit data not found	No knowledge exists in the Unit.	Load knowledge on Unit using "A: Affirm" under "L: Link".
Unit disabled	Trying to execute monitor when condition of Unit is disabled.	Start Unit inferencing using "R: Inference" and execute monitor.
Verification error	There is an error in editing knowledge.	Check error by selecting "C: Check" and "G: General".
Write protect	Floppy disk is write protected.	Remove write protect of floppy disk.

Appendix B
Fatal Error Messages

These errors will cause control to be passed back to the operating system.

Error	Possible cause	Solution
Cannot open log buffer file	Error in opening temporary file.	Change attributes of working directory.
Cannot open message file	No message file in the current directory or in the directory set in the FSS environment when starting up the software.	Store message file into the current directory or the directory set in FSS environment to start up the software.
Cannot put buffer in disk	Error when trying to write logged data to temporary file.	Check write protection of disk and disk space.
Cannot read from file	Unable to read from file.	Change attributes of working directory.
Fatal error deleting file	Error in deleting temporary file.	Check file protection.
Insufficient memory	Attempt to allocate too much dynamic memory.	Try to increase the amount of free memory available after loading FSS.EXE.
Set FSS environment path	Unable to find a message file because there is no FSS environment variable when starting up the software.	Set path name at the time of startup with FSS environment variable.

Glossary

condition part

The "if" clauses of a rule. A single rule can have up to 8 condition parts in the form "IF X_1 AND X_2 ... AND X_8."

center of gravity method

A method of defuzzification. The center of gravity of the fuzzy outputs (along the x-axis) is calculated as the final result of fuzzy logic processing.

conclusion part

The "then" clauses of a rule. A single rule can have up to 2 conclusion parts in the form "THEN Y_1 AND Y_2."

defuzzification

Defuzzification is the process that combines the fuzzy outputs to a single result that is output from the Fuzzy Logic Unit. There are two methods of defuzzification available in the C200H-FZ001: the center of gravity method and maximum value method.

fuzzy output

After all of the rule grades are calculated, the grade for each label is calculated. The grade for a label is called its fuzzy output. The fuzzy output is the maximum rule grade for that label. The maximum value is taken because the rules are linked by logical ORs.

fuzzy variable

A variable such as distance, temperature, or pressure, that is measured by the PC's sensors. The measured values of the fuzzy variables are input to the Unit for fuzzy logic processing.

grade

A number between 0 and 1 that indicates how well the given value of the fuzzy variable satisfies a label. A grade of 0 means the label is not satisfied at all, and a grade of 1 means the label is perfectly satisfied at the given value of the fuzzy variable.

label

Labels are used to describe the state of a fuzzy variable. Labels for distance might be "close," "OK," and "far." Labels for temperature might be "cold," "cool," "warm," and "hot." Labels for pressure might be "light," "moderate," and "hard." The C200H-FZ001 can have up to 7 labels for each fuzzy variable.

knowledge base

The rules and membership functions.

maximum value method

A method of defuzzification. The position (along the x-axis) of the maximum fuzzy output is used as the final result of fuzzy logic processing. Either the leftmost or rightmost position will be used if there are two or more fuzzy outputs with the same maximum value.

membership function

Defines the relationship between the grade and the fuzzy variable for each label. The most accurate shape for a membership function is usually a bell curve, but triangles and trapezoids are used most often to simplify and speed up processing.

rule

An if/then statement that expresses a relationship between inputs and outputs. The C200H-FZ001 can have up to 128 rules.

rule grade

Membership functions assign grades to the labels of the condition parts of a rule according to the present conditions. The rule grade is the minimum of these grades.

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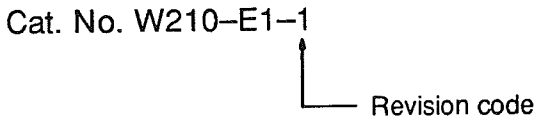

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