ADVANTEST®
ADVANTEST CORPORATION

R3265A/71A Series

Controller Function

OPERATION MANUAL

MANUAL NUMBER OEC00 9705

This manual is for the following models.

R3265A	R3271A
R3365A	R3371A
R3265AP	R3271AP

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No. ESC00

Safety Summary

To ensure thorough understanding of all functions and to ensure efficient use of this instrument, please read the manual carefully before using. Note that Advantest bears absolutely no responsibility for the result of operations caused due to incorrect or inappropriate use of this instrument.

If the equipment is used in a manner not specified by Advantest, the protection provided by the equipment may be impaired.

■Warning Labels

Warning labels are applied to Advantest products in locations where specific dangers exist. Pay careful attention to these labels during handling. Do not remove or tear these labels. If you have any questions regarding warning labels, please ask your nearest Advantest dealer. Our address and phone number are listed at the end of this manual.

Symbols of those warning labels are shown below together with their meaning.

DANGER: Indicates an imminently hazardous situation which will result in death or serious personal injury.

WARNING: Indicates a potentially hazardous situation which will result in death or serious personal injury.

CAUTION: Indicates a potentially hazardous situation which will result in personal injury or a damage to property including the product.

■Basic Precautions

Please observe the following precautions to prevent fire, burn, electric shock, and personal injury.

- Use a power cable rated for the voltage in question. Be sure however to use a power cable conforming to safety standards of your nation when using a product overseas. Do not place anything heavy on top of the power cable.

- When inserting the plug into the electrical outlet, first turn the power switch OFF and then insert the plug as far as it will go.

● When removing the plug from the electrical outlet, first turn the power switch OFF and then pull it out by gripping the plug. Do not pull on the power cable itself. Make sure your hands are dry at this time.

● Before turning on the power, be sure to check that the supply voltage matches the voltage requirements of the instrument.

● Be sure to plug the power cable into an electrical outlet which has a safety ground terminal. Grounding will be defeated if you use an extension cord which does not include a safety ground terminal.

● Be sure to use fuses rated for the voltage in question.

● Do not use this instrument with the case open.

● Do not place objects on top of this product. Also, do not place flower pots or other containers containing liquid such as chemicals near this product.

● When the product has ventilation outlets, do not stick or drop metal or easily flammable objects into the ventilation outlets.

● When using the product on a cart, fix it with belts to avoid its drop.

● When connecting the product to peripheral equipment, turn the power off.

■Caution Symbols Used Within this Manual

Symbols indicating items requiring caution which are used in this manual are shown below together with their meaning.

DANGER : Indicates an item where there is a danger of serious personal injury (death or serious injury).

WARNING : Indicates an item relating to personal safety or health.

CAUTION : Indicates an item relating to possible damage to the product or instrument or relating to a restriction on operation.

■Safety Marks on the Product

The following safety marks can be found on Advantest products.

 : ATTENTION - Refer to manual.

 : Protective ground (earth) terminal.

 : DANGER - High voltage.

 : CAUTION - Risk of electric shock.

■Precautions when Disposing of this Instrument

When disposing of harmful substances, be sure dispose of them properly with abiding by the state-provided law.

Harmful substances: (1) PCB (polycarbon biphenyl)

(2) Mercury

(3) Ni-Cd (nickel cadmium)

(4) Other

Items possessing cyan, organic phosphorous and hexadic chromium and items which may leak cadmium or arsenic (excluding lead in solder).

Example : fluorescent tubes, batteries

R3265A/71A Series

Controller Function

GUIDE

PREFACE

1. This manual describes Controller function in a question and answer form for easier under standing.
   You can understand the functions and practical operating method of Controller function if you read this manual from Chapter 1.

2. This manual consists of the following contents:

   1. Preparation before application of Controller function

   2. Creation of program

   3. Execution of program

   4. Applied operation

   Refer to the separated "R3265A/3271A Series Controller function (Reference)" for details.

3. External keyboards connected to the R3265A/3271A Series Controller function 101-type keyboard (connector shape: mini DIN6 pin) and equivalents.

4. The following abbreviations are used in this manual:

   HP : Personal computer manufactured by Hewlett-Packard Co.
   External keyboard : 101-type keyboard

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1. Preparation Before Application

Q1. What do you need to prepare to create the programs?

A1. You have to prepare a measuring device and external keyboard in order to create a BASIC program using the controllan function (ate editor+ BASIC interpreter). You have to connect the external keyboard to the KEYBOARD connector on the back panel of the measuring device.

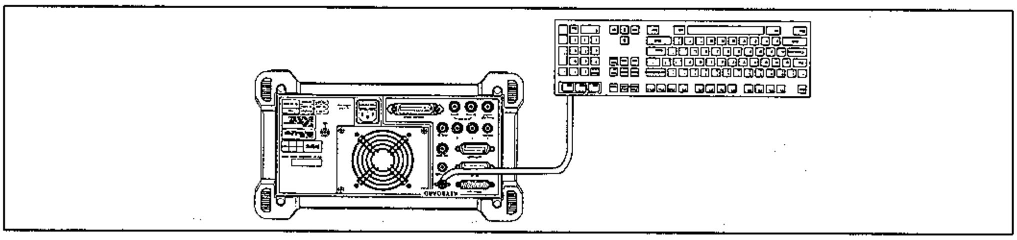


Figure 1 Connecting the External keyboard

In addition, you have to prepare the momory card for the storing program (standard equipment (32Kbyte)) and a GPIB cable.

Q2. How do you start the controller?

A2. Connect the external keyboard to the R3265A/3271A, then turn on the power supply switch of terminal.
The following initial screen is displayed by pressing the CNTRLR ON key and the controller (editor) starts the operation.

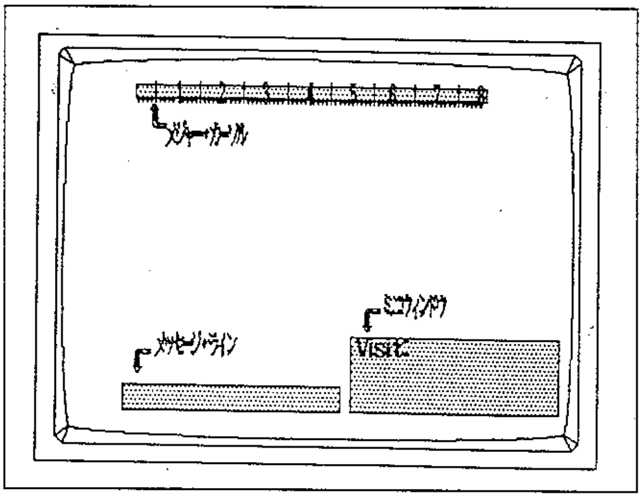


Figure 2 Initial Screen of Controller (Editor)

Q3. How do you initialize the memory card?

A3. Insert the memory card into the measuring device and operate it as follows: However, if you initialize the card saved data, all saved data will be deleted.

① Press SHIFT key and 4 key.

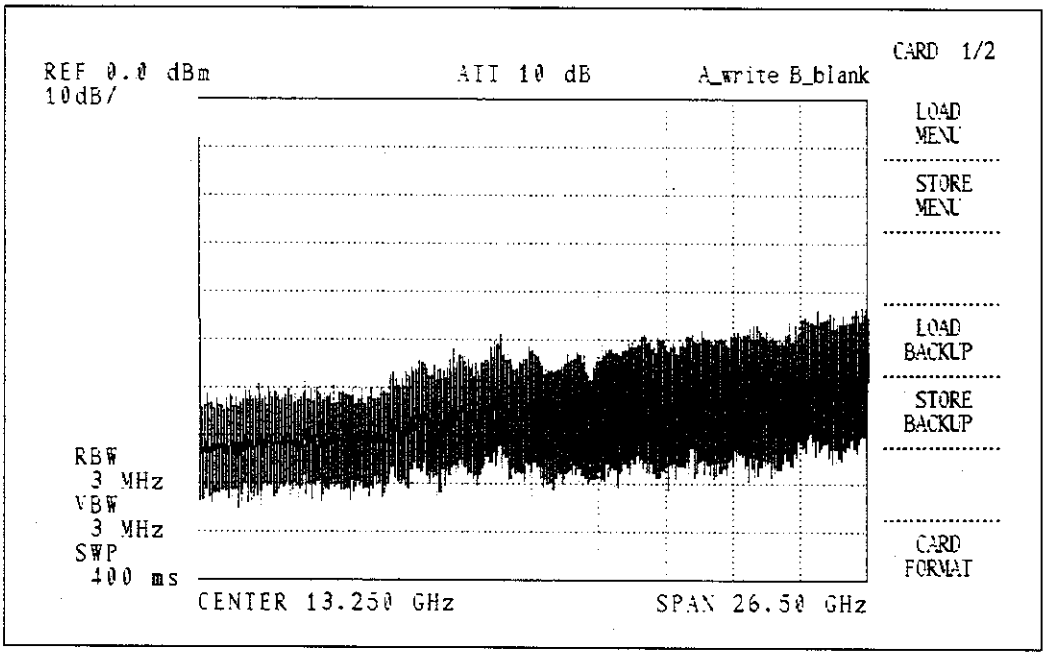


Figure 3 Initializaiton Procedure of the Memory Card

② Press CARD FORMAT key.

③ The message of reconfirmation is displayed on the screen. When the initialization is performed, select "CONFIRM". When not performed, select "CANCEL".

2. Creation of Program

Q4. How do you create a program?

A4. Since the controller starts operation when you turn on the power supply switches of the measuring device, key-in the data using the keyboard.

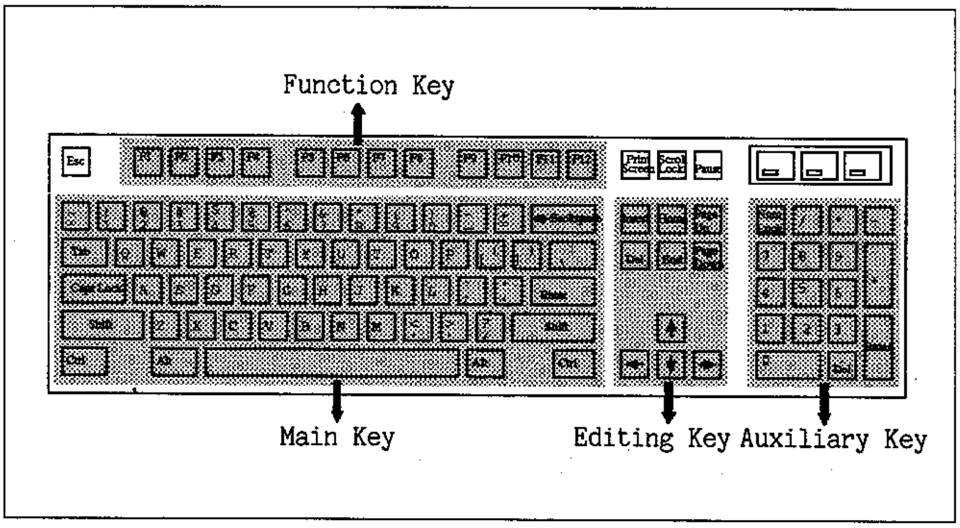


Figure 4 External keyboard

The following is an example of the simple program:

```
TOTAL=0
FOR I=1 TO 100
  TOTAL=TOTAL+I
NEXT I
PRINT "1-100 TOTAL = ",TOTAL
STOP
END
```

Figure 5 Example of Simple Program

Q5.	How do you use the pop up menu?

A5. Press "Alt" key or "Ctrl-A" key of the function keypad. Then, the pop up menu is displayed at the top of the screen. Select the menu with the cursor key and press the "Enter" key.

BASIC	Region	Window/Other	File	Search/Replace
COMPILE and RUN BASIC mode RUN CONT Line No. Renumbering	Set mark Kill region Copy region Yank	Only Split Next Redisplay Help SCRATCH	Load Save Write	Forward search Backward Search Query replace

Figure 6 Pop up Menu List

Q6.	How many lines can this editor create in a program?

A6. Suppose there are 40 letters in one line with no line numbers, the editor can create a program with about 2500 lines.

Q7. The execution result of the program created in lowercase letters is incorrect.

A7. Since the lowercase letters in the program are recognized as variables, the machine outputs the data different from what you expected.
Therefore, use uppercase letters for programming. Use lowercase letters for variables is placed.

Q8. How do you save the created program in the memory card?

A8. First, insert the card into the measuring device. Next, select "Write" in the pop up menu or press "Shift + F3" (hold down the shift key and press the F3 key). The mini window is displayed at the lower right-hand portion of the screen. Then, input the file name to be saved. The number of lines written will be displayed if the file is correctly saved.

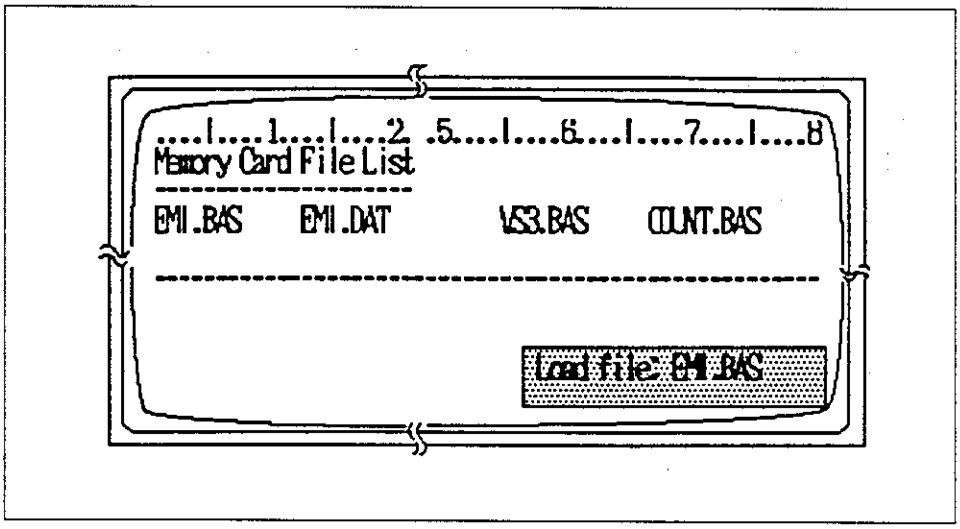


Figure 7 Saving a File

Q9. I cannot save a file in the memory card.

A9. Is the "Write protect" switch of the memory card turned on?
Is the card full? You can check the remaining space in the card with the CAT command in the BASIC mode.

```
16 FILE_1      BAS     256  1991-01-01  10:10
17 DATA_NO1    DAT   19200  1991-02-14  12:10
18 FILE_2      BAS     256  1991-01-15  10:20
19 PROGRAM001  BAS     128  1990-10-04  15:35
20 PROGRAM002  BAS     128  1990-12-24  09:04
21 PROGRAM003  BAS    1408  1991-05-05  11:22
22 NOISE       SET    1280  1991-03-03  13:45
23 FILE_4      BAS    1792  1991-05-05  14:56
24 FILE_5      BAS     128  1991-07-14  17:24


          9 files exists in  24 files
              Total    25600 Bytes
              Used     25476 Bytes (96 %)
```

Figure 8 Execution of CAT Command

Q10. How do you load the file from memory card?

A10. First, insert the memory card into the measuring device. Next, select "Load" in the pop up menu or press "Shift + F1". The screen is divided into two windows. The top window displays a file list and the bottom section displays a mini window. Then, iuput the file name to be loaded.
If you file is not there, an error message is displayed.

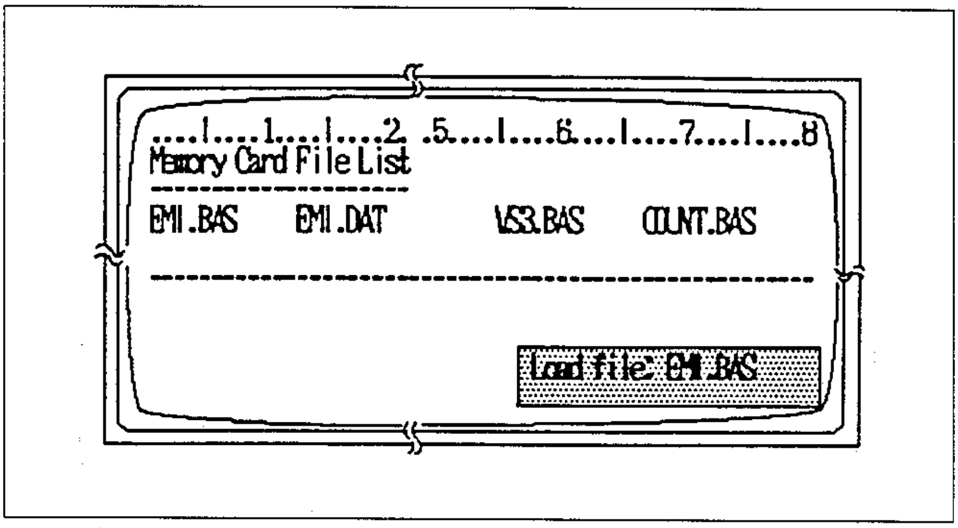


Figure 9 Loading a File

3. Execution of Program

Q11. How do you execute the program?

A11. Select "COMPILE and RUN" in the pop up menu or press the CNTRLR ON COMPILE &RUN keys of the R3265A/3271A or the "F1" key of the function key. Then, the program is executed and the result is displayed.

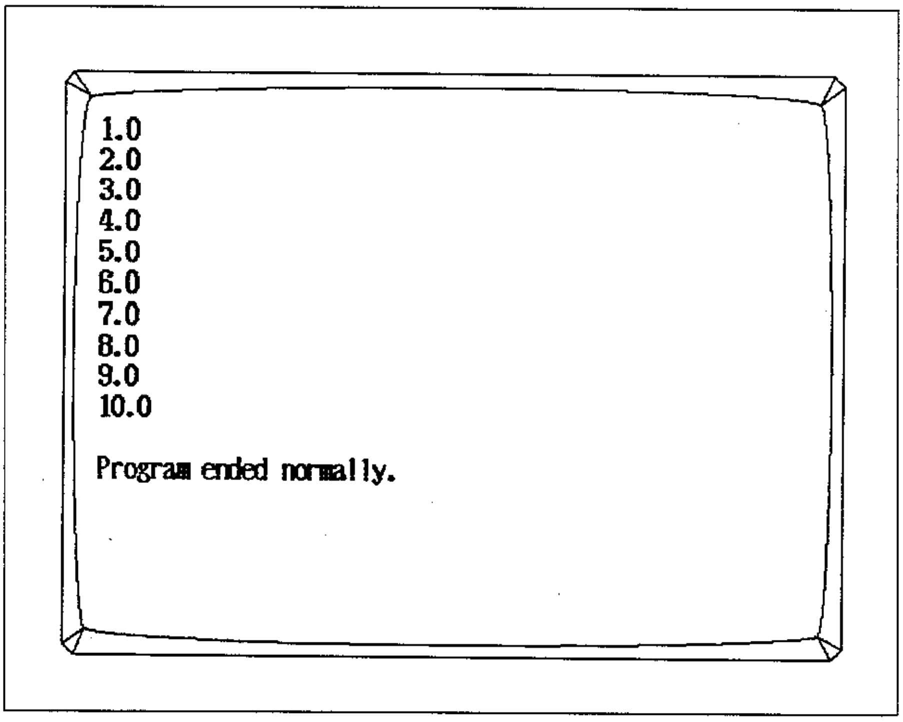


Figure 10 Execution Result of Program

Q12. How do you display the execution result on the measuring device screen?

A12. Set the display condition described below (Figure 11), and then display the result on the screen using the PRINT or graphic instruction.

Setting instruction	Display condition	Sweep condition	Clear screen instruction
SCREEN 0	Spectrum waveform screen	Measuring	
SCREEN 1	Coupled-screen of spectrum waveform + BASIC	Measuring	CLS
SCREEN 2	BASIC screen	Measuring	CLS, CLS 1, CLS 2
SCREEN 3	BASIC screen	Stop measuring	CLS, CLS 1, CLS 2
SCREEN 4	Split-screen (2 sections) of spectrum waveform + BASIC	Measuring	CLS

Figure 11 Setting the Display Condition

Note: In the spectrum waveform screen, its grid is cleared when CLS 1 or CLS 2 graphic clear-screen instruction is executed.

These screen settings are initialized by the IP command. After executing the IP command, therefore, reset them.

The screen settings can be made with OUTPUT 31;"VS○". For details, refer to "(2) Graphic function on page 3-3 of PART II SYSTEM CONTROLLER".

Q13. How do you print the program source list with the GPIB printer?

A13. First, connect the printer GPIB port to the measuring device GPIB port (controller side), then turn on the power supply switch.

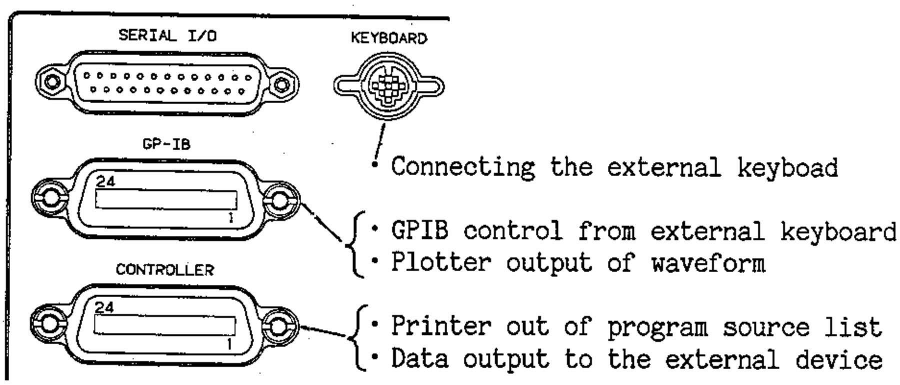


Figure 12 GPIB Port on Rear Panel of Measuring Device

Next, select "BASIC mode" in the pop up menu or press the "F2" key of the function key. You can input the following command in the mini window displayed at lower right-hand side of the screen.
However, "COMPILE and RUN" must be executed beforehand.

Input procedure	Explanation
PRINTER 3 GLIST	Specify the printer. ("3" is the GPIB address) Output the program source list with the GPIB Printer.

Figure 13 Source List Printer Output

Q14. How do you output the execution result with the GPIB printer?

A14. First, connect the printer and measuring device with cables using the same procedure in A16. Next, input the following command in the BASIC mode.

Input procedure	Explanation
PRINTER 3 GPRINT	Specify the printer. ("3" is the GPIB address) Output the execution result by the GPIB Printer.

Figure 14 Execution Result Printer Output

Q15. How do you automatically load the multiple programs from the memory card for execution?
Also, how do you reside the program in the internal memory for execution?

A15. Both are not available. The ate editor loads only one program, and the BASIC interpreter executes only the program saved in the ate editor. Therefore, you cannot perform the above executions.

4. Applied Operation

Q16. How do you set the data in the measuring section?

A16. Use the OUTPUT command. The address number is 31. In "31", the communication is done internally without passing through the external GPIB cable. The following shows a sample program:

```
OUTPUT 31;"IP"                  ! Preset
OUTPUT 31;"CF200MZ"             ! Set the center frequency 200MHz.
OUTPUT 31;"SP100KZ"             ! Set the frequency span 100kHz.
WAIT 200                        ! Wait approx. 200ms
OUTPUT 31;"PS"                  ! Peak search
```

Figure 15 "OUTPUT 31" Sample Program

Q17. How do you read the measurement data from the measuring section?

A17. Use the ENTER command. The address number is 31. In "31", the Communication is done internally without passing through the external GPIB cable. Specify the data to be read with the OUTPUT command. Place "?" at the end of the GPIB command like "OUTPUT 31;"MF?"
The following shows a sample program :

```
OUTPUT 31;"IP"                  ! Preset
OUTPUT 31;"CF200MZ"             ! Set the center frequency 200MHz.
OUTPUT 31;"SP100KZ"             ! Set the frequency span 100kHz.
WAIT 200                        ! Wait approx. 200ms
OUTPUT 31;"PS"                  ! Peak search
OUTPUT 31;"MF?"                 ! Read the peak frequency.
ENTER 31;MKRF                   ! Read the peak frequency.
PRINT "MARKER FREQ = ",MKRF     !
OUTPUT 31;"ML?"                 ! Read the peak level.
ENTER 31;MKRL                   ! Read the peak level.
PRINT "MARKER LEVEL = ",MKRL    !
```

Figure 16 "ENTER 31" Sample Program

Q18. How do you execute the program in conversation form?

A18. Use the ON KEY command or INPUT command. You can specify the range from 1 to 7 in the ON KEY command. Set the INPUT command by pressing the "Enter" key or "Unit" key. Key-in of the numerals in available without connecting to the keyboard. Input of letters or negative numbers is available only by the keyboard. It is not available if there is only the measuring device. The following shows a sample program:

```
ON KEY 1 GOTO *KEY1          ! Specify the ON KEY command.
ON KEY 2 GOTO *KEY2
ON KEY 3 GOTO *KEY3
*L
  ENABLE INTR                ! Approve the interruption.
  PRINT">> key in !"
*LL
  GOTO *LL                   ! Wait for the interruption.
!
*KEY1
  DISABLE INTR: INPUT "---> key 1 OK? (Y=1/N=0)",I

                             ! Interruption is disabled and execute
                               the INPUT command.
  IF I=0 THEN GOTO *KEY1
  GOTO *L
*KEY2
  DISABLE INTR: INPUT "---> key 2 OK? (Y=1/N=0)",I
  IF I=0 THEN GOTO *KEY2
  GOTO *L
*KEY3
  DISABLE INTR: INPUT "---> key 3 OK? (Y=1/N=0)",I
  IF I=0 THEN GOTO *KEY3
  GOTO *L
STOP
```

Figure 17 Sample Program for Executing Conversation Form

Q19. How do you control the other measuring device by the GPIB?

A19. Use the OUTPUT command. The address number is 0 to 30. The following shows a sample program:

```
X$=1500:Y$=600                ! Draw a real line from (1500,600)
                                to (2000,600).
OUTPUT 5;"PU;PA"&X$&","&Y$&";"
                                ! The GPIB address is 5.
X$=2000;Y$=600
OUTPUT 5;"PD;PA"&X$&","&Y$&"
```

Figure 18 Sample Program for Plotter Control

Q20. How do you save the data in the program execution stage in the memory card?

A20. Use the OPEN/CLOSE and OUTPUT command. If a file is already saved there, delete it, then, save the new file. The following shows a sample program:

See the OPEN/CLOSE command for details.

```
DIM A(100)
FILE$="ABC"                   ! The file name is "ABC."
INPUT "Is ¥"ABC¥" file new ? (Y=1/N=0) ->",NEW
IF NEW=0 THEN PURGE FILE$
OPEN FILE$ FOR OUTPUT AS #FD;ASCII
                              ! Open the "ABC" file.
FOR I=1 TO 100
  A(I)=I
  OUTPUT #FD;A(I)             ! Write the data.
  PRINT "Save = ",A(I)
NEXT I
CLOSE #FD                     ! Close the "ABC" file.
STOP
```

Figure 19 Sample Program for Saving Variables

Q21. How do you load the data saved in the memory card?

A21. Use the OPEN/CLOSE and ENTER commands. The file to be loaded must already exist. Also, it must be written in the same format. The following shows a sample program:

```
DIM B(100)
FILE$="ABC"                      ! The file name is "ABC."
OPEN FILE$ FOR INPUT AS #FD;ASCII
                                 ! Open the "ABC" file.
FOR I=1 TO 100
  ENTER #FD;B(I)                 ! Read the data.
  PRINT "Load = ",B(I)
NEXT I
CLOSE #FD                        ! Close the "ABC" file.
STOP
```

Figure 20 Sample Program for Loading Data

Q22. How do you read the trace data in the variables?

A22. Use the GTA/GTB command the built-in function RTRACE( ). The GTA/GTB command reads the trace data in the work area of the measuring device. The GTA/GTB command must be executed before the built-in function RTRACE( ) is used. The following shows a sample program:

```
INTEGER T1(701)              ! Specify the storage area.
!
OUTPUT 31;"GTA"              ! Read the trace A in the work area.
FOR I=1 TO 701
  T1(I)=RTRACE(I-1,0)        ! Read the trace data in the variables.
NEXT 1
STOP
```

Figure 21 Sample Program for Reading the Trace Data

Use the PTA/PTB command and built-in function WTRACE( ) when you want to write the trace data. The PTA/PTB command transfers the data written in the work area by the built-in funciton WTRACE( ) to the trace memory in the measuring device. The following shows a sample program:

```
INTEGER T1(701)              ! Specify the variable.
!
FOR I=1 TO 701
  WTRACE(T1(I),I-1,1)        ! Write the data to the work area.
NEXT I
OUTPUT 31;"PTB"              ! write the data, which is in the work
                             ! area, in trace B.
OUTPUT 31;"BV"               ! Set B view.
STOP
```

Figure 22 Sample Program for writing the Trace Data

The following sample program saves the trace A data in the memory card and writes it to trace B.

```
! trace A              ->Memory card (FILE$)
! Memory card (FILE$)  ->trace B
INTEGER T1(701),T2(701)
!
GOSUB *SETUP                 ! Set up
GOSUB *FSAVE                 ! Save the data in the memory card.
GOSUB *FLOAD                 ! Load the data from the moemory card.
STOP
!
*SETUP
  OUTPUT 31;"VS2":CLS
  PRINT "##### OPEN/CLOSE #####"
  BUZZER 1000,500
  CURSOR 5,5:PRINT "> >Please, write protect switch is off !"
  CURSOR 5,7:INPUT "> >Save file name = ?", FILE$
                             ! Input the file name.
  CURSOR 5,9:INPUT "> >New file ? (Y=1/N=0) ",NEW
  IF NEW=0 THEN PURGE FILE$  ! Current file is deleted.
  OUTPUT 31;"IP VS1":CLS
  OUTPUT 31;"CLN CF30MZ SP1MZ RE-10DB RB100KZ"
  RETURN
!
*FSAVE
  OUTPUT 31;"VS1":CLS
  BUZZER 500,500
  PRINT "trace A ->Card saving .. (file) = ",FILE$
  OPEN FILE$ FOR OUTPUT AS #FD;ASCII
                             ! Open the file.
  OUTPUT 31;"GTA"            ! Read trace A.
  FOR I=1 TO 701
    T1(I)=RTRACE(I-1,0)      ! Save the data in the variables.
    OUTPUT #FD;T1(I)         ! Save the data in the memory card.
  NEXT I
  CLOSE #FD                  ! Close the file.
  OUTPUT 31;"AB"             ! A blank
  CLS:BUZZER 500,500
  RETURN
```

Figure 23 Sample Program for Read/Write the Trace Data from/to the Memory Card

```
!
*FLOAD
  OUTPUT 31;"VS1":CLS
  BUZZER 500,500
  OUTPUT 31;"CWB BV"          ! B clear & view
  CLS:PRINT "Card loading .. ->trace B (file) = ",FILE$
  OPEN FILE$ FOR INPUT AS #FD;ASCII
                              ! Open the file.
  FOR I=1 TO 701
    ENTER #FD;T2(I)           ! Load the data from the memory card.
    WTRACE(T2(I),I-1,1)       ! Write the data in the work area.
  NEXT I
  OUTPUT 31;"PTB"             ! Write the data in trace B.
  OUTPUT 31;"BV"              ! B view
  CLOSE #FD                   ! Close the file.
  CLS:BUZZER 500,500
  RETURN
```

Figure 23 Sample Program for Read/Write the Trace Data from/to the Memory Card (cont'd)

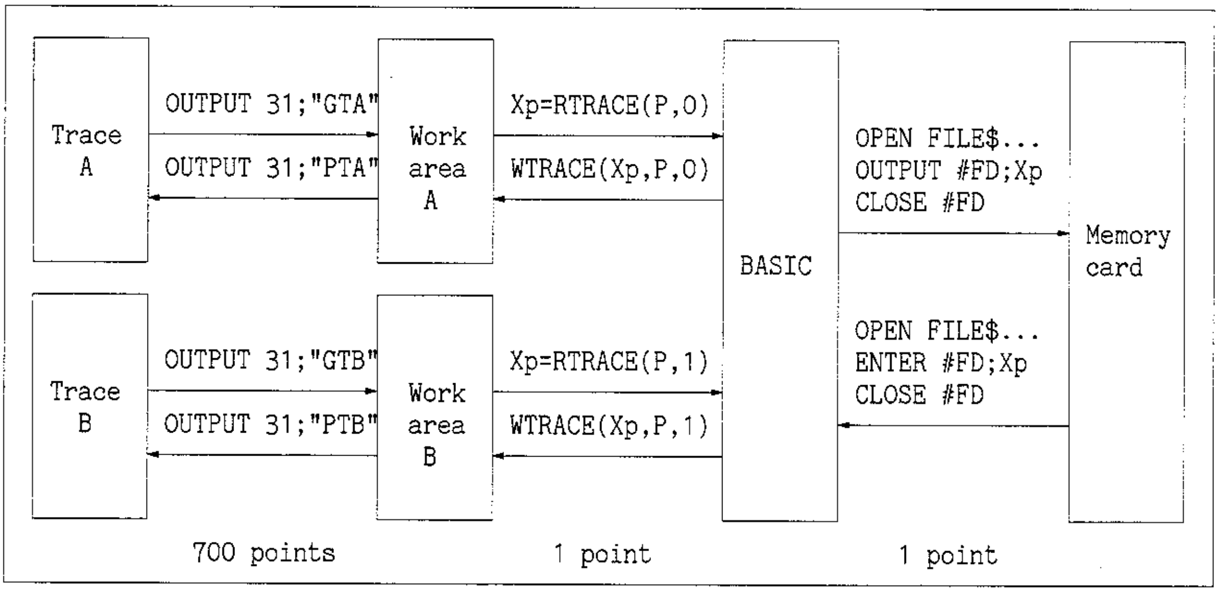


Figure 24 Data Transfer Between the Trace and Memory Card

Q23. How do you use the service request (SRQ)?

A23. Use the SPOLL and bit operator. Interruption can be applied. The following shows a sample program using the interruption function:

```
INTEGER S
SPA=31
ON ISRQ GOSUB *SRQCHK         ! Specify the interruption.
OUTPUT SPA;"IP"
OUTPUT SPA;"VS1 SO"
!----- Calibration -----!
DATA "CLG","IT0","IT1","IT2","IT3","IT4"
FUNC$="CAL"
RESTORE
FOR I=0 TO 5
  READ CAL$
  OUTPUT SPA;CAL$
  GOSUB *SWAIT
  WAIT 1000
NEXT I
!----- Sweep end -----!
FUNC$="SWP"
OUTPUT SPA;"IP CLN CF30MZ SP500KZ SW2SC SI"
FOR I=0 TO 5
  OUTPUT SPA;"SP DN SR"
  GOSUB *SWAIT
NEXT I
STOP
!
!----- SRQ interrupt wait -----!
*SWAIT
  FLAG=0
  ENABLE INTR                 ! Approve the interruption.
*LL
  IF FLAG=1 THEN RETURN       ! Wait for the interruption.
  GOTO *LL
!----- SRQ status check -----!
*SRQCHK
  DISABLE INTR                ! Interrpution is disabled.
  S=SPOLL(SPA)                ! Status polling
  IF FUNC$="CAL" AND (S BAND 2) <>0 THEN
    GOSUB *CALEND: RETURN
  END IF
```

Figure 25 Sapmple Program Using SQR Function

```
  IF FUNC$="SWP" AND (S BAND 4)<>0 THEN
    GOSUB *SWPEND: RETURN
  END IF
  ENABLE INTR                       ! Approve the interruption.
  RETURN
!
!----- Calibration end -----!
*CALEND
  BUZZER 500,50
  PRINT "CAL. end -->",CAL$
  FLAG=1
  RETURN
!
!----- Sweep end -----!
*SWPEND
  BUZZER 500,50
  FLAG=1
  FREQ=BND(PMAX(0,700,0),10,0)
  PRINT "10 dB down band = ",FREQ/1000,"kHz"
  RETURN
```

Figure 25 Sapmple Program Using SQR Function (cont'd)

Q24. How do you transfer the program created by the personal computer to the ate editor?

A24. The transferred program (GOTO GOSUB) to be branched with the line number, is changed to the label. The program is saved in a file with ASCII type. Next, the control program is created. The control program transfers a transfer program to the measurement device by the following procedure.

Specify the down mode for the measurement device. (GPIB CODE "LOAD START")
Read one line of the transforms.
Delete the line number.
Transfer one line to the measurement device. (GPIB CODE "LOAD END")
Specify if the normal mode for the measurement device.

Note: When use the down mode, surely return to the normal mode.

When you complete the setting for the transfer on the external personal computer, you have to set the measuring device.
First, connect the GPIB port on the rear panel of measuring device and GPIB port of the external personal computer with a cable.

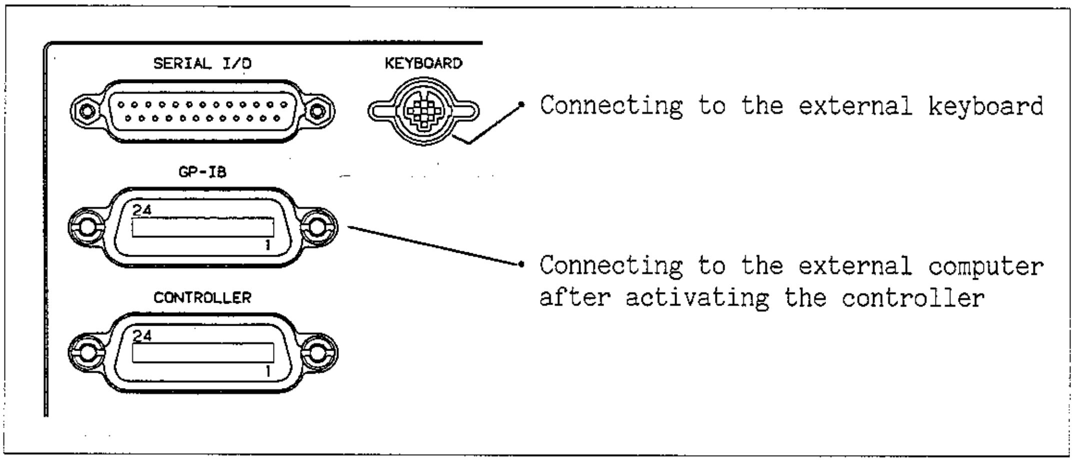


Figure 26 GPIB Port of on the Rear Panel of Measuring Device

Turn on the switch for the measurement device, and activate the controller then execute the control program to be created on the external personal computer. This procedure starts to transfer programs from the external personal computer to the measurement device.

Therefore, execute "SCRATCH" for the pop up menu before the transfer as to initialize an editor.

Sample program (PC98 control program)

```
10 DIM FILE$(10)
20 DIM PROG$(128)
30 '
40 SPA=8                          ! GPIB address.
50 ISET IFC
60 ISET REN
70 CMD DELIM=0
80 '
90 INPUT "Down load file name=?";FILE$     ! Input file name.
100 OPEN "B:"+FILE$+".BAS" FOR INPUT AS 1 ! Open file.
110 WHILE EOF(1)=0
120  LINE INPUT #1,PROG$          ! Read one line.
130  LL=LEN(PROG$)                ! Delete line number (to 140).
140  PROG$=MID$(PROG$,6,LL-5)     !
150  PROG$="@"+PROG$              ! Add '@' to the top of line.
160  PRINT PROG$
170  PRINT @SPA;PROG$             ! Transfer one line.
180  FOR I=0 TO 3000:NEXT I       ! Waiting time.
190 WEND
200 CLOSE                         ! Close file.
210 PRINT "Down load end!!"
220 END
```

The line number 170 is unique sentence of PC98 (NEC PC), so please modify for IBM PC or other PC.

R3265A/71A Series

Controller Function

REFERENCE

Preface

1. Description of R3265A/3271A Series

All descriptions on the R3265A/3271A Manual are also applicable to the R3365A/3371A.

	Types	Contents	Pemarks
1.	R3265A/3271A Series Spectrum Analyzer Instruction Manual	Explains the instruction of R3265A/3271A. • Accessories • Panel side Explanation • Function Explanation • Operation Explanation • Specifications	Standard accessories
2.	R3265A/3271A Series Quick Guide	Indicates key operation from basic to advance with practical example. • Start/Stop Specification procedure of frequency. • Procedure in the measurement window. • Data store procedure. • Initialize procedure of soft menu. • Measurement procedure of occupied frequency bandwidth.	Standard accessories
3.	R3265A/3271A Series Controller function Instruction Manual	Explains the instruction of Controller function. • Guide • Reference	Standard accessories
4.	R3265/3271 Series GPIB command extended function Instruction Manual	Explains the instruction of GPIB command extended function. • Part 1 : GPIB outline • Part 2 : GPIB command extended mode 1. Supports command of 8562. • Part 3 : GPIB command extended mode 2. Supports command of 8566.	Sold separately.

2. This manual consists of the following contents:

   PART I ate EDITOR
   PART II SYSTEM CONTROLLER
   APPENDIX Error Message List

3. R3265A/3271A SERIES CONTROLLER FUNCTION GUIDE is provided as a separated volume to describe briefly the functions and the operating method of the Controller function in the questions and answers form.
   Read R3265A/3271A SERIES CONTROLLER FUNCTION GUIDE before reading this manual.

4. The following abbreviations are used in this manual:

   HP : Personal computer manufactured by Hewlett-Packard Co.
   External keyboard : 101-type keyboard

5. Products Outine

   This Function is the controller function included the Spectrum analyzer R326A5/3271A.
   Controller language uses easy BASIC language and enable to control this device R3265A/3271A and other GPIB devices connected with GPIB.
   Parallel I/O is enable to control Parallel I/O (input-output) device also.
   Enable to save created program and data in the IC memory card. The saved program will enable to execute the program in this device only.

TABLE OF CONTENTS

【PART I】

P A R T I a t e E D I T O R

1. OUTLINE

The ate editor is a full screen editor developed so that BASIC programming can easily be made on the measuring instrument.
Because editing can be made by using the external keyboard connected to the KEYBOARD connector on the panel at the back of the measuring instrument, the operability is greatly improved.

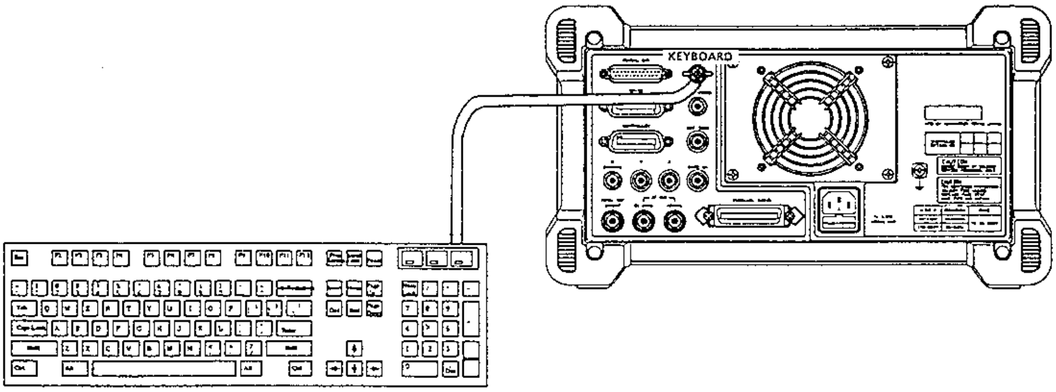


Figure 1 - 1 Connection Between R3265A/3271A and External keyboard

2. FEATURES

The ate editor is a full screen editor having sophisticated editing functions. The function includes cursor control, text insertion/deletion, copying, moving, replacement, search, window, file, and BASIC program running. In addition to the above, the pop-up and help menus are prepared to smoothly execute these functions.

2.1 Keyboard

The basic functions of the ate editor is assigned to the external keyboard. Complicated editing can easily be made through keyboard operations.

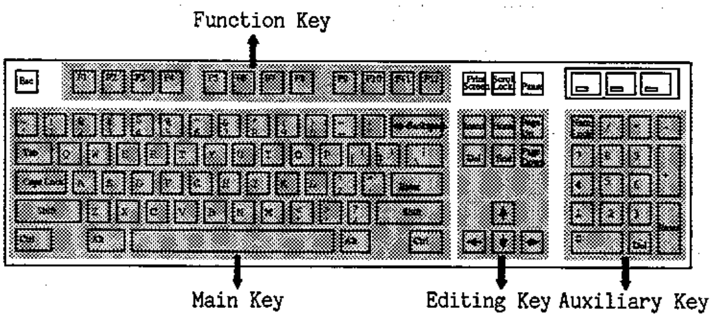


Figure 2 - 1 External Keyboard

2.2 Pop-up Menu

All functions of the ate editor can be executed with the pop-up menu (excluding cursor movement).
Select a function to be executed in the pop-up menu with the cursor and press the Enter key, then the function is executed.

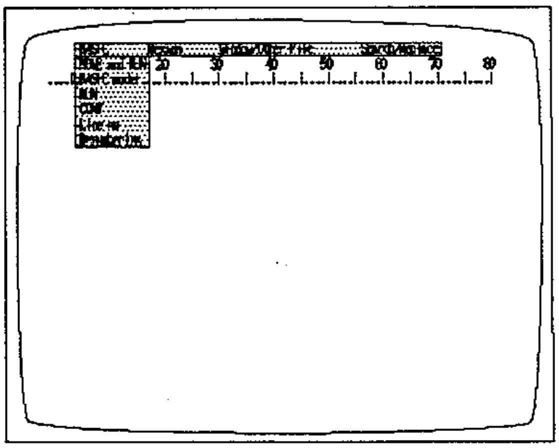


Figure 2 - 2 Pop-up Menu

2.3 BASIC Running Condition

A BASIC program edited by the ate editor can directly be run on the editor. The RUN, CONT, SCRATCH commands of BASIC can be executed with the keyboard or pop-up menu. Commands other than the above ones can be executed in the mini-window of the BASIC mode.

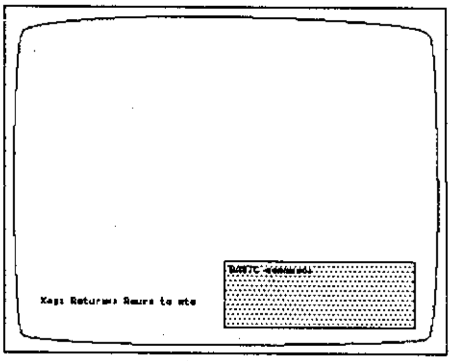


Figure 2 - 3 BASIC Mode

2.4 Definition of Label

For the ate editor, line numbers are omitted and labels are defined. By defining labels, understandable programs can be created when using sub-routine call.

Note: For the label, be sure to put an asterisk "*" at the top of the character string.

```
....|....1....|....2
  A=0
*LABEL1
  A=A+1
  IF A >= 10 THEN
    GOTO *ABCD
  END IF
  GOTO *LABEL1
*ABCD
```

Figure 2 - 4 Definition of Label

2.5 File

It is possible to save the created programs in the memory card of the main unit in files. It is also possible to load a file from the memory card to edit the file.

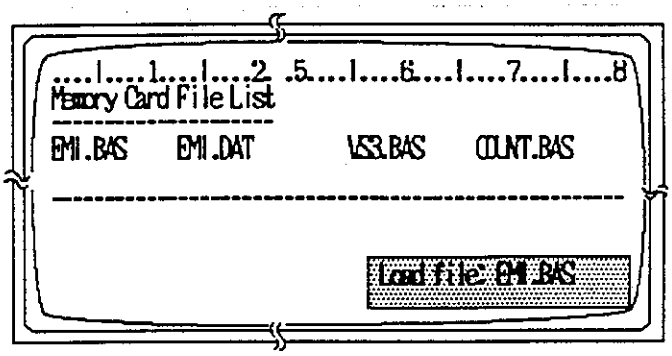


Figure 2 - 5 File Loading

2.6 Help Menu

The functions assigned to the external keyboard are listed on the screen.

--- Command Key Help Menu ---

Backspace	Delete backward character
Del	Delete forward character
Shift-Del	Kill from the cursor position to end of line
Shift-F1	Get a file, read write
Shift-F2	Save current file
Shift-F3	Write a file
Shift-F4	Move cursor to file name view window
Shift-F5	Make current window only one
Shift-F6	Split current window
Shift-F7	Move cursor to the next window
Shift-F8	Clear screen and redisplay everything
Shift-F9	Set line no. of the BASIC
Shift-F10	Renumber line no. of the BASIC
Shift-F11	Help menu (Command keys)
Shift-F12	SCRATCH
F1	Compile and execute RUN
F2	Change to BASIC mode
F3	Execute RUN
F4	Execute CONT

BASIC
LOAD
COMPILE & RUN
RUN
RETURN

Figure 2 - 6 Help Menu

2.7 User-Defined Menu (ON KEY x LABEL)

The characters in the menu can be specified by using the ON KEY instruction.

User-Defined Menu is defined on the menu screen corresponding to ON KEY 1 to 7.

In the interruption from the User-Defined Menu, the permission/prohibition can be set using ENABLE INTR/DISABLE INTR instructions.

The User-Defined Menu is sometimes changed when PANEL 0 instruction is executed, however, the User-Defined Menu can be displayed normally by pressing the CNTRLR ON key.

SAMPLE)

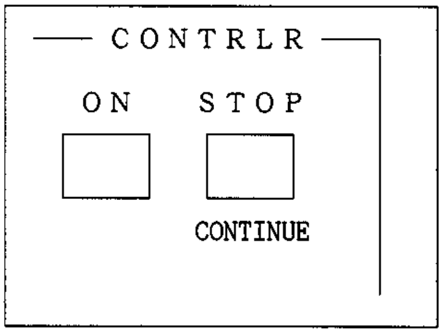
```
ON KEY 1 LABEL "ABC" GOTO *ABC
ON KEY 3 LABEL "DEF" GOTO *DEF
ON KEY 7 LABEL "XYZ" GOTO *XYZ
KEY ON
```

The User-Defined Menu is displayed as follows:

```
ABC

.........................


.........................
DEF

.........................


.........................


.........................


.........................
XYZ
```

3. ACTIVATING

(1) Operation



Right-upper side of mainframe

ON: Enables to open the BASIC editor of controller.
The User-Defined Menu is displayed during BASIC operation.

STOP/CONTINUE: Enables to stop or re-start the BASIC operation.

(2) BASIC Menu
LOAD:
Selects the BASIC program to be loaded.
(selected using the rotary encoder, and started using the unit key).

COMP & RUN:
Compiles the BASIC program and then runs the program.

RUN & RUN:
Runs the program after compiling on the backup memory. If this menu is displayed in reverse, the program still exists on the backup memory.

AUTO EXEC CARD/MEM:
Selects the auto-start execution (Card or Memory).
  CARD: Auto-start execution from memory card
  MEM: Auto-start execution from backup memory

ABORT:
Aborts the program on the LOAD menu.

Return:
Returns to the spectrum screen.

4. FUNCTION LIST

Each function of the ate editor is assigned to the keyboard excluding some functions.

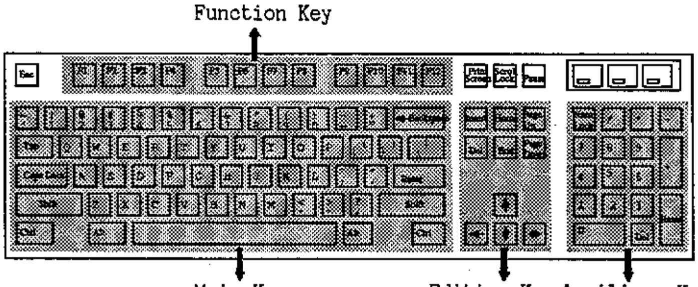


Figure 4 - 1 Key Pad Layout

4.1 Cursor Control

→	:	Moving to the next character
←	:	Moves the cursor to the preceding character.
↑	:	Moves the cursor to the preceding line.
↓	:	Moves the cursor to the next line.
Home or Shift + ↑	:	Moves the cursor to the top of the file.
End or Shift + ↓	:	Moves the cursor to the end of the file.
Shift + ←	:	Moves the cursor to the top of the line.
Shift + →	:	Moves the cursor to the end of the line.
Page Up	:	Moves the cursor to the preceding screen.
Page Down	:	Moves the cursor to the next screen.

4.2 Insertion

Enter	:	Inserts line-feed characters.
Tab	:	Inserts tab instruction.
Main key pad other than above	:	Inserts general characters.

4.3 Deletion

Backspace	:	Deletes the character before the cursor.
Delete	:	Deletes the character at the cursor.
Shift + Delete	:	Deletes Dharacters from the cursor position through the line end.

4.4 Copying, Moving, and Deleting (Region designation)

F5	:	Sets a mark necessary for region processing to the cursor position.
F6	:	Deletes characters from the mark through the cursor position to save them in the buffer.
F7	:	Stores characters from the mark through the cursor position.
F8	:	Copies the characters saved in the buffer with the F6 or F7 key to the cursor position.

4.5 Window

Shift + F5	:	Merges windows into one.
Shift + F6	:	Splits a window into two.
Shift + F7	:	Moves the cursor to the next window.
Shift + F8	:	Clears the screen and displayes data again.

4.6 File

Shift + F1	:	Loads the designated file from the memory card.
Shift + F2	:	Saves files in the memory card.
Shift + F3	:	Saves a file with the designated file name in the memory card.
Shift + F4	:	Moves the cursor to the file name list window.

4.7 Search

F9	:	Searches character strings forward.
F10	:	Searches character strings backward.

4.8 Replacement

F11	:	Replaces character strings.

4.9 BASIC Mode

Shift + F9	:	Sets automatic line-number insertion.
Shift + F10	:	Re-defines line numbers.
F1	:	Moves a program to the BASIC buffer before running the program.
F2	:	Changes the mode to the BASIC mode.
F3	:	Runs the transferred progrem.
F4	:	Continues the program interrupted by Ctrl-C.

4.10 Help

Shift + F11 : Displays the editor functions and key assignment list.

4.11 Pop-up Menu

Alt (Ctrl-A) : Displays the pop-up menu.

4.12 Cancel

ESC (Ctrl-Z) : Cancels the editor functions.

4.13 Editor Restarting

Shift + F12 : Ends the current editor and initializes the buffer for restarting.

4.14 Controller Activating

F12 : Activates the controller and indicates the editor screen.

5. DESCRIPTION OF FUNCTIONS

5.1 Cursor Control

The cursor indicates the editing position and editing is made according to the cursor.
The cursor control is defined as movement of the cursor to a certain position on the screen.
There are the functions to move the cursor upward, downward, rightward, or leftward by one character. These functions are assigned to the cursor keys respectively to move the cursor from the current position to a destination.

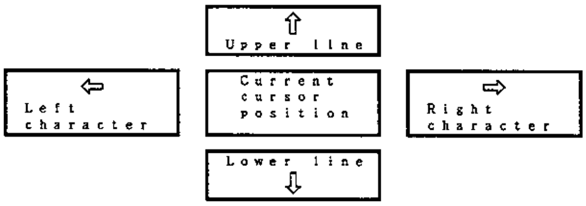


Figure 5 - 1 Cursor Key

These are the basic cursor moving function frequently used. When it is attempted to move the cursor exceeding the upper or lower limit of the screen, the text in the direction is scrolled and the cursor always remains in the screen.

In addition to the above, the following functions are provided:

Home or Shift + ↑	Moves the cursor to the top of the file.
End or Shift + ↓	Moves the cursor to the end of the file.
Shift + ←	Moves the cursor to the top of the line.
Shift + →	Moves the cursor to the end of the line.
Page Up	Advances the cursor to the next page.
Page Down	Returns the cursor to the previous page.

Figure 5 - 2 Key Pads To Move Cursor

5. 2 Insertion

Because the ate editor is always ready for inserting texts, all characters other than control ones can be inserted with the keyboard. The character includes the general character and the control character.
The general character includes visible characters such as "A" and "1" while the control character includes invisible characters such as "ESC" and "CTRL".

When the length of a line exceeds the screen width, the sign "$" is displayed at the right end of the screen to show that the line is continued.

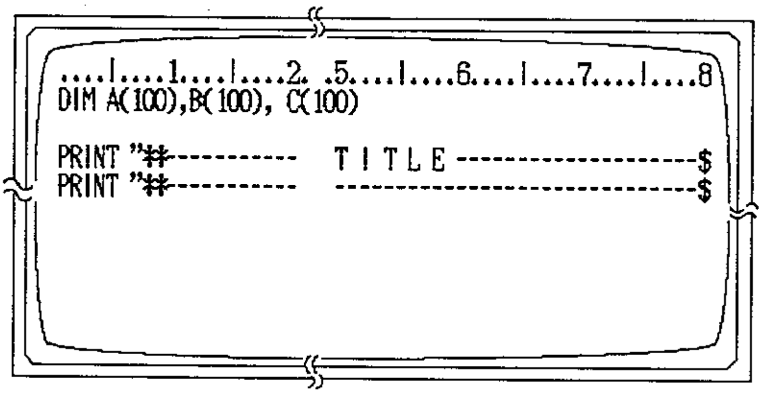


Figure 5 - 3 Sign Showing Continuation of Characters

Press the Enter key at the end of a line to input the line feed character.
Press Tab key for the tab function to adjust character position. The tab size is provided with the length of eight characters.

Enter	Inserts line feed characters.
Tab	Inserts tab.
Key pad other than above	
	Inserts general characters.

Figure 5 - 4 Key Pad for Insertion

5. 3 Deletion

The deleting function includes one-character deletion, one-line deletion, and designated region deletion.

5. 3. 1 One-character Deletion

The one-character deleting function includes two methods; one to delete the character immediately before the cursor and the other to delete the character at the cursor position.

(1) Deletion of the character immediately before the cursor

To delete the character immediately before the cursor, press Backspace key.

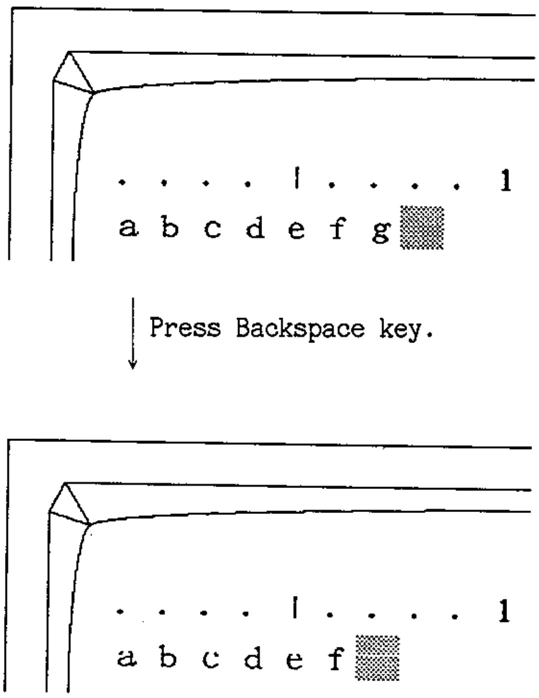


Figure 5 - 5 Deletion of the Character Immediately Before the Cursor

(2) Deletion of the character at the cursor position

To delete the character at the cursor position, press Delete key.

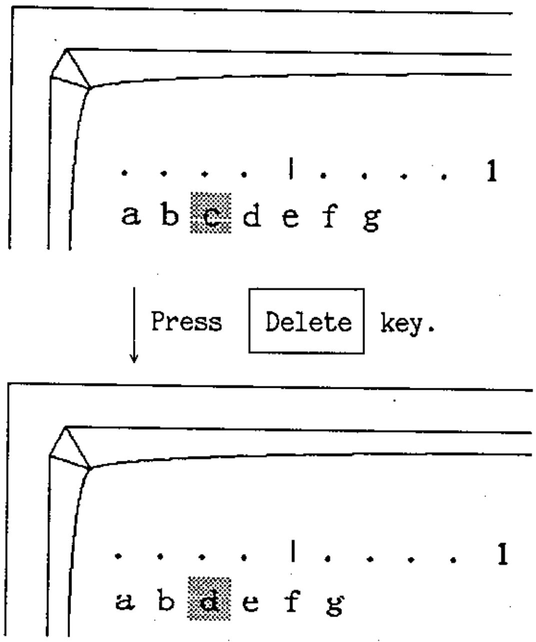


Figure 5 - 6 Deletion of the Character at the Cursor Position

5.3.2 One-line Deletion

To delete characters from the cursor position through the line end, press Shift + Delete key. The contents of the line are deleted by pressing Shift + Delete key first time and the line is deleted by pressing Shift + Delete key again.

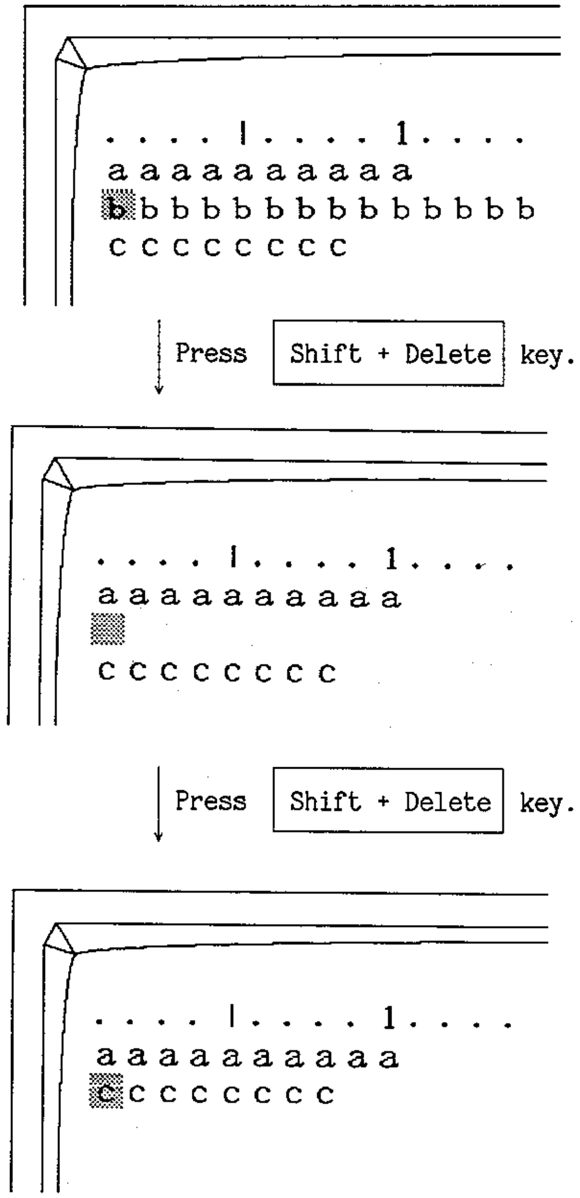


Figure 5 - 7 Deletion of Characters from Cursor Position Through Line End

5.3.3 Designated Region Deletion

The method to delete characters by designating a region is described in Section 5.4 because the method is related to storage of text.

Backspace	Deletes the character immediately before the cursor.
Delete	Deletes the character at the cursor position.
Shift + Delete	Deletes the characters from the cursor through the line end.

Figure 5 - 8 Key Pad for Deletion

5.4 Copying, Moving, and Deleting (Region designation)

Store a text by designating a region for copying, moving, and deleting.

5.4.1 Deletion of Text

(1) Mark Setting

For deleting and moving, move the cursor to the top of the region to be deleted and set a mark with F5 key or Mark set in the pop-up menu.

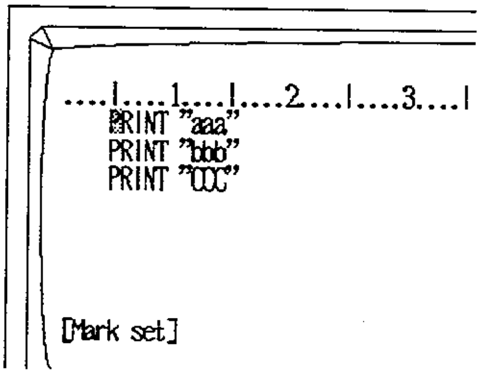


Figure 5 - 9 Mark Setting

(2) Deletion of Text

Move the cursor to the position one character ahead of the final position of the region to be deleted and press F6 key or input Kill region of the pop-up menu. Then the text from the position where the mark is set in Item (1) through the position before the current cursor position is deleted. Because the deleted text is saved in the internal buffer, perform the operation in Items (1) and (2) before moving, recovering, or copying the text to be mentioned later.

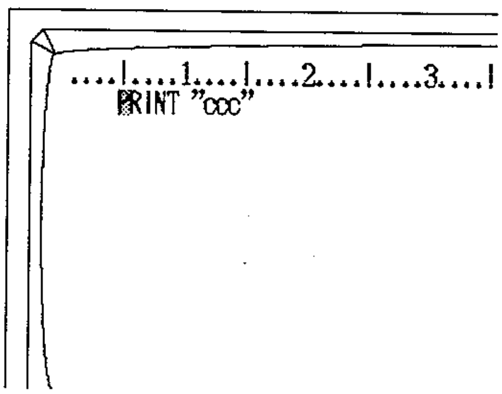


Figure 5 - 10 Storage of Text (Deletion)

5.4.2 Recovering and Moving of Text

To recover the deleted text, press F8 key at the current cursor position or input Yank of the pop-up menu. To move the text, move the cursor to the destination and press F8 key or input Yank of the pop-up menu.
As mentioned above, F8 key and Yank in the pop-up menu are the function to insert the saved text into the current cursor position.

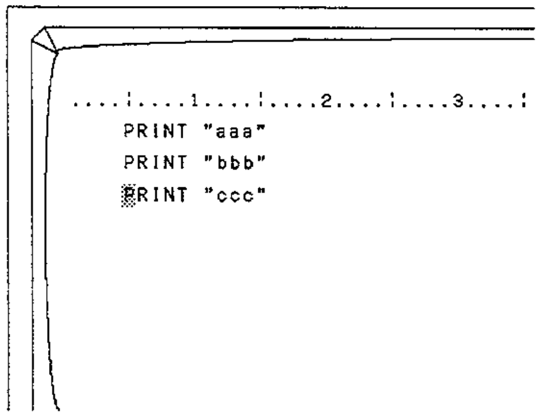


Figure 5 - 11 Recovery of Text

5.4.3 Copying of Text

To copy a text, set the top of the region similarly to the case of deletion, move the cursor to the final position, and press F7 key or input Copy region of the pop-up menu.
In this case, because the designated text is saved in the internal buffer though it seems that no data is changed in the region, move the cursor to the copying position and press F8 key or input Yank of the pop-up menu.

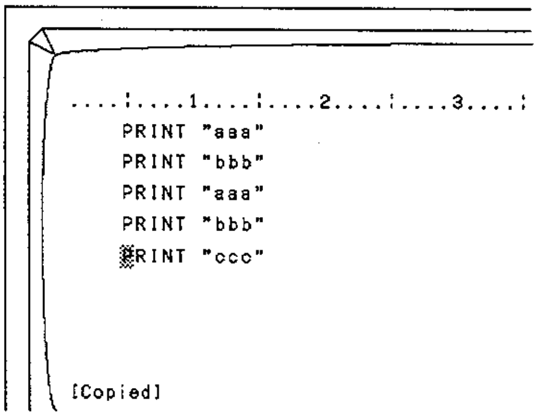


Figure 5 - 12 Copying of Text

The text recovered by F8 key or Yank in the pop-up menu is used as the latest text in the internal buffer.

F5	Sets the mark necessary for designating a region to the cursor position.
F6	Stores the text deleted from the mark through the cursor position
F7	Stores the text from the mark through the cursor position.
F8	Inserts the stored text into the cursor position.

Figure 5 - 13 Key Pad for Region Processing

5.5 Window

The normal window includes the overlapping type and the tile type. The ate editor window uses the tile type which splits the screen into the top and bottom ones.

Generally, the number of windows is one, the ate editor, however, can have two windows in each of which the text is displayed.
For example, it is possible to simultaneously reference two areas each of which is larger than the screen.
However, it is impossible to open different files in two windows respectively because only one file can be opened.

5.5.1 Splitting of Window

To split a window into two, press Shift + F6 key or input Split of the pop-up menu.

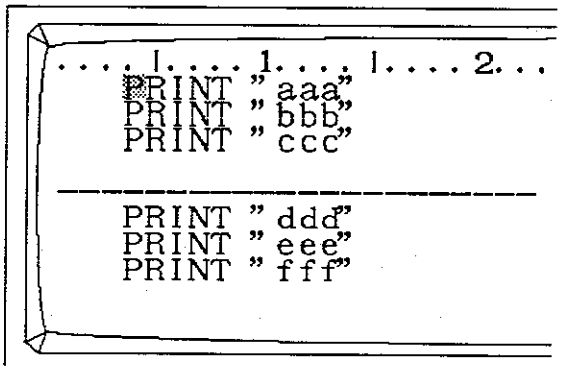


Figure 5 - 14 Window Split into Top and Bottom Ones

5.5.2 Initialization of Window

To merge the top and bottom window into one, press Shift + F7 key or input Next of the pop-up menu to move the cursor to the window to be left. Then press Shift + F5 key or input Only of the pop-up menu and the two windows are merged into one.

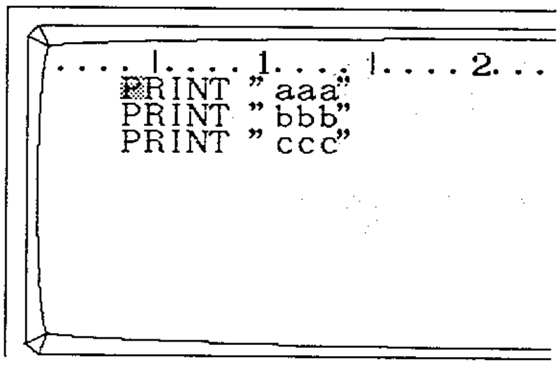


Figure 5 - 15 Merged Window

5.5.3 Re-displaying of Screen

To display the text being edited again, press Shift + F8 (comma) key or input Redisplay of the pop-up menu to display the text again.

Shift + F5	Deletes other windows to display only the window in which the cursor is present.
Shift + F6	Splits a window into the top and bottom ones and brings the cursor to the top one.
Shift + F7	Moves the cursor to the next window.
Shift + F8	Clears the screen to display the text again.

Figure 5 - 16 Key Pad for Window

5.6 File

The ate editor saves texts in the memory card of the main unit and loads them from the memory card in files.
Therefore, be sure to save edited texts in the memory card.

Note: If the editor is turned off before saving the edited texts, the texts are lost.

The following describes how to save/load file.

5.6.1 Saving of Files

To save an edited text in the memory card, press Shift + F3 9 key on the auxiliary key pad or input Write of the pop-up menu. In this case, give a name to the file to be saved. The file name is allowed up to 10 characters.

After saving the text, the number of written lines is displayed in the message line.

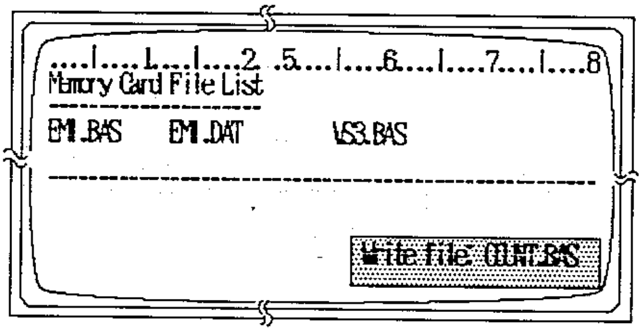


Figure 5 - 17 Saving of Text (Input a file name.)

5.6.2 Loading of Files

To load the saved files, press Shift + F1 key or the CNTRLR ON LOAD key of the R3265A/3271A or input Load of the pop-up menu. Then the files currently saved in the memory card are listed on the screen and the file to be loaded is queried.
In this case, input the file name or move the cursor to the window showing the list by pressing Shift + F4 key before selecting the file name with the cursor and finally pressing Enter key.

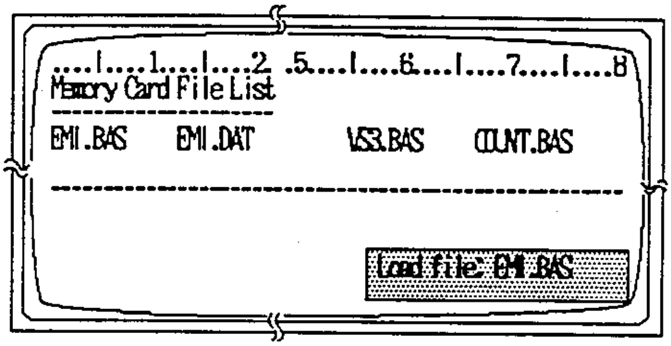


Figure 5 - 18 Inputting of File Name

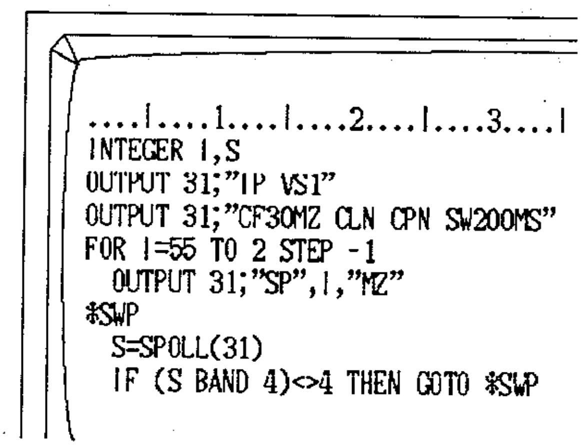


Figure 5 - 19 Loading of File

While a file is loaded from the memory card, the LED on the memory card entrance of the main unit lights. When loading is completed, the text is displayed on the screen and the number of read lines is displayed in the message line.
In this case, the automatic line number inserting (AUTO) function is set to the lines with a line number.
To create a new file, input the file name.
Unless the memory card is set, the buzzer sounds or an error message is displayed.

5.6.3 Updating of Files

To save the same file name, press Shift + F2 key or input Save of the pop-up menu. Then whether or not to save it is queried. If no data in the text is changed, the message "No change" is displayed.

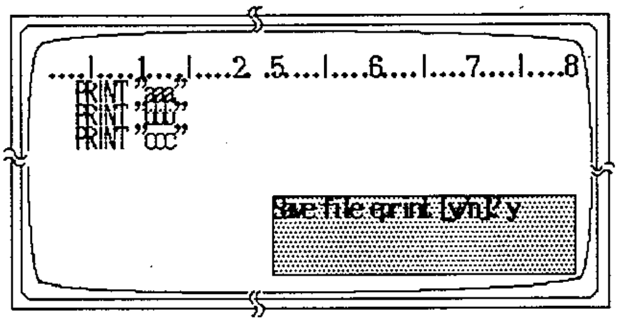


Figure 5 - 20 Updating of Text (Same File Name)

When you press y and Enter keys, the text is written in the file. When saving is completed, the number of lines of the file is displayed in the message line.
When you press n and Enter keys, text saving is not executed.

Shift + F1	Loads the designated file from the memory card.
Shift + F2	Saves a file with the same name in the memory card.
Shift + F3	Saves a file with the designated file name in the memory card.
Shift + F4	Moves cursor to the file list window.

Figure 5 - 21 Key Pad for File

5.6.4 Program automatic Start Function

A program can be automatically loaded (read) from the memory card and activated on power-on.
Register (save) the created program with file name AUTOSTART into the memory card.
Register the program with the [Write] function on the pop-up menu.

(1) Resume Function
When the BASIC program is running, the program after compiling is stored into the backup memory. This function enables to keep the program after compiling in the memory if the power is turned off.
Therefore the quickly start can be provided after turning the power on due to this function.

BASIC menu

RUN	:	When the column is displayed in reverse, the program after compiling exists in the backup memory.

Note: Basic program cannot be stored (only the program after compiling can be stored.)

If the power is turned off when the program is running, the program cannot re-start after power-on. Be sure to turn off the power by confirming the program stops.

(2) Auto-start function
Enables to start the program automatically after power-on. Selects the program existed in a memory card or a backup memory and starts the program. The selection method is as follows:

Select "CARD" or "MEM" using the [AUTO EXEC CARD/MEM] of the BASIC menu.

CARD: Runs (starts) the program by loading the file name "AUTOSTART" in the memory card. If that file is not existed or the memory card is not inserted, the system is operated on the spectrum screen.
When normally activating the system on the spectrum screen, always select this mode.

MEM: Runs the program that is stored (registered) in the backup memory equipped with the R3265/3271 controller function. If the program does not exist in the backup memory, the system is operated on the spectrum screen.
To check whether the program exists or not in the backup memory, confirm the display "RUN" (displayed or not) of the BASIC menu. (See the Resume Function.)

CAUTION

Be sure to register file name AUTOSTART in uppercase characters.
Only one AUTOSTART file can exist in one memory card.
The AUTOSTART file can be activated only once after power-on.

5. 7 Search

This is the function to search a character string forward or backward in a text. To search the character string after the cursor position, press F9 key or input Forward search of the pop-up menu. To search it before the cursor position, press F10 key or input Backward search of the pop-up menu.
The both types of search execute the same function except searching direction.

The following is the example to search a character string after the cursor position. Press F9 key or input Forward search of the pop-up menu.
A mini-window is displayed on the screen and the character string to be searched is queried. Therefore, input the character string to be searched.

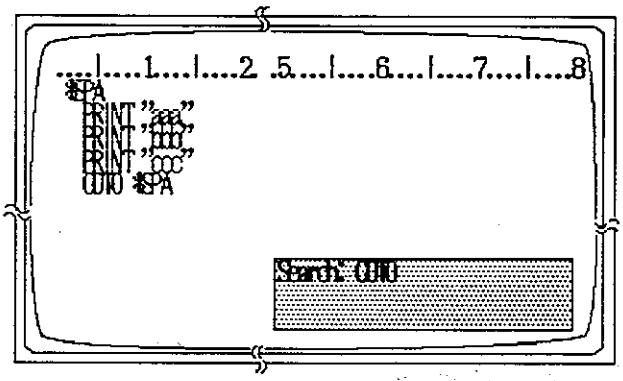


Figure 5 - 22 Search of Character String After Cursor Position

The cursor moves to the top of the character string to be searched to end search. To search the same character string consecutively, perform the same operation. However, character string input can be omitted.

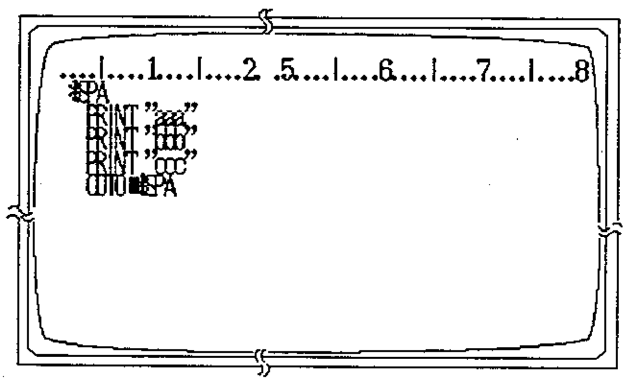


Figure 5 - 23 Execution Result

If the character string cannot be searched, the message "Not found" is displayed.

F9	Searches a character string backward from the cursor position.
F10	Searches a character string forward from the cursor position.

Figure 5 - 24 Key Pad for Search

5.8 Replacement

This is the function to replace any character string after the cursor position in a text.

The following is the example to replace a character string. Press F11 key or input Query replace of the pop-up menu, then a mini-window is displayed on the screen and the character string to be replaced is queried. Therefore, input the character string to be replaced.

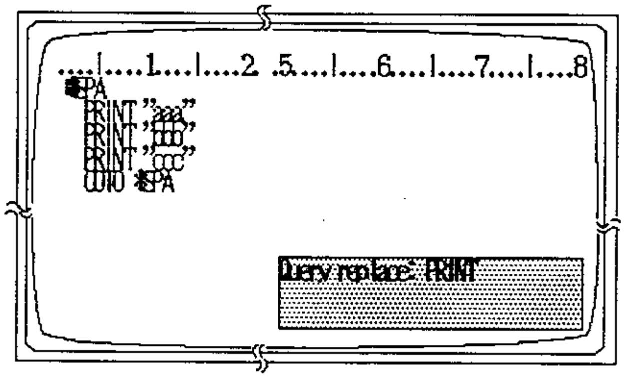


Figure 5 - 25 Inputting of Character String to be Replaced

When the character string to be newly changed is queried, input an optional character string.

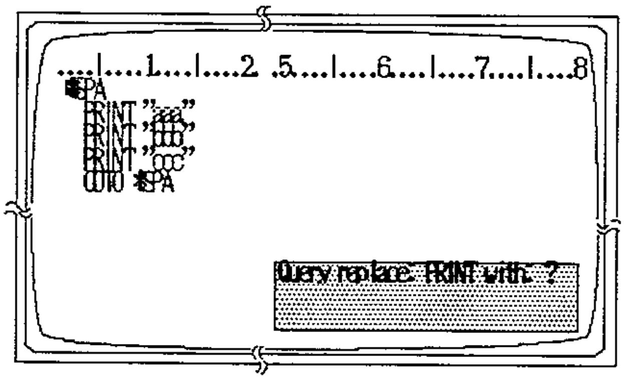


Figure 5 - 26 Inputting of New Character String

When the character string concerned is searched, the cursor moves to the top of the character string and the character string is ready for replacement.
In this case, press space key to replace the character string or Backspace key unless replacing it.
To end the operation after replacement, press . key. To end the operation without replacement, press ESC or Ctrl-Z key.

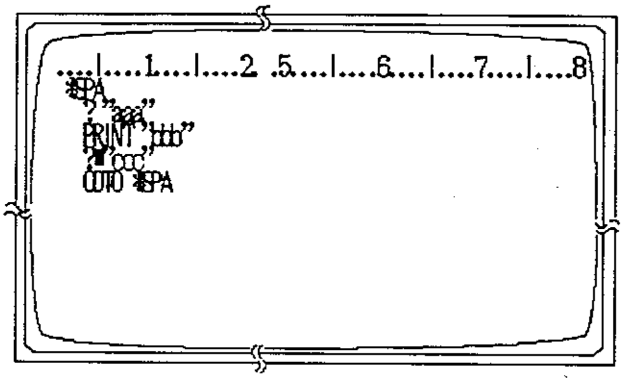


Figure 5 - 27 Execution Result

F11	Replaces a character string.
space	Executes replacement.
Backspace	Executes no replacement.
.	Ends operation after replacement.
ESC (Ctrl-Z)	Ends operation.

Figure 5 - 28 Key Pad for Replacement

5.9 BASIC

The ate editor is a portable editor developed to make BASIC programming on the measuring instrument. Therefore, it allows the operator to easily run BASIC and debugging while editing. In addition, it is possible to execute various BASIC commands in the BASIC mode. The following describes the BASIC commands which can be executed on the editor.

5.9.1 Setting of Line Number

Though line numbers have been used so far to create a BASIC program, the ate editor uses labels in stead of line numbers to simplify the program.

```
A=1:B=0
*LOOP
        B=B+A^2
        IF B>10000000 THEN GOTO *ENDLOOP
        PRINT B
        GOTO *LOOP
*ENDLOOP
STOP
```

Figure 5 - 29 Program Using Labels

It is also possible to make editing while giving line numbers with the automatic line number inserting (AUTO) function.
When you press Shift + F9 key or input Line no. of the pop-up menu, and the mini-window is displayed to designate and the starting number and interval.
When pressing Enter key for editing under the above condition, line numbers are automatically output.

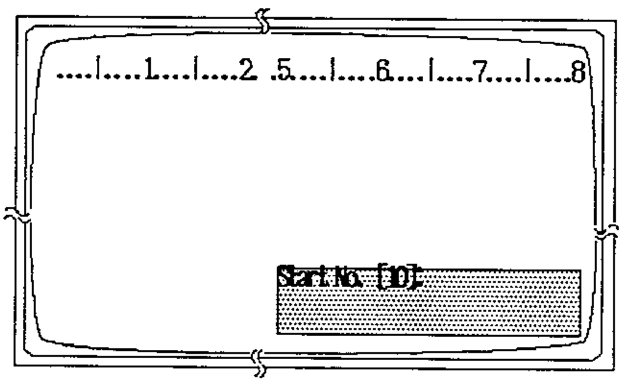


Figure 5 - 30 Designation of Starting Number

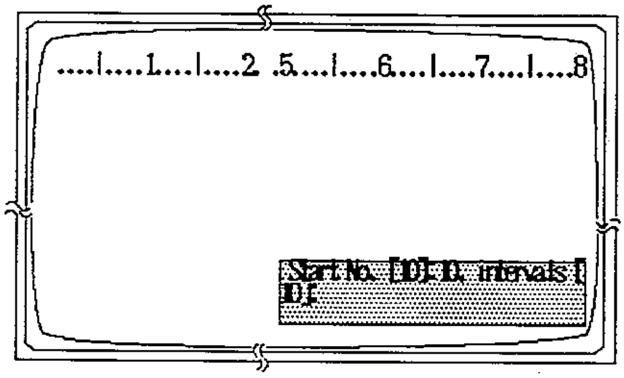


Figure 5 - 31 Designation of Line Number Interval

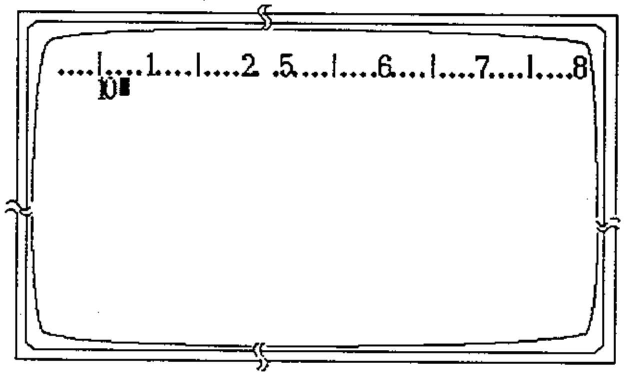


Figure 5 - 32 Automatic Line Number Inserting Function

Also it is possible to add line numbers with the function during editing.
If a line is inserted between lines, the number obtained by adding "1" to the upper line number is used for the line number of the inserted line.

Note: Once this function is executed, it is retained until the editor is initialized (see section 5.13).

This function re-numbers lines according to a certain rule.
When you press Shift + F10 key or input Renumbering of the pop-up menu, the starting number and the interval are designated similarly to automatic line-number inserting function.

5.9.2 Running of BASIC

Before the program is run, the relationship between the ate editor and BASIC interpreter is roughly described below.
The program has been edited by the ate editor.
Therefore, completed programs are saved in the internal buffer. Meanwhile, because the BASIC interpreter also has an internal buffer, the BASIC program must exist in the buffer to run the program.

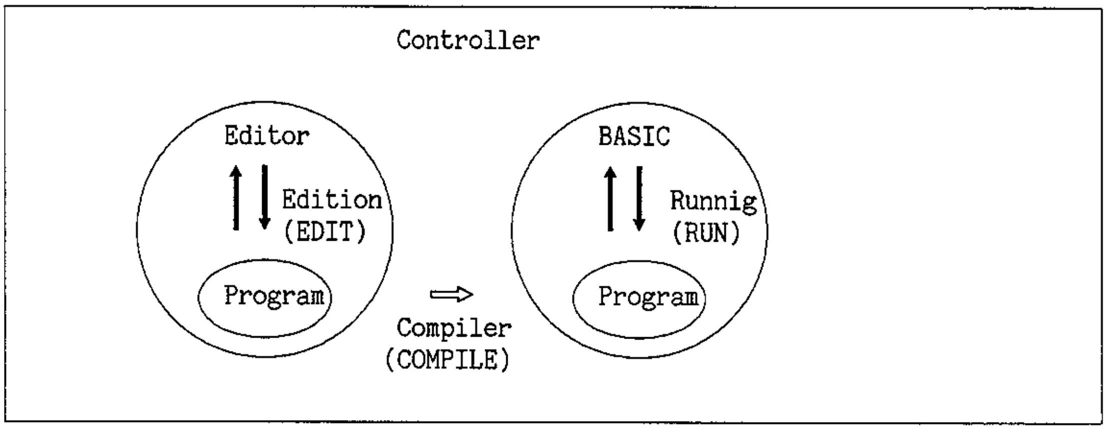


Figure 5 - 33 Relationship Between Editor and Interpreter

Therefore, move the program from the editor to the interpreter before running the program.
When you press F1 key or the CNTRLR ON COMPILE &RUN key of the R3265A/3271A or input COMPILE and RUN of the pop-up menu, the program is moved from the editor and run. In this case, the program last run is deleted. If an error occurs between program running, control is transferred to the editor and the cursor moves to the error line.

To run a moved program, press F3 key or the CNTRLR ON RUN key of the R3265A/3271A or input RUN of the pop-up menu. If the program is executed with F3 key or RUN of the pop-upmenu before it is moved, the error message "Program not exist" is displayed.
When program running ends, the prompt "BASIC command:" is displayed in the mini-window and the debugging environment is ready. To return control to the editor, press Enter key.

5.9.3 Stopping of BASIC

To stop running BASIC, press Ctrl-C key.

5.9.4 BASIC Mode

The BASIC mode is the environment capable of executing commands for BASIC, which includes the debugging environment previously mentioned.
Press F2 key or input BASIC mode of the pop-up menu, and the mini-window appears.

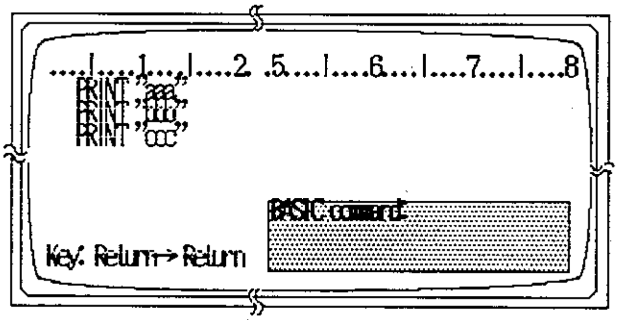


Figure 5 - 34 BASIC Mode

The commands RUN, LIST, and CONT can be executed.

Note: To change the program contents, be sure to return the control to the editor.

For description of commands, see Part 2 "System controller".

5.9.5 Continuation of BASIC

To continuously run the program which is interruped by Ctrl-C key or PAUSE command, press F4 key or the STOP CONTINUE key of the R3265A/3271A or input CONT of the pop-up menu. This is the same with the BASIC command CONT.
The program is run from the line next to the interrupted line.
If there is no program to be run, the message "Program cannot be continued" is displayed.

Shift + F9	Automatically inserts line numbers.
Shift + F10	Numbers lines.
F1	Moves the program before running it.
F2	Changes the mode to the BASIC mode.
F3	Runs the moved program.
F4	Continues the program interrupted by Ctrl-C key or the PAUSE command.

Figure 5 - 35 Key Pad for BASIC

5.10 Help

This allows the operator to check the relationship between the editor functions and keyboard on the screen.

When you press Shift + F11 key or input Help of the pop-up menu, brief description of each key function is displayed.
The function to move the cursor including scrolling of menu screen is the same as the editing function. However, there is not the function to move the cursor right and left.
Press ESC or Ctrl-Z key, and the HELP function stops andthe original editing screen appears.

```
      --- Command Key Help Menu ---                                BASIC

Backspace   Delete backward character                              LOAD
Del         Delete forward character
Shift-Del   Kill from the cursor position to end of line           COMPILE
Shift-F1    Get a file, read write                                 & RUN
Shift-F2    Save current file
Shift-F3    Write a file                                           RUN
Shift-F4    Move cursor to file name view window
Shift-F5    Make current window only one
Shift-F6    Split current window
Shift-F7    Move cursor to the next window
Shift-F8    Clear screen and redisplay everything
Shift-F9    Set line no. of the BASIC
Shift-F10   Renumber line no. of the BASIC
Shift-F11   Help menu (Command keys)
Shift-F12   SCRATCH
F1          Compile and execute RUN
F2          Change to BASIC mode
F3          Execute RUN                                            RETURN
F4          Execute CONT
```

Figure 5 - 36 Help Menu

Shift + F11	Displays the help menu.
ESC (Ctrl-Z)	Cancels the help menu.

Figure 5 - 37 Key Pad for Help

5.11 Pop-up Menu

Though every function of the ate editor previously mentioned is executed by operating the keyboard, the same operation is realized with the pop-up menu to be described below.
All editor functions except the cursor key function are displayed in the pop-up menu. Therefore, select any function among them for execution.
This menu is very effective when you cannot understand key assignment.

When you press Alt or Ctrl-A key, the pop-up menu is displayed at the top of the screen.

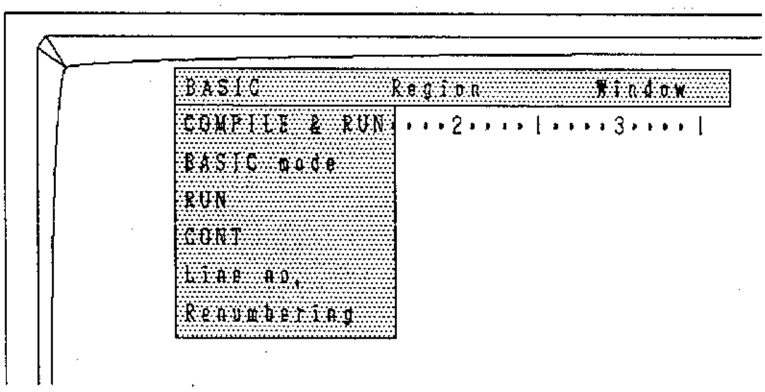


Figure 5 - 38 Pop-up Menu

BASIC	Region	Window/Other	File	Search/replace
COMPILE and RUN	Set mark	Only	Load	Forward search
BASIC mode	Kill region	Split	Save	Backward search
RUN	Copy region	Next	Write	Query replace
CONT	Yank	Redisplay		
Line No.		Help		
Renumbering		SCRATCH		

Figure 5 - 39 Pop-up Menu List

To move the cursor between items, use , keys.
The and keys move the cursor right and left and F6 through F10 keys are assigned to each item.

When the menu of the item concerned is displayed, select the function to be executed with the and keys.

Alt (Ctrl-A)	Displays the pop-up menu
ESC (Ctrl-Z)	Cancels the pop-up menu.

Figure 5 - 40 Key Pad for Pop-up Menu

Menu	Description	Reference
COMPILE and RUN	Moves and runs BASIC programs.	5.9.2
BASIC mode	Executes BASIC commands.	5.9.4
RUN	Runs the moved programs.	5.9.2
CONT	Continues the program interrputed by Ctrl-C key.	5.9.5
Line no.	Sets line numbers.	5.9.1
Renumbering	Resets line numbers.	5.9.1
Set mark	Deletes texts and sets the top position for copying.	5.4.1
Kill region	Deletes a text from the text mark through the cursor position.	5.4.1
Copy region	Stores a text from the text mark through the cursor position.	5.4.2
Yank	Copies (Recovers) the stored text.	5.4.3
Only	Merges windows into one.	5.5.2
Split	Splits a window into top and bottom ones.	5.5.1
Next	Moves the cursor to other window.	5.5
Redisplay	Re-displays a text.	5.5.3
Help	Displays the editor functions assigned to VG-920.	5.10
SCRATCH	Initializes the editor.	5.13
Load	Loads files from the memory card.	5.7.2
Save	Updates files.	5.7.3
Write	Saves files in the memory card.	5.7.1
Forward search	Searches a character string backward from the cursor position.	5.7
Backward search	Searches a character string forward from the cursor position.	5.7
Query replace	Replaces character strings.	5.8

Figure 5 - 41 Description of Pop-up Menu

	F1	F2	F3	F4	F5	F6	F7	F8
Base Case	COMPILE and RUN	BASIC mode	RUN	CONT	Set mark	Kill region	Copy region	Yank
Shift Case	Load	Save	Write	File window	Only	Split	Next	Redisplay

	F9	F10	F11	F12
Base Case	Forward search	Bachward search	Query replace	CNTRLR ON
Shift Case	Line no.	Renumbering	Help	SCRATCH

File window: Moves the cursor to the window of file display list.

Figure 5 - 42 Function Key Arrangement

5.12 Cancel of Pop-up Menu

To cancel the pop-up menu being executed, press ESC or Ctrl-Z key.

Note: The function cannot be canceled while a text is moved to the BASIC buffer or a file is saved or loaded.

ESC (Ctrl-Z)	Cancels editor functions.

Figure 5 - 43 Key Pad for Cancel

5.13 Initialization of Editor

Initialize the editor being operated. When you press Shift + F12 key or input SCRATCH of the pop-up menu, the mini-window is displayed and it is queried whether or not to save the text being edited. (Only when changing the text) After you respond the query, it is queried whether or not to initialize the editor. When you press y and Enter keys, the editor is initialized. When you press n and Enter keys, the editor is not initialized and original editor screen appears.

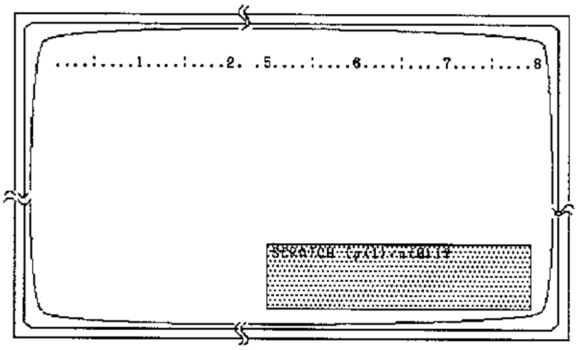


Figure 5 - 44 Mini-window To End Editor Operation

Press y and Return keys.

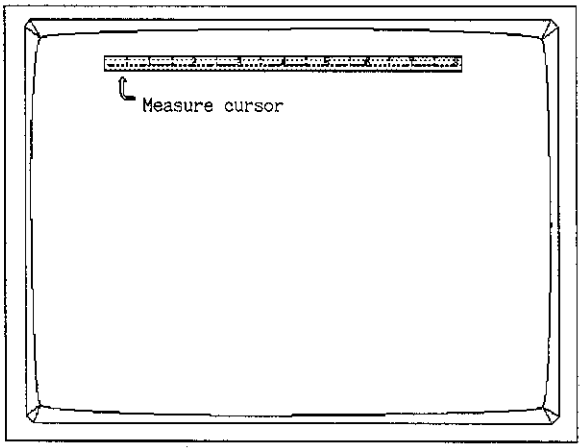


Figure 5 - 45 Initialization of Editor

Shift + F12	Initializes the ate editor.

Figure 5 - 46 Key Pad for Initialization of Editor

PART II SYSTEM CONTROLLER

1. BASIC GPIB CONTROLLER

1.1 Outline

The BASIC language, Controller function, covers the GPIB control commands as well as the
general-purpose BASIC commands. It allows small-size GPIB systems to be constructed. Moreover, measurement-dedicated built-in functions enable simple and high-speed measurement.

Note :Controller function controllers' GPIB adresses are set by CONTROL command BASIC language.

1.2 BASIC Programming

1.2.1 Program Configuration

Statements are the smallest unit that the BASIC manipulates. A group of statements configure a BASIC program.
Statements are roughly divided into the control statements and execution statements (commands).

- Statements
  - Control statements
    - Declaration statements (DIM, INTEGER)
    - Loop and branch statements (FOR, IF, etc.)
    - Interruption statements (ON, OFF)
  - Execution statements (commands)
    - Program execution control commands
    - Program edition commands
    - I/O commands
    - GPIB commands
    - File control commands

Each statement consists of the keyword and expressions. The structure of each statement is determined by the syntax rule.
In BASIC, keywords have been already assigned specific meanings and uses.
The table in the next paragraph shows the keywords in BASIC. Same name as variables cannot be used.

1. 2. 2 Keywords

【List of keywords】

AND	AS	ASCII	BAND	BINARY	BNOT
BOR	BREAK	BUZZER	BXOR	CASE	CAT
CLEAR	CLOSE	CLS	CMD	CONT	CONTINUE
CONTROL	CSR	CURSOR	DATA	DELIMITER	DIM
DISABLE	ELSE	ENABLE	END	ENT	ENTER
ERROR	FOR	GLIST	GLISTN	GOSUB	GOTO
GPRINT	IF	INIT	INITIALIZE	INP	INPUT
INTEGER	INTERFACE	INTR	ISRQ	KEY	LISTEN
LISTN	LLIST	LLISTN	LOCAL	LOCKOUT	LPRINT
NEXT	NOT	OFF	ON	OPEN	OR
OUT	OUTPUT	PAUSE	PRF	PRINT	PRINTER
PRINTF	PURGE	READ	REM	REMOTE	RENAME
REQUEST	RESTORE	RETURN	RUN	SCRATCH	SELECT
SEND	SPRINTF	SRQ	STEP	STOP	TALK
TEXT	THEN	TO	TRIGGER	UNL	UNT
USE	USING	WAIT	XOR		
Non-executable keywords					
APPEND	BASIC	CHKDSK	COPY	COPYFILES	COUNT
DEL	DSTAT	ENTERF	FORMAT	LABEL	LOAD
MERGE	NEWVERSION	REN	SAVE	SYSTEM	TIME
POKE	DUMP				

Note: Non-executable keywords have been registered as keywords but cannot be executed as commands.

1.2.3 Short Name

Short names can be used to input those keywords that may be used frequently and have a long name. They are also keywords and cannot be used as variables. Whether to output short name or full name (LIST, GLIST, etc.) can be specified with the CONTROL command (in the BASIC mode of the editor).

```
CONTROL 3;0  .........  Full-name output
          ;1  .........  Short-name output
```

【Relations between full names and short names】

Full name	Short name
CURSOR	CSR
ENTER	ENT
INITIALIZE	INIT
INPUT	INP
OUTPUT	OUT
PRINTF	PRF
USING	USE

1.3 Objects

The objects that BASIC manipulates include variables, constants, and functions. Each object should has a data type. Data types contain integer, real, and character string.

- Object
  - ① Constant (See Section 1.4.)
    - Integer constant
      - Decimal
      - Hexadecimal
    - Real constant
    - Character-string constant
    - Label constant
  - ② Variable (See Section 1.5.)
    - Scalar variable
      - Integer variable
      - Real variable
      - Character variable
    - System variable
      - Current line variable
      - Built-in variable
    - Array
      - Integer array variable
      - Real array variable
      - Character string
  - ③ Function (See Section 1.6.)
    - Intrinsic function
    - Built-in function

1.4 Constant

1.4.1 Integer Constant

A sequence of digits that does not contain decimal points is taken to be an integer constant. Both decimal and hexadecimal numbers are used as integer constants. Since an integer constant is represented with 4 bytes inside, BASIC can take values between -2,147,483,648 and +2,147,483,647.
A sequence of digits preceded by 0x is taken to be a hexadecimal number.

Decimal numbers

```
Example:  A=123
          PRINT 456
```

Hexadecimal numbers

```
Example:  A=0x10AB
          PRINT 0xFFFF
```

1.4.2 Real Constant

A sequence of digits consisting of a decimal number or represented with a floating point is taken to be a real constant.
Since real constants are represented with 8 bytes inside, BASIC can take values between approximately -1E+308 to 1E+308.
The accuracy is of 15 digits.

```
Example:  A=123.0
          B=1.23456789
          C=1.23E6-9.87654
```

Note: Operation between constants

For example, the operation PRINT 3/2 will be evaluated as 1.0 because 3 and 2 are assumed integers.
To obtain a real value, the fractional part should be attached to either or both of the constants, as shown: PRINT 3.0/2.0.

1.4.3 Character Constant

A sequence of within 255 characters enclosed in double quotations is called a character constant. A character constant can contain either a null-character string "" or up to 255 characters.
To represent those characters that are not assigned keyboard, escape sequences may be used. Each escape sequence consists of a character preceded by a backslash (\). Escape sequences may also be used to represent the ASCII control characters.

Note: A backslash should be used with an octal number or the following escape sequences:

Escape sequence	Octal	Decimal	
\b	010	8	Backspace
\t	011	9	Horizontal tab
\n	012	10	Line feed
\v	013	11	Vertical tab
\f	014	12	Formfeed
\r	015	13	Carriage return

Example:

```
A$="ABCDE"
CR$="\r"
NL$="\n"
B$=""
PRINT "ABCD\014"
PRINT "AB\007"
PRINT "ABC\n"
```

1.4.4 Label Constant

A label constant takes the part of a statement number. A label name should be preceded by an asterisk (*) when it is declared.
Those characters used for a label name are the same as those for a variable. However, a numeric value cannot be entered to a label since it is not a variable. The positions where the labels can be specified are limited by the syntax rule. The labels should be specified in the positions indicated as <label> described in the section 2.3 "Description on commands and statements".

1.5 Variables

A variable name consists of up to 20 alphanumeric characters, beginning with an alphabetic character.

Note: Any keyword cannot be used as a variable name.

【Alphanumeric】

```
A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q
R, S, T, U, V, W, X, Y, Z
a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q
r, s, t, u, v, w, x, y, z,
1, 2, 3, 4, 5, 6, 7, 8, 9, 0
_ (Underscore)
```

A variable name terminated by a $ is a character variable. A variable name terminated by a pair of parentheses ( ) is an array variable.
A variable is taken to be a real variable if it is not declared as an INTEGER.

```
Example: VAL             : Real variable
         STRG$           : Character variable
         ARRY1(4)        : Real array variable
         INTEGER code2   : Integer variable
         INTEGER wk(7)   : Integer array variable
```

1.5.1 Scalar Variables

- Integer variable
- Real variable
- Character variable

Any numeric variables of the above will be initialized to zero when a BASIC program that includes those variable starts.
Therefore, if a variable should be initialized to a specific value, it must be entered the value explicitly in the program.
The range of values to be entered to an integer variable is the same as that of integer constants used in BASIC (from -2,147,483,648 to +2,147,483,647).
The range of values to be assigned to a real variable is the same as that of real constants used in BASIC (between approximately -1E+308 and 1E+308, and the accuracy is of 15 digits).

Character variables do not include arrays.

Character variables, as well as character strings, have attributes of the length.The length should be declared with a DIM statement.

```
Example: DIM STRG$ [100] : Declares a variable where the length is 100
                           characters.
```

If the length of a variable is not declared, a space for 18 characters will be assigned to the variable.

1.5.2 System Variables

- Current line variable @

  A current line variable stores the line number where a program is executed. No value may be entered.

  Example: LIST @ : Displays the line being currently executed.

- Built-in variable

  When a BASIC program starts, built-in variables are automatically registered and initialized to the specified values. The value of a built-in function can be changed if it is entered another value. A variable may be returned to the initial value if it is assigned the initial value or the program is initialized with COMPILE and RUN.

```
PI   :3.141592.....
EXP  :2.718281.....
```

- Error number variable

  The error number variable holds the error number in BASIC. It is initialized to zero when a BASIC program starts. If an error occurs, the value of the error is assigned to the variable.

  Example: PRINT ERRN

  The error number has the following structure inside of the program:

  Error class * 256 + Error message number

  Error class
  1 : Data I/O errors
  2 : Data operation errors
  3 : Built-in function errors
  4 : BASIC syntax errors

1.5.3 Arrays

Arrays should be declared with DIM or INTEGER statements. If two or more subscripts separated by comma are specified with an array variable name, the array variable will have a number of dimensions according to the number of the subscripts. (The maximum number of the dimensions is 10 but limited by the memory capacity.)

- Numeric arrays

If an array that has not been declared is referred to, the array size, the number of elements, is assumed to be 10. The array could have been declared as in the following examples:

Subscripts always start with 1.
The subscript specified in DIM declaration will be the maximum number of the elements. The range which can declare DIM is up to 32767.

```
DIM      AB(10)
INTEGER  CD(10)
```

Example:

```
DIM      RL(30)     :  Declares a real array variable.
INTEGER  IT(10,20)  :  Declares a integer array variable (two
                       dimensional).
```

- Character string

The number of characters to be stored in a character-string variable can be declared with a DIM statement.

Example:

```
DIM A$ [100] :  Up to 100 characters can be entered.
DIM B$ [50]  :  Up to 50 characters can be entered.
```

Note: Two dimensional arrays cannot be used as character-string variable.

1.6 Functions

1.6.1 Intrinsic Functions

Intrinsic Functions	Explanation
ERRM$ (Error number)	Returns the error message specified with the parameter. If 0 is passed as parameter, the function returns the error message that has been output last. The error number has the following structure inside of the program. Error class * 256 + Error message number However, even if a number including an error class is specified, only the error message number will be referred to inside of the program. Therefore, ERRN can be set as an error number, as follows: Example: PRINT ERRM$ (ERRN): Displays the error message that has been displayed last.
NUM (character-string expression)	Returns the ASCII code of the first character of the character-string expression. Example: NUM ("ABC") → 65 A$="XYZ" NUM (A$) → 88
CHR$ (arithmetic expression)	Returns the character-string expression determined by the value of the arithmetic expression. Example: CHR$ (65) → "A" A=88 CHR$ (A) → "X"
LEN (character-string expression)	Returns the length of the character-string expression. Example: LEN ("ADVANTEST") → 9 A$="CORP." LEN (A$) → 5
POS (character-string expression 1, character-string expression 2)	Returns the position of the first set ofcharacter-string expression 2 in character-string expression 1. Example: A$="AN" POS ("ADVANTEST",A$) → 4

Intrinsic Functions	Explanation
ABS (arithmetic expression)	Returns the absolute value of the arithmetic expression. Example: ABS (-1.2) → 1.2
ATN (arithmetic expression)	Returns the arc tangent of the arithmetic expression. (The arithmetic expression should be passed in radian.) Example: ATN (PI) → 1.26262...
COS (arithmetic expression)	Returns the cosine of the arithmetic expression. (The arithmetic expression should be passed in radian.) Example: COS (PI) → -1.0
FRE (0)	Returns the size (bytes) of the free area in the memory for BASIC. Example: FRE (0) → 502718 (When the system is turned on, this function is executed as follows in the BASIC mode: PRINT FRE (0).)
LOG (arithmetic expression)	Returns the natural logarithm (base e logarithm) of the arithmetic expression. (The arithmetic expression should be passed in radian.) Example: LOG (EXP) → 1.0
SIN (arithmetic expression)	Returns the sine of the arithmetic expression. (The arithmetic expression should be passed in radian.) Example: SIN (PI) → 0.0
SPOLL (arithmetic expression)	Performs serial polling to the GPIB device and then returns the status byte. (The arithmetic expression should be in range between 0 and 31.) Example: SPOLL (2) : Performs serial polling to address 2 of the external GPIB device connected. SPOLL (31): Performs serial polling to the measurement section of the main device.

Intrinsic Functions	Explanation
SQR (arithmetic expression)	Returns the square root of the arithmetic expression. Example: SQR (2) → 1.41421356...
TAN (arithmetic expression)	Returns the tangent of the arithmetic expression. (The arithmetic expression should be passed in radian.) Example: TAN (PI) → 1.0
RAND (0)	Generates random numbers from 0 to 1. Example: RAND (0) → .375
LGT (Arithmetic expression)	Returns common logarithm (logarithm based on radix of 10) for arithmetic expression. Example: LGT (10) → 1

1.6.2 Built-in Function

Item	Built-in Function
(1) Obtains the frequency.	FREQ (P) DFREQ (P1, P2) FMAX (P1, P2, M) FMIN (P1, P2, M) BND (P, X, M) BNDL (P, X, M) BNDH (P, X, M) CBND (F, X, M) CBNDL (F, X, M) CBNDH (F, X, M) FRPLHN (N, M) FRPLLN (N, M)
(2) Obtains points.	POINT (F) DPOINT (F1, F2) PMAX (P1, P2, M) PMIN (P1, P2, M) PRPLHN (N, M) PRPLLN (N, M)
(3) Obtains the traced data.	LVPOINT (L) LVDPOINT (L1, L2)

(cont'd)

Item	Built-in Function
(4) Obtains levels.	VALUE (P, M) DVALUE (P1, P2, M) CVALUE (F1, F2, M) DCVALUE (F1, F2, M) LEVEL (T) DLEVEL (T1, T2) MAX (P1, P2, M) MIN (P1, P2, M) RPL1 (P1, P2, Dx, Dy, M) VRPLHN (N, M) VRPLIN (N, M)
(5) Obtains the total power.	POWER (P1, P2, M)
(6) Obtains the number of ripples (maximum and minimum waves)	NRPLH (P1, P2, Dx, Dy, M) NRPLL (P1, P2, Dx, Dy, M)
(7) Checks the upper and lower limits.	LMTMD1 (Dd, S, Ds) LMTMD2 (P, S, Ds, M) LMTUL1 (Dd, Up, Lo) LMTUL2 (P, Up, Lo, M)
(8) Inputs and outputs the traced data.	RTRACE (P, M) WTRACE (T, P, M)
(9) Graphics functions	GADRS (MO, X, Y) GFLRECT (W, X1, Y1, X2, Y2) GLINE (L, W, X1, Y1, X2, Y2) GMKR (M, W, X, Y) GPOINT (W, X, Y) GRECT (L, W, X1, Y1, X2, Y2) GSTR (W, X, Y, Character-string expression)

1.7 Operation Expression

Objects are manipulated by operators. An expression consists of a combination of operators and objects.

```
Operators ──┬─ (1) Assignment operator        (See subsection 1.7.1.)
            ├─ (2) Unary arithmetic operator  (See subsection 1.7.2.)
            ├─ (3) Binary arithmetic operator (See subsection 1.7.3.)
            ├─ (4) Logical operator           (See subsection 1.7.4.)
            ├─ (5) Relational operator        (See subsection 1.7.5.)
            ├─ (6) Substring operator         (See subsection 1.7.6.)
            └─ (7) Bitwise operator           (See subsection 1.7.7.)
```

1.7.1 Assignment Operator

An assignment expression has its value.

Example:
```
A=123
PRINT A
PRINT B$="ADVANTEST"
PRINT (A=2)+A
```

【Result】

```
123.0
ADVANTEST
4.0
```

Assignment operators are summarized below.

Assignment operator	Example	Meaning
=	A=123	Normal assignment
+=	A += 5	Equivalent to A = A + 5.
-=	A -= 5	Equivalent to A = A - 5.
*=	A *= 5	Equivalent to A = A * 5.
/=	A /= 5	Equivalent to A = A / 5.
%=	A %= 5	Equivalent to A = A % 5.
=>	A$=>"ABCD"	Enter a character string right-justified.
=<	A$=<"ABCD"	Enter a character string left-justified.

Note: % is a modulus operator, which produces a remainder.

Example:
```
DIM S$ [15]
A = 5     :PRINT A
A += 10   :PRINT A
A -= 3    :PRINT A
A *= A    :PRINT A
A /= 2    :PRINT A
A %= 5    :PRINT A
PRINT "123456789012345"
S$ => "TEST"   :PRINT S$
S$ =< "TEST"   :PRINT S$
```

【Result】

```
5.0
15.0
12.0
144.0
72.0
2.0
123456789012345
           TEST
TEST
```

1.7.2 Unary Arithmetic Operator

-	Minus sign
+	Plus sign
++	Prefix/postfix increment: Add 1 to a variable. • Prefix increment Example: A = 2 Assign 2 to A. B = ++A Add 1 to A before entering A to B. • Postfix increment Example: A = 2 Assign 2 to A. B = A++ Add 1 to A after entering A to B.
--	Prefix/postfix decrement: Subtract 1 from a variable. • Prefix decrement Example: A = 2 Enter 2 to A. B = --A Subtract 1 from A before entering A to B. • Postfix decrement Example: A = 2 Assign 2 to A. B = A-- Subtract 1 from A after entering A to B.

When an increment operator (++) is placed before a variable, 1 is added to the variable before the its value is used. When an increment operator is placed after a variable, 1 is added to the variable after its value has been used.
In case of a decrement operator (--), the same operations take place except that 1 is subracted from a variable before or after the assignment.

Example:
```
A = 10
A++                 : Equivalent to A = A + 1.
++A                 : Equivalent to A = A + 1.
A--                 : Equivalent to A = A - 1.
--A                 : Equivalent to A = A - 1.
PRINT "1", A++      : Add 1 to A after displaying the value of A.
PRINT "2", A
B = --A             : Enter A to B after subtracting 1 from A.
C = A++             : Enter A to C before adding 1 to A.
PRINT "3", A
PRINT "4", B
PRINT "5", C
B = A--             : Enter A to B before subtracting 1 from A.
PRINT "6", A
PRINT "7", B
C = -123
D = C + (-23) - (+50)
PRINT "8", C
PRINT "9", D
```

【Result】

```
1    10.0
2    11.0
3    11.0
4    10.0
5    10.0
6    10.0
7    11.0
8    -123.0
9    -196.0
```

1.7.3 Binary Arithmetic Operator

+	Addition
-	Subtraction
*	Multiplication
/	Division
%	Modulus (remainder)
^	Power
&	Connecting character strings

Example:
```
PRINT 10+2
A=10
PRINT A-5
PRINT A*A
PRINT 20/A
PRINT A%3
B=3^4
PRINT B
S$="ABCD"
S1$=S$&"EFG"
PRINT S1$
```

【Result】

```
12
5.0
100.0
2.0
1
81.0
ABCDEFG
```

1.7.4 Logical Operator

Logical operators connects two or more relational operators to express compound conditions.

NOT	Negation	X 0 1		NOT X 1 0
AND	Conjunction (Logical AND)	X 0 0 1 1	Y 0 1 0 1	X AND Y 0 0 0 1
OR	Disjunction (Logical OR)	X 0 0 1 1	Y 0 1 0 1	X OR Y 0 1 1 1
XOR	Exclusive OR	X 0 0 1 1	Y 0 1 0 1	X XOR Y 0 1 1 0

Example: IF NOT A THEN GOTO *MI
If A is zero, a jump to *MI takes place.

IF X<100 OR 199<X THEN GOTO *LA
If X is less than 100 or greater than 199, a jump to *LA takes place.

IF 0<=X AND X<=100 THEN PRINT X
If X is greater than or equal to 0 and less than or equal to 100, X is printed.

IF A XOR B THEN PRINT A, B
If A is true but B is false or if A is false but B is true, both A and B are printed.

1.7.5 Relational Operator

A relational operator is used to compare two numeric values. The result of the comparison will be either true (1) or faluse (0).
It is used to branch the flow of the program in such a statement as a condition judgment statement (IF statement).
In the conditional expression of an IF statement, a logical operation always takes place and an equal sign (=) will always be taken to be a relational operator. Therefore, the conditional expression cannot include any assignment expression.
To express equality out of the conditional expression of IF statement, use "==" and distinguish it from "=" for an assignment operator.

Example: A=(B$=="ADVAN")
If the character variable B$ is "ADVAN", 1 is assigned to A.

Symbol	Meaning	Example
= (or ==)	Equal to	X=Y, X==Y
<>	Not equal to	x<>Y
<	Less than	x<Y
>	Greater than	x>Y
<=	Less than or equal to	x<=Y
>=	Greater than or equal to	x>=Y

Note: "<=" or ">=" cannot be substitute for "=<" or "=>".

Example:
```
A=1
B=2
IF A=1 AND B>1 THEN PRINT "A"
IF A<>1 OR B=5 THEN PRINT "B"
IF NOT A THEN PRINT "C"
IF A XOR B>=3 THEN PRINT "D"
IF A==(B-1) THEN PRINT "E"
```

【Result】

```
A
D
E
```

1.7.6 Substring Operator

With substring operator, a part of a character-string expression can be referenced.

- Character-string expression (arithmetic expression 1, arithmetic expression 2)

  Pick up characters from the first arithmetic expression character to the second arithmetic expression character of the character string.

  Example:
```
A$="ABCDEFG"
PRINT A$ [3, 5]
PRINT "*ADVANTEST*" [2, 6]
PRINT "*ADVANTEST*" [7, 10]
```

  【Result】

```
CDE
ADVAN
TEST
```

- Character-string expression (arithmetic expression 1; arithmetic expression 2)

  Pick up character line of 2-digit arithmetic expression character from the first arithmetic expression character.

  Example:
```
A$="ABCDEFG"
PRINT A$ [3; 4]
PRINT "*ADVANTEST*" [7; 4]
PRINT "*ADVANTEST*" [2; 5]
```

  【Result】

```
CDEF
TEST
ADVAN
```

1.7.7 Bitwise Operators

Bitwise operators directly manipulate each of bits that consist of data. They provide logical operations (AND, OR, XOR, etc.) for each bit.
Bit operations may only be applied to integers. The range of bit operations can take place within 16 bits, 0 to 65535. If a minus number is specified, an error occurs. (NO operand in ...)
To use a bit operator with a numeric variable, declare the variable as an integer by using the INTEGER instruction.

BNOT	(One's complement) BNOT 0 → 65535 BNOT 65535 → 0
BAND	(Logical AND) 65535 BAND 255 → 255 255 BAND 1024 → 0
BOR	(Logical OR) 255 BOR 1024 → 1279 1 BOR 2 → 3
BXOR	(Exclusive OR) 255 BXOR 128 → 127 1 BXOR 3 → 2

Example:
```
INTEGER S
*L
S=SPOLL (31)
IF S BAND 4 THEN PRINT "SWEEP END"
GOTO *L
```

1.8 Precedence of Operation

Various operators have precedence.
Operators on the same line are evaluated according to the number shown below.

Precedence	Operator
1	Expression enclosed in parantheses ().
2	Function
3	^
4	Sign
5	++, --
6	*, /
7	%
8	+, -
9	Relational operator
10	BNOT
11	BAND
12	BOR
13	BXOR
14	NOT
15	AND
16	OR
17	XOR

1.9 Character-string Operation

In BASIC, operations can take place with character strings.

1.9.1 Join Character Strings

Character strings may be joined with "&".

```
Example:  A$="ADVANT"&"TEST"
          B$=A$&" co."
          PRINT A$
          PRINT B$
```

【Result】

```
ADVANTEST
ADVANTEST co.
```

1.9.2 Compare Character Strings

As well as numbers, characters may be compared with each other with relational operations.

=, <, >, <>, <=, >=

"==" should be used to indicate equality out of IF statements.

```
Example:  PRINT A==B
```

Comparison takes place from the first character serially. If two character strings to compare are of the same length, the character string that has the larger ASCII code will be evaluated to be greater than the other.
If either of the two character strings to compare is shorter, the shorter one will be evalutated to be less than the other.
Note that blank spaces have meanings in character strings.

```
Example:  "AA"="AA"    →  True
          "AA"<"aa"    →  True
          "AAA">"AA"   →  True
```

1.9.3 Type Conversion

Input may take place from chracter-string expression to numeric variables or from numeric expression to character-string variables, directly.
When a character-string expression include both alphabetic and numeric characters, only the first numeric character string will be assigned to a numeric variable.

Example;
```
A="123.4"
B="ABC456.7DEF89"
C$=123
D$=B
PRINT A
PRINT B$
PRINT C$
PRINT D$
```

【Result】

```
123.4
456.7
123
456.7
```

2. GRAMMARS AND DESCRIPTION OF COMMANDS AND STATEMENTS

2.1 Outline

This chapter provides descriptive expression on the syntax of commands and statements so that it can be understood.

2.2 Introduction

2.2.1 Structure of Description

BUZZER	·········	Command name (Short name: abbreviation)
【Outline】	·········	Function of the instruction
【Format】	·········	How to describe the instruction (Descriptive expression)
【Description】	·········	Usage and details of the instruction
【Example】	·········	Example of the instruction
【Note】	·········	Note on using the instruciton
【Program example】	·········	Program example where the instruction is used
【Result】	·········	Execution results of the program example

(1) 【Format】

The following symbols are used in descriptive expressions of 【Format】 .

<> : The item enclosed in brackets (<>) should be specified by the user.
[] : The item enclosed in square brackets ([]) may be omitted.
{} : The item enclosed in braces may be used repeatedly.
, : Two or more parameters may be specified if they are separated by a comma.
| : A vertical bar means OR.

Example: <A> | <B> ········· <A> or <B> is used.

(2) 【Description】

The meanings of the terms used in the description are explained below.

Numeric expression:
Indicates any of a numeric constant, numeric variable, or numeric expression.

Character-string expression:
Indicats a character-string expression consisting of character-string constants, character-string variables, character-string function, and substrings.

Device address:
A GPIB address of the device connected to the GPIB.

File descriptor:
It is equivalent to a variable and attached to a data input or output statement.

Label: Label name (including a line number).
A label name consists of alphabetic characters lead by an asterisk (*).

(3) Commands and Statements Classified by Functions

Function	Command and Statement	Description	Page
① Commands	CONT	Resumes the execution of the program after it has stopped.	2-18
	CONTROL	Sets values for each control.	2-19
	LIST	Displays a program list.	2-59
	LLIST	Displays a program list. (RS-232C)	2-62
	LISTN	Displays a program list.	2-61
	LLISTN	Displays a program list. (RS-232C)	2-63
	RUN	Executes a program.	2-108
	SCRATCH	Deletes a program in BASIC.	2-110
	STEP	Executes a line of a program.	2-122
② Arithmetic functions	ABS	Produces the absolute value of the given value.	1-12
	ATN	Produces the arc tangent of the given value.	1-12
	COS	Produces the cosine of the given value.	1-12
	LOG	Produces the natural logarithm of the given value.	1-12
	SIN	Produces the sine of the given value.	1-12
	SQR	Produces the square root of the given value.	1-13
	TAN	Produces the tangent of the given value.	1-13
③ Bitwise operations	BAND	Produces a bit AND.	1-23
	BNOT	Produces a bit NOT.	1-23
	BOR	Produces a bit OR.	1-23
	BXOR	Produces a bit XOR.	1-23
④ Interrupt controls	ENABLE INTR	Enables interrupts to be received.	2-28
	DISABLE INTR	Disables interrupts to be received.	2-27
	ON END	Defines the branch of an EOF interrupt.	2-76
	ON KEY	Defines the branch of a key interrupt.	2-80
	ON ISRQ	Defines the branch of an SRQ interrupt of the main measurement section.	2-82
	ON SRQ	Defines the branch of an SRQ interrupt of GPIB.	2-82
	ON ERROR	Defines the branch of an error occurrence interrupt.	2-78

Note: See section 2.3 for details of each command and statement.

Function	Command and Statement	Description	Page
④Interrupt controls (cont'd)	OFF END	Releases the branch of an EOF interrupt.	2-71
	OFF KEY	Releases the branch of a key interrupt.	2-73
	OFF ISRQ	Releases the branch of an SRQ interrupt of the main measurement section.	2-75
	OFF SRQ	Releases the branch of an SRQ interrupt of GPIB.	2-75
	OFF ERROR	Releases the branch of an error occurrence interrupt.	2-72
⑤Character-string manipulations	NUM	Converts the first character of a character string to the ASCII code.	1-11
	CHR$	Converts a numeric character to an ASCII character.	1-11
	LEN	Obtains the length of a character string.	1-11
	POS	Positions character string 1 in character string 2.	1-11
	SPRINTF	Formats a string and enters it to a character-string variable.	2-119
⑥Memory card controls	CAT	Displays the contents of a memory card.	2-11
	CLOSE #	Close a file.	2-16
	ENTER #	Reads data from a file.	2-30
	OPEN #	Open a file.	2-85
	OUTPUT #	Writes data into a file.	2-87
	INITIALIZE (or INIT)	Initializes a memory card.	2-51
	PURGE	Deletes the specified file.	2-109
	RENAME	Rename a file.	2-106
⑦Screen controls	CURSOR (or CSR)	Moves the cursor to the specified position.	2-21
	CLS	Clears the screen.	2-14
	SCREEN	Sets up the basic screen.	2-111
	KEY ON	Displays the user-defined menu.	2-58
	KEY OFF	Clears (deletes) the user-defined menu.	2-57
	PANEL	Enables/Disables the panel key control.	2-92
⑧Statements	BUZZER	Sounds the buzzer.	2-7
	DIM	Declares array variables.	2-25
	FOR TO STEP NEXT	Sets an iteration.	2-35
	BREAK	Exits from the current iteration.	2-35
	CONTINUE	Returns to the beginning of the current iteration.	2-35
	GOSUB	Branches to a subroutine.	2-41
	RETURN	Returns from the current subroutine.	2-41
	GOTO	Branches to the specified statement.	2-43

Note: See section 2.3 for details of each command and statement.

Function	Command and Statement	Description	Page
⑧Statements (cont'd)	IF THEN ELSE END IF	Executes the statements after evaluating conditions.	2-48
	INPUT (or INP)	Inputs a value to a variable.	2-55
	INTEGER	Declares integer-type variables.	2-52
	LPRINT	Outputs data on a printer (RS-232C).	2-66
	LPRINT USING (or USE)	Outputs formatted data on a printer (RS-232C).	2-68
	PAUSE	Stops execution temporarily.	2-93
	PRINT (or ?)	Displays characters on the screen.	2-97
	PRINT USING (or USE)	Displays formatted characters on the screen.	2-99
	PRINTER	Addresses a GPIB printer device.	2-101
	PRINTF(or PRF)	Displays formatted characters on the screen.	2-94
	READ DATA	Reads data from a DATA statement and assigns it to a variable.	2-102
	RESTORE	Specifies the DATA statement to read by the READ DATA statement.	2-102
	REM (or !)	Provides a comments.	2-104
	SELECT CASE END SELCT	Executes statements after evaluating condition.	2-113
	STOP	Stops program execution.	2-123
	WAIT	Holds the program execution for the specified periond.	2-125
⑨GPIB commands	CLEAR	Transfers DCL and SDC.	2-13
	DELIMITER	Sets a delimiter.	2-23
	ENTER (or ENT)	Inputs GPIB data.	2-33
	GLIST	Outputs the program list to a GPIB printer.	2-38
	GLISTN	Ouuputs the program list to a GPIB printer.	2-40
	GPRINT	Ouputs data to a GPIB printer.	2-44
	GPRINT USING (or USE)	Outputs formatted data to a GPIB printer.	2-46
	INTERFACE	Transfers IFC.	2-54
	CLEAR LOCAL	Places the specified device in the local status.	2-64
	LOCAL LOCKOUT	Places the specified device in the local lokced-out status.	2-65
	OUTPUT(or OUT)	Outputs data to GPIB.	2-90
	REMOTE	Places the specified device in the remote status.	2-105
	REQUEST	Outputs SRQ to the standard GPIB.	2-107
	SEND	Outputs a set of GPIB data.	2-115
	SPOLL	Provides serial polling to the specified device.	2-117
	TRIGGER	Outputs GET.	2-124

Note: See section 2.3 for details of each command and statement.

2.3 Description on Commands and Statements

This section describes commands and statements in the sequence shown below.

(1) BUZZER

【Outline】

Sounds the buzzer that the main device has inside.

【Format】 BUZZER <interval>, <time>

【Description】

The BUZZER statement sounds the specified <interval> for the specified amount of <time>.
<interval> : Integer 0 to 65535 (Hz)
<time> : Integer 0 to 65535 (millisecond)

【Intervals】

261	: Do	C	277	: Do#	C#
294	: Re	D	311	: Re#	D#
339	: Mi	E			
349	: Fa	F	370	: Fa#	F#
392	: Sol	G	415	: Sol#	G#
440	: La	A	466	: La#	A#
494	: Si	B			

If the value is doubled, the interval is raised by an octave. If the value is halved, the interval is lowered by an octave.
As the value becomes greater, the sound becomes higher.

【Example】 BUZZER 440, 1000 : Sounds la for one second.

【Note】

Since the BUZZER statement only gives the settings to the circuit that sounds the buzzer, the execution completes immediately while the buzzer continues sounding for the specified amount of time. (If one second is set as the amount of time, the control passes to the next statement immediately after the BUZZER statement gives the settings to the circuit.)
To sound buzzer continuously, place the WAIT statement after the BUZZER statement. The amount of time set in the WAIT statement must be equal to the one in the BUZZER statement.

【Program Example】

```
FOR I=1 TO 8
  READ S
  BUZZER S,1000
  WAIT 1000
 NEXT I
 DATA 261,294,330,349,392,440
 DATA 494,523
```

【Result】 The buzzer sounds each interval for one second, changing intervals as follows: do, re, mi, fa, sol, la, si, and do.

(2) CALL

【Outline】

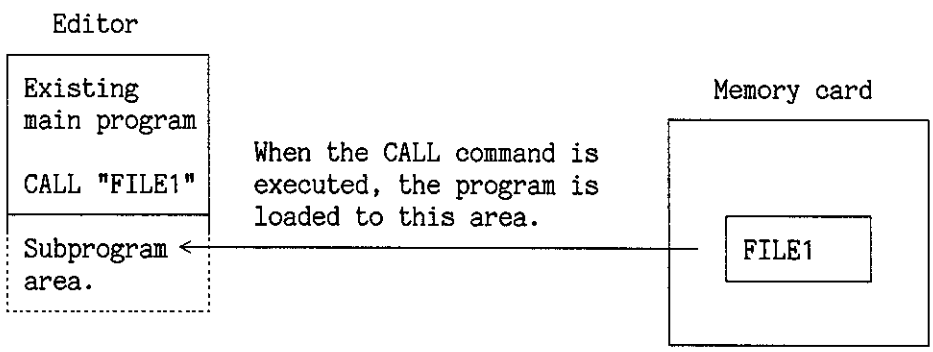
This function reads a file (subprogram) in the memory card and adds it to the end of a program created for executing it as a subroutine.

【Format】

CALL <filename>

【Description】

- The CALL command in the program existing in this system, which is regarded as the main program, reads a program from the memory card to add it to the end of the main program. The added program is regarded as a subprogram. (A subprogram is treated as a subroutine.)
  (Program CANNOT be continued)
- After the subprogram is read and executed as a subroutine by the CALL command in the main program, the control returns and restarts to execute the statement following the CALL command (the same as GOSUB and RETURN).



【Example】

CALL "FILE1" : Program "FILE1" is read and executed.

【Notes】

- The CALL command cannot be used in a subprogram. If used, an error results and execution is stopped.
  (CANNOT next CALL)
- The system deletes the loaded subprogram after execution of the subprogram and returns, Therefore, no program is displayed on the editor but the main program.

- Since variables are used in common with the main program, use of same variables in the loop process such as FOR ~NEXT causes malfunction. Variables specific to subprograms (local variables) cannt be defined.
- When a subprogram is loaded, the RETURN command is automatically inserted. Even if the RETURN command already exists, operation is not influenced.
- If a subprogram contains line numbers, the line numbers are ignored during loading. Even if the line numbers overlap once in the main program, opration is normally performed.

【Program example】

```
• FOR I=1 TO 10          :  This program is saved as "FILE1".
    PRINT I;             :
  NEXT I                 :

• FOR K=1 TO 5           :  This program is executed as the main program.
    CALL "FILE1"         :
    PRINT                :
  NEXT K                 :
```

【Result】

```
loading...

12345678910
loading...

12345678910
loading...

12345678910
loading...

12345678910
loading...

12345678910
Program ended normally.
```

(3) CAT

【Outline】

Outputs the list of the files stored in the memory card.

【Format】

CAT

【Description】

- The CAT command outputs the list of the files stored in the memory card.
- The CAT command should be entered in the the BASIC mode of the editor.
- If the CAT command is executed, the list is displayed on the screen, as follows:

```
16 FILE_1      BAS     256  1991-01-01  10:10
17 DATA_NO1    DAT   19200  1991-02-14  12:10
18 FILE_2      BAS     256  1991-01-15  10:20
19 PROGRAM001  BAS     128  1990-10-04  15:35
20 PROGRAM002  BAS     128  1990-12-24  09:04
21 PROGRAM003  BAS    1408  1991-05-05  11:22
22 NOISE       SET    1280  1991-03-03  13:45
```

File creating time (Date time)

File size (bite)

File type
BAS: BASIC program
DAT: BASIC data
SET: Setting data
KEY: User define menu data

File name

File number

•
•

```
23 FILE_4      BAS    1792  1991-05-05  14:56
24 FILE_5      BAS     128  1991-07-14  17:24

      9 files exists in 24 files
            Total    25600 Bytes
            Used     24576 Bytes (96%)
```

Registered file number/ registerable file number

All card capacity

Used capacity (Occupied rate)

【Example】

CAT

【Note】

New cards cannot be used until they are initialized by the (24).

(4) CLEAR

【Outline】

To initialize every or specified devices connected to GPIB.

【Format】

CLEAR [device address {, device address}]

【Description】

- If a CLEAR statement is executed without specifying device addresses, an universal command, Device Clear (DCL), will be sent. This command initializes every device on GPIB.
- If a device address (0 to 30) are specified after the CLEAR statement, an universal command, Selector Device Clear(SDC) is sent only to the device specified by the device address. This enables to initialize only the specified deivce.
  More than one device addresses can be specified.

【Example】

CLEAR

CLEAR 1

CLEAR 2, 5, 8

【Note】

- To specify numbers other than 0 to 30 as device addresses causes an error to interrupt the program execution. The following message will be displayed. (UNIT addr error in CLEAR)
- Not function in slave mode.

【Sample program】	【Result】
CLEAR 3	: Device address 3 will be initialized.
OUTPUT 3;"CF3MZ"	: Sent data to device address 3.
CLEAR 3,5	: Device addresses 3 and 5 will be initialized.
OUTPUT 3,5;"CF2MZ"	: Sent data to device addresses 3 and 5.
CLEAR	: Every connected device will be initialized.

(5) CLS

【Outline】

Deletes the screen of the main-body CRT.

【Format】

CLS [1 | 2]

【Description】

- The CLS statement clears the character and graphics screens of the main-body CRT.
- The following parameters are available:
  Not specified: Clears only the character screen.
  1: Clears only the graphics screen.
  2: Clears both character and graphics screen.

【Example】

```
CLS
CLS 1
CLS 2
```

【Note】

Before use of the graphics screen, the GPIB code "VS3" should be transmitted with the OUTPUT 31 statement.

【Program Example】

No.1
```
OUTPUT 31;"VS3"
GLINE(0,1,0,0,1023,439)
PRINT "TEST"
WAIT 2000
CLS
```

No.2
```
OUTPUT 31;"VS3"
GLINE(0,1,0,0,1023,439)
PRINT "TEST"
WAIT 2000
CLS 1
```

No.3

```
OUTPUT 31;"VS3"
GLINE(0,1,0,0,1023,439)
PRINT "TEST"
WAIT 2000
CLS 2
```

【Result】

No.1
The character string "TEST" is deleted and the graphics objects remain.

No.2
The graphics objects are deleted and the character string "TEST" remain.

No.3
Both graphics objects and the character string "TEST" remain.

(6) CLOSE

【Outline】

Closes the file that is assigned to the specified file descriptor.

【Format】

CLOSE <# file descriptor>

【Description】

- All of the opened files should be closed before the memory card is removed or the main body is turned off. Otherwise, the file is broken.
- In the BASIC program, the files are not automatically closed if the execution of a program is stopped by the PAUSE statement or pressing the STOP key. In other cases, all files are automatically closed when a program ends.
  Files are closed when a program is terminated because of errors.
  If there is an ON ERROR definition in the program, the files are not closed.
  Therefore, the opened files should be explicitly closed if the program ends because of erros, as follows:

```
CLOSE *
```

  This commands closes all files.

【Example】

```
CLOSE #FD
CLOSE *
```

【Note】

All of the files that has been opened in a program should be closed in the end of the program.

【Program Example】

```
OPEN "FFF" FOR OUTPUT AS #FD
FOR I=1 TO 100
 OUTPUT #FD;I
NEXT I
CLOSE #FD
OPEN "FFF" FOR INPUT AS #FD
FOR I=1 TO 100
 ENTER #FD;N
 PRINT N
NEXT I
CLOSE #FD
```

【Result】

The above program first writes real numbers from 1 to 100 into the file "FFF". It then reads the numbers and displays then.
(The numbers 1.0 to 100.0 are thus printed.)

(7) CONT

【Outline】

Resumes the execution of a BASIC program.

【Format】

CONT [<label>]

【Description】

- When a label is omitted, the program execution restarts from the next line of that where it has stopped.
  If this command is executed when the program has ended, however, the following error message appears:
  (Program CANNOT be continued)
- When a label is specified, the program execution starts from the command following the label.

【Example】

```
CONT

CONT *ABC
```

【Note】

- The CONT command with a label should be executed in the BASIC mode. (To execute a CONT command without a label, press the CONT key on the main-body CRT.
- Contents of variables will not be initialized with a CONT command.
- To stop executing a program, use the (50) PAUSE.

(8) CONTROL

【Outline】

Sets the values related to BASIC controls.

【Format】

CONTROL <register number>;<numeric expression>

<registser number>: Specify any of 2, 3 and 4.

【Description】

Register number 2: Specifies the left margin for the output on printers.
Register number 3: Specifies whether to output short names to printers.
Register number 4: Specifies GPIB adress.

● Register 2

The value in register 2 will be used as the offset size from the left edge of the paper, when data is output with a LIST command.
Each line will be preceded by the number of the spaces which is determined by the offset size.

● Register 3

Register 3 specifies whether to display LIST output with short names or full names. (Refer to short names.)

0: Full name output
1: Short name output

● Register 4

Specifies GPIB adress.
Specifies the numeric in 0 to 30.

※ At initial value at power ON is 0.

【Example】

Register 2

To put 5 spaces before each line of the data to be printed, specify CONTROL 3;5.

```
-----10 PRINT"ADVANTEST"
-----30   PRINT I
-----40 NEXT I
```

Register 3

To output data on printers with short names, specify CONTROL 3;1.

```
-----10 CSR 10,10
-----20 OUT 31;"CF1.23MZ"
-----30 ENT 31;A
-----40 PRF"%f",A
```

To output data on printers with full names, specify CONTROL 3;0.

```
-----10 CURSOR 10,10
-----20 OUTPUT 31;"CF1.23MZ"
-----30 ENTER 31;A
-----40 PRINTF"%f",A
```

Register 4

Specifies GPIB adress 10.
Specifies CONTROL 4;10.

(9) CURSOR or CSR

【Outline】

Moves the cursor to the specified position on the screen.

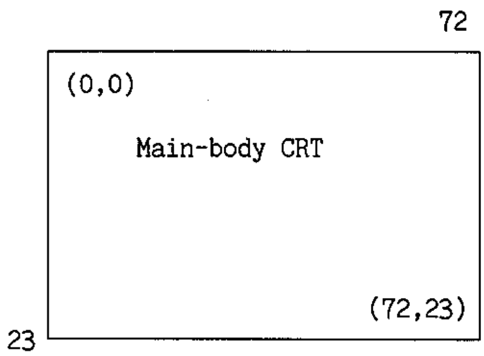
【Format】

```
CURSOR <X: column>,<Y: line>
or
CSR <X: column>,<Y: line>
```

【Description】

CURSOR may be abbreviated to CSR. The CURSOR statement moves the cursor to the position determined by the column and the line.

In both CRTs, the position of the top-left corner is (0, 0).



【Example】

```
CURSOR 10,20:  Moves the cursor to column 10, line 20.
CSR 50, 11  :  Moves the cursor to column 50, line 11.
```

【Program Example】

```
OUTPUT 31;"VS2"
FOR X=0 TO 53
 CURSOR X,X%10
 PRINT "*";
 CSR 20,15:PRINT X
NEXT X
```

【Result】

```
   *         *         *         *         *         *
    *         *         *         *         *         *
     *         *         *         *         *         *
      *         *         *         *         *         *
       *         *         *         *         *
        *         *         *         *         *
         *         *         *         *         *
          *         *         *         *         *
           *         *         *         *         *
            *         *         *         *         *

                     53.0
```

(10) DELIMITER

【Outline】

To select delimiters from four types, and set.

【Format】

DELIMITER <X>
<X>: numeric expression either of 0, 1, 2 and 3

【Description】

- OUTPUT 0 to 30 commands set terminators (delimiters) for output.
- Delimiter selection numbers and types are listed as follows.

Selection number	Delimiter type
0	Output "CR" or "LF", and two bytes of a single line signal EOI.
1	Output a byte of a "LF".
2	Output a single line signal simultaneously with the last byte of data.
3 ◎	Output two bytes of "CR" or "LF".

(◎ means default at turning on.)

【Example】

DELIMITER 0

DELIMITER 1

DELIMITER 2

DELIMITER 3

【Note】

- If numbers other than 0 to 3, an error will be resulted to interrupt program execution. The following message will be displayed.
  (Invalid value in DELIMITER)
- Default of the DELIMITER statement is 3.

【Sample program】	【Result】
DELIMITER 0	: Set a delimiter at CR and LF+EOI.
OUTPUT 3;"CF3MZ"	: Output data to device address 3.
DELIMITER 1	: Set a delimiter at LF.
OUTPUT 3;"CF4MZ"	: Output data to device address 3.
DELIMITER 2	: Set a delimiter at the last byte+EOI.
OUTPUT 3;"CF5MZ"	: Output data to device address 3.
DELIMITER 3	: Set a delimiter at CR and LF.
OUTPUT 3;"CF6MZ"	: Output data to device address 3.

(11) DIM

【Outline】

Declares the size of array variables or character string variables.

【Format】

DIM <X>, {,<X>}
X: variable name (<numeric expression> {,<numeric expression> }) |
character string variable name" ["<numeric expression>"] "

【Description】

- Declare the size of array variable and the length of character string variable.
  Subscript, which shows the array element of specifies maximum value. (When using without declaration, the array goes to the factor number of the maxim value, 10, per one dimension, and the character line goes to the length of 18 characters.)
- If tha DIM statement declares arrays, the specified size of the array variables are secured in the memory. If too large arrays are declared, the memory areas run out, the following message appears, and the execution of the program is stopped: (memory space full).
- Even if a numeric expression indicating the size of an array variable is of real numbers, its fractional part is truncated.
  The expression is then declared and referenced as an integer expression.
- A numeric expression indicating the size of an array variable declares the length of the character string.
- If more than one subscript is specified, the array variable is declared as multi-dimensional. The number of the subscripts will be the number of dimensions. (As many dimensions as allowed by the memory capacity may be specified).

【Example】

DIM A (20)	:	Secures 20 elements for the real-type array variable A.
DIM B (30),C(25,5)	:	Secures 30 elements for the real-type array variable B and 25 by 5 elements for the real-type two-dimensional array variable C.
DIM S$ [50]	:	Secures 50 characters for the character-string variable S$.
DIM D(15),T$ [50]	:	Secures 15 elements for the real-type array variable D and 50 characters for the character-string variable T$.

DIM E(3.8,5,2) : Secures 3 by 5 by 2 elements of the real type 3 dimensional array variable E.

【Note】

- The minimum number of the subscripts for an array variable is 1.
- Maximum value of array declaration becomes up to 32767 but the capacity would be changed according to program size.
- Length of character-string variable is a maximum of 128.
- For the declaration of integer-type variables, see the description on the INTEGER statement.
- If the number of the subscripts is out of the specified range or less than or equal to zero, the following error message appears when the array variable is referenced:
  (Array's range error, or Invalid dimension parameter)
- Multi-dimensional arrays cannot be declared as character-string variables.

【Program Example】

```
DIM A(20),B(5,4),S$ [20] :  Declares real-type array variables and a
                            character-string variable.
FOR I=1 TO 20            :  Loops since I is equal to zero until it
                            exceeds 20.
 A(I)=I                  :  Enters I the an array variable A.
NEXT I                   :  NEXT I
FOR X=1 TO 5             :  Loops since X is equal to 1 until it exceeds 5.
 FOR Y=1 TO 4            :  Loops since Y is equal to 1 until it exceeds 4.
  B(X,Y)=A((Y-1)*5+X)    :  Enters the array variable A to the array
                            variable B.
 NEXT Y                  :  NEXT Y
NEXT X                   :  NEXT X
S$="ABCDEFGHIJKLMNOPQRSTUVWXYZ
                         :  Enters a character string of 26 characters to
                             S$.
FOR X=1 TO 5             :  Loops since X is equal to 1 until it exceeds 5.
 FOR Y=1 TO 4            :  Loops since Y is equal to 1 until it exceeds 4.
  CURSOR X*5,Y:PRINT B(X,Y)
                         :  Outputs the array variable B.
 NEXT Y                  :  NEXT Y
NEXT X                   :  NEXT X
PRINT S$                 :  Outputs the character string S$.
```

【Result】

```
      1.0  2.0  3.0  4.0  5.0
      6.0  7.0  8.0  9.0  10.0
      11.0 12.0 13.0 14.0 15.0
      16.0 17.0 18.0 19.0 20.0
  ABCDEFGHIJKLMNOPQRST
```

(12) DISABLE INTR

【Outline】

Disables the reception of the interrupts caused by the ON (KEY/SRQ/ISRQ) instructions.

【Format】 DISABLE INTR

【Description】

Disable the reception of interrupts that has been enabled by an ENABLE INTR instruction.

【Note】

- When a branch is caused by an interrupt, a DISABLE INTR instruction should be executed at the destination of the branch. Otherwise, the interrupts will be nested.
- If you specify the interrupt operation as a subroutine, we recommend that you place an ENABLE INTR instruction immediately before the RETURN instruction of the subroutine. The operation will take place smoothly.

【Program example】

```
INTEGER S              : Declares an integer-type variable.
ON ISRQ GOSUB *SWPEND  : Defines the destination of an interrupt branch.
OUTPUT 31;"IP SW1SC SO": Sets IP, a second of sweep, interrupt output.
*L                     : ┐ (Loop)
 GOSUB *ONESWP         : │ Subroutine for one sweep.
 M=MAX(0,700,0)        : │ Maximum level (built-in function)
 PRINT M               : │ Maximum level output
 GOTO *L               : ┘ Causes a jump to the label *L.
!
*ONESWP
 F=0                   : F=0
 ENABLE INTR           : Enables interrupts to be received.
 OUTPUT 31;"SI"        : Starts a single sweep.
 *LL                   : ┐ (Loop)
  IF F THEN RETURN     : │ Returns if F is true.
  GOTO *LL             : ┘ Causes a jump to the label *LL.
!
*SWPEND
 DISABLE INTR          : Disables interrupts from being received.
 S=SPOLL(31)           : Serial polling to the main-body measurement section.
 IF S BAND 4 THEN F=1  : Enter 1 to F when bit 3 is on.
 RETURN                : Return
```

【Result】 Outputs the maximum level of each sweep.

(13) ENABLE INTR

【Outline】

Enables the interrupts caused by the ON (KEY/SRQ/ISRQ) instructions to be received.

【Format】

ENABLE INTR

【Description】

Enables the reception of interrupts that has been disabled with a DISABLE INTR instruction.

【Note】

- When a branch is caused by an interrupt, a DISABLE INTR instruction should be executed at the destination of the branch. Otherwise, the interrupts will be nested.
- If you specify the interrupt operation as a subroutine, we recommend that you place an ENABLE INTR instruction immediately before the RETURN instruction of the subroutine. The operation will take place smoothly.
- After running a program, the reception of the interrupts are disabled. Execute an ENABLE INTR instruction before using interrupts.

【Program example】

```
ON KEY 1 GOSUB *K1
ON KEY 2 GOSUB *K2
ENABLE INTR
*L
 GOTO *L
!
*K1
 DISABLE INTR
 PRINT "KEY1"
 ENABLE INTR
 RETURN
*K2
 DISABLE INTR
 PRINT "KEY2"
 ENABLE INTR
 RETURN
```

【Result】

When 1 or 2 on a full keyboard or 1 or 2 of the ten-key pad of the main-body panel is pressed, KEY1 or KEY2 is displayed on the screen.

(14) ENTER

【Outline】

Inputs (reads) data from the file that is assigned to the specified file descriptor.

【Format】

```
ENTER <# file descriptor> ; <X> [,<X>]
<X>:  entry (numeric variable, character string variable)
```

【Description】

- The ENTER# statement reads data from the file that is assigned to the specified file descriptor. The read data is formatted for the data type of the associated entry and entered to the entry.
- According to the type specified with the OPEN statement, the data is read in the following format.

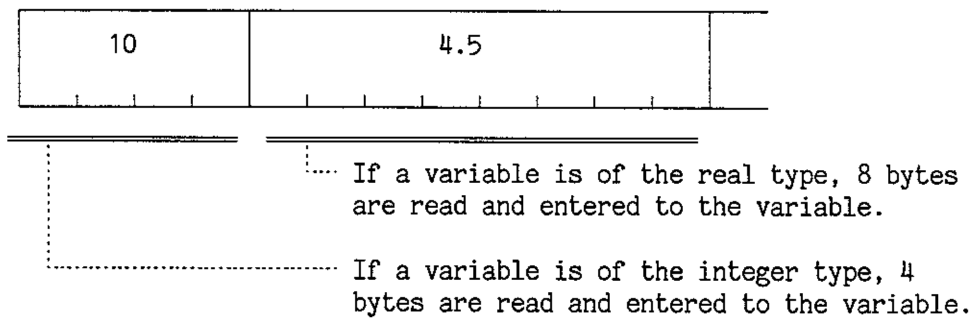
BINARY type

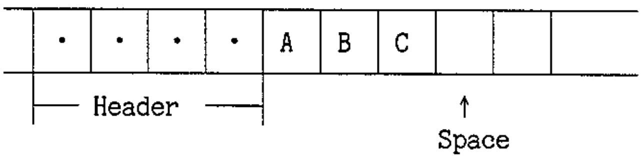
Data is read in the same type that of the internal expression.

The data length differs according to the type, as follows:
Integer type : 4 bytes
Real type : 8 bytes
Character string: Data size (number of bytes) is indicated by the 4-byte header.

Example)

```
INTEGER I
OPEN "FILE" FOR INPUT AS # FD
ENTER # FD;I,R,S$
```





If a variable is a character string, the header is read first. The header indicates the length of the data to read. Then the specified length of the data is read and ssigned to the character string variable.

TEXT type

In regardless of the number of the input entries, data is read until a line feed character is detected. Each data object is terminated by a comma. It is converted to the type of the entry and entered to the variable.

Data is converted to the ASCII codes and output. A numeric data object is lead by a space or a sign. A character string ends with a line feed character (0x0a).

Example)

```
INTEGER I
OPEN "FILE" FOR INPUT AS # FD;TEXT
ENTER  # FD;I,R,S$
```

	1	0	,		4	.	5	,	A	B	C	n	

Each entry is separated by a comma (,).

A character string ends with a line feed character (0x0a).

ASCII type

The 2-byte header is read first. The headr indicates the length of the data to read. According to the length, data is read, converted into the type of the associated variable, and entered to the variable.

Example)

```
INTEGER I
OPEN "FILE" FOR INPUT AS # FD;ASCII
ENTER # FD;I,R,S$
```

·	·		1	0		·	·		4	.	5	·	·
Header						Header						Header	

	A	B	C	

【Example】

```
ENTER #FD;S$
ENTER #FD;A,B
```

【Note】

- Specify a file descriptor that has been opened with the OPEN statement.
- A header is a separator of entries and has the length of a data object.
- If there are more entries than the data objects, no data is entered to excessive variables. The excessive variables holds the old data.
  If the number of the data objects is greater than that of the entries, however, the excessive objects are abandoned.
- The number of the bytes to read is determined by the type of an entry. The data objects should be input (entered) in the same type that will be used for output. Otherwise, the contents of the output will differ from those of the input.
- The following error message appears if this statement is used for the file that has not been opened with the OPEN statement:
  (file NOT open)

【Program Example】

Execute the program of page 2-90 before executing the following program.

```
OPEN "A" FOR INPUT AS #FA;BINARY
INTEGER S
FOR I=1 TO 10
 ENTER #FA;R,S
 PRINT R,S
NEXT I
CLOSE #FA

OPEN "AA" FOR OUTPUT AS #FB;TEXT
INTEGER S
FOR I=1 TO 10
 ENTER #FB;R,S
 PRINT R,S
NEXT I
CLOSE #FB

OPEN "AAA" FOR OUTPUT AS #FC;ASCII
INTEGER S
FOR I=1 TO 10
 ENTER #FC;R,S
 PRINT R,S
NEXT I
CLOSE #FC
```

【Result】

All of the left programs print the same contents, as follows:

```
 1.0   1
 2.0   2
 3.0   3
 4.0   4
 5.0   5
 6.0   6
 7.0   7
 8.0   8
 9.0   9
10.0  10
```

(15) ENTER or ENT

【Outline】

To enter data from the measuring device of the main unit or the parallel I/O.

【Format】

ENTER<device address> | 31 | 32;<X>
or
ENT<device address> | 31 | 32;<X>

Device address 0 to 30: Enter data from the devices on GPIB.
31: Enter data from the measuring device of the main unit.
32: Enter data from the parallel I/O. *1

<X>: [numeric variable | character variable {, numeric variable | character variable }]

【Description】

- The device addresses 0 to 30 enter data from the specified devices on GPIB (below: CONTROLLER) of the rear panel of the main unit.
- To set 31 causes data to enter from the measuring device of the main unit through the internal memory into a variable. To set 32 causes data to enter from the 16 bits parallel I/O into a variable.
- When 32 is specified, only numeric values are handled. Therefore it causes an error to specify in character variable and the program will be interrupted. The following message will be displayed. (Invalid type in assume)
- More than one variables can be specified by delimiting a variable with commas(,) or delimiters (except for ENTER 32). In this case, received data will be entered every delimiting by commas. If specified number of the variables are more than the received data, the variables which are not corresponding with the data receives nothing. On the contrary the variables are more than the received data, the remainder of those data will be ignored. 1,024 characters can be received by the ENTER command. Even if more than 1,024 characters are sent, the remainder will be ignord.

*1 Refer to the Parallel I/O (2.4).

【Example】

```
ENTER 5;A
ENTER 5;A, B
ENTER 5;S$

ENTER 31;A
ENTER 31;A, B
ENTER 31;S$

ENTER 32;A
```

【Note】

- To address numbers other than 0 to 32 causes an error to terminate the program execution. The following message will displayed.
  (UNIT addr error in ENTER)
- If the enter data type dose not correspond with the variable type, an error will be caused.
- Refer to "4. MASTER/SLAVE MODE" when using in slave mode.

【Sample Program】

①

```
DIM B$ [80]
OUTPUT 3;"CF?"
ENTER 3;A
OUTPUT 5;"SP?"
ENTER 5;B$
PRINT A
PRINT B$
```

②

```
DIM S$ [80]
OUTPUT 31;"CF1.23MZ"
OUTPUT 31;"CF?"
ENTER 31;A
ENTER 31;S$
PRINT A
PRINT S$
```

③

```
INTEGER A
ENTER 32;A
IF A BAND 4 THEN PRINT "BIT 3"
```

(16) FOR... TO... STEP BREAK/CONTINUE - NEXT

【Outline】

Repeats the execution of the statements between the for statement and the NEXT statement.

【Format】

```
FOR <numeric variable>=<initial value> TO <final value>
                                  [STEP <increment>]
BREAK
CONTINUE
NEXT <numeric variable>
```

<initial value>, <final value>, <increment> : numeric expression

【Description】

- The specified numeric variable is used as a counter. Its value is increased in the specified increments beginning with the initial value to the final value. If the counter value exceeds the final value, the looping is terminated and control moves to the statement following the NEXT statement.
- The NEXT statement increases or decreases the counter value. It adds the increment to the numeric variable and returns control to the FOR statement.
- If STEP <increment> is omitted, the increment is taken to be 1.
- FOR - NEXT statements can be nested.
- The same variables must be used after FOR and NEXT that are paired. Otherwise, the following error occurs: (NEXT without FOR).

- The BREAK statement allows the control to exit from a FOR - NET loop.
- The CONTINUE statement adds the increment to <numeric variable> and returns control to the beginning of the loop even before the control reaches the NEXT statement.

【Example】

```
FOR I=1 TO 5            :  1-1
  PRINT I               :  1-2
NEXT I                  :  1-3

FOR J=1 TO 20 STEP 3    :  2-1
  PRINT J               :  2-2
  IF J>12 THEN BREAK    :  2-3
NEXT J                  :  2-4

FOR K=10 TO 0 STEP -.5:  3-1
  IF K>3 THEN CONTINUE:  3-2
  PRINT K               :  3-3
NEXT K                  :  3-4
```

1-1: Enters 1 to the counter I and loops until I exceeds 5.
1-2: Prints I.
1-3: NEXT (returns to 1-1).

2-1: Enters 1 to the counter J and loops increasing I in increments of 3 until it exceeds 20.
2-2: Prints J.
2-3: Exits (BREAK) from the loop if J is larger than 12.
2-4: NEXT (returns to 2-1).

3-1: Enters 10 to the counter J and loops increasing I in increments of -0.5 until it becomes less than 0.
3-2: If K is greater than 3, CONTINUE (returns to 3-1).
3-3: Prints K.
3-4: NEXT (returns to 3-1).

【Note】

- If the value of the numeric varialbe used as the loop counter is changed in a FOR-NEXT loop, looping may not be performed normally (endless looping, etc.).
- If a GOTO statement or the other jump statement transfers control into a FOR-NEXT loop from the outside or if it passes control outside from the inside the FOR - NEXT loop, the operations of the program may not be ensured.
- BREAK and CONTINUE statements may only be used within FOR-NEXT loops.
- In the following cases, the FOR - NEXT loop cannot be executed and control jumps to the statement following the NEXT statement:
  1: The increment is positive and <initial value> is greater than <final value>.
  2: The increment is negative and <initial value> is less than <final value>.

【Program Example】

See the example shown above.

【Result】

```
Program 1
   1.0
   2.0
   3.0
   4.0
   5.0

Program 2
   1.0
   4.0
   7.0
   10.0
   13.0

Program 3
   3.0
   2.5
   2.0
   1.5
   1.0
   0.5
   0.0
```

(17) GLIST

【Outline】

To output a program list to the GPIB printer.

【Format】

GLIST [<label> [,]]

【Description】

- GLIST outputs a program list, whose location is specified by a labels, to the GPIB printer.
- To specify a label, and comma(,) after the label causes the program list to be output from the label position to the end of it.
- To output to a printer, first transfer the BASIC program (COMPILE and RUN), next terminate the program, then execute a PRINTER and GLIST command in the BASIC mode. Those commands can be located in a program.

【Example】

```
GLIST

GLIST *ABC,
```

【Note】

- Though to specify by line numbers is possible, the format differs from the above.
  GLIST [<output start line>] [, [<output end line>]]

  (Example)
  ```
  GLIST 100
  GLIST 100,
  GLIST ,200
  GLIST 100,200
  ```
- The connecting GPIB connector should be used the CONTROLLER side of the rear panel.
- Refer to the (54) PRINTER command for specifying the GPIB addresses of a printer.
- Note that if the device addresses are missed or no device connects to the specified address, this command will be ignored and the program will proceeds to the next step.
- The output program list is the last one transferred (COMPILE and RUN) to the buffer of the BASIC interpreter side.

【Program Example】

① Transfer a program, whose list is to be output, into the editor, then select "COMPILE and RUN" from the popup menu.
After the transfer of the program has been completed and the program starts to execute, terminate it by "control+C". (You may have the program execute completely.)
Then the mini-window of the BASIC mode appears at the lower right of the display, execute a PRINTER command and a GLIST command. (Those commands can be selected from the popup menu.)

(Example)

```
PRINTER 3
GLIST
```

② Allocate the following commands at the head of a program whose list is to be output;

PRINTER command
GLIST command
STOP command

Then execute "MOVE and RUN".

(Example)

```
PRINTER 3
GLIST
STOP
⋮
```

【Result】

① The list is output to the GPIB address 3 printer.

② To execute "COMPILE and RUN" causes the list output to the GPIB address 3 printer.

(18) GLISTN

【Outline】

To output a program list to the GPIB printer.

【Format】

GLISTN [<label>] [,<number of lines>]

【Description】

- GLISTN outputs a program list, whose position is specified with labels, to the GPIB printer.
- If a label is specified, and after it a comma(,) and line numbers are specified, the list is displayed as many lines as specified.
- If a label is omitted and number of lines is specified, positive number of lines causes as many lines as specified to be displayed from the head of a program, negative number of lines causes to be displayed as many as specified from the end of a program.
- To output follows the same way as the (17) GLIST.

【Example】

```
GLISTN
GLISTN  *ABC, 10
GLISTN  *ABC, -10
GLISTN  , 20
GLISTN  , -20
```

【Note】

Though you may specify with line number, the format differs from the above.

GLISTN [<output start line>] [, [<number of lines>]]

(Example)

```
GLISTN 100
GLISTN 100, 15
GLISTN 100, -15
GLISTN , 20
GLISTN , -20
```

- To specify the GPIB address of a printer, refer to the (54) PRINTER command.
- If the device addresses are missed or no device connects to the specified address, this command will be ignored and the program will proceeds to the next step.
- The way to use this command is the same as the (17) GLIST.

(19) GOSUB - RETURN

【Outline】

Branches to the specified subroutine and returns back.

【Format】

```
GOSUB <label>
RETURN
```

【Description】

- The GOSUB statement passes control to the subroutine specified with <label>.
- When the control reaches the RETURN statement, it returns to the statement following the GOSUB statement where it has branched.
- GOSUB - RETURN pairs can be nested. Therefore, control may branch from a subroutine to the other subroutine. If too many levels of nesting is used, the memory capacity may run out and the following error occurs: (GOSUB nest overflow).

【Example】

```
GOSUB *S1

*S1
  A=A*2
  RETURN
```

【Note】

If the specified label does not exist in the program, the following error occurs and execution of the program is stopped when control jumps with the GOSUB statement. (Undefined LABEL)

【Program Example】

```
FOR I=2 TO 5              :  Enters 2 to I and loops until I exceeds 5.
 A=2                      :  A=2
 B=A                      :  B=A
 GOSUB *SUB1              :  Jumps to the subroutine labeled *SUB1.
 PRINTF"2^%2d=%5d\n\r",I,B
                          :  Outputs the data.
NEXT I                    :  Next
STOP                      :  Program end
!                         :
*SUB1                     :  Label *SUB1
 FOR C=1 to I-1           :  Assigns 1 to C and loops until C exceeds I-1.
  GOSUB *SUB2             :  Jumps to the subroutine labeled *SUB2.
 NEXT C                   :  NEXT
 RETURN                   :  Return
!                         :
*SUB2                     :  Label *SUB2
  B *=A                   :  B=B*A
  RETURN                  :  Return
```

【Result】

```
2^ 2 =    4
2^ 3 =    8
2^ 4 =   16
2^ 5 =   32
```

(20) GOTO

【Outline】

Branches to the specified label.

【Format】

GOTO <label>

【Description】

A GOTO statement causes a branch to the specified <label> unconditionally.

【Example】

GOTO *LA

【Note】

If the specified label does not exist in the program, the following error occurs and the execution of the program is stopped when control jumps with the GOSUB statement. (Undefined LABEL)

【Program Example】

```
I=0                : Enters 0 to the variable I.
*L                 : Label name
 I=I+1             : Adds 1 to the variable I.
 IF I=10 THEN STOP : Terminates when I reaches 10.
 PRINT I           : Outputs I.
 GOTO *L           : Jumps to *L.
```

【Result】

```
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
```

(21) GPRINT

【Outline】

To output numeric and character strings to a printer connected with GPIB.

【Format】

GPRINT [<X> { [,| ; <X>] }] [<;>]
<X>: numeric expression | character expression

【Description】

- GPRINT outputs numeric and character strings to the GPIB address device specified with the (54) PRINTER command.
- The numeric or character expression can be delimited with a semicolon(;) or comma(,) to specify more than one.
- If a semicolon is put at the end of a PRINT statement, the line will not start a new line. Therefore when the next PRINT statement is executed, the output will follows the previous output.

【Example】

```
S$="DEF"                 : ①
GPRINT "ABC" ;           : ②
GPRINT S$                : ③
GPRINT "A=",A            : ④
GPRINT "CF", CFQ, "KHz"  : ⑤
GPRINT A+100             : ⑥
```

① Enters "DEF" to the character string variable S$.
② Outputs "ABC" to a printer without no line feed.
③ Outputs the character variable S$.
④ Outputs the character string constants and the numeric.
⑤ Outputs the character string constants and the numeric.
⑥ Adds 100 to the numeric variable and output.

【Note】

- Before an output to the GPIB printer, set the address of the GPIB printer with a (54) PRINTER command exactly. (If the address differs from the address of the GPIB printer, the output does not fed to the printer.)
- If the device address are missed or no device connects to the specified address, this command will be ignored and the program will proceed to the next step.

【Sample program】

```
PRINTER 5
FOR I=1 TO 10
 GPRINT "I= ";
 GPRINT I
NEXT I
```

【Result】

The GPIB address 5 printer displays from 1 to 10.

(22) GPRINT USING or GPRINT USE

【Outline】

To edit numeric or character strings and so on, and output to the GPIB.

【Format】

GPRINT USING <image specification> ; {, <X>}
or
GPRINT USE <image specification> ; {, <X>}

<X>: numeric expression | character expression

【Description】

- Numeric or character strings are edited and output to the GPIB port in the ASCII cord.
- Numeric or character strings are output to the GPIB address devices specified with a (54) PRINTER command. (Refer to the PRINTER command.)
- To specify the image specification, represent with character strings and delimit with comma(,). (The line will be fed automatically.)

【image specification list】

D	To print spaces on the rest of the specified fields.
Z	To insert 0s on the rest of the specified fields.
K	To print numeric just as they are.
S	To add a +/- symbols at all times.
M	To add a - symbols to negative values, and add a space to positive values.
.(Decimal point)	To print a decimal point.
E	To print with the exponent form (e, sign, exponent).
H	To display numeric or character strings as they are with the European type decimal point.
R	To print the European type decimal point.
*	To print *s on the rest of the specified fields.
A	To print a character.
k	To character strings just as they are.
X	To print spaces.
Listeral	To write a literal in format specifications, put them in\"s.
B	Print numeric with the ASCII cord.
@	To feed lines.
+	To move the printing positions to the top of the same line.
-	To move the printing positions to the next line.
#	To not feed lines at the last position.
n	To output with accuracy of n decimals. If specify n to character strings, output value will be the length of the specified character strings.

【Example】

```
GPRINT USING "DDD.DD" ; 1. 2

GPRINT USE "ZZZ.ZZ" ; 1. 2
```

【Note】

- The strings printed with GPRINT USING will not be returned. Insert return symbols in the parameters of GPRINT USING.
  GPRINT USING "K, k" 123,"\n"
- If the number specified with the image specification is more than the number specified with the parameter, an error will be caused.
  (Unmatched IMAGE-spec in USING)
- Before an output to the GPIB printer, set the address of the GPIB printer with a PRINTER command exactly. (If the address differs from the address of the GPIB printer, the output does not fed to the printer.)
- If the device address are missed or no device connects to the specified address, this command will be ignored and the program will proceed to the next step.

【Program Example】

```
PRINTER 5
GPRINT USING "DDD.DD,k"; 1.2,"\r"
GPRINT USE "ZZZ.ZZ,k"; 1.2,"\r"
GPRINT USE "***.ZZ,k"; 1.2,"\r"
A$="K,5X,B,DDDRDD,k"
GPRINT USE A$; 2.34,65,1.2,"\r"
```

【Result】

The GPIB printer outputs as follows.

```
  1.20
001.20
**1.20
2.34      A  1,20
```

(23) IF THEN ELSE/ELSE IF/END IF

【Outline】

Tests a condition and causes a brance or executes the specified statement according to the result.

【Format】

```
・IF <logical expression> THEN <statement>
・IF <logical expression> THEN
       <compound statement>
 END IF
・IF <logical expression> THEN
       <compound statement>
 ELSE
       <compound statement>
 END IF
・IF <logical expression> THEN
       <compound statement>
 ELSE IF <conditional expression> THEN
       <compound statement>
 ELSE IF <conditional expression> THEN
       <compound statement>
           .
           .
 ELSE
       <compound statement>
 END IF
```

【Description】

- According to the condition of <logical expression, the execution of the program is controlled. If the result of <logical expression> is zero, it is false. If it is not zero, the logical expression is true.
- Not only logical expressions but also numeric expressions may be used as <logical expression>. The numeric expression is evaluated first. Then, if the result is zero, the expression is false. Otherwise, the expression is true.
- If <logical expression> is true, the THEN statement is executed. The THEN statement may be followed by a statement. (In this case, the IF statement should be written in a single line.)
- To continue more than one statement after THEN, terminate the line by THEN first. Then place the statements over the following lines and terminate the continuation by END IF. The ELSE statement may be placed to specify the statements to execute if the condition is false.

- The ELSE IF statement allows two or more logical expressions to be placed.
- Relational operators include the following:

Symbol	Meaning	Example
= (or ==)	Equal to	X=Y, X==Y
<>	Not equal to	X<>Y
<	Less than	X<Y
>	Greater than	X>Y
<=	Less than or equal to	X<=Y
>=	Greater than or equal to	X>=Y

Note) '=<' or '=>' cannot be substitute for '<=' or '>='.

- Relational operators can be joined with logical operators.
  (See the description on the logical operators: operational expression.)

NOT AND OR XOR

【Example】

```
IF A=1 THEN PRINT "A=1"

IF B>10 THEN
  PRINT "B>10"
END IF

IF B>2 THEN
  PRINT "B>2"
ELSE
  PRINT "B<=2"
END IF

IF 1<C AND C<5 THEN
  PRINT "1<C<5"
ELSE IF C=10 THEN
  PRINT "C=10"
ELSE
  PRINT "C:ELSE"
END IF
```

【Note】

If an IF block extends over more than one line, the block must end with END IF. If the number of IFs does not match the number of END IFs, the following error occurs: (Unbalanced IF block)

【Program Example】

```
FOR I=1 TO 100          : Assigns 1 to I and loops until I exceeds 100.
 IF 10<=I AND I<=20 THEN: ① If I is greater than or equal to 10 and les
                             than or equal to 20,
   PRINT "10<=I<=20"    :    Outputs the character string as shown.
 END IF                 : Terminates the IF block ①.
 IF I=50 OR I=60 THEN   : ② If I=50 or I=60,
   IF I=50 THEN         :     ③ If I=50,
     PRINT "I=50"       :        Outputs the character string as shown.
   ELSE                 :     ③ If I is not equal to 50,
     PRINT "I=60"       :        Outputs the character string as shown.
   END IF               :     Terminates the IF block ③.
 ELSE IF I=70 THEN      : ② If I=70,
   PRINT "I=70"         :    Outputs the character string as shown.
 ELSE IF I=90 THEN      : ② If I=90,
   PRINT "I=90"         :    Outputs the character string as shown.
 END IF                 : Terminates the IF block ②.
NEXT I                  : Retruns to the beginning of the loop.
```

【Result】

```
10<=I<=20
10<=I<=20
10<=I<=20
10<=I<=20
10<=I<=20
10<=I<=20
10<=I<=20
10<=I<=20
10<=I<=20
10<=I<=20
10<=I<=20
I=50
I=60
I=70
I=90
```

(24) INITIALIZE or INIT

【Outline】

Initializes a memory card.

【Format】

INITIALIZE
or
INIT

【Description】

- The INITIALIZE command initializes a memory card. INITIALIZE may be abbreviated to INIT.
- The INITIALIZE command should be executed in the BASIC mode of the editor.

【Example】

INITIALIZE
INIT

【Note】

- Before initialization, check the contents of the file with the CAT Command or Load of the editor.
- New memory cards cannot be used until initialized. Note that if an memory card that stores files is initialized, all of the files will be deleted.

(25) INTEGER

【Outline】

Declares integer-type variables or array variables.

【Format】

INTEGER <X> | <X>(numeric expression) {,<X> | <X>(numeric expression) }
<X>: numeric variable

【Description】

- Numeric variables or array variables specified with the INTEGER statement will be treated as the integer type.
- The range of numbers that an integer-type variable can contain is the -2, same as that for integer constant, as follows:
  147, 483, 648 to +2, 147, 483, 647
- It is recommended that a variable that contains integers should be declared with the INTEGER statement. Integer-type variables are manipulated a little faster than real variables.
- If the INTEGER statement declares arrays, the specified size of the array variables are secured in the memory. If too large arrays are declared, the memory areas run out and the execution of the program is stopped because of the following error: (memory space full)
- If more than one subscript is specified, the array variable is declared as multi-dimensional. The number of the subscripts will be the number of dimensions.
  (Number of dimensions can be specified up to the allowance of memory capacity.)

【Example】

```
INTEGER A
INTEGER B,C
INTEGER D(20), E(30)
```

【Note】

- If integer-type variables are used in statement such as IF, the operation speed is improved.
- The (11) DIM statement should be used to declare real variables.
  (See the description on the DIM statement.)

【Program Example】

```
INTEGER A(20),B(5,4),I,X,Y :  Integer-type declaration
FOR I=1 TO 20              :  Sets I to 1 and loops until I exceeds 20.
 A(I)=I                    :  Enters I to the array variable A.
NEXT I                     :  NEXT I
FOR X=1 TO 5               :  Sets X to 1 and loops until X exceeds 5.
 FOR Y=1 TO 4              :  Sets Y to 1 and loops until Y exceeds 4.
                              Enters the array variable A to the array.
  B(X,Y)=A((Y-1)*5+X)      :  variable B.
 NEXT Y                    :  NEXT Y
NEXT X                     :  NEXT X
FOR X=1 TO 5               :  Sets X to 1 and loops until X exceeds 5.
 FOR Y=1 TO 4              :  Sets Y to 1 and loops until Y exceeds 4.
  CURSOR X*5,Y:PRINT B(X,Y):  Outputs the contents of the array variable B.
 NEXT Y                    :  NEXT Y
NEXT X                     :  NEXT X
```

【Result】

```
1     2     3     4     5
6     7     8     9     10
11    12    13    14    15
16    17    18    19    20
```

(26) INTERFACE CLEAR

【Outline】

To initialize interfaces of all devices connected to the GPIB of the CONTROLLER side of the main-unit rear panel.

【Format】

```
INTERFACE CLEAR
```

【Description】

- INTERFACE CLEAR enables the single line signal, IFC, of the GPIB to output (true mode) for 100μs.
- GPIB interfaces of all devices connected to the GPIB of the main-unit release the talker or listener modes.

【Example】

```
INTERFACE CLEAR
```

【Note】

Not function in slave mode.

【Sample program】

```
INTERFACE CLEAR
OUTPUT 3;"CF1MZ"
```

(27) INPUT or INP

【Outline】

Enters the data entered from the keyboard or the main panel to a numeric variable or character-string variable.

【Format】

INPUT [<character-string constant>,] <X> [, | ; <X>]
or
INP [<character-string constant>,] <X> [, | ; <X>]

<X>: <numeric variable> | <character-string variable>

【Description】

- When the INPUT statement is executed, the program pauses to wait for key entry. The wait state continues until the Return key is pressed on the terminal or the unit key is pressed on the main panel. If the Return or unit key is pressed, the input is entered to the specified variable.
- If a character-string constant (prompt) is specified, the program displays the prompt on the screen before entering the wait state.
- The INPUT statement can manipulate both numeric and character-string variables. If alphabetic characters or symbols are entered together with numeric ones to be assigned to numeric variable, only the numeric characters are assigned and others omitted. If the character string to be entered to a numberic variable does not include any numbers. 0 is entered to the variable. If only the Return key is pressed in the wait state, assignment does not take place and the value of the variable does not change.

【Example】

```
INPUT A
INPUT "B= ",B
INP C,D$
INP "name & No ?",NA$,N
```

【Note】

- A character string needs not be enclosed in quotations when it is entered.
- A character string may not be entered from the main panel.
  (Only numbers can be entered from the ten-key pad of the main panel.)

【Program】

```
INPUT "Center Freq. (MHz)? ",CF
INP "Span Freq. (MHz) ? ",SF
INP "No. ? ",A$
OUTPUT 31;"CF",CF,"MZ"
OUTPUT 31;"SP",SF,"MZ"
PRINT "No.  :",A$
PRINT "CF   :",CF,"MHz"
PRINT "SF   :",SF,"MHz"
```

【Result】

```
Center Freq. (MHz)? 12
Span Freq. (MHz)? 30
No.  ? 5
No.  :   5
CF   :   12.0    MHz
SF   :   30.0    MHz
```

(28) KEY OFF

【Outline】

Clears the display of user-defined menu.

【Format】

KEY OFF

【Description】

- Clears the display of user-defined menu.
- Interrupiton from the softkey cannot be generated after KEY OFF operation.

【Note】

- KEY OFF function can clear the display of user-defined menu only, however, cannot perform the interruption enable/disable. Refer to "(13) ENABLE INTR" or "(12) DISABLE INTR.

【Program】

```
ON KEY 1 LABEL "KEY-OFF" GOSUB *KOF
KEY ON
*LOOP
ENABLE INTR
GOTO *LOOP
*KOF
PRINT "KEY-OFF"
KEY OFF
RETURN
```

(29) KEY ON

【Outline】

Displays the user-defined menu on the softkey menu.

【Format】

KEY ON

【Description】

- Displays the user-defined menu and enables to perform the interruption from softkey using the ON KEY instruction. Also, displays the letters defined by the ON KEY LABEL.

【Example】

KEY ON

【Note】

- KEY ON function can clear the display of user-defined menu only, however, cannot perform the interruption enable/disable. Refer to "(13) ENABLE INTR" or "(12) DISABLE INTR.

【Program】

```
ON KEY 1 LABEL "PROGRAM \n A" GOSUB *PRG-A: Defines KEY 1.
ON KEY 2 LABEL "PROGRAM \n B" GOSUB *PRG-B: Defines KEY 2.
KEY ON: ENABLE INTR: Displays LABEL on softmenu.
ENABLE INTR: Enables interruption.
*LOOP: Loops.
GOTO *LOOP:
*PRG-A: Calls PRG-A if KEY 1 is pressed.
RETURN
*PRG-B: Calls PRG-B if KEY 2 is pressed.
CALL "PRG-B"
RETURN
```

(30) LIST

【Outline】

Displays the program list on the screen of the main body.

【Format】

LIST [<label> [,]]

【Description】

- Displays a program list at the position specified with the label on the screen.
- If a label followed by a comma is specified, the program will be listed on the screen from the label to the end of the program.
- To output the list, first transfer a BASIC program (COMPILE and RUN), stop the program and then issue the LIST command in the BASIC mode.
  A LIST command can be placed in the program.

【Example】

LIST

LIST *ABC,

【Note】

- Line numbers may be specified instead of a label: a different format is required.

  LIST [<start line>] [, [<end line>]]

  Example: LIST 100
  LIST 100,
  LIST ,200
  LIST 100,200

【Program example】

Execute COMPILE and RUN of the editor.
Stop the program with Control C.
Execute LIST in the BASIC mode of the editor.

【Result】

A progam list is displayed on the screen.

(31) LISTN

【Outline】

Displays a program list on the screen of the main body.

【Format】

LISTN [<label>] [,<number of lines>]

【Description】

- Displays the program list at the position specified with the label on the screen.
- If a label is followed by a comma and a number of lines is specified, the specified number of the lines from the label will be listed on the screen.
- If a label is omitted and a plus number is specified, the specified number of lines from the top of the program will be displayed. If the line number is a minus number, lines will be counted from the bottom to the top.
- A program list will be output with the same procedure as that for the (30) LIST.

【Example】

```
LISTN
LISTN  *ABC,10
LISTN  *ABC,-10
LISTN  ,20
LISTN  ,-20
```

【Note】

- Line numbers may be specified instead of a label: a different format is required.

  LISTN [<start line>] [,<number of lines>]

```
Example:  LISTN  100
          LISTN  100,15
          LISTN  100,-15
          LISTN  ,20
          LISTN  ,-20
```

(32) LLIST

【Outline】

Outputs a program list of the device connected with the serial I/O port (RS-232C).

【Format】

LLIST [<label> [,]]

【Description】

- Outputs the program list at the position specified with the label to the serial I/O port (RS-232C).
- If a label followed by a comma is specified, the program will be listed on the screen from the label to the end of the program.
- To output the list, first transfer a BASIC program (COMPILE and RUN), stop the program and then issue the LLIST command in the BASIC mode. An LLIST command can be placed in the program.

【Example】

LLIST

LLIST *ABC,

【Note】

- Line numbers may be specified instead of a label: a different format is required.

  LLIST [<start line>] [, [<end line>]]

  Example: LLIST 100
  LLIST 100,
  LLIST ,200
  LLIST 100,200

- For the setting of the serial I/O port (RS-232C), see the (8) CONTROL.

【Program example】

Execute COMPILE and RUN of the editor.
Stop the program with Control C.
Execute LLIST in the BASIC mode of the editor.

【Result】

A program list is displayed on the screen.

(33) LLISTN

【Outline】

Outputs a program list to the device connected with the serial I/O port (RS-232C).

【Format】

LLISTN [<label>] [,<number of lines>]

【Description】

- Outputs the program list at the position specified with the label to the serial I/O port (RS-232C).
- If a label followed by a comma and a number of lines is specified, the specified number of the lines from the label will be listed on the screen.
- If a label is omitted and a plus number is specified, the specified number of lines from the top of the program will be displayed. If the line number is a minus number, lines will be counted from the bottom to the top.
- A program list will be output with the same procedure as that for the (32) LLIST.

【Example】

```
LLISTN
LLISTN  *ABC,10
LLISTN  *ABC,-10
LLISTN  ,20
LLISTN  ,-20
```

【Note】

- Line numbers may be specified instead of a label: a different format is required.

  LLISTN [<start line>] [, [<number of lines>]]

```
Example:  LLISTN  100
          LLISTN  100,15
          LLISTN  100,-15
          LLISTN  ,20
          LLISTN  ,-20
```

- For the setting of the serial I/O port (RS232C), see the (8) CONTROL.

(34) LOCAL

【Outline】

To release specified devices from the remote mode or to make the Remote Enable(REN) line false.

【Format】

LOCAL [device address {, device address}]
Device address : 0 to 30

【Description】

- To execute the LOCAL command without the device address specification makes the Remote Enable(REN) line false and all devices on the GPIB become local.
  When the REN line is false, to set the devices on the GPIB using OUTPUT command is impossible. To set the REN line true, execute a REMOTE command. (Refer to the REMOTE command.)
- When a device address is specified after a LOCAL command, only the device of the specified address will be released from the remote mode. More than one device addresses can be specified, delimiting with commas(,).

【Example】

```
LOCAL

LOCAL 2

LOCAL 3,4,5
```

【Note】

Not function in slave mode.

【Sample program】

```
REMOTE 11
WAIT 2000
LOCAL 11
```

【Result】

The device address 11 will be in the remote mode (The remote lamp will light if available) and two seconds after it will be in the local. (The remote lamp will turn off.)

(35) LOCAL LOCKOUT

【Outline】

To lock devices connect to the GPIB, and prohibit to localize those devices from their panels.

【Format】

```
LOCAL LOCKOUT
```

【Description】

- When the devices on the GPIB is under the remote mode (controlled remotely by the main-unit controller), the panel keys of the devices are locked. Though it is impossible to set data from their panels, their local keys are unlocked. Therefore it is allowed to press each of them and localize the devices themselves to set data. If they were localized, various obstacles may arise and they cannot be controlled accurately. To avoid this case, execute LOCAL LOCKOUT command to lock the local keys of every devices on the GPIB, and prohibit to set from the panels of the devices.
- Execution of LOCAL LOCKOUT command send the GPIB universal command, Local Lockout (LLO).

【Example】

```
LOCAL LOCKOUT
```

【Note】

- To release the local lockout mode, execute a LOCAL command.
- Not function in slave mode.

【Sample progrm】

```
REMOTE 11,12
LOCAL LOCKOUT

LOCAL
```

【Result】

The device address 11 and 12 become invalid. To release this mode, execute a LOCAL command.

(36) LPRINT

【Outline】

Outputs numeric values and character strings to the device (printer, etc.) connected through the RS-232C interface.

【Format】

LPRINT [<X> { [, | ; <X>] }]
<X>: numeric expression | character-string expression

【Description】

- Two or more numeric expressions or character-string expressions may be specified with each expression separated by a comma.
- The LPRINT statement always causes line feeding (moves the display or print position to the same column of the next line).

【Example】

```
S$="DEF"                : ①
LPRINT "ABC"            : ②
LPRINT S$               : ③
LPRINT "A=",A           : ④
LPRINT "CF",CFQ,"KHz"   : ⑤
LPRINT A+100            : ⑥
```

① Enters "DEF" to the character string variable S$.
② Outputs "ABC" on the display without no line feed.
③ Outputs the character-string variable S$.
④ Outputs the character string and the numeric.
⑤ Outputs the character strings and the numeric variable CFQ as shown.
⑥ Adds 100 to the numeric variable and outputs the contents of A.

【Note】

- If the LPRINT statement ends with a semicolon (;), it causes line feeding.

【Program Example】

```
FOR I=1 TO 10  :  Sets I to 1 and loops until I exceeds 10.
 LPRINT "I=",I :  Outputs I to the serial I/O port.
NEXT I         :  NEXT I
```

【Result】

```
I=    1.0
I=    2.0
I=    3.0
I=    4.0
I=    5.0
I=    6.0
I=    7.0
I=    8.0
I=    9.0
I=    10.0
```

(37) LPRINT USING or LPRINT USE

【Outline】

Edits numeric values or character strings and outputs them through the RS-232C interface.

【Format】

LPRINT USING <image specification>; {,<X>}
or
LPRINT USE <image specifications> ; {,<X>}

<X>: numeric expression | character-string expression

【Description】

- The LPRINT USE (USING) statement first edits numeric values or character strings according to the image specifications. It then outputs the edited values to the serial I/O port (RS-232C) in the ASCII notation.
- The image specifications are represented by character-string expressions, where each expression is separated by a comma (,).
  (Line feeding is automatically performed at the end of the specifications.)

【image specification list】

D …………	To print spaces on the rest of the specified fields.
Z …………	To insert 0s on the rest of the specified fields.
K …………	To print numeric just as they are.
S …………	To add a +/- symbols at all times.
M …………	To add a - symbols to negative values, and add a space to positive values.
.(Decimal point)…	To print a decimal point.
E …………	To print with the exponent form (e, sign, exponent).
H …………	To display numeric or character strings as they are with the European type decimal point.
R …………	To print the European type decimal point.
* …………	To print *s on the rest of the specified fields.
A …………	To print a character.
k …………	To character strings just as they are.
X …………	To print spaces.
Listeral …………	To write a literal in format specifications, put them in\"s.
B …………	Print numeric with the ASCII cord.
@ …………	To feed lines.
+ …………	To move the printing positions to the top of the same line.
- …………	To move the printing positions to the next line.
# …………	To not feed lines at the last position.
n …………	To output with accuracy of n decimals. If specify n to character strings, output value will be the length of the specified character strings.

【Example】

```
LPRINT USING "DDD.DD"; 1.2
LPRINT USE "ZZZ.ZZ" ; 1.2
```

【Note】

- A carriage return is not automatically caused by the LPRINT USING statement. The display position just moves to the same column of the next line. A new-line character should be included in the statement, as follows:

  ```
  LPRINT USING "K,k";123,"\r"
  ```

- If number of the expressions for the image specifications is greater than that of the parameters, the program is stopped by the following errors: (Unmatched IMAGE-spec in USINT)

【Program Example】

```
LPRINT USING "DDD.DD,k"; 1.2 "\r"
LPRINT USE "ZZZ.ZZ,k"; 1.2,"\r"
LPRINT USE "***.ZZ,k"; 1.2,"\r"
A$="K,5X,B,DDDRDD,k"
LPRINT USE A$; 2.34,65,1.2,"\r"
```

【Result】

```
  1.20
001.20
**1.20
2.34       A    1,20
```

(38) OFF END

【Outline】

Releases a definition of the branch destination given by the ON END instruction.

【Format】

OFF END <# file descriptor>

【Description】

The OFF END instruction releases the definition of the destination (statement) of a branch caused by the EOF of <# file descriptor>. The definition has been given by the ON END instruction.

【Example】

OFF END # FD

【Note】

- After the definition of a branch destination has been released with this instruction, an error occurs and the execution of the program stops in the middle if an EOF is read with the ENTER # instruction.
- The branch destination can be defined with the (42) ON END.

(39) OFF ERROR

【Outline】

Releases a definition of the branch destination given by the ON ERROR instruction.

【Format】

OFF ERROR

【Description】

The OFF ERROR instruction releases the definition of the branch destination (the statement to branch to) that has been given by the ON ERROR instruction.

【Example】

OFF ERROR

【Note】

- If the program causes an error after the definition of a branch destination has been released with this instruction, it stops immediately.
- The branch destination can be defined with the (43) ON ERROR.

(40) OFF KEY

【Outline】

Cancels the branch destination defined using the ON KEY.

【Format】

OFF KEY (key numbers)

Key numbers (numeric expression)

1 to 7: Softkey
10: Step key. ↑
11: Step key ↓
12: Rotary encoder ◯ (clockwise)
13: Rotary encoder ◯ (counterclockwise)

【Explanation】

- Cancels the branch destination defined in the key numbers using the ON KEY.
- Cancels each definition individually for the destination by the key numbers.

【Example】

```
OFF KEY 1
OFF KEY 2
OFF KEY 10
OFF KEY 11
OFF KEY KK
OFF KEY BB
```

【Note】

- After canceling the definition using this instruction, does not branch if softkey, step key, or rotary encoder is used for inputting.
- For definition of destination, conduct it by "(44) ON KEY Instruction".

【Program】

```
ON KEY 1 GOSUB *L1
ON KEY 2 GOSUB *L2
ON KEY 3 GOSUB *L3
ENABLE INTR
*LOOP
GOTO *LOOP
*L1
PRINT "OFF KEY 1"
OFF KEY 1
RETURN
*L2
PRINT "OFF KEY 2"
OFF KEY 2
RETURN
*L3
PRINT "OFF KEY 3"
OFF KEY 3
RETURN
```

【Result】

IF the interruption is generated once, 2nd interruption cannot be generated.

(41) OFF SRQ/ISRQ

【Outline】

Releases a definition of the branch destination given by the ON SRQ or ON ISRQ instruction.

【Format】

OFF SRQ

OFF ISRQ

【Description】

The OFF SRQ or OFF ISRQ instruction releases the definition of the branch destination (the statement to branch to) that has been given by the ON SRQ or ON ISRQ instruction.

【Example】

```
OFF SRQ
OFF ISRQ
```

【Note】

• The branch destination can be defined with the (45) ON SRQ or ON ISRQ.

(42) ON END - GOTO/GOSUB

【Outline】

Defines the statement to which control will branch when an EOF occurs.

【Format】

ON END <#file desciptor> GOTO <label>

ON END <#file desciptor> GOSUB <label>

【Description】

- This instruction defines the statement to which control will branch when the end of file (EOF) is detected in a file being read with an ENTER # instruction.
- If data is serially read by the ON END statement where an operation after an EOF detection has not been defined, the following error message appears and the execution stops when an EOF read.
  (end of <file name> file)

【Example】

ON END #FD GOTO *EOF

ON END #FD GOSUB *EOF

【Note】

- A branch will be taken when an EOF is read. If control has branched to a subroutine with GOSUB statement, it returns to the instruction following the ENTER instruction by which the EOF was read.
- A ON END - GOTO/GOSUB statement causes control to branch to the specified statement in regardless of ENABLE INTR or DISABLE INTR instructions.
- To release the statement to branch to, execute the (38) OFF END.
- For writing and reading data, see the (47) OUTPUT# and (14) ENTER.

【Program example】

```
OPEN "FFF" FOR OUTPUT AS #FD: Opens "FFF" for the file to which data is
                               to be written.
FOR I=100 TO 200             : Loops I from 100 to 200.
  OUTPUT #FD;I               : Saves the data of I.
NEXT I                       : NEXT I
CLOSE #FD
!
ON END #FR GOTO *LA          : Defines the destination of the branch with
                               an EOF.
OPEN "FFF" FOR INPUT AS #FR  : Opens "FFF" for the file from which data
                               is to be read.
*LOOP
 ENTER #FR;N                 : Loads data from the file to the load and
                               enters it to N.
 PRINT N                     : Displays the contents of N on the screen.
 GOTO *LOOP                  : Jumps to the statement labeled "*LOOP".
!
*LA
 CLOSE #FR                   : Closes the file.
 PRINT "EOF"                 : Displays "EOF" on the screen.
 STOP                        : Program end
```

【Result】

```
100.0
101.0
102.0
  .
  .  (Omitted)
  .
199.0
200.0
EOF
```

(43) ON ERROR - GOTO/GOSUB

【Outline】

Defines the statement to which control will branch when an error occurs during execution of a BASIC program.

【Format】

ON ERROR GOTO <label>

ON ERROR GOSUB <label>

【Description】

- Defines the destination to branch to when an error occurs during execution of a BASIC program.
- If this instruction has been executed, the execution of the program transfers to the position specified with <label> when an error occurs.
- This instruction can be used for error operations while executing a built-in function.

【Example】

ON ERROR GOTO *ERR

ON ERROR GOSUB *ERR

【Note】

- A branch will be taken when an error occurs. If control has branched to a subroutine with GOSUB statement, it returns to the instruction following the instruction where the error occurred.
- A ON ERROR - GOTO/GOSUB instruction causes control to branch to the specified statement in regardless of ENABLE INTR or DISABLE INTR instructions.
- To release the statement to branch to, execute the (39) OFF ERROR.

【Program example】

```
ON ERROR GOTO *ERR    :  Defines the destination of the branch to be caused
                         by an error input.
PRINT "START"         :  Displays "START" on the screen.
PRINT 1/0             :  Divides 1 by zero.
PRINT "END"           :  Outputs "END".
STOP                  :  Program end
*ERR                  :
PRINT "<<ERROR>>"     :  Outputs "<<ERROR>>"
PRINT " >> ",ERRM$(0):   Outputs an error message.
```

【Result】

```
START
<<ERROR>>
  >>    40: 0 divide
```

(44) ON KEY - GOTO/GOSUB

【Outline】

Defines the statement to which control will branch when receiving the interruption by key of the main-body panel.

【Format】

ON KEY <Key number> GOTO <label>
ON KEY <Key number> GOSUB <label>
ON KEY <Key number> LABEL <string expression> GOTO <label>
ON KEY <Key number> LABEL <string expression> GOSUB <label>

Key numbers (numeric expression)

1 to 7: Softkey
10: Step key. ↑
11: Step key ↓
12: Rotary encoder (clockwise)
13: Rotary encoder (counterclockwise)

【Description】

- The key numbers (1 to 7) define the destination to branch the interruption (SF1 to SF7) corresponding to the softkey of the main-body panel. The interruption from the softkey is available only when the user-defined menu of the softmenu is displayed. (Refer to KEY ON.)
- In case of the key numbers (1 to 7), displays letters specified in the softkey menu using LABEL.
- The key numbers (10 to 13) define the destination to branch the interruption by the rotary encoder or step keys of the main-body panel.
- Refer to ENABLE INTR/DISABLE INTR for the interruption enable/disable.

【Example】

```
ON KEY 1 GOTO *K3
ON KEY 2 GOSUB *K4
ON KEY XX LABEL " ON" GOTO *K1
ON KEY BB LABEL " OFF" GOSUB *K2
ON KEY XX LABEL ST$ GOTO *K1
ON KEY BB LABEL ST$&" ON" GOSUB *K2

ON KEY 10 GOSUB *STUP
ON KEY 11 GOTO *STDWN
ON KEY 12 GOSUB *ENR
ON KEY 13 GOTO *ENL
```

【Note】

- A branch will be taken after the instruction being executed on the occurrence of an interruption is executed. If control has branched to a subroutine with GOSUB statement, it returns to the instruction following the instruction being executed when the interruption generated.
- To cancel the statement to branch to, execute the OFF KEY instruction. (Refer to OFF KEY.)
- The softkey (SF1 to SF7) for interruption cannot be used when the user-defined menu is not displayed. To display the user-defined key, execute the KEY ON instruction or press the CONTRLR ON key while executing the program.

【Program example】

```
ON KEY 1 LABEL "PROGRAM \n A" GOSUB *PRG-A: Defines the KEY 1.
ON KEY 2 LABEL "PROGRAM \n B" GOSUB *PRG-B: Defines the KEY 2.
KEY ON: ENABLE INTR: Displays LABEL on the softmenu.
ENABLE INTR: Enables interruption.
*LOOP: Loops.
GOTO *LOOP:
*PRG-A: Calls PRG-A if KEY 1 is pressed.
RETURN
*PRG-B: Calls PRG-B if KEY 2 is pressed.
CALL "PRG-B"
RETURN
```

(45) ON SRQ/ISRQ - GOTO/GOSUB

【Outline】

Defines the statement to which control will branch when the GPIB controller receives a service request (SRQ).

【Format】

```
ON SRQ GOTO <label>
ON SRQ GOSUB <label>
```

(Defines the destination of the branch to be caused by an SRQ from an external GPIB.)

```
ON ISRQ GOTO <label>
ON ISRQ GOSUB <label>
```

(Defines the destination of the branch to be caused by an SRQ from the measurement section of the main body.)

【Description】

- Defines the statement to which control will branch when an interrupts is caused by an SRQ.
- ON SRQ defines the destination of the branch to be caused by an SRQ from an external GPIB device.
- ON ISRQ defines the destination of the branch to be caused by an SRQ from the measurement section of the main body.

【Example】

```
ON SRQ GOTO *SS
ON SRQ GOSUB *SS
ON ISRQ GOTO *IS
ON ISRQ GOSUB *IS
```

【Note】

- When an ON ISRQ instruction is used, an SRQ interrupt should be caused in the measurement section. To cause an SRQ interrupt, execute the OUTPUT 31 instruction with the following codes:

GPIB code	Function
S0	The measurement section transmits an SRQ interrupt to the controller.
S1	The measurement section does not transmit an SRQ interrupt to the controller.
S2	Clears the status bytes.

- A branch will be taken after the instruction being executed on the occurrence of an interrupt is executed. If control has branched to a subroutine with GOSUB statement, it returns to the instruction following the instruction being executed when the interrupt occurred.
- For enabling or disabling reception of interrupts, see the (13) ENABLE INTR and (12) DISABLE INTR.
- To release the statement to branch to, execute the (41) OFF SRQ or OFF ISRQ.

【Program example】

Example 1:

```
TGT=7
ON SRQ GOSUB *SS
ENABLE INTR
*MAINLOOP
 GOSUB *BEEP
 GOTO *MAINLOOP

*BEEP
 BUZZER 440,20
 WAIT 200
 RETURN

*SS
 DISABLE INTR
 S=SPOLL (TGT)
 PRINT "SPOLL", S
 ENABLE INTR
 RETURN
```

Example 2:

```
INTEGER S
ON ISRQ GOTO *SS
*ST
 OUTPUT 31;"SO SI"
 ENABLE INTR
 *MAINLOOP
 GOTO *MAINLOOP

*SS
 S=SPOLL(31)
 IF S BAND 4 THEN
   PRINT "MAX :",MAX(0,700,0)
   PRINT "MIN :",MIN(0,700,0)
 GOTO *ST
```

【Result】

Example 1: A branch is caused by the SRQ from the external GPIB and the result of serial polling is output.

Example 2: Every time the measurement section of the main body completes a sweep, the maximum and minimum levels are obtained.

(46) OPEN

【Outline】

Assings a file to a file descriptor and opens the file in the specified operation mode.

【Format】

OPEN "file name" FOR <processing mode> AS <# file descriptor> [; <type>]

<operation mode>
 OUTPUT: Write
 INPUT : Read

<type>
 BINARY: Binary
 TEXT : ASCII code
 ASCII : ASCII code with a header

【Description】

- The OPEN # statement assigns a file descriptor to a file and opens it in the specified mode, thus allowing the program to identify the file.
- Allowable operation modes are OUTPUT and INPUT.
  The former is used to write data in the file and the latter to read data from the file.
- file descriptor
  Actually, writing and reading data to and from files are performed by the ENTER and OUTPUT statements, respectively.
  These statements identify the object file with the file descriptor.
  Each file descriptor begins with a # , followed by alphanumeric characters.
- Type
  There are the following three types: BINARY, TEXT, and ASCII.
  (If the type is not specified, BINARY is assumed.)
  Refer to (47) OUTPUT #

【Example】

```
OPEN "FILE1" FOR OUTPUT AS #FD
OPEN "FILE2" FOR OUTPUT AS #FD;BINARY
OPEN "FILE3" FOR OUTPUT AS #FF;TEXT
OPEN "FILE4" FOR OUTPUT AS #FA;ASCII

OPEN "FILE1" FOR INPUT AS #FD
OPEN "FILE2" FOR INPUT AS #FD;BINARY
OPEN "FILE3" FOR INPUT AS #FF;TEXT
OPEN "FILE4" FOR INPUT AS #FA;ASCII
```

【Note】

- If the file descriptor being opened has already been assigned to the other file, the following error message appears and the program execution is stopped.
  ("file name" file is already exist.)
  ("file name" file is already with another path.)
- All of the files opened in a program should be closed in the end of the program.
- One file may not be opened with more than one file descriptor.
- If the file opened in the OUTPUT (write) mode exists in the memory card, the error occurs and the execution of the program is stopped.
  Necessary files are thus prevented from being deleted by mistake.
  To renew a file, the file should be deleted with a PURGE command.

【Program Example】

```
OPEN "B" FOR OUTPUT AS #FA;BINARY
FOR I=1 TO 10
 OUTPUT #FA;I
NEXT I
CLOSE #FA

OPEN "BB" FOR OUTPUT AS #FB;TEXT
FOR I=1 TO 10
 OUTPUT #FB;I
NEXT I
CLOSE #FB

OPEN "BBB" FOR OUTPUT AS #FC;ASCII
FOR I=1 TO 10
 OUTPUT #FC;I
NEXT I
CLOSE #FC
```

(47) OUTPUT

【Outline】

Outputs (writes) data to the file that is assigned to the specified file descriptor.

【Format】

```
OUTPUT <#file descriptor> ; <X>  [,<X>]
  <X>:  print item (numeric expression, character string expression)
```

【Description】

According to the type specified with the OPEN statement, the data is written in the following format.

BINARY type

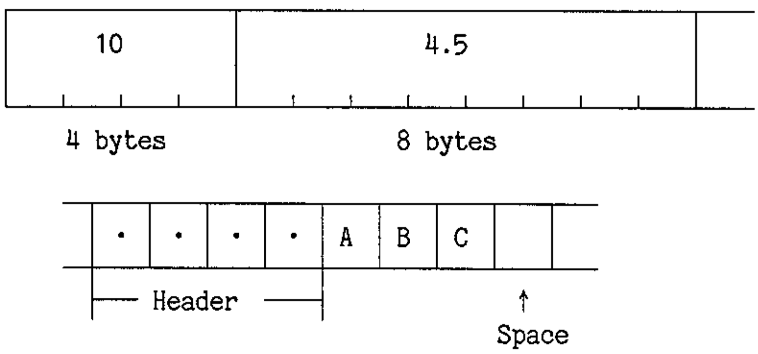
Data is written in the same type as that of the internal expression.

The data length differs according to the type, as follows:

Integer type   : 4 bytes
Real type   : 8 bytes
Character string: A four-byte header plus a character string of several bytes. (If the number of characters are odd, a space will follow the character string.)

Example)

```
OPEN "FILE" FOR OUTPUT AS #FD
OUTPUT #FD;10,4.5,"ABC"
```



TEXT type

Data is converted to the ASCII codes and output. A numeric data object is preceded by a space or a sign. A character string is terminated by a line feed character (0x0a).

Example)

```
OPEN "FILE" FOR OUTPUT AS #FD;TEXT
OUTPUT #FD;10,4.5,"ABC"
```

	1	0	,		4	.	5	,	A	B	C	n	

Each item is separated by a comma (,).

A character string ends with a line feed character (0x0a).

ASCII type

Data is converted to the ASCII codes and output. A numeric data object is preceded by a space or a sign.
A 2-byte header leads each item. If the number of characters in a data object is odd, a space will follow the object.

Example)

```
OPEN "FILE" FOR OUTPUT AS #FD;ASCII
OUTPUT #FD;10,4.5,"ABC"
```

•	•		1	0		•	•		4	.	5	•	•
Header						Header						Header	

	A	B	C	

【Example】

```
OUTPUT #FD;"ABC"

OUTPUT #FD;A,B,C
```

【Note】

- Specify a file descriptor that has been opened with the OPEN statement.
- A file descriptor should be assigned to the file to which data is written, when it is opened by the (46) OPEN# .
  The assigned file descriptor will always be used in stead of the name of the file when it is manipulated.
- A header is a separator of items and has the length of a data object.
- The following error occurs if the OUTPUT statement is used for the file that has not been opened with the OPEN statement:
  (file NOT open)

【Program Example】

```
OPEN "A" FOR OUTPUT AS #FA;BINARY
INTEGER S
FOR I=1 TO 10
 S=I
 OUTPUT #FA;I,S
NEXT I
CLOSE #FA

OPEN "AA" FOR OUTPUT AS #FB;TEXT
INTEGER S
FOR I=1 TO 10
 S=I
 OUTPUT #FB;I,S
NEXT I
CLOSE #FB

OPEN "AAA" FOR OUTPUT AS #FC;ASCII
INTEGER S
FOR I=1 TO 10
 S=I
 OUTPUT #FC;I,S
NEXT I
CLOSE #FC
```

(48) OUTPUT or OUT

【Outline】

To send data to the GPIB, measuring device of the main-unit or parallel I/O.

【Format】

OUTPUT <A {,A} | 31 | 32>;<X {,X} >
or
OUT <A {,A} | 31 | 32>;<X {,X} >

A: Device address 0 to 30: Outputs data to the devices on the GPIB
31: Outputs data to the measuring device of the main-unit
32: Outputs data to the parallel I/O

<X>: numeric expression | character expression

【Description】

- OUTPUT or OUT send numeric or character strings in the ASCII code to the devices specified with the device addresses (0 to 30). ※1

  More than one device addresses can be set by delimiting commas (,).
  Mixed setting of numeric and character expressions is available by delimiting with comma (,).
  When the REN(Remote Enable) line is true, to execute the OUTPUT command (0 to 30) causes the devices specified with the device addresses to be automatically in the remote mode.

- To specify 31 causes send data to the measuring devices of the main-unit. ※1
  (To send the talker/listener GPIB codes to the measuring devices enables to set them as the external controller.)
- To set 32 causes outputs data to the 16 bits parallel I/O. ※2
  The value can be output are between 0 and 65535. Only numeric expression is available in the 32 specification. If character strings are used, an error will result to interrupt a program execution.

※1: Refer to section 7 of the manuals (separate volumes) of R3265A/R3271A series for the list of the GPIB codes.

※2: Refer to the parallel I/O (2.4).

【Example】

```
OUTPUT 3;"CF3MZ"
OUTPUT 3,4,5;"SP",S,"MZ"

OUTPUT 31;"CF",CF,"MZ"

OUTPUT 32;128
OUTPUT 32;DT
```

【Note】

- No addresses can be specified other than 0 to 30 by delimiting with comma (,). (Multiple specification is available only between 0 and 30.)
- If the device addresses are missed or no device connects to the specified address, this command will be ignored and the program will proceeds to the next step.
- Refer to "4. MASTER/SLAVE MODE" when using in slave mode.

【Sample program】

```
DIM S$[26],B$[20]
OUTPUT 5;"CF?"
ENTER 5;C
ENTER 5;S$
PRINT C,S$

CF=1.23
A$="CF?"
OUTPUT 31;"CF",CF,"MZ"
OUTPUT 31;A$
ENTER 31;B$
PRINT B$

INTEGER S
ENTER 32;S
IF S BAND 4 THEN OUTPUT 32;128
```

(49) PANEL

【Outline】

Enables/Disables the operation using the main-body panel key.

【Format】

PANEL <numeric expression>
Numeric expression: 0 to 1

【Description】

	Panel condition
0	Panel unlock: Permits the normal operation using the main-body panel. (Enables the operation of center, span, etc.)
1	Panel lock: Inhibits the operation using the main-body panel. (Disables the operation.)

【Example】

```
PANEL 0
PANEL 1
PANEL X
```

【Note】

- If the user-defined menu is cleared during panel unlock operation, it will be displayed again by pressing the CONTLRL ON key.

【Program example】

```
ON KEY 1 LABEL "PANEL \n UNLOCK" GOSUB *PU
ON KEY 2 LABEL "PANEL \n LOCK" GOSUB *PL
KEY ON
ENABLE INTR
SCREEN 4
*LL
GOTO *LL
*PU
PANEL 0
PRINT "PLEASE KEY OPERATION"
RETURN
*PL
PANEL 1
PJRINT "PANEL LOCK"
RETURN
```

(50) PAUSE

【Outline】

Stops executing the program temporarily.

【Format】

PAUSE

【Description】

The execution of the program pauses where the PAUSE statement is placed.
The execution will resumes when the CONT command is entered or the CONT of the main-body panel is pressed.
(The CONT command should be entered in the BASIC mode.)

【Example】

PAUSE

【Program Example】

```
FOR I=1 TO 5          :  Initializes the counter I to zero.
 PRINT I              :  Outputs the variable I.
 PRINT "Hit CONT key":  Outputs the character constant.
 PAUSE                :  PAUSE
NEXT I                :  NEXT
```

【Result】

The execution always pauses after the content of the variable I have been printed.

(51) PRINTF or PRF

【Outline】

To output numeric and character strings to main display.

【Format】

```
PRINTF <character expression> [,<x>]
or
PRF    <character expression> [,<x>]
```

<x>: numeric expression | character expression

【Description】

- If the following format is specified in the character expression, it is allowed to edit and output the data of the arguments. (The editing specification will start with %.)

  Minus symbol: To cause the edited parameter to be aligned to the left side of the field (output area).
  Period : To delimit the two type of numeric strings, representing the length and accuracy of the fields.
  0 : To fill the rest of fields with zero suppression.

- Editing characters and meanings

  d: To change parameters into the decimal numeral.

  o: To change parameters into the octal numeral without symbols. (No 0 at the head)

  x: To change parameters into the hexadecimal numeral without symbol. (No 0x at the head)

  s: Character strings

  e: To accept as real numbers and change the decimal numeral, with the form of [-] m. nnnnnnE [±] xx (The length of n strings determined by the accuracy. The default is six)

  f: To accept as real numbers and change the decimal numeral, with the from of [-] mmm. nnnn. (The length of n strings determined by the accuracy. The default is six)

- The characters after % are output themselves, except when they are editing characters. Therefore to % will be output with the %% form.

【Sample program】

```
PRINTF "C=%d", C       : Displays the variable C with the decimal numeral.
PRINTF "C=%5d", C      : Displays the variable C in five figures with the
                         decimal numeral. (Right justification)
PRINTF "C=%-5d", C     : Displays the variable C in five figures with the
                         decimal numeral. (Left justification)
PRINTF "C=%05d", C     : Displays the variable C in five figures with the
                         decimal numeral.
                         (Right justification:  suppress with zero)

PRINTF "H=%x", H       : Displays the variable H with the hexadecimal unmeral.
PRINTF "H=%4x", H      : Displays the variable H in four figures with the
                         hexadecimal unmeral. (Right justification)
PRINTF "H=%-4x", H     : Displays the variable H in four figures with the
                         hexadecimal unmeral. (Left justification)
PRINTF "H=%04x", H     : Displays the variable H in four figures with the
                         hexadecimal unmeral.
                         (Right justification:  suppress with zeros)

PRINTF "S$=%s", S$     : Displays character strings
PRINTF "S$=%8s", S$    : Output 8 string characters from right-justify.
PRINTF "S$=%-8s", S$   : Output 8 string characters from left-justify.
PRINTF "%20.10s", S$   : Displays character strings justifying to the right
                         most column in a 20 characters length field.
PRINTF "%-20.10s", S$: Displays ten character strings justifying to the
                         left most column in a 20  characters length field.

PRINTF "F=%f",F        : Displays the variable F in a real number with
                         decimal numeral.
PRINTF "F=%8.2f", F    : Displays the variable F in a eight figures to the
                         second decimal including a decimal point.
PRINTF "F=%08.2f", F : Displays the xariable F in eight figures to the
                         second decimal including a decimal point. (Suppress
                         with zeros)
```

【Note】

- Since the output using PRINTF statements does not strat a new line, insert line feed cords into the PRINTF statements or add PRINT statements after PRINTF statements.

```
PRINTF "A=%d\n\r",A
               ↑
        Line feed cords
```

- If lack of the PRINTF editing characters or parameters, or the type specifications errors are detected, invalid print may be resulted.

【Example】

```
PRINTF "%d * %4d=%05d",12,34,12*34
PRINT
PRINTF ":%-10d:%10d:",123,456
PRINT
A$="ABCD"
PRINTF ":%8s:%-8s:%8.2s:%-8.2s:",A$,A$,A$,A$
PRINT
PRINTF "%f+%8.3f-%06.3f=%e",1.23,4.56,7.89,1.23+4.56-7.89
```

【Result】

```
12 *   34 =00408
:123       :       456:
:    ABCD:ABCD    :      AB:AB      :
1.230000+   4.560 - 07.890=-2.100000e+00
```

(52) PRINT or ?

【Outline】

To output numeric or character strings to the main display.

【Format】

```
PRINT  [ <X> { [, | ;<X>] } ]  [<, | ;>]
or
  ?    [ <X> { [, | ;<X>] } ]  [<, | ;>]
```

<X>: Numeric expresion | Character expession

【Description】

- The numeric or character expression can be delimited with a semicolon(; or comma (,) to specify more than one. (Semicolons output sequentially, and commas output at a tab's intervals)
- If a semicolon is put at the PRINT statement's end, the line will not start a new line. Therefore when the next PRINT statement is executed, the output will follows the previous output.

【Example】

```
S$="DEF"                : ①
PRINT "ABC" ;           : ②
PRINT S$                : ③
PRINT "A=" , A          : ④
PRINT "CF", CFQ,"KHz"   : ⑤
PRINT A+100             : ⑥
```

① Enters "DEF" to the character string variable S$.
② Outputs "ABC" on the display without no line feed.
③ Outputs the character string variable S$.
④ Outputs the character strings and the numeric.
⑤ Outputs the character strings and the numeric.
⑥ Adds 100 to the numeric variable and output.

【Sample program】

```
FOR I=1 TO 10
 PRINT "I= ";
 PRINT I
NEXT I
```

【Result】

```
I= 1.0
I= 2.0
I= 3.0
I= 4.0
I= 5.0
I= 6.0
I= 7.0
I= 8.0
I= 9.0
I= 10.0
```

(53) PRINT USING or PRINT USE

【Outline】

To edit numeric or character strings and output to the main display.

【Format】

PRINT USING < image specification > ; {, <x> }
or
PRINT USE < image specification > ; {, <x> }
<x>: numeric expression | character expression

【Description】

- To specify the image specification, represent with character strings and delimit with comma ('). (The line will be fed automatically.)

【image specification list】

D	To print spaces on the rest of the specified fields.
Z	To insert 0s on the rest of the specified fields.
K	To print numeric just as they are.
S	To add a +/- symbols at all times.
M	To add a - symbols to negative values, and add a space to positive values.
.(Decimal point)	To print a decimal point.
E	To print with the exponent form (e, sign, exponent).
H	To display numeric or character strings as they are with the European type decimal point.
R	To print the European type decimal point.
*	To print *s on the rest of the specified fields.
A	To print a character.
k	To character strings just as they are.
X	To print spaces.
Listeral	To write a literal in format specifications, put them in\"s.
B	Print numeric with the ASCII cord.
@	To feed lines.
+	To move the printing positions to the top of the same line.
-	To move the printing positions to the next line.
#	To not feed lines at the last position.
n	To output with accuracy of n decimals. If specify n to character strings, output value will be the length of the specified character strings.

【Description】

```
PRINT USING "DDD.DD" ; 1.2

PRINT USE "ZZZ.ZZ" ; 1.2
```

【Note】

- The strings printed with PRINT USING will not be returned.
  Insert return symbols in the parameters of PRINT USING.

  ```
  PRINT USING "K, k"; 123, "\ n"
  ```

- Image

【Sample program】

```
PRINT USING "DDD.DD,k" ; 1.2,"\r"
PRINT USE "ZZZ.ZZ,k" ; 1.2,"\r"
PRINT USE "***.ZZ,k" ; 1.2,"\r"
A$="K,5X,B,DDDRDD,k"
PRINT USE A$; 2.34,65,1.2,"\r"
```

【Result】

```
  1.20
001.20
**1.20
2.34     A  1,20
```

(54) PRINTER

【Outline】

To specify the GPIB addresses for the GPIB printer output.

【Format】

PRINTER <GPIB addresses>
<GPIB addresses>: 0 to 30

【Description】

- PRINTER specifies the GPIB addresses of devices to which commands of GPRINT, GLIST, GLISTN, etc. are issued. (Note to execute a PRINTER command before executions of GPRINT, GLIST, GLISTN, etc.)
- The GPIB addresses can be specified between 0 and 30. (Since 31 is set as the default, the GPIB addresses, from 0 to 30, with a PRINTER command whenever PRINTER is used.)

【Example】

```
PRINTER 1
PRINTER 5
```

【Note】

- The default, 31, has no relation with the address number 31 of OUTPUT/ INPUT commands.
- If no addresses is specified, no output will be executed.

【Sample program】

```
PRINTER 1           :  Specifies the output to GPIB address 1.
GPRINT "ABCD"       :  Outputs "ABCD" to address 1.
A=12                :  Enters 12 to the variable A.
PRINTER A           :  Specifies the output to GPIB address 12.
GPRINT "printer=",A:  Outputs character strings and contents of variable
                       to address 12.
```

【Result】

Each of two GPIB printers is assigned to address 1 and address 2.
Address 1 printer outputs
ABCD
and
Address 12 printer outputs
printer=12. 0

(55) READ DATA/RESTORE

【Outline】

To enter a constant in a DATA statements into a variable.

【Format】

```
READ <X> {, <X> }
<X>:  numeric variable | character variable

DATA <Y> {, <Y> }
<Y>:  numeric variable | character variable

RESTORE  [<label> ]
```

【Description】

- READ DATA enters numeric or character strings, determined in a DATA statement, into variables specified with a READ statement.
- The first READ generally retrieves DATA statement from the start to the end, and the first value of the DATA statement will be entered into a variable. Then the corresponding DATA statement constants will be retrieved and entered one by one.
- The specified character strings in a DATA statement must be put in double quotations (").
- A RESTORE command specifies the start position of a DATA statement to be read by a READ statement. (If a label is specified, the DATA statement after the label will be retrieved. If no label is specified, the DATA statement will be retrieved from the start of a program.)

【Example】

```
READ A
READ A, B$
DATA 1,2,3,4
DATA "ABC", 5, "DEF", 6
RESTORE
RESTORE *LA
```

【Note】

- If the number of constants specified in a DATA statement are less than the corresponding variables of a READ statement, an error will be caused. (Unmatched DATA's values and READ variable)
- When unmatched entering variable style and DATA's specified constant variable, error occurs.
(Invalid type in getdata)

【Sample program】

```
RESTORE *LA :  Specifies to read a DATA statement after the label *LA.
READ A, B$  :  Reads numeric value A and character value B.
PRINT A, B$ :  Outputs the contents of the variable to the display.
RESTORE *LB :  Specifies to read a DATA statement after the label *LB.
READ A, B$  :  Reads numeric value A and character value B.
PRINT A, B$ :  Outputs the contents of the variable to the display.
STOP        :  Termination of the program
!
*LB         :  Label *LB
 DATA 2, "B":  Data
*LA         :  Label *LA
 DATA 1, "A":  Data
```

【Result】

```
  1.0     A
  2.0     B
```

(56) REM or !

【Outline】

To write comments into a program.

【Format】

```
REM  [<character strings> ]
or
 !  [<character strings> ]
```

【Description 】

- REM or ! are used to add comments to a program.
- Since REM is a nonexcutable command, all the characters after a REM statement will be ignored. (Therefore all the characters, numbers and symbols are available.)

【Example】

```
REM  <<<remark>>>
 !
 !    **** ADVANTEST ****
```

【Note】

Since all the statements after a REM statement are assumed as comments, multi-statements with a colon (:) can not function after a REM statement.

【Sample program】

```
 !  *****************  :  Comment
 !  ** <<PROGRAM>> **   :  Comment
 !  *****************  :  Comment
REM                     :  Comment
REM          ADVANTEST  :  Comment
 !                      :  Comment
PRINT "TEST"            :  Outputs character strings.
STOP                    :  Termination of the program
```

【Result】

```
TEST
```

(57) REMOTE

【Outline】

To set a specified in the remote mode or to make the Remote Enable (REN) line true.

【Format】

REMOTE [device address {, device address}]
  Device address: 0 to 30

【Description 】

- To execute the REMOTE command without the device address specification makes the Remote Enable (REN) line true and all devices on the GPIB remote-controllable.
  To make the REN line false, execute the (34) LOCAL.
- When a device address is specified after a REMOTE command, only the device of the specified address will be in remote mode.
  More than one device addresses can be specified, delimiting with commas (,).
- To execute the following commands causes the remote mode without a execution of a REMOTE command.
  OUTPUT ············ See (48).
  SEND LISTEN ········ See (65).

【Example】

```
REMOTE

REMOTE 6

REMOTE 6,7,10
```

【Note】

Not function in slave mode.

【Sample program】

```
REMOTE 11
WAIT 2000
LOCAL 11
```

【Result】

The device address 11 will be in the remote mode (The remote lamp will light if available) and two seconds after it will be in the local. (The remote lamp will turn off.)

(58) RENAME

【Outline】

Renames a file in the memory card.

【Format】

RENAME <current file name>,<new file name>

【Description】

- The RENAME command changes the file name of a program file or data file in the memory card.
- The RENAME command should be entered in the BASIC mode of the editor.
- If the specified file is not found, the following error message appears: (RENAME (current file name, new file name) error)

【Example】

RENAME "BAS1","BASIC1"

【Notes】

- Before renaming a file, check the contents of the file with the CAT command or Load of the editor.
- A file name should be within 10 characters. If 11 or more characters are specified, the 11th and the following characters are ignored.
- The RENAME command cannot be executed when the write protect of the memory card is turned on.

(59) REQUEST

【Note】

- Not function in master mode.
- Refer to "4. MASTER/SLAVE MODE" when the external controller is connected or the slave mode is used.

(60) RUN

【Outline】

Starts executing a program.

【Format】

RUN [<label>]

【Description】

- If the label is omitted, the execution starts from the top of the program.
- If the label is specified, the execution starts from the position of the label.
- This command is used to reexecute (RUN only) the program that has been transferred to the BASIC buffer with COMPILE and RUN.

【Example】

```
RUN

RUN *ABC
```

【Note】

- A RUN command with a label should be executed in the BASIC mode. (To start the program execution, press the RUN key on the main-body CRT. In this case, the program must be transferred to the BASIC interpreter buffer beforehand.)

(61) PURGE

【Outline】

Deletes a file in the memory card.

【Format】

PURGE <file name>

【Description】

- The PURGE command deletes a program file or data file in the memory card
- The PURGE command should be used in the BASIC mode of the editor.
- If the specified file is not found, the following error message appears: (PURGE (file name) error)

【Example】

PURGE "BAS1"

【Note】

- Before entering the PURGE command, check the contents of the file to delete with the CAT command or Load of the editor.
- The PURGE command cannot be executed when the write protect of the memory card is turned on.

(62) SCRATCH

【Outline】

Clears the internal buffer of the BASIC interpreter.

【Format】

SCRATCH [<numeric expression>]

<numeric expression>: Either 1 or 2.

【Description】

- Execute this command when a BASIC program that has been transferred to the buffer is not required.
- Specify 1 for <numeric expression> when intialize program data (variable values) of internal buffer at the BASIC interpreter side.
- To initialize only the program (variable values will remain) in the buffer, specify 2 as <numeric expression>.

【Example】

```
SCRATCH

SCRATCH 1

SCRATCH 2
```

【Notes】

Need to transfer BASIC program to the internal buffer at the BASIC interpreter side for SCRATCH.

(63) SCREEN

【Outline】

Specifies the display condition of the main-body screen.

【Format】

SCREEN <numeric expression>

Numeric expression: 0 to 4

【Description】

- Specifies the display condition of the main-body screen at the execution of the program.
- The following numbers from 0 to 4 correspond to the main-body GPIB codes from VS0 to VS4.

	Display condition	
0	SPA waveform screen	(Measuring)
1	Coupled-screen of SPA waveform + BASIC	(Measuring)
2	BASIC screen	(Measuring)
3	BASIC screen	(No measuring)
4	Split-screen (2 sections) of SPA waveform + BASIC	(Measuring)

0: SPA waveform screen
Displays the normal waveform screen only, not display the the PRINT and graphicinst ructions.

1: Coupled-screen of SPA waveform screen + BASIC screen
Displays the PRINT and graphic instructions on the waveform screen with coupling the screens.

2: BASIC screen (Measuring)
Displays the PRINT and graphic instructions on the BASIC screen with performing the measurement.

3: BASIC screen (No measuring)
Displays the PRINT and graphic instructions speedy on the BASIC screen with no measurement.

4: SPA waveform screen + BASIC screen (multi-screen)
Displays the SPA waveform on the top screen, and the BASIC screen on the bottom screen.

These screen settings are initialized by the IP command. After executing the IP command, therefore, reset them.

The screen settings can be made with OUTPUT 31;"VS○". For details, refer to "(2) Graphic function" on page 3-3.

【Example】

```
SCREEN 0

SCREEN 1

SCREEN M
```

【Note】

The specification of display position is different in the display condition (1 to 3, and 4) by the CURSOR instruction.

(64) SELECT CASE/CASE ELSE/END SELECT

【Outline】

To branch more than one times, using the value of a expression as a condition

【Format】

```
SELECT <numeric expression>
CASE   <numeric expression>
END SELECT
```

【Description】

- Execute sentence following to the CASE sentence matched specified value by CASE sentence and specified value by SELECT sentence.
- If each of the values is the same, the CASE statements will be executed. If not, a CASE ELSE statements will be executed.
- SELECT statements can be nested.

【Example】

```
INPUT "A= ",A
SELECT A
 CASE 1
  PRINT "1"
 CASE 3
  PRINT "3"
 CASE 5
  PRINT "5"
 CASE ELSE
  PRINT "ELSE"
 END SELECT
```

【Note】

- END SELECT must be put, when a SELECT statement is specified.
- The SELECT statement allows only numeric expressions.

【Sample program】

```
INPUT "A= ",A               : Inputs to the variable A.
INPUT "B= ",B               : Inputs to the variable B.
SELECT A                    : ─┐ SELECT statement of A
 CASE 1                     :  │  If A=1, goes to the following processes.
   SELECT B                 :  │ ┐ SELECT statement of B
    CASE 10                 :  │ │  If B=10, goes to the following processes.
      PRINT "A=1,B=10"      :  │ │   Prints character strings
    CASE ELSE               :  │ │  If B<>10, goes to the following processes.
      PRINT "A=1,B=ELSE"    :  │ │   Prints character strings
   END SELECT               :  │ ┘ Termination of the SELECT statement of B
 CASE 2                     :  │  If A=2, goes to the following processes.
   PRINT "A=2"              :  │   Prints character strings
 CASE 10                    :  │  If A=10, goes to the following processes.
   PRINT "A=10"             :  │   Prints character strings
END SELECT                  : ─┘ Termination of the SELECT statement of A
```

【Result】

```
A=1
B=10
A=1, B=10

A=1
B=20
A=1, B=ELSE

A=10
B=10
A=10
```

(65) SEND

【Outline】

To output commands and data to the GPIB.

【Format】

SEND <A> | <B> | <C> {,<A> | <B> }

<A>: CMD | DATA | LISTEN [<D> {,<D>}]
<B>: UNT | UNL
<C>: TALK [<D>]
<D>: numeric expression

【Description】

- SEND sends the universal command, address command and data independently to the GPIB.

CMD : Makes attention line true and sends provided numeric in eight bits binary data to the GPIB. Therefore the numeric must be between 0 and 255 and expression using decimal will be converted into the integer type.
To execute without numeric specification makes the Attention line (ATN) true.

DATA : Makes the Attention (ATN) line false and sends provided numeric in eight bits binary data to the GPIB. The numeric is the same one as handled in "CMD".
To execute without numeric specification makes the Attention line (ATN) false.

LISTEN: Sends provided numeric to the GPIB as the Listener Address Group (LAG). It is allowed to specify the numeric between 0 and 30, and more than one.

TALK : Sends provided numeric to the GPIB as the Talker Address Group (TAG). The numeric is between 0 and 30. (Multiple specification is not allowed.)

UNL : Sends an Unlisten (UNL) command to the GPIB. Devices specified as a listener before this command exection will be released its listener mode.

UNT : Sends an Untalk (UNT) commands to the GPIB. Devices specified as a talker before this command execution will be released its talker mode.

【Example】

```
SEND UNT UNL TALK 1 LISTEN 2,3 DATA 0x43 0x46 0x35 0x4d 0x5a 0xd 0xa
SEND CMD
SEND DATA
```

【Note】

Not function in slave mode.

【Sample program】

```
FOR I=1 TO 9
 A=I+0x30
 SEND UNT UNL TALK 30 LISTEN 11 DATA 0x43 0x46 A 0x4d 0x5a 0xd 0xa
 WAIT 1000
NEXT I
SEND UNL UNT
```

【Result】

Change specification for center frequency of address 11 from 1MHz to 9MHz by each one second.
Release listener condition of address 11 and talker condition of address 30.

(66) SPOLL (X)

【Outline】

To provide a serial pole onto a specified device on the GPIB and read its status byte.

【Format】

SPOLL (X)

X: Device address 0 to 30: Devices on the GPIB
31: measuring devices of the main unit

【Description】

- SPOLL provides a serial pole onto a specified device on the GPIB (CONTROLLER side) and read its status byte.
- The status byts of the measuring devices of the main unit is as follows.

Bit	Description
0	Sets when UNCAL arises.
1	Sets when a calibration is completed.
2	Sets when a scanning is completed.
3	Sets when an average reaches a set up times.
4	Sets when a plot output is completed.
5	Sets when an error is detected in the GPIB code.
6	Sets when either of bits, 0 to 5 and 7, is set during the mode is set in "SO", in which an SRQ interruption may occur.
7	Sets when a REQUEST command is executed.

【Example 】

SPOLL (11): Provides a serial pole to the device address 11.
SPOLL (31): Provides a serial pole to the measuring device of the main unit.

【Note】

Not function in slave mode. (Return "0" in slave mode.)

【Sample program】

```
INTEGER S
OUTPUT 31;"SO"
ON ISRQ GOSUB *SS
ENABLE INTR
*L
 GOTO *L
*SS
 S=SPOLL(31)
 IF S BAND 4 THEN PRINT "SWEEP END"
 RETURN
```

【Result】

"SWEEP END" will be printed whenever the measuring device of the main unit finishes its scanning.

(67) SPRINTF

【Outline】

Edits numeric values and character strings and enters them to a character-string variable.

【Format】

SPRINTF <character-string variable>, <character-string expression> [,<X>]

<X>: Numeric expression | character-string expression

【Description】

- The SPRINTF instruction is equivalent to the PRINTF instruction, except that SPRINTF can enter a edited character string to the specified character-string variable.
- If the character-string expression includes the following conversion-specification characters, SPRINTF converts its arguments and enters them to a character-string expression.
  (Each conversion specification starts with a %.)

  Minus sign: Light-justifies the converted argument in its output field.
  Period : Separates the numeric string for the field width from that for the number of characters (precision).
  0 (zero) : Zero-suppresses the excessive character positions of the field.
- Conversion characters and their meanings

  d: Converts the argument to decimal number.
  o: Converts the argument to unsigned octal number (without a leading zero).
  x: Converts the argument to unsigned hexadecimal number (without a leading zero.)
  s: Prints the character string.
  e: Accepts the argument as a real number and converts it into a decimal number in the form of [−] m.nnnnnnE [±] xx. (The size of the n-character string is determined by the precision, normally 6.)
  f: Accepts the argument as a real number and converts it into a decimal number in the form of [−] mmm.nnnn (The size of the n-character string is determined by the precision, normally 6.)

- If a non-conversion character follows a %, the character is entered to the character-string expression to be output. Therefore, specify %% to enter % to the output.

【Example】

SPRINTF S$,"C=%d",C
Enters variable C as a decimal number.

SPRINTF S$,"C=%5d",C
Enters variable C as a decimal number of 5 digits (right-justified).

SPRINTF S$,"C=%-5d",C
Enters variable C as a decimal number of 5 digits (left-justified).

SPRINTF S$,"C=%05d",C
Enters variable C as a decimal number of 5 digits (right-justified and zero-suppressed).

SPRINTF S$,"H=%x",H
Enters variable H as a hexadecimal number.

SPRINTF S$,"H=%4x",H
Enters variable H as a hexadecimal number. (right-justified).

SPRINTF S$,"H=%-4x",H
Enters variable H as a hexadecimal number. (left-justified).

SPRINTF S$,"H=%04x",H
Enters variable H as a hexadecimal number. (right-justified and zero-suppressed).

SPRINTF B$,"S$=%s",S$
Enters a character string.

SPRINTF B$,"S$=%8s",S$
Enter 8 string characters from right-justify.

SPRINTF B$,"S$=%-8s",S$
Enter 8 string characters from left-justify.

SPRINTF B$,"%20.10s",S$
Enters 10 characters right-justified in the field of 20-character width.

SPRINTF B$,"%-20.10s",S$
Enters 10 characters left-justified in the field of 20-character width.

SPRINTF B$,"F=%f",F
Enters variable F as a real decimal number.

SPRINTF B$,"F=%8.2f",F
Enters variable F as a 8-digit number, including a decimal point and two fractional digits.

SPRINTF B$,"F=%08.2f",F
Enters variable F as a zero-suppressed number of 8 digits, including a decimal point and two fractional digits.

【Note】

If there are not enough conversion characters or arguments or they are the wrong type, the assignment may turn out meaningless.

【Program example】

```
DIM S$ [80]
SPRINTF S$,"%d * %4d=%05d",12,34,12*34
PRINT S$
SPRINTF S$,":%-10d:%10d:",123,456
PRINT S$
A$="ABCD"
SPRINTF S$,":%8s:%-8s:%8.2s:%-8.2s:",A$,A$,A$,A$
PRINT S$
SPRINTF S$,"%f+%8.3f - %06.3f=%e",1.23,4.56,7.89,1.23+4.56-7.89
PRINT S$
```

【Result】

```
12 *   34 =00408
:123       :       456:
:    ABCD:ABCD    :      AB:AB      :
1.230000+   4.560 - 07.890=-2.100000e+00
```

(68) STEP

【Outline】

Execute a line of a BASIC program.

【Format】

STEP [<label>]

【Description】

- If a label is specified, the labeled line is executed.
- If a label is not specified, the next line of the line that was executed last is executed. (If this command is issued continuously, the program is executed line by line.)
- Even when the program has temporarily stopped with a PAUSE command, the program lines can be executed one by one with STEP commands.

【Example 】

```
STEP

STEP *ABC
```

【Note】

- STEP commands can only be executed when the program has been stopped with the stop key (control C) or a PAUSE command. (STEP commands can be used only in the BASIC mode of the pop-up menu.)
- STEP commands cannot be executed in the loop of a GOTO statement or FOR-NEXT statement.

(69) STOP

【Outline】

To terminate the execution of a program.

【Format】

STOP

【Description】

STOP terminates the execution of a program. The following message will be displayed with STOP termination.
(Program ended normally.)

【Example】

STOP

【Note】

If a program was stopped with STOP, it cannot be restarted.

【Sample program】

```
FOR I=1 TO 10     :  Enters 1 into the counter1, then loops until I>10.
 IF I=5 THEN STOP:  If I=5, terminates the program.
 PRINT I          :  Outputs variable I.
NEXT I            :  Returns to the loop.
```

【Result】

```
1.0
2.0
3.0
4.0
Program ended normally.
```

(70) TRIGGER

【Outline】

To send Group Execute Triggers(GET) of Address Command Group(ACG) to all or specified devices on GPIB.

【Format】

```
TRIGGER [device address {, device address} ]
  device address:  0 to 30
```

【Description】

- If a TRIGGER command is executed without a device address specification, only a Group Execute Trigger (GET) is send. In this case devices to be triggered must be set as a listener previously.
- If a device address is specified after a TRIGGER command, a GET command is sent only to a specified device.

【Example】

```
TRIGGER

TRIGGER 2

TRIGGER 3,4,5
```

【Note】

Not function in slave mode.

【Sample program】

```
TRIGGER 5
ENTER 5;A$
PRINT A$
```

【Result】

The device address 5 is triggered and input data from it.

(71) WAIT

【Outline】

To terminate the execution of a program for specified time.

【Format】

WAIT <numeric expression>

【Description】

- The numeric expression specifies time in milliseconds.
- It allows to specify time between 0 and 63999 milliseconds.

【Example】

```
WAIT 1000
WAIT 60000
A=200
WAIT A
```

【Note】

- Time must be specified in milliseconds.
- Even if a interruption specified by ON (SRQ/ISRQ/KEY) arises, no branching will be executed by the interruption during a execution of this command.

【Sample program】

```
FOR I=1 TO 8
 READ S
 BUZZER S, 1000
 WAIT 1000
NEXT I
DATA 261, 294, 330, 349, 392, 440
DATA 494, 523
```

【Result】

Sounds in a music scale, changing every second just as, "do, re, mi, fa, sol, la, si, do".

3. BUILT-IN FUNCTION

3.1 Outline

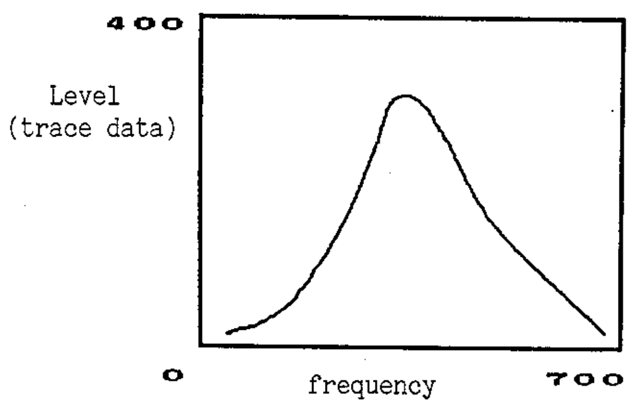
The built-in function can perform analytical process with easy operation, and shorter the time for program development and handle high throughput.

3.2 Before Using The Built-in Function

3.2.1 Point, Trace data and Notes

(1) Point processing

The point includes both frequency (horizontal axis) and level (vertical axis), and indicates the precious as shown in the following figure.



- Frequency point
  Horizontal axis   701 points   The frequency per one point shows frequency span/700.

- Level point (trace data)
  Vertical axis   401 points   The level per one point shows dynamic range /400.

(2) Graphic function

This BASIC has a graphic function.
Before you go to the graphic description, you should know the function of the display.

There are three types of the screen.

Waveform screen: Appears first after the preset button is depressed.
Character screen(Execution screen):
Displays characters by BASIC PRINT command and so on.
Graphic screen : The BASIC graphic function displays this screen.

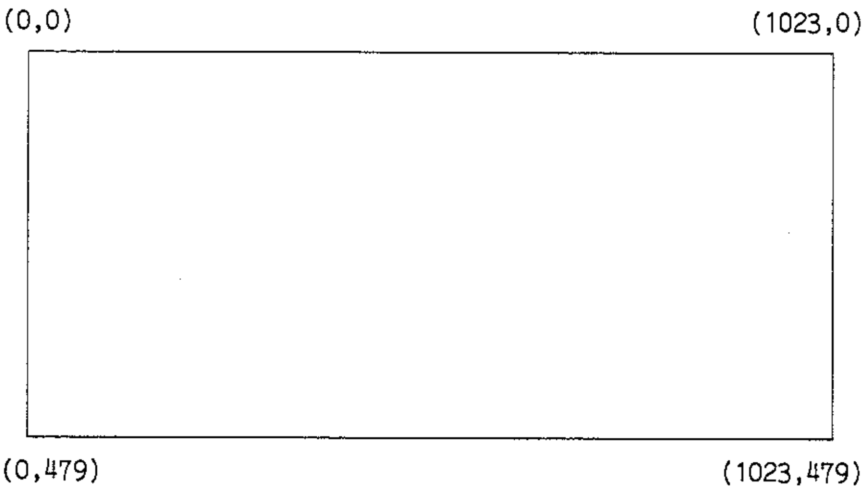
Before output either of the above screens by the BASIC program, execute either of the following GPIB codes.
(The SCREEN command also allows the specification. For details, refer to 2-111.)

Display mode	GPIB command
Waveform screen	OUTPUT 31;"VS0"
Waveform screen + Character screen	OUTPUT 31;"VS1"
Character screen	OUTPUT 31;"VS2"
Graphic screen	OUTPUT 31;"VS3"
Waveform screen + Character screen (Split-screen (2 sections))	OUTPUT 31;"VS4"

Before executing the graphic function, execute OUTPUT 31 for "VS3".

These screen settings are initialized by the IP command. After executing the IP command, therefore, reset them.

The graphic screen is specified as follows.



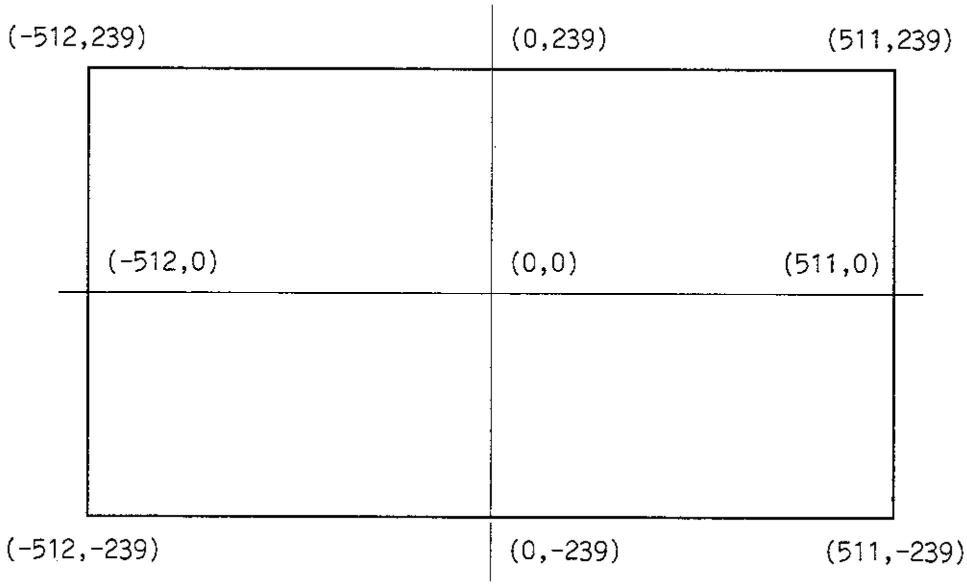
The above figure is called an absolute address. The upper left is the original (0, 0).

When view-port address is set in GADRS function, the starling point (0, 0) can be specified accordingly within the range at the figure of the previous page.

(Example)

If GADRS (1, 512, 240) is determined, the display is as the follows.

Note: In the view port address specification, specification which exceeds the picture range in setting will occur on error.



Refer to ① to ⑧ of section 3.4.

3.2.2 Note for Use

① To calculate data related the ripple, the maximum and minimum number must be calculated first by the following built-in functions. Without this calculation result in a error. (function error)

NRPLH -- for the maximum data
NRPLL -- for the minimum data

Note: In the case both data (maximum and minimum) is needed, execute both calculation.

After the above calculation, the following built-in functions are available.

PRPLHN
PRPLLN
FRPLHN
FRPLLN
VRPLHN
VRPLLN

② If an error occurs in function parameter and the like, only an error message will be displayed without a termination of the program. (function error)
In this case, the calculated value will be indefinite.

③ The built-in function calculates faster than the set of OUTPUT 31 and ENTER 31. (Both the set of OUTPUT 31 and ENTER 31 and the built-in function calculate the same value.)

④ To specify the point (0 to 700), trace data (0 to 400) and trace A/B (0/1) out of the range causes an error. (function error)

3.2.3 Structure of Description

The function will be described as follows.

FREQ (Frequency)	-- Frequency number (return value)
【Feature】	-- Feature of functin
【Format】	-- Syntax (format) in the BASIC
【Return value】	-- Returned value from execution of a function
【Error】	-- Specified parameter error, etc.
【Note】	-- Note for specification of a parameter
【Example】	-- Sample BASIC program

(1) 【Error】

If an error arises in built-in function, the BASIC program will not terminate.
To identify an error in a program, use the (41) ON ERROR statement.

(Example)
```
ON ERROR GOTO *ERR
```

(2) Built-in function and Graphic function

【Frequency/point (horizontal axis) operation】

No.	Function	Contents
1	FREQ	Calculates a frequency from a point value.
2	DFREQ	Calculates a frequecny from a width between points.
3	POINT	Calculates a point (horizontal axis).
4	DPOINT	Calculates a point between specified frequencies.

【Level/point (vertical axis) operation】

No.	Function	Contents
5	LEVEL	Calculates a level of trace data specified with a point value (vertical axis).
6	DLEVEL	Calculates a level between points (vertical axis).
7	LVPOINT	Calculates the point (vertical axis) of trace data from a level.
8	LVDPOINT	Calculates the point (vertical axis) of trace data between levels.
9	VALUE	Calculates a level at a frequency position specified with a point value.
10	DVALUE	Calculates a difference of levels at two frequency positions specified with point values.
11	CVALUE	Calculates a level at a frequency position.
12	DCVALUE	Calculates the level difference between two specified frequency positions.

【Maximum/minimum operation】

No.	Function	Contents
13	FMAX	Calculates the frequency at the maximum level position between two positions specified with point value.
14	FMIN	Calculates the frequency at the minimum level position between two positions specified with point value.
15	PMAX	Calculates the frequency point (horizontal axis) maximum level position between two positions at the specified with point values.
16	PMIN	Calculates the frequency point (horizontal axis) at the minimum level position between two positions specified with point values.
17	MAX	Calculates the maximum level between two positions specified with point values.
18	MIN	Calculates the minimum level between two positions specified with point values.

【Bandwidth operation】

No.	Function	Contents
19	BND	Calculates the frequency bandwidth of a LOSS level at a position specified with point values.
20	BNDL	Calculates the low frequency bandwidth of a LOSS level at a position specified with point values.
21	BNDH	Calculates the high frequency bandwidth of a LOSS level at a position specified with point values.
22	CBND	Calculates the frequency bandwidth of a LOSS level at a position specified with a frequency.
23	CBNDL	Calculates the low frequency bandwidth of a LOSS level at a position specified with a frequency.
24	CBNDH	Calculates the high frequency bandwidth of a LOSS level at a position specified with a frequency.

【Maximum/minimum (ripple) operation】

No.	Function	Contents
25	NRPLH	Set the number of every maximum point.
26	NRPLL	Set the number of every minimum point.
26	PRPLHN	Set horizontal axis point for maximum point of N's turn from the left.
28	PRPLLN	Set horizontal axis point for minimum point of N's turn from the left.
29	FRPLHN	Set frequency for maximum point of N's turn from the left.
30	FRPLLN	Set frequency for minimum point of N's turn from the left.
31	VRPLHN	Set level for maximum point of N's turn from the left.
32	VRPLLN	Set level for minimum point of N's turn from the left.
33	RPL1	Set level difference between maximum value of maximum point and minimum value of minimum point.

【Decision for upper and lower limit】

No.	Function	Contents
34	LMTMD1	Decide specified data with standard value and width of upper and lower
35	LMTMD2	Decide waveform data for horizontal axis-point position with standard value and width of upper and lower.
36	LMTUL1	Decide specified data with upper limit value and lower limit value.
37	LMTUL2	Decide waveform data for horizontal axis-point position with upper limit value and lower limit value.

【Electric power operation】

No.	Function	Contents
38	POWER	Set total electric power between horizontal axis points.

【Trace data】

No.	Function	Contents
39	RTRACE	Read trace data for appointed point.
40	WTRACE	Write trace data for appointed point.

【Graphic function】

No.	Function	Contents
1	GADRS	Specify absolute address/view-point address for graplhic point.
2	GFLRECT	Paint out rectangle which includes diagonal between appointed 2 point.
3	GLINE	Draw line between appointed 2 points.
4	GMKR	Draw marker normal/delta) at appointed position.
5	GPOINT	Draw dot at appointed position.
6	GRECT	Draw rectangle which includes diagonal between appointed 2 points.
7	GSTR	Draw character line.
8	GSTYLE	Specify the length for factor of short dashes line, dotted line and alternate long and short dash line.

(3) List of Parameter specification

<Built-in structure>

Function	No.	Structure
Frequency/point operation	1	F=FREQ (P)
	2	F=DFREQ (P1, P2)
	3	P=POINT (F)
	4	P=DPOINT (F1, F2)
Level/point operation	5	L=LEVEL (T)
	6	L=DLEVEL (T1, T2)
	7	T=LVPOINT (L)
	8	T=LVDPOINT (L1, L2)
	9	L=VALUE (P, M)
	10	L=DVALUE (P1, P2, M)
	11	L=CVALUE (F, M)
	12	L=DCVALUE (F1, F2, M)
Naximum/minimum operation	13	F=FMAX (P1, P2, M)
	14	F=FMIN (P1, P2, M)
	15	P=PMAX (P1, P2, M)
	16	P=PMIN (P1, P2, M)
	17	L=MAX (P1, P2, M)
	18	L=MIN (P1, P2, M)
Bandwidth operation	19	F=BND (P, X, M)
	20	F=BNDL (P, X, M)
	21	F=BNDH (P, X, M)
	22	F=CBND (F, X, M)
	23	F=CBNDL (F, X, M)
	24	F=CBNDH (F, X, M)
Maximum/minimum operation	25	N=NRPLH (P1, P2, Dx, Dy, M)
	26	N=NRPLL (P1, P2, Dx, Dy, M)
	27	P=PRPLHN (N, M)
	28	P=PRPLLN (N, M)
	29	F=FRPLHN (N, M)
	30	F=FRPLLN (N, M)
	31	L=VRPLHN (N, M)
	32	L=VRPLLN (N, M)
	33	L=RPL1 (P1, P2, Dx, Dy, M)
Decision for upper and lower limit	34	C=LMTMD1 (Dd, S, Ds)
	35	C=LMTMD2 (P, S, Ds, M)
	36	C=LMTUL1 (Dd, Up, Lo)
	37	C=LMTUL2 (P, Up, Lo, M)

Function	No.	Structure
Electric power operation	38	W=POWER (P1, P2, M)
Read/write of trace data	39 40	T=RTRACE (P, M) WTRACE (T, P, M) Note: This function returns no value.

● Graphic

Function	No.	Structure
Graphic	1 2 3 4 5 6 7 8	GADRS (Mo, X, Y) GFLRECT (D, X1, Y1, X2, Y2) GLINE (S, D, X1, Y1, X2, Y2) GMKR (MK, D, X, Y) GPOINT (D, X, Y) GRECT (S, D, X1, Y1, X2, Y2) GSTR (C, X, Y, STR) GSTYLE (dash, space, dot)

C:	Character size	0 - 16×20 dot 1 - 18×24 dot
D:	Set/Erase	0 - Erase 1 - Set (Draw)
MK:	Marker	0 - Normal marker 1 - Δ marker
Mo:	Address mode	0 - Absolute address 1 - Viewport address
S:	Line style	0 - Solid line 1 - Broken line 2 - Dotted line 3 - Chain line

STR: Character expression
X: Coordinate (Horizontal axis)
Y: Coordinate (Vertical axis)
dash: Dash part
dot: Dot part
space: Space part

3.3 Built-in Functions

The built-in functions are described as the following order.

(1) FREQ (Frequency)

【Feature】

Specify a point, and FREQ will calculate the corresponding frequency.

【Format】

FREQ (P)
P: Specified Point (0 to 700)

【Return value】

Normal termination: Frequency (Hz) converted from the point value.
At zero frequency span, the time (sec).
Error interruption: Indefinite value.

【Error】

- If the specified value is out of the range, 0 to 700, an error will result.
- Return value will be indefinite.
- An error causes only an error message and not terminates the program.

【Example】

To calculate the frequency at the 350th point.

```
F=FREQ (350)
```

To calculate the frequency at the 400th point.

```
I=200
F=FREQ (I*2)
```

(2) DFREQ (Frequency)

【Feature】

Specify a point width (point 1 and 2), and DFREQ will calculate the corresponding frequency bandwidth.

【Format】

DFREQ (P1, P2)

P1: Specified point 1 (0 to 700)
P2: Specified point 2 (0 to 700)

【Return value】

Normal termination:	Frequency (Hz) between the point 1 and point 2. At zero frequency span, the time (sec).
Error interruption:	Indefinite value.

【Error】

- If the specified value is out of the range, 0 to 700, an error will result.
- Return value will be indefinite.
- An error causes only an error message and not terminates the program.

【Note】

If P1>P2, convert P1 and P2.

【Example】

To calculate the frequency betweeen the 300th point and 400th point.

```
FS=DFREQ (300,400)

I=400
FS=DFREQ (I, 300)
```

(3) POINT (Point: horizontal axis [0 to 700])

【Feature】

Specify a frequency, and POINT will calculate a point number (0 to 700) in a measuring device. (This function is important for the built-in function to operate rapidly.)

【Format】

POINT (F)
F: Specified frequency (Hz). At zero frequency span, the time (sec).

【Return value】

Normal termination: Point number (0 to 700) converted from the frequency.
Error interruption: Indefinite value.

【Error】

- If the specified value is out of the range between a start frequency and stop frequency, an error will result.
- Return value will be indefinite.
- An error causes only an error message and not terminates the program.

【Example】

To calculate the measuring point at 3MHz.

```
PO=POINT (3E6)
```

To calculate the measuring point at 10MHz.

```
F=10E6
PO=POINT (F)
```

(4) DPOINT (Point: horizontal axis 〔0 to 700〕)

【Feature】

Specify a frequency width (frequency 1 and 2), and DPOINT will calculate a point number (0 to 700) in a measuring device.

【Format】

DPOINT (F1, F2)

F1: Specified frequency 2 (Hz). At zero frequency span, the time should set 1 (sec).
F2: Specified frequency 1 (Hz). At zero frequency span, the time should set 2 (sec).

【Return value】

Normal termination: Point number (0 to 700) between the specified frequencies F1 and F2.
Error interruption: Indefinite value.

【Error】

- If the specified value is out of the range between a start frequency and stop frequency, an error will result.
- Return value will be indefinite.
- An error causes only an error message and not terminates the program.

【Note】

If F1>F2, convert F1 and F2.

【Example】

To calculate the measuring point between 3MHz and 4MHz.

```
PSPAN=DPOINT (3E6, 4E6)
PSPAN=DPOINT (4E6, 3E6)
```

To calculate the measuring point between 3MHz and 3.5MHz.

```
FA=3E6
PSPAN=DPOINT (FA, 3.5E6)
```

(5) LEVEL (Level)

【Feature】

Specify a trace data (vertical axis [0 to 400]), and LEVEL will calculate the corresponding level.

【Format】

LEVEL(T)
T: Specified trace data.

【Return value】

Normal termination: Level converted from the trace data. (The same unit as the reference level.)
Error interruption: Indefinite value.

【Error】

- If the specified trace data are out of the range, 0 to 400, an error will result.
- Return value will be indefinite.
- An error causes only an error message and not terminates the program.

【Example】

To calculate the level at trace data 200.

```
L=LEVEL (200)
```

To convert all the trace data of trace A into level values.

```
DIM L [701]
OUTPUT 31;"GTA"
FOR I=0 TO 700
 L [I+1] = RTRACE (I,0)
NEXT I
```

(6) DLEVEL (Level)

【Feature】

Specify a trace data (vertical axis: [0 to 400]) span (T1, T2), and DLEVEL will calculate the corresponding level.

【Format】

DLEVEL (T1, T2)

T1: Specified trace data 1
T2: Specified trace data 2

【Return value】

Normal termination: Level converted from the trace data.
(Unit is dB or V, W.)
Error interruption: Indefinite value.

【Error】

- If the specified trace data are out of the range, 0 to 400, an error will result.
- Return value will be indefinite.
- An error causes only an error message and not terminates the program.

【Note】

If T1<T2, convert T1 and T2.

【Example】

To calculate the level between trace data 200 and 300.

```
L=LEVEL (200, 300)

L=LEVEL (300, 200)
```

(7) LVPOINT (Trace data: [0 to 400])

【Feature】

Specify a level, and LVPOINT will calculate a corresponding trace data value (vertical axis).

【Format】

LVPOINT (L)
L: Level (The same unit as the reference level).

【Return value】

Normal termination: Trace data converted from the level.
Error interruption: Indefinite value.

【Error】

- When each specification level 1, 2 shows external range of lower level to REF level, error occurs.
- Return value will be indefinite.
- An error causes only an error message and not terminates the program.

【Example】

To calculate the trace data at -10dBm.

```
TD=LVPOINT (-10)
```

To calculate the trace data at -20dBm.

```
L=-20
TD=LVPOINT (L)
```

(8) LVDPOINT (Trace data: [0 to 400])

【Feature】

Specify a level range (L1, L2), and LVDPOINT will calculate a trace data value (vertical axis) between the levels.

【Format】

LVDPOINT (L1, L2)

L1: Level 1 (The same unit as the reference level).
L2: Level 2 (The same unit as the reference level).

【Return value】

Normal termination: Trace data converted from the level.
Error interruption: Indefinite value.

【Error】

- When each specification level 1, 2 shows external range of lower level to REF level, error occurs.
- Return value will be indefinite.
- An error causes only an error message and not terminates the program.

【Note】

If L1<L2, convert L1 and L2.

【Example】

To calculate the trace data between -5 and -10dBm.

```
TD=LVDPOINT (-5, -10)
```

To calculate the trace data between -5 and -20dBm.

```
L=-20
TD=LVDPOINT (-5, L)
```

(9) VALUE (Level)

【Feature】

Specify a point value and the trace (A/B), and VALUE will calculate the level of the point in the specified trace side.

【Format】

VALUE (P, M)

P: Specified point value (0 to 700)
M: Trace 0: Trace A
Trace 1: Trace B

【Return value】

Normal termination: Level of the specified value. (The same unit as the reference level.)
Error interruption: Indefinite value.

【Error】

- If the specified trace memory is other than the trace A/B or the specified point is out of the range, 0 to 700, an error will result.
- Return value will be indefinite.
- An error causes only an error message and not terminates the program.

【Example 】

To calculate the level of the 300th point of the trace A.

```
L=VALUE (300, 0)
```

To calculate the level at 3MHz of the trace B frequency.

```
F=3E6
P=POINT (F)        =    L=CVALUE (3E6, 1)
L=VALUE (P, 1)
```

(both the right and left programs calculate the same answer.)

(10) DVALUE (Level)

【Feature】

Specify a point width (point 1 and 2) and the trace (A/B). DVALUE will calculate the level difference between the two points in the specified trace side.

【Format】

```
DVALUE (P1, P2, M)

P1:  Specified point 1 (0 to 700)
P2:  Specified point 2 (0 to 700)
M:   Trace 0: Trace A
     Trace 1: Trace B
```

【Return value】

Normal termination:	Level difference between the two specified points. (Unit is dB or V, W.)
Error interruption:	Indefinite value.

【Error】

- If the specified trace memory is other than the trace A/B or the specified point is out of the range, 0 to 700, an error will result.
- Return value will be indefinite.
- An error causes only an error message and not terminates the program.

【Note】

If P1>P2, convert P1 and P2.

【Example】

To calculate the level difference between 30th points and 40th points of the trace A.

```
L=DVALUE (30, 40, 0)
L=DVALUE (40, 30, 0)
```

To calculate the level difference between 2MHz and 5MHz of the trace B frequency.

F=2E6 P1=POINT (F) P2=POINT (5E6) L=DVALUE (P1, P2, 1)	=	L=DCVALUE (2E6, 5E6, 1)

(both the right and left programs calculate the same answer.)

(11) CVALUE (Level)

【Feature】

Specify a point value and the trace (A/B). CVALUE will calculate the level of the frequency position in the specified trace side.

【Format】

CVALUE (F, M)

F: Specified frequecny position (Hz). At zero frequency span, the time (sec).
M: Trace 0: Trace A
Trace 1: Trace B

【Return value】

Normal termination: Level of the specified frequency. (The same unit as the reference level.)
Error interruption: Indefinite value.

【Error】

- If the specified trace memory is other than the trace A/B or the specified point is out of the range, 0 to 700, an error will result.
- Return value will be indefinite.
- An error causes only an error message and not terminates the program.

【Example】

To calculate the level at 3.5MHz of the trace A.

```
L=VALUE (3.5E6, 0)
```

To calculate the level at 3MHz of the trace B frequnecy.

```
F=3E6
P=POINT (F)      | = |  L=CVALUE (3E6, 1)
L=VALUE (P, 1)
```

(both the right and left programs calculate the same answer.)

(12) DCVALUE (Level)

【Feature】

Specify a frequency width (point 1 and 2) and the trace (A/B). CVALUE will calculate the level difference between the two frequencies in the specified trace side.

【Format】

DCVALUE (F1, F2, M)

F1: Specified frequency 1 (Hz). At zero frequency span, the time should set 1 (sec).
F2: Specified frequency 2 (Hz). At zero frequency span, the time should set 2 (sec).
M : Trace 0: Trace A
        1: Trace B

【Return value】

Normal termination:	Level difference between the two specified frequencies. (Unit is dB or V, W.)
Error interruption:	Indefinite value.

【Error】

- If the specified trace memory is other than the trace A/B or the specified point is out of the range, 0 to 700, an error will result.
- Return value will be indefinite.
- An error causes only an error message and not terminates the program.

【Note】

If F1>F2, convert F1 and F2.

【Example】

To calculate the level difference between 3MHz and 4MHz of the trace A.

```
L=DCVALUE (3E6, 4E6, 0)

L=DCVALUE (4E6, 3E6, 0)
```

To calculate the level difference between 2MHz and 5MHz of the trace B.

```
F=2E6                |   |
P1=POINT (F)         |   |
P2=POINT (5E6)       | = | L=DCVALUE (2E6, 5E6, 1)
L=DVALUE (P1, P2, 1) |   |
```

(Both the right and left programs calculate the same answer.)

(13) FMAX (Frequency)

【Feature】

Specify a measuring point range (point 1 and 2) and the trace A/B, and FMAX will calculate the frequency at the maximum position on the vertical axis of the specified trace side.

【Format】

FMAX (P1, P2, M)

P1: Specified point 1 (0 to 700)
P2: Specified point 2 (0 to 700)
M : Trace 0: Trace A
Trace 1: Trace B

【Return value】

Normal termination: Frequency (Hz) at the maximum value position on the vertical axis between the range of specified points.
Error interruption: Indefinite value.

【Error】

- If the specified value is out of the range, 0 to 700, an error will result.
- Return value will be indefinite.
- An error causes only an error message and not terminates the program.

【Note】

If P1>P2, convert P1 and P2.

【Example】

To calculate the frequency at the maximum value position between the 0th and 700th points of the trace A.

```
MF=FMAX (0, 700, 0)
```

To calculte the frequency at the maximum value position between the 10 and 20MHz of the trace B frequency.

```
F1=10E6
P1=POINT (F1)
MF1=FMAX (P1, POINT(20E6), 1)
MF2=FMAX (POINT(F1), POINT(20E6), 1)
```

(MF1 and MF2 are equal.)

(14) FMIN (Frequency)

【Feature】

Specify a measuring point range (point 1 and 2) and the trace A/B, and FMIN will calculate the frequency at the minimum position on the vertical axis of the specified trace side.

【Format】

```
FMIN (P1, P2, M)

P1:  Specified point 1 (0 to 700)
P2:  Specified point 2 (0 to 700)
M :  Trace 0: Trace A
     Trace 1: Trace B
```

【Return value】

Normal termination:	Frequency (Hz) at the minimum value position between a range of specified points.
Error interruption:	Indefinite value.

【Error】

- If the specified value is out of the range, 0 to 700, an error will result.
- Return value will be indefinite.
- An error causes only an error message and not terminates the program.

【Note】

If P1>P2, convert P1 and P2.

【Example】

To calculate the frequency at the minimum value position between 0th and 700th points of the trace A.

```
MF=FMIN (0, 700, 0)
```

To calculte the frequency at the minimum value position between the 10 and 20MHz of the trace B frequency.

```
F1=10E6
P1=POINT (F1)
MF1=FMIN (POINT(20E6), P1, 1)
MF2=FMIN (POINT(20E6), POINT(P1), 1)
```

(MF1 and MF2 are equal.)

(15) PMAX (Point: horizontal axis [0 to 700])

【Feature】

Specify a measuring point range (point 1 and 2) and the trace A/B. PMAX will calculate a point number (horizonal: 0 to 700) on the vertical axis of the specified trace side.

【Format】

PMAX (P1, P2, M)

Trace 0: Trace A
Trace 1: Trace B
Specified point 2 (0 to 700)
Specified point 1 (0 to 700)

【Return value】

Normal termination: Point at the maximum value position on the vertical axis between the range of specified points. (horizontal axis: 0 to 700)
Error interruption: Indefinite value.

【Error】

- If the specified value is out of the range, 0 to 700, an error will result.
- Return value will be indefinite.
- An error causes only an error message and not terminates the program.

【Note】

If P1>P2, convert P1 and P2.

【Example 】

To calculate the point (horizontal axis: 0 to 700) at the maximum value position between the 0th and 700th points of the trace A.

```
MP=PMAX (0, 700, 0)
```

To calculate the point (horizontal axis: 0 to 700) at the maximum value position between 10 and 20MHz points of the trace B.

```
F1=10E6
P1=POINT (F1)
MP1=PMAX (P1, POINT(20E6), 1)
MP2=PMAX (POINT(F1), POINT(20E6), 1)
```

(MP1 and MP2 are equal.)

(16) PMIN (Point: horizontal axis [0 to 700])

【Feature】

Specify a measuring point range (point 1 and 2) and the trace A/B. PMIN will calculate a point (horizonal axis: 0 to 700) at the minimum position on the vertical axis of the specified trace side.

【Format】

PMIN (P1, P2, M)

P1: Specified point 1 (0 to 700)
P2: Specified point 2 (0 to 700)
M : Trace 0: Trace A
    Trace 1: Trace B

【Return value】

Normal termination: Point (horizontal axis: 0 to 700) at the minimum value position between a range of specified points.
Error interruption: Indefinite value.

【Error】

- If the specified value is out of the range, 0 to 700, an error will result.
- Return value will be indefinite.
- An error causes only an error message and not terminates the program.

【Note】

If P1>P2, convert P1 and P2.

【Example】

To calculate the point (horizontal axis: 0 to 700) at the minimum value position between the 0th and 700th points of the trace A.

```
MP=PMIN (0, 700, 0)
```

To calculate the point (horizontal axis: 0 to 700) at the minimum value position between 10 and 20MHz points of the trace B frequency.

```
F1=10E6
P1=POINT (F1)
MP1=PMIN (P1, POINT(20E6), 1)
MP2=PMIN (POINT(F1), POINT(20E6), 1)
```

(MP1 and MP2 are equal.)

(17) MAX (Level)

【Feature】

Specify a measuring point range (point 1 and 2) and the trace A/B.
MAX will calculate the maximum level value level on the vertical axis of the specified trace side.

【Format】

MAX (P1, P2, M)

P1: Specified point 1 (0 to 700)
P2: Specified point 2 (0 to 700)
M : Trace 0: Trace A
1: Trace B

【Return value】

Normal termination: Maximum level on the vertical axis between the range of specified points. (The same unit as the reference level.)
Error interruption: Indefinite value.

【Error】

- If the specified value is out of the range, 0 to 700, an error will result.
- Return value will be indefinite.
- An error causes only an error message and not terminates the program.

【Note】

If P1>P2, convert P1 and P2.

【Example】

To calculate the maximum level between the 0th and 700th points of the trace A.

```
ML=MAX (0, 700, 0)
```

To calculate the maximum level betweeen 10MHz and 20MHz of the trace B frequency.

```
F1=10E6
P1=POINT (F1)
ML1=MAX (P1, POINT (20E6), 1)
ML2=MAX (POINT (F1), POINT (20E6), 1)
```

(ML1 and ML2 are equal.)

(18) MIN (Level)

【Feature】

Specify a measuring point range (piont 1 and 2) and the trace A/B.
MIN will calculate the minimum level value level on the vertical axis of the specified trace side.

【Format】

```
MIN (P1, P2, M)

P1:  Specified point 1 (0 to 700)
P2:  Specified point 2 (0 to 700)
M :  Trace 0:  Trace A
           1:  Trace B
```

【Return value】

Normal termination:	Minimum level on the vertical axis between the range of specified points. (The same unit as the reference level.)
Error interruption:	Indefinite value.

【Error】

- If the specified value is out of the range, 0 to 700, an error will result.
- Return value will be indefinite.
- An error causes only an error message and not terminates the program.

【Note】

If P1>P2, convert P1 and P2.

【Example】

To calculate the minimum level between the 0th and 700th points of the trace A.

```
ML=MIN (0, 700, 0)
```

To calculate the minimum level betweeen 10MHz and 20MHz of the trace B frequency.

```
F1=10E6
P1=POINT (F1)
ML1=MIN (P1, POINT (20E6), 1)
ML2=MIN (POINT (F1), POINT (20E6), 1)

    (ML1 and ML2 are equal.)
```

(19) BND (Frequency)

【Feature】

Specify a measuring point of reference data, a LOSS level and the trace A/B. BND will calculate a frequency bandwidth in the specified trace side.

【Format】

BND (P, X, M)

P: Point of reference data (0 to 700)
X: LOSS level (dB)
M: Trace 0: Trace A
   Trace 1: Trace B

【Return value】

Normal termination: A width (Hz) of a LOSS level from reference data in a specified trace side.
Error interruption: Indefinite value.

【Error】

- If the specified value is out of the range, 0 to 700, an error will result.
- Return value will be indefinite.
- An error causes only an error message and not terminates the program.

【Example】

To calculate a bandwidth 3dB lower than the maximum value position of the trace A.

```
MP=PMAX (0, 700, 0)
BW1=BND (MP, 3, 0)

BW2=BND (PMAX (0, 700, 0), 3, 0)
```

(BW1 and BW2 are equal.)

To calculate a bandwidth 5dB lower than the center frequency point of the trace B.

```
BW=BND (350, 5, 1)
```

(20) BNDL (Frequency)

【Feature】

Specify a measuring point of reference data, a LOSS level and the trace A/B. BNDL will calculate a frequency of the lower frequency band side (left side) in the specified trace side.

【Format】

```
BNDL (P, X, M)
```

P: Point of reference data (0 to 700)
X: LOSS level (dB)
M: Trace 0: Trace A
Trace 1: Trace B

【Return value】

Normal termination: Frequency (Hz) of the lower frequency band side (left) of a LOSS level from reference data of a specified trace side.
Error interruption: Indefinite value.

【Error】

- If the specified value is out of the range, 0 to 700, an error will result.
- Return value will be indefinite.
- An error causes only an error message and not terminates the program.

【Example】

To calculate a frequency of the lower frequency band side (left side), 5dB lower than the maximum value position of the trace A.

```
MP=PMAX (0, 700, 0)
BL1=BNDL (MP, 5, 0)

BL2=BNDL (PMAX (0, 700, 0), 5, 0)
```

(BL1 and BL2 are equal.)

To calculate a frequency of the lower frequency band side (left side), 5dB lower than the center frequency point of the trace B.

```
BL=BNDL (350, 5, 1)
```

(21) BNDH (Frequency)

【Feature】

Specify a measuring point of reference data, a LOSS level and the trace A/B. BNDH will calculate a frequency of the higher frequency band side (right side) in the specified trace side.

【Format】

BNDH (P, X, M)

P: Point of reference data (0 to 700)
X: LOSS level (dB)
M: Trace 0: Trace A
Trace 1: Trace B

【Return value】

Normal termination:	Frequency (Hz) of the higher frequency band side (right) of a LOSS level from reference data of a specified trace side.
Error interruption:	Indefinite value.

【Error】

- If the specified value is out of the range, 0 to 700, an error will result.
- Return value will be indefinite.
- An error causes only an error message and not terminates the program.

【Example】

To calculate a frequency of the higher frequency band side (right side), 5dB higher than the maximum value position of the trace A.

```
MP=PMAX (0, 700, 0)
BL1=BNDH (MP, 5, 0)

BL2=BNDH (PMAX (0, 700, 0), 5, 0)
```

(BL1 and BL2 are equal.)

To calculate a frequency of the higher frequency band side (right side), 5dB higher than the center frequency point of the trace B.

```
BL=BNDH (350, 5, 1)
```

(22) CBND (frequency)

【Feature】

Specify a frequency position of reference data, a LOSS level and the trace A/B. CBND will calculate a frequency bandwidth in the specified trace side.

【Format】

CBND (F, X, M)

F: Frequency of reference data
X: LOSS level (dB)
M: Trace 0: Trace A
Trace 1: Trace B

【Return value】

Normal termination: The bandwidth (Hz) of a LOSS level from reference data in a specified trace side.
Error interruption: Indefinite value.

【Error】

- If the specified value is out of the range between a start frequency and stop frequency, an error will result.
- Return value will be indefinite.
- An error causes only an error message and not terminates the program.

【Example】

To calculate a bandwidth 3dB lower than 3MHz of the trace A frequency.

```
BW=CBND (3E6, 3, 0)
```

To calculate a bandwidth 5dB lower than 10MHz of the trace B frequency.

```
F=10E6
L=5
BW=CBND (F, L, 1)
```

(23) CBNDL (Frequency)

【Feature】

Specify a frequency position of reference data, a LOSS level and the trace A/B. CBNDL will calculate the frequency of the lower frequency band side (left side) in the specified trace side.

【Format】

CBNDL (F, X, M)

F: Frequency position of reference data
X: LOSS level (dB)
M: Trace 0: Trace A
   Trace 1: Trace B

【Return value】

Normal termination: The frequency (Hz) of the lower frequency bandwidth (left side) of a LOSS level from reference data in a specified trace side.
Error interruption: Indefinite value.

【Error】

- If the specified value is out of the range between a start frequency and stop frequency, an error will result.
- Return value will be indefinite.
- An error causes only an error message and not terminates the program.

【Example】

To calculate the left side of a bandwidth 3dB lower than 3MHz of the trace A frequency.

```
BW=CBNDL (3E6, 3, 0)
```

To calculate the left side of a bandwidth 5dB lower than 10MHz of the trace B frequency.

```
F=10E6
L=5
BW=CBNDL (F, L, 1)
```

(24) CBNDH (Frequency)

【Feature】

Specify a frequency position of reference data, a LOSS level and the trace A/B. CBNDH will calculate the frequency of the higher frequency band side (right side) in the specified trace side.

【Format】

CBNDH (F, X, M)

F: Frequency position of reference data
X: LOSS level (dB)
M: Trace 0: Trace A
Trace 1: Trace B

【Return value】

Normal termination:	The frequency (Hz) of the higher frequency bandwidth (right side) of a HIGH level from reference data in a specified trace side.
Error interruption:	Indefinite value.

【Error】

- If the specified value is out of the range between a start frequency and stop frequency, an error will result.
- Return value will be indefinite.
- An error causes only an error message and not terminates the program.

【Example】

To calculate the right side of a bandwidth 3dB higher than 3MHz of the trace A frequency.

```
BW=CBNDH (3E6, 3, 0)
```

To calculate the right side of a bandwidth 5dB higher than 10MHz of the trace B frequency.

```
F=10E6
L=5
BW=CBNDH (F, L, 1)
```

(25) NRPLH (Maximum points number)

【Feature】

Specify a measuring point range (point 1 and 2), trace A/B and a differential coefficient. NRPLH will search the maximum value corresponding with the frequency axis (horizontal axis: from the left) in the specified trace side to calculate the number of them.

【Format】

NRPLH (P1, P2, Dx, Dy, M)

P1: Specified point 1 (0 to 700)
P2: Specified point 2 (0 to 700)
Dx: Differential coefficient point (1 to 700)
Dy: Differential coefficient point (1 to 400)
M : Trace 0: Trace A
1: Trace B

【Return value】

Normal termination: Number of the maximum values corresponding with the frequency axis. (horizontal axis: from the left) (maximum number: 255)
Error interruption: Indefinite value.

【Error】

- If the specified point is out of the range, 0 to 700, an error will result.
- If no maximum is searched, an error will result. (Change the Dx and Dy numeric.)
- Return value will be indefinite.
- An error causes only an error message and not terminates the program.

【Note】

If P1>P2, convert P1 and P2.

Before PRPLHN, FRPLHN and VRPLHN are executed this function (NPRLH) must be executed exactly.

【Example】

To calculate the number of maximum value of coefficient Dx=5 and Dy=3 in the range 0 to 700 point of the trace A.

```
RH=NRPLH (0, 700, 5, 3, 0)
```

To calculate the number of maximum value of coefficient Dx=3 and Dy=5 in the range 10 to 20MHz of the trace B frequency.

```
STF=10E6
SPF=20E6
X=3
Y=5
STP=POINT (STF)
SPP=POINT (SPF)
TS=1
RH=NRPLH (STP, SPP, X, Y, TS)
```

(26) NRPLL (Minimum points number)

【Feature】

Specify a measuring point range (point 1 and 2), trace A/B and a differential coefficient. NRPLL will search the minimum value corresponding with the frequency axis (horizontal axis: from the left) in the specified trace side to calculate the number of them.

【Format】

NRPLL (P1, P2, Dx, Dy, M)

P1: Specified point 1 (0 to 700)
P2: Specified point 2 (0 to 700)
Dx: Differential coefficient point (1 to 700)
Dy: Differential coefficient point (1 to 400)
M : Trace 0: Trace A
1: Trace B

【Return value】

Normal termination: Number of the minimum values corresponding with the frequency axis. (horizontal axis: from the left) (minimum number: 255)
Error interruption: Indefinite value.

【Error】

- If the specified point is out of the range, 0 to 700, an error will result.
- If no minimum is searched, an error will result. (Change the Dx and Dy numeric.)
- Return value will be indefinite.
- An error causes only an error message and not terminates the program.

【Note】

If P1>P2, convert P1 and P2.

Before PRPLLN, FRPLLN and VRPLLN are executed this function (NPRLL) must be executed exactly.

【Example】

To calculate the number of minimum value of coefficient Dx=5 and Dy=3 in the range 0 to 700 point of the trace A.

```
RL=NRPLL (0, 700, 5, 3, 0)
```

To calculate the number of minimum value of coefficient Dx=3 and Dy=5 in the range 10 to 20MHz of the trace B frequency.

```
STF=10E6
SPF=20E6
X=3
Y=5
STP=POINT (STF)
SPP=POINT (SPF)
TS=1
RL=NRPLL (STP, SPP, X, Y, TS)
```

(27) PRPLHN (Point: horizontal axis [0 to 700])

【Feature】

Specify the trace A/B and n-th minimum position number from the left on the frequency axis. PRPLHN will calculate the point (0 to 700) at the specified minimum position.

【Format】

PRPLHN (N, M)

N: Number of the n-th maximum position from the left on the frequency axis. (horizontal axis: from the left)
M: Trace 0: Trace A
Trace 1: Trace B

【Return value】

Normal termination: Point number (0 to 700) of the n-th maximum position from the left on the frequency axis.
Error interruption: Indefinite value.

【Error】

- If no n-th maximum position is detected, an error will result. (Before this function, execute the NRPLH.)
- Return value will be indefinite.
- An error causes only an error message and not terminates the program.

【Example】

To calculate all the maximum of the differential coefficient Dx=5 and Dy=3 in the range 0 to 700 point of the trace A, and next the point number at the maximum position third from the left.

```
RH=NRPLH (0, 700, 5, 3, 0)
P=PRPLHN (3, 0)
```

To calculate all the maximum of the differential coefficient Dx=3 and Dy=5 in the range 10 to 20MHz of the trace B frequency, and next the point number at the maximum position second from the left.

```
STF=10E6
SPF=20E6
X=3
Y=5
STP=POINT (STF)
SPP=POINT (SPF)
TS=1
RH=NRPLH (STP, SPP, X, Y, TS)
P=PRPLHN (2, TS)
```

(28) PRPLLN (Point: horizontal axis [0 to 700])

【Feature】

Specify the trace A/B and n-th minimum position number from the left on the frequency axis. PRPLLN will calculate the point (0 to 700) at the specified minimum position.

【Format】

PRPLLN (N, M)

N: Number of the n-th minimum position from the left on the frequency axis. (horizontal axis: from the left)
M: Trace 0: Trace A
Trace 1: Trace B

【Return value】

Normal termination: Point number (0 to 700) of the n-th minimum position from the left on the frequency axis.
Error interruption: Indefinite value.

【Error】

- If no n-th minimum position is detected, an error will result. (Before this function, execute the NRPLL.)
- Return value will be indefinite.
- An error causes only an error message and not terminates the program.

【Example】

To calculate all the minimum of the differential coefficient Dx=5 and Dy=3 in the range 0 to 700 point of the trace A frequnecy, and next the point number at the minimum position third from the left.

```
RH=NRPLL (0, 700, 5, 3, 0)
P=PRPLLN (3, 0)
```

To calculate all the minimum of the differential coefficient Dx=3 and Dy=5 in the range 10 to 20MHz of the trace B, and next the point number at the minimum position second from the left.

```
STF=10E6
SPF=20E6
X=3
Y=5
STP=POINT (STF)
SPP=POINT (SPF)
TS=1
RH=NRPLL (STP, SPP, X, Y, TS)
P=PRPLLN (2, TS)
```

(29) FRPLHN (Frequency)

【Feature】

Specify the trace A/B and n-th maximum position number from the left on the frequency axis. FRPLHN willl calculate the frequency at the specified maximum position.

【Format】

FRPLHN (N, M)

N: Number of the n-th maximum position from the left on the frequency axis.
M: Trace 0: Trace A
Trace 1: Trace B

【Return value】

Normal termination: The frequency (Hz) of the n-th maximum position from the left on the frequency axis.
Error interruption: Indefinite value.

【Error】

- If no n-th maximum position is detected, an error will result.
- Return value will be indefinite.
- An error causes only an error message and not terminates the program.

【Example】

To calculate all the maximum of the differential coefficient Dx=5 and Dy=3 in the range 0 to 700 point of the trace A, and next the frequency at the maximum position third from the left.

```
RH=NRPLH (0, 700, 5, 3, 0)
F=FRPLHN (3,0)
```

To calculate all the maximum of the differential coefficient Dx=3 and Dy=5 in the range 10 to 20MHz of the trace B frequency, and next the frequency at the maximum position second from the left.

```
STF=10E6
SPF=20E6
X=3
Y=5
STP=POINT (STF)
SPP=POINT (SPF)
TS=1
RH=NRPLH (STP, SPP, X, Y, TS)
F=FRPLHN (2, TS)
```

(30) FRPLLN (Frequency)

【Feature】

Specify the trace A/B and n-th minimum position number from the left on the frequency axis. FRPLLN willl calculate the frequency at the specified minimum position.

【Format】

FRPLLN (N, M)

N: Number of the n-th minimum position from the left on the frequency axis. (horizontal axis: from the left)
M: Trace 0: Trace A
Trace 1: Trace B

【Return value】

Normal termination: The frequency (Hz) of the n-th maximum position from the left on the frequency axis.
Error interruption: Indefinite value.

【Error】

- If no n-th minimum position is detected, an error will result.
- Return value will be indefinite.
- An error causes only an error message and not terminates the program.

【Example】

To calculate all the minimum of the differential coefficient Dx=5 and Dy=3 in the range 0 to 700 point of the trace A, and next the frequency at the minimum position third from the left.

```
RH=NRPLL (0, 700, 5, 3, 0)
F=FRPLLN (3,0)
```

To calculate all the minimum of the differential coefficient Dx=3 and Dy=5 in the range 10 to 20MHz of the trace B frequency, and next the frequency at the minimum position second from the left.

```
STF=10E6
SPF=20E6
X=3
Y=5
STP=POINT (STF)
SPP=POINT (SPF)
TS=1
RH=NRPLL (STP, SPP, X, Y, TS)
F=FRPLLN (2, TS)
```

(31) VRPLHN (Level)

【Feature】

Specify the trace A/B and n-th maximum position number from the left on the frequency axis. VRPLHN will calculate the level at the specified maximum position.

【Format】

VRPLHN (N, M)

N: Number of the n-th maximum position from the left on the frequency axis.
M: Trace 0: Trace A
1: Trace B

【Return value】

Normal termination: Level of the n-th maximum position from the left on the frequency axis. (The same unit as the reference level.)
Error interruption: Indefinite value.

【Error】

- If no n-th maximum position is detected, an error will result.
- Return value will be indefinite.
- An error causes only an error message and not terminates the program.

【Example】

To calculate all the maximum of the differential coefficient Dx=5 and Dy=3 in the range 0 to 700 point of the trace A, and next the level at the maximum position third from the left.

```
RH=NRPLH (0, 700, 5, 3, 0)
L=VRPLHN (3, 0)
```

To calculate all the maximum of the differential coefficient Dx=3 and Dy=5 in the range 10 to 20MHz of the trace B frequency, and next the level at the maximum position second from the left.

```
STF=10E6
SPF=20E6
X=3
Y=5
STP=POINT (STF)
SPP=POINT (SPF)
TS=1
RH=NRPLH (STP, SPP, X, Y, TS)
L=LRPLHN (2, TS)
```

(32) VRPLLN (Level)

【Feature】

Specify the trace A/B and n-th minimum position number from the left on the frequency axis. VRPLLN will calculate the level at the specified minimum position.

【Format】

VRPLLN (N, M)

N: Number of the n-th minimum position from the left on the frequency axis.
M: Trace 0: Trace A
1: Trace B

【Return value】

Normal termination: Level of the n-th minimum position from the left on the frequency axis. (The same unit as the reference level.)
Error interruption: Indefinite value.

【Error】

- If no n-th minimum position is detected, an error will result. (Before this function, execute the NRPLH.)
- Return value will be indefinite.
- An error causes only an error message and not terminates the program.

【Example】

To calculate all the minimum of the differential coefficient Dx=5 and Dy=3 in the range 0 to 700 point of the trace A, and next the level at the minimum position third from the left.

```
RH=NRPLL (0, 700, 5, 3, 0)
L=VRPLLN (3, 0)
```

To calculate all the minimum of the differential coefficient Dx=3 and Dy=5 in the range 10 to 20MHz of the trace B frequency, and next the level at the minimum position second from the left.

```
STF=10E6
SPF=20E6
X=3
Y=5
STP=POINT (STF)
SPP=POINT (SPF)
TS=1
RH=NRPLL (STP, SPP, X, Y, TS)
L=VRPLLN (2, TS)
```

(33) RPL1 (Level)

【Feature】

Specify a measuring point range (point 1 and 2), trace A/B and a differntial coefficient. RPL1 will search the maximum and minimum values in the point area of the specified trace side to calculate the level difference between the biggest maximum and smallest minimum values.

【Format】

RPL1 (P1, P2, Dx, Dy, M)

P1: Specified point 1 (0 to 700)
P2: Specified point 2 (0 to 700)
Dx: Differential coefficient point (1 to 700)
Dy: Differential coefficient point (1 to 400)
M : Trace 0: Trace A
1: Trace B

【Return value】

Normal termination: Level difference between the biggest maximum and smallest minimum values. (dB or V, W.)
Error interruption: Indefinite value.

【Error】

- If the specified point P1, P2 is out of the range, 0 to 700, an error will result.
- If no maximum and minimum are searched, an error will result. (Change the Dx and Dy numeric.)
- Return value will be indefinite.
- An error causes only an error message and not terminates the program.

【Note】

If P1>P2, convert P1 and P2.

【Example】

To calculate level difference between the biggest maximum and smallest minimum values of coefficient Dx=5 and Dy=3, in the range 0 to 700 point of the trace A.

```
RP=RPL1 (0, 700, 5, 3, 0)
```

To calculate level difference between the biggest maximum and smallest minimum values of coefficient Dx=3 and Dy=5 in the range 10 to 20 MHz of the trace B frequency.

```
STF=10E6
SPF=20E6
X=3
Y=5
STP=POINT (STF)
SPP=POINT (SPF)
TS=1
RP=RPL1 (STP, SPP, X, Y, TS)
```

(34) LMTMD1 (Check Value [0, 1, 2])

【Feature】

When standard value, upper and lower limit width from the standard value and tested data are given, it is checked whether or not to stay inside of up-down range width.

【Format】

LMTMD1 (Dd, S, Ds)

Dd: Sample data
S : Reference value
Ds: Upper and lower limit width

Check whether it is ((S-Ds) ≦ Dd ≦ (S+Ds)).

【Return value】

Normal termination:	Inside ·····	0
	Above the upper limit ·····	1
	Under the lower limit ·····	2

【Example】

To check whether the input value is between 40 and 60.

```
INPUT D
T=LMTMD1 (D, 50, 10)
IF T=0 THEN PRINT "OK"
IF T=1 THEN PRINT "UPPER"
IF T=2 THEN PRINT "LOWER"
```

To determine whether the 30MHz level of the trace A is between +10 and -10 of the input reference value.

```
INPUT S
LV=CVALUE (30E6, 0)
T=LMTMD1 (LV, S, 20)
IF T=0 THEN PRINT "OK"
IF T=1 THEN PRINT "UPPER"
IF T=2 THEN PRINT "LOWER"
```

(35) LMTMD2 (Check Value [0, 1, 2])

【Feature】

When each point of standard value, upper and lower limit width from the standard value and trace A/B are given, it is checked whether the level of trace side point stay inside of up-down range width or not.

【Format】

LMTMD2 (P, S, Ds, M)

P : Point (0 to 700)
S : Reference value (Unit is the same as REF level.)
Ds: Up-down range width (dB or V, W)
M : Trace 0: Trace A
1: Trace B

Check whether it is ((S-Ds) ≦ level ≦ (S+Ds)).

【Return value】

Normal termination:	Inside ·····	0
	Above the upper limit ·····	1
	Under the lower limit ·····	2

【Example】

To determine whether the 30MHz level of the trace A is between ±10dB of the input reference value.

```
INPUT S
P=POINT (30E6)
T=LMTMD2 (P, S, 20, 0)
IF T=0 THEN PRINT "OK"
IF T=1 THEN PRINT "UPPER"
IF T=2 THEN PRINT "LOWER"
```

(36) LMTUL1 (Check Value [0, 1, 2])

【Feature】

Specify an upper and lower limits and sample data. LMTUL1 will check if the sample data are inside or outside of the range between the upper and lower limits.

【Format】

LMTUL1 (Dd, Up, Lo)

Dd: Sample data
Up: Upper limit
Lo: Lower limit

Check whether it is (Lo ≦ Dd ≦ Up)

【Return value】

Normal termination: Inside ····· 0
Above the upper limit ····· 1
Under the lower limit ····· 2

【Example】

To check whether the input value is between 30 and 40.

```
INPUT D
T=LMTUL1 (D, 40, 30)
IF T=0 THEN PRINT "OK"
IF T=1 THEN PRINT "UPPER"
IF T=2 THEN PRINT "LOWER"
```

To determine whether the 30MHz level of the trace A is between the input upper and lower limits.

```
INPUT "UPPER", U
INPUT "LOWER", L
LV=CVALUE (30E6, 0)
T=LMTUL1 (LV, U, L)
IF T=0 THEN PRINT "OK"
IF T=1 THEN PRINT "UPPER"
IF T=2 THEN PRINT "LOWER"
```

(37) LMTUL2 (Check Value [0, 1, 2])

【Feature】

When each point of upper and lower limit value and trace A/B are given, it is checked whether the point level of trace side level stay inside range of upper and lower limit value.

【Format】

LMTUL2 (P, Up, Lo, M)

P : Point (0 to 700)
Up: Upper limit (Unit is the same as REF level.)
Lo: Lower limit (Unit is the same as REF level.)
M : Trace 0: Trace A
1: Trace B
Check whether it is (Lo ≦ level ≦ Up)

【Return value】

Normal termination: Inside ····· 0
Above the upper limit ····· 1
Under the lower limit ····· 2

【Example】

To determine whether the 30MHz level of the trace A is between the input upper and lower limits.

```
INPUT "UPPER", U
INPUT "LOWER", L
P=POINT (30E6)
T=LMTUL2 (P, U, L, 0)
IF T=0 THEN PRINT "OK"
IF T=1 THEN PRINT "UPPER"
IF T=2 THEN PRINT "LOWER"
```

(38) POWER (Total Power)

【Feature】

Find out table electric power for REF level at Od Bm. Frequency range is based on point width (point 1, point 2). Specification of vertical axis should be 10dB/div.

【Format】

POWER (P1, P2, M)

P1: Specified point 1 (0 to 700)
P2: Specified point 2 (0 to 700)
M : Trace 0: Trace A
1: Trace B

【Return value】

Normal termination: Total power (W) between the specified points, P1 and P2.
Error interruption: Indefinite value.

【Error】

- If the specified value is out of the range, 0 to 700, an error will result.
- Return value will be indefinite.
- An error causes only an error message and not terminates the program.

【Note】

If P1>P2, convert P1 and P2.

Calculate of the total power with the REF level set to other than 0 dBm is possible only when the REF level is set in the unit of the 10 dBm step. (that is, it is set to -20, -10, 0, 10, 20 dBm, etc.)

The equation for calculation is as follows:

Total power = power (P1, P2, M) * $10^{\frac{x}{10}}$ (x dBm)

【Example】

To calculate the total power between point 300 and 400 of the trace A frequency. (When REF level=0 dBm)

AW=POWER (300, 400, 0)

To calculate the total power between point 0 and 700 of the trace A frequency. (When REF level=-20dBm)
AW = POWER (0,700,0)/100

(39) RTRACE (Trace data: [0 to 400])

【Feature】

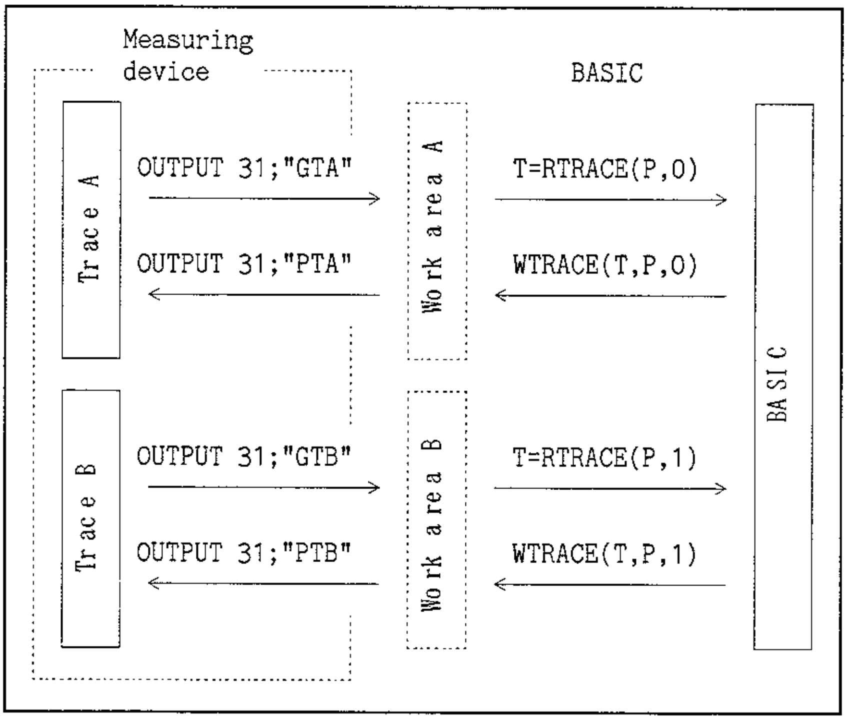
RTRACE returns the trace data of a specified point.

【Format】

RTRACE (P, M)

P: Point (0 to 700)
M: Trace 0: Trace A
1: Trace B

Before this function is executed, execute "GTA" or "GTB" with OUTPUT 31 command. This makes trace data in a measuring device to be transferred to a work area.
To transfer trace A data to a work area, execute OUTPUT 31 for "GTA".
To transfer trace B data to a work area, execute OUTPUT 31 for "GTB".
The above both operations transfer all the 701 points.
Note that this RTRACE function is for reading data from a work area one by one point.



Trace data and BASIC data transfer

【Return value】

Normal termination: Trace data (0 to 400)
Error interruption: Indefinite value

【Error】

Though to specify a point other than 0 to 700 causes no error, an indefinite value will be returned.

【Example】

To store the trace A data (0 to 700) into the array variable A.

```
INTEGER I,A(701)
OUTPUT 31;"GTA"
FOR I=0 TO 700
  A(I+1)=RTRACE(I,0)
NEXT I
```

【Data】

The above sample program executes in about 2.5s.
The running time per data point is about 3.5ms.

(40) WTRACE

【Feature】

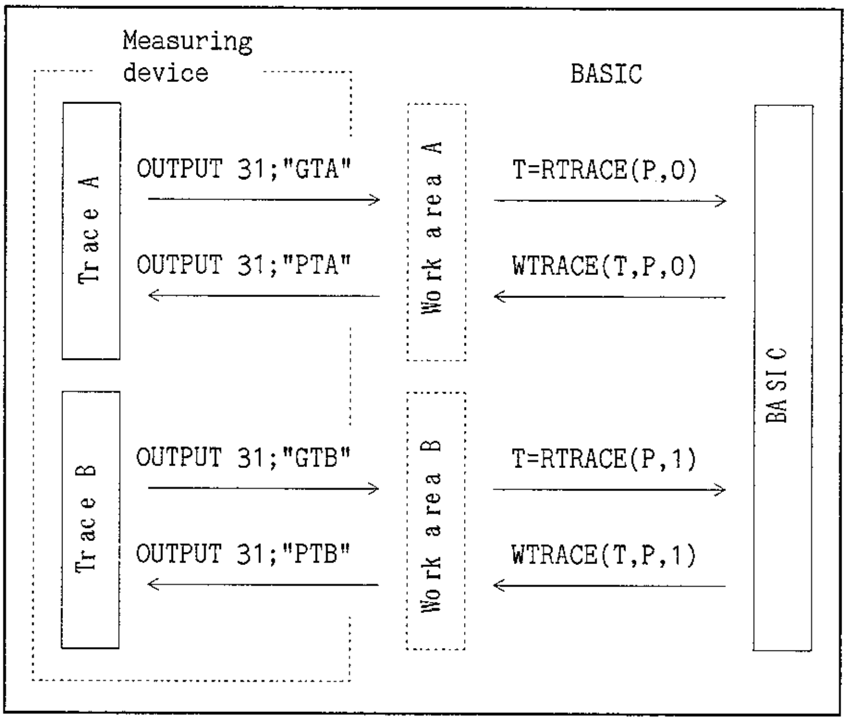
WTRACE writes the trace data into a specified point.

【Format】

WTRACE (T, P, M)

T: Trace data (0 to 400)
P: Point (0 to 700)
M: Trace 0: Trace A
1: Trace B

After this function is executed, execute "PTA" or "PTB" with OUTPUT 31 command. This makes trace data in a work area to be transferred to a measuring device.
To write work area A data into the trace A, execute OUTPUT 31 for "PTA".
To write work area B data into the trace B, execute OUTPUT 31 for "PTB".
The above both operations write all the 701 points.
Note that this WTRACE function is for writing data into a work area one by one point.



Trace data and BASIC data transfer

【Error】

Though to specify a point other than 0 to 700 causes no error, no data will be written.

【Example】

To transfer the array variable B data to the trace B data (measuring device).
(The array variable B is 0.)

```
INTEGER I,B(701)
FOR I=0 TO 700
  WTRACE(B(I+1),I,1)
NEXT I
OUTPUT 31;"PTB"
```

【Data】

The above sample program executes in about 2.2s.
The running time per data point is about 3.1ms.

3.4 Graphic Function

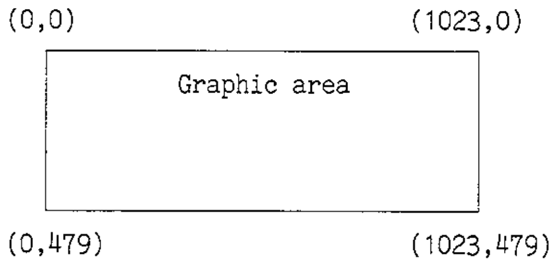
The graphic function will be described as the following order.

(1) GADRS

【Feature】

GADRS specify the address mode of the graphic display.
Two address modes are available.

0: Absolute address
1: Viewport address



The origin is located at the upper left by specifying the absolute address mode. In this mode, the X and Y coordinates specification will be ignored. The origin is the X and Y when the viewpoint address is specified.

Note: To specify the X and Y by absolute address and not to deviate from the above area. When a viewpoint address is specified, the upper right of the origin is the first quadrant.

【Format】

GADRS (Mo, X, Y)

Mo: mode 0: Absolute address
        1: View point address
X : Horizontal axis (0 to 1023)
Y : Vertical axis (0 to 479)

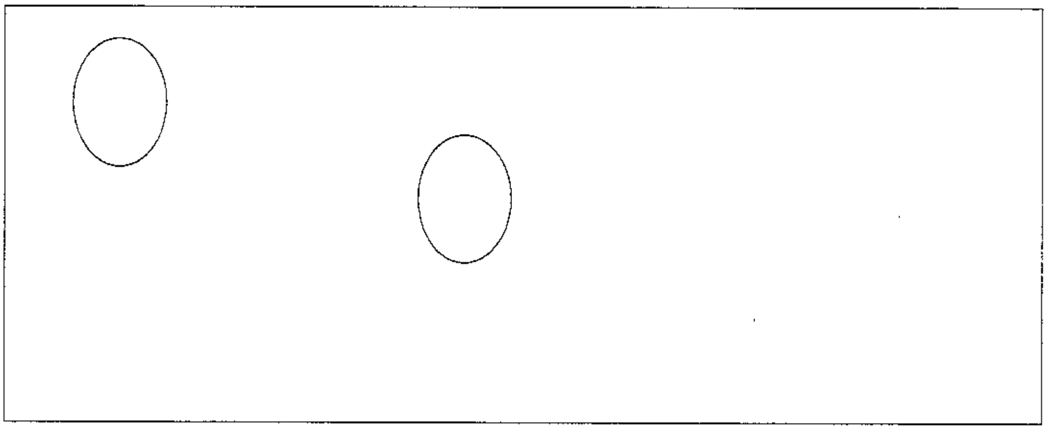
【Error】

- An error will arise when the XY is set out of the graphic display area.
- Though the error outputs a message, does not interrupt a program execution.

【Example】

```
OUTPUT 31;"VS3"
CLS 1
R=100
OFFSET=100
FOR M=0 TO 1
  GADRS(M,512,240)
  FOR I=0 TO PT*2 STEP PI/90
    X=SIN(I)*R+OFFSET
    Y=COS(I)*R+OFFSET
    GPOINT(1,X,Y)
  NEXT I
NEXT M
```

【Result】



(2) GFLRECT

【Feature】

GFLRECT draw painted rectangular which has a diagonal between specified two points (coordinate 1, coordinate 2).

【Format】

```
GFLRECT (D,   X1,   Y1,   X2,   Y2)
         |    ========    ========
         |        |           |
         └─ 0: Erase          └─ coordinate2
            1: Draw   └───────── coordinate1
```

【Error】

- An error will arise, if the X and Y are specified out of the graphic display area.
  (Take care when being in the viewport address mode.)
- Though the error outputs a message, does not interrupt a program execution.

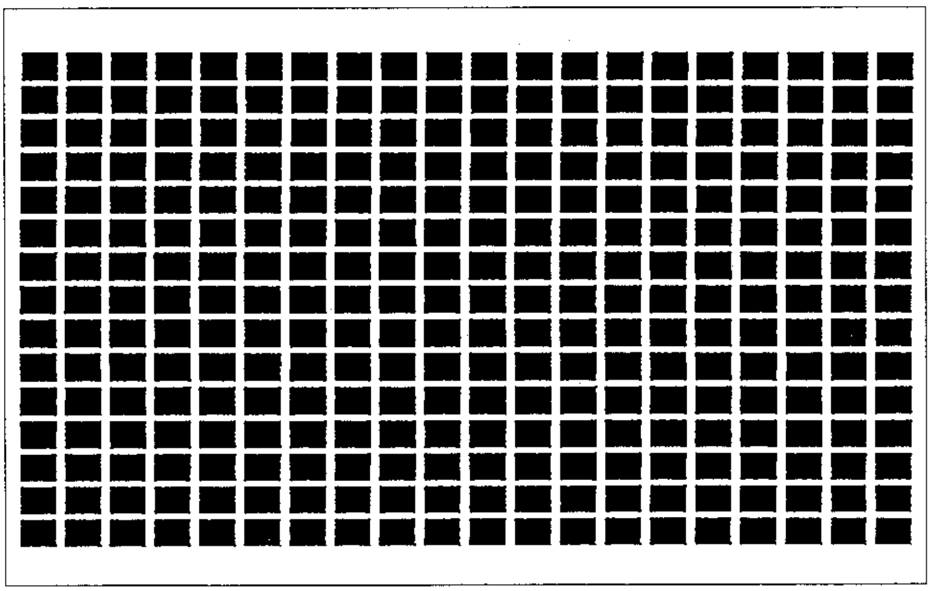
【Note】

Coordinate 1 must be specified at the upperleft, and coodinate 2 at the upper right.

【Example】

```
OUTPUT 31;"VS3"
 CLS 1
 INTEGER X,Y
 FOR X=10 TO 970 STEP 50
   FOR Y=10 TO 450 STEP 30
     GFLRECT(1,X,Y,X+40,Y+25)
   NEXT Y
 NEXT X
 STOP
```

【Result】



(3) GLINE

【Feature】

GLINE draw a line between specified two points (coordinate 1, coordinate 2).

【Format】

```
GLINE (S,   D,   X1,   Y2,   X2,   Y2)
       |    |    ==========    ==========
       |    |        |             └── coordinate 2
       |    └── 0: Erase ───────────── coordinate 1
       |        1: Draw
       └──Style 0: Solid line
                1: Broken line
                2: Dotted line
                3: Chain line
```

【Error】

- An error will arise, if the X and Y are specified out of the graphic display area.
  (Take care when being in the viewport address mode.)
- Though the error outputs a message, does not interrupt a program execution.

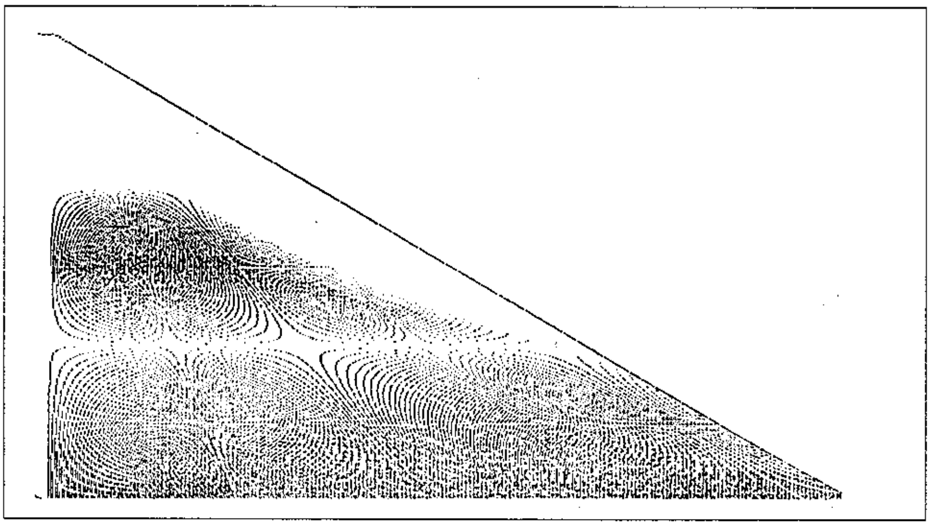
【Note】

The style must be specified previously by the line style (GSTYLE function) except for a solid line drawing. (Refer to the (8) GSTYLE function.)

【Example】

```
OUTPUT 31;"VS3"
 CLS 1
 FOR I=2 TO 1023 STEP 3
   GLINE(0,1,2,0,I,479)
   GLINE(0,1,0,0,I-2,479)
 NEXT I
 STOP
```

【Result】



(4) GMKR

【Feature】

GMKR draw a marker (normal, △) at a specified position.

【Format】

```
GMKR (MK,   D,   X,   Y)
         |     |     ‾‾‾‾‾‾‾
         |     |       └─ coordinate
         |     └───────── 0: Erase
         |                1: Draw
         └─────────────── Marker type 0: Normal marker
                                      1: △ marker
```

【Error】

- An error will arise, if the X and Y are specified out of the graphic display area.
  (Take care when being in the viewport address mode.)
- Though the error outputs a message, does not interrupt a program execution.

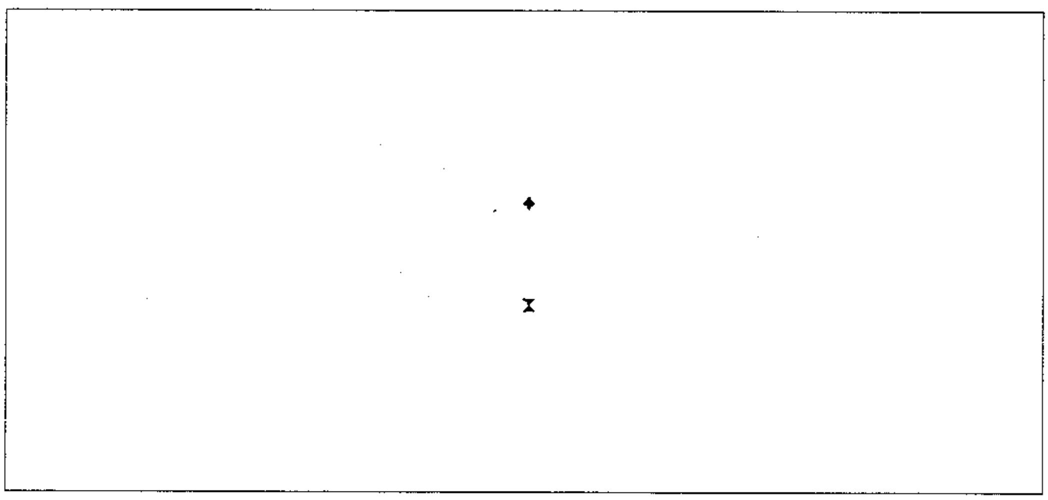
【Note】

- The marker size is 11×11 dot.
- A marker is drawn being its center at a specified position.

【Example】

```
OUTPUT 31;"VS3"
CLS 1
GMKR (0,1,512,200)
GMKR (1,1,512,280)
```

【Result】



(5) GPOINT

【Feature】

GPOINT dots a point at a specified position.

【Format】

```
GPOINT (D,   X,   Y)
         |   ======
         |      └── coordinate
         └───────── 0: Erase
                    1: Draw
```

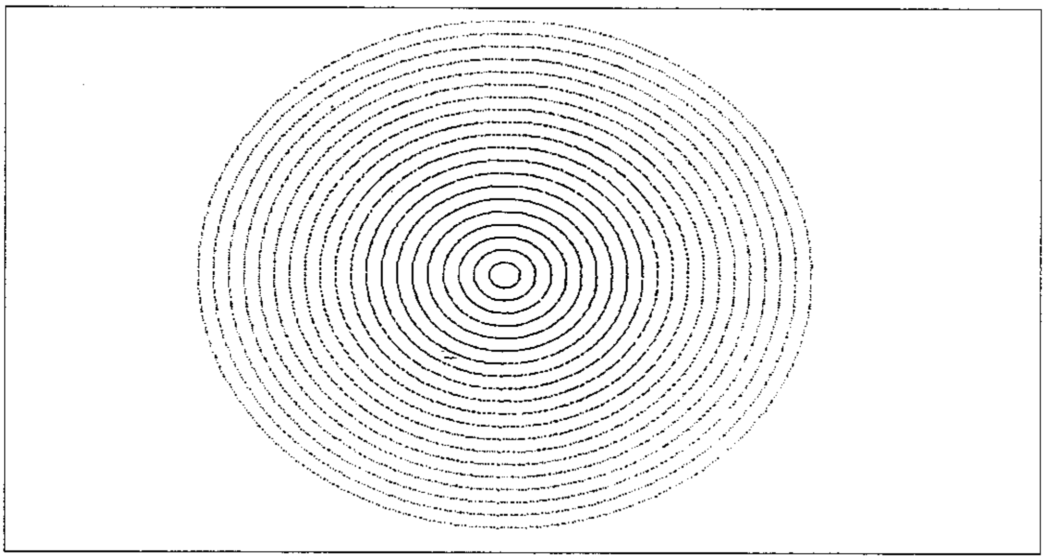
【Error】

- An error will arise, if the X and Y are specified out of the graphic display area.
  (Take care when being in the viewport address mode.)
- Though the error outputs a message, does not interrupt a program execution.

【Example】

```
OUTPUT 31;"VS3"
CLS 1
FOR R=200 TO 1 STEP -10
  FOR I=0 TO PI*2 STEP PI/270
    X=SIN(I)*R*1.5+512
    Y=COS(I)*R+240
    GPOINT(1,X,Y)
  NEXT I
NEXT R
```

【Result】



(6) GRECT

【Feature】

GRECT draws a rectangular whose diagonal is across specified two points (coordinate 1, coordinate 2).

【Format】
```
GRECT (S,   D,   X1,   Y1,   X2,   Y2)
                 ==========   ========
       |    |         |           └─ coorcinate 2
Style 0: Solid line   └───────────── coordinate 1
      1: Dash line  ──────────────── 0: Erase
      2: Broken line                 1: Draw
      3: Dotted line
      4: Chain line
```

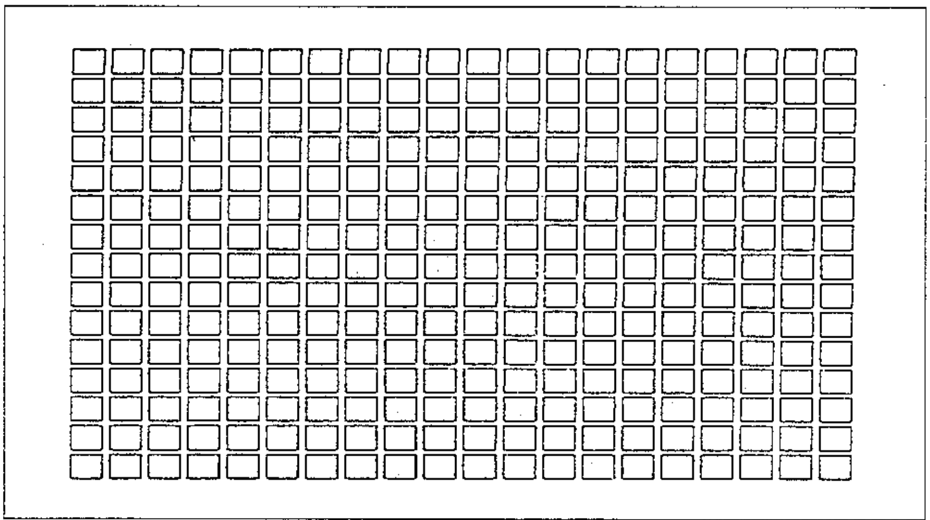
【Error】

- An error will arise, if the X and Y are specified out of the graphic display area.
  (Take care when being in the viewport address mode.)
- Though the error outputs a message, does not interrupt a program execution.

【Note】 The style must be specified previously by the line style (GSTYLE function) except for a solid line drawing. (Refer to the (8) GSTYLE function.)

【Example】
```
OUTPUT 31;"VS3"
 CLS 1
 INTEGER X,Y
 FOR X=10 TO 970 STEP 50
   FOR Y=10 TO 450 STEP 30
     GRECT(0,1,X,Y,X+40,Y+25)
   NEXT Y
 NEXT X
 STOP
```

【Result】



(7) GSTR

【Feature】

GSTR draws a character at a specified position on the graphic display.

【Format】

GSTR (C, X, Y, STR)

C : Character size 0: 16×20 dot, 1: 18×24 dot
X : Horizontal axis (absolute address: 0 to 1023)
Y : Vertical axis (absolute address: 0 to 479)
STR: Character expression

【Error】

- An error will arise, if the X and Y are specified out of the graphic display area.
  (Take care when being in the viewport address mode.)
- Though the error outputs a message, does not interrupt a program execution.

【Example】

```
OUTPUT 31;"VS3"
 S$="ADVANTEST"
 FOR I=0 TO 450 STEP 25
   GSTR(I%2,I,I,S$)
 NEXT I
 STOP
```

【Result】

```
ADVANTEST
 ADVANTEST
  ADVANTEST
   ADVANTEST
    ADVANTEST
     ADVANTEST
      ADVANTEST
       ADVANTEST
        ADVANTEST
         ADVANTEST
          ADVANTEST
           ADVANTEST
            ADVANTEST
             ADVANTEST
              ADVANTEST
               ADVANTEST
                ADVANTEST
                 ADVANTEST
                  ADVANTEST
```

(8) GSTYLE

【Feature】

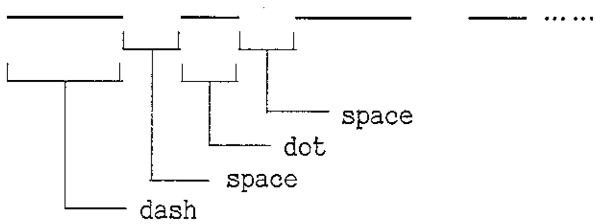
GSTYLE specifies the component length of a broken line, dotted line and chain line.

【Format】

GSTYLE (dash, space, dot)
This function specifies component length of a broken line, dotted line and chain line. Components means a dash, space and dot parts.
These components are combined as the follows.

Broken line: dash + space
Dotted line: dot + space
Chain line : dash + space + dot + space

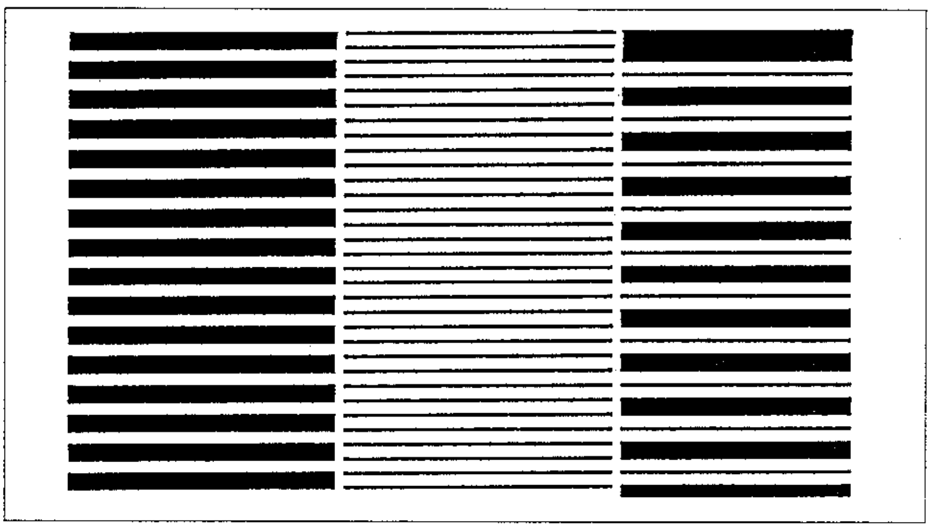
(Example) To specify a chain line as follows.



【Example】

```
OUTPUT 31;"VS3"
 CLS 1
 S=0
 GSTYLE(20,10,5)
 FOR X=1 to 1000
   IF X % 350 = 1 THEN ++S : X+=10
   GLINE(S,1,X,0,X,479)
 NEXT X
 STOP
```

【Result】



4. MASTER/SLAVE MODE

4.1 Outline

This chapter explains the two modes for connecting the R3265A/3271A and the host computer, i.e., external controller.

CONNECTED HOST	This mode is selected when the host computer is connected to the GPIB port on the spectrum analyzer side (upper side) on the rear panel of the R3265A/3271A. In this mode, the R3265A/3271A executes the BASIC program on it while transferring or receiving data to/from the host computer. The GPIB port on the controller side (lower side) of the R3265A/3271A is set to the system controller mode automatically, allowing control of connected GPIB devices.
MASTER/ SLAVE	This mode is selected when the host computer is connected to the controller-side GPIB port (lower side) on the rear panel of the R3265A/3271A. In this mode, the GPIB port on the controller side (lower side) of the R3265A/3271A is set to the master (controller)/slave (controlled device) mode. In master mode, externally connected GPIB devices excluding the host computer can be controlled by the BASIC program on the R3265A/3271A. In slave mode, data transfer can be performed between the host computer and the BASIC program on the R3265A/3271A. (In the master or slave mode, however, the host computer or other GPIB devices cannot be connected to the R3265A/3271A, respectively. For this reason, it is necessary to switch between the two mode using the CONTROL command of the BASIC program.)

The soft-menu for each mode can be displayed by pressing SHIFT + 6 + NEXT MENU .

4.2 CONNECTED HOST Mode

4.2.1 Outline

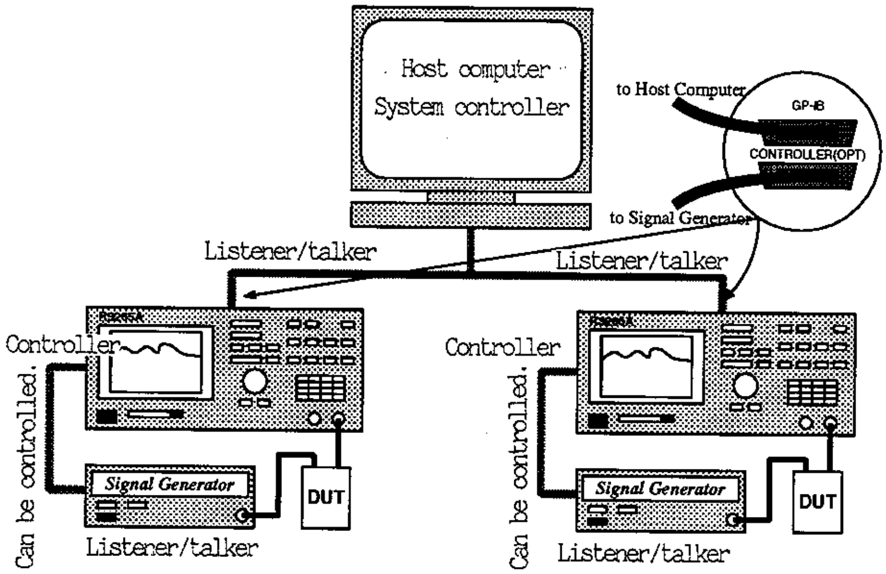


Figure 4 - 1 Connecting the R3265A/3271A and External Devices

The figure above shows an example of connection of the R3265A/3271A and the host computer, i.e., external controller in the [CONNECTED HOST] mode. When the host computer is connected to the GPIB port on the spectrum analyzer side (upper side) of the R3265A/3271A, the host computer becomes a system controller and the R3265A/3271A becomes a listener or talker, allowing the host computer to control the R3265A/3271A.

When an external device excluding the host computer is connected to the GPIB port on the controller side (lower side) of the R3265A/3271A, the R3265A/3271A becomes a system controller and an external device such as a signal source (SG) and a plotter becomes a listener or talker, allowing the R3265A/3271A controller to control external devices.

With the above system configuration, there is no case when multiple controllers exist on the same bus and each device on the bus can operate as a controller. It is possible to execute the BASIC program on the R3265A/3271A controller to transfer the contents of variables used in the program to the host computer and to control the R3265A/3271A controller from the host computer, thus realizing extensive system configuration.

In addition, the system operates quite normally even when two or more R3265A/3271A's are connected to the host computer as shown in the figure above. In this case, it is possible to manage measurement result data of each R3265A/3271A using the host computer.

4.2.2 Controlling the R3265A/3271A Controller and Transferring Variables

Table 4 - 1 R3265A/3271A Controller Control Commands

Command name	Function	Remarks
@LOAD∆file name	Loads the program.	
@RUN	Executes the program.	
@STOP	Stops the program.	
@CONT	Restarts the program.	
@EXIT	Exits the BASIC (editor) mode.	
@CR	Carriage return	Used as an input to the INPUT statement.
@numeric-value	Enters a numeric value.	Used as an input to the INPUT statement.
@CNTRLR	Displays a user-defined menu.	
@SF numeric-value	Executes a user-defined menu.	
@INFO?	Returns the R3265A controller status.	Combination with SRQ recommended.
@INFO∆CLR	Clears the R3265A controller status.	
@variable-name?	Outputs variable value (ASCII type) to the host computer.	
@variable-name∆ BIN?	Outputs variable value (BINARY type) to the host computer.	Conforms to the IEEE 64-bit floating point format.
@variable-name∆ MANY?	Outputs array variable in multiple times to the host computer.	

∆ : Denotes a space.

The previous table lists the commands used to control the R3265A/3271A controller from the host computer. When an "@" mark is found at the top of the command, it is recognized as a control command for the R3265A/3271A controller. When the R3265A/3271A receives a command with "@", it interprets the command and requests the R3265A/3271A controller to perform corresponding process.
When the R3265A/3271A receives the @variable-name? command, it issues a data request to the R3265A/3271A controller (according to steps (1) and (2) in the figure below) because it is necessary to send the variable value to the host computer. The obtained variable value is stored in the dedicated buffer. When a request of the variable value is issued by the host computer, the R3265A/3271A sends the contents of the dedicated buffer to the host computer (according to steps (3) to (6) in the figure below.)

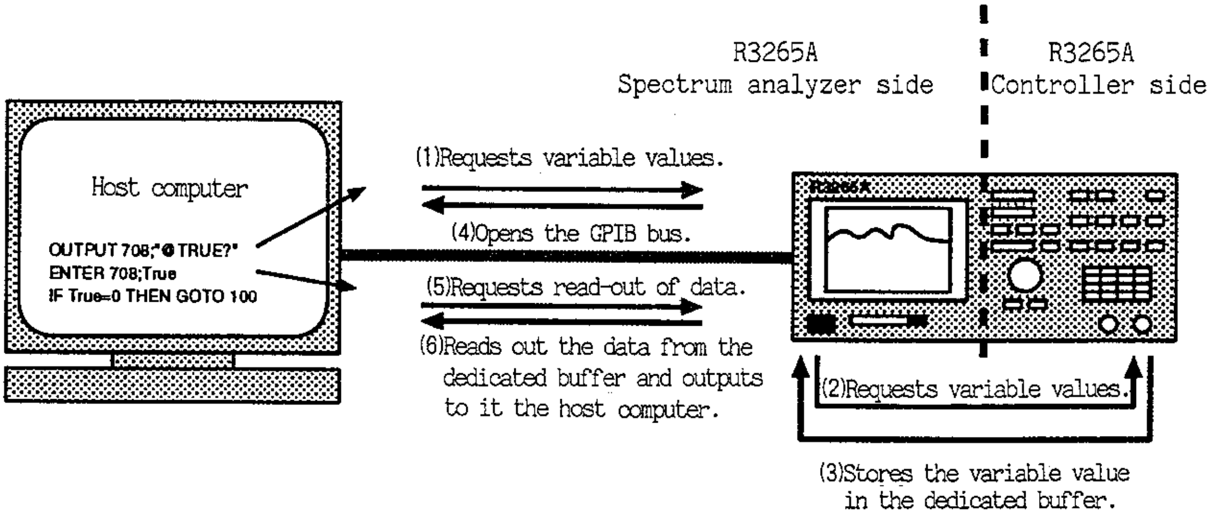


Figure 4 - 2 Transferring Variables from the R3265A/3271A controller

Variables can be read in ASCII or BINARY form. When the ASCII type is specified, the R3265A/3271A converts the numeric value into ASCII characters, adds a terminator at the end of the ASCII data, and then outputs it byte by byte. In this case, the number of significant digits of the mantissa is 15. When the BINARY type is specified, an integer number value is output as four bytes and a real number value as eight bytes conforming to the IEEE floating point format with a terminator of the EOI signal.

The following types of variables can be read. Up to 50 characters can be used as a variable name. When an array variable is specified, values of all elements are output at one time.

1. Character string variables

2. Integer-type variables

3. Real-type variables

4. Integer-type array variables (with up to ten dimensions, 1 to 32767 elements for each dimension)
5. Real-type array variables (with up to ten dimensions, 1 to 32767 elements for each dimension)

6. Built-in variables

Synchronization of the host computer with the R3265A/3271A controller is required for read-out of variable values. See subsection 4.2.3, "Synchronizing the R3265A/3271A with the Host Computer" for details.

4.2.3 Synchronizing the R3265A/3271A with the Host Computer

Since the R3265A/3271A controller and the host computer do not exist on the same bus, they cannot be accessed by a GPIB address. To access them, it is necessary to send or receive data via the spectrum analyzer side of the R3265A/3271A. (See subsection 4.2.2 "Controlling the R3265A/3271A Controller and Transferring Variables" for details.)

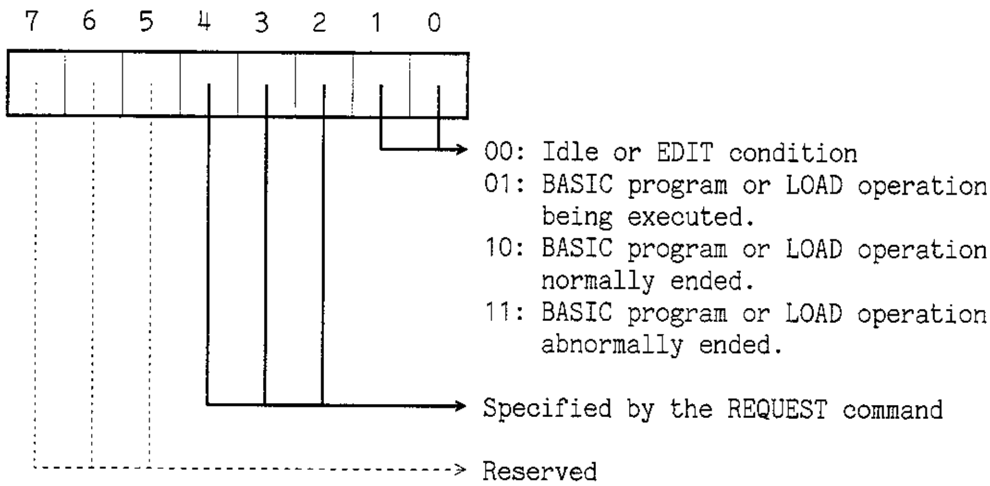


Figure 4 - 3 Bit Assignment of the R3265A/3271A Controller Status

The figure above shows the bit information of the R3265A/3271A controller status. To synchronize the R3265A/3271A controller with the host computer, the R3265A/3271A condition is transferred to the host computer as bit information, by using the REQUEST command in the BASIC program. The host computer can establish synchronization for data acquisition by polling the bit information. However, when necessary information is collected only by means of polling, the load to the spectrum analyzer side of the R3265A/3271A will increase. For this reason, it is recommended that SRQ interrupt be used together with polling.

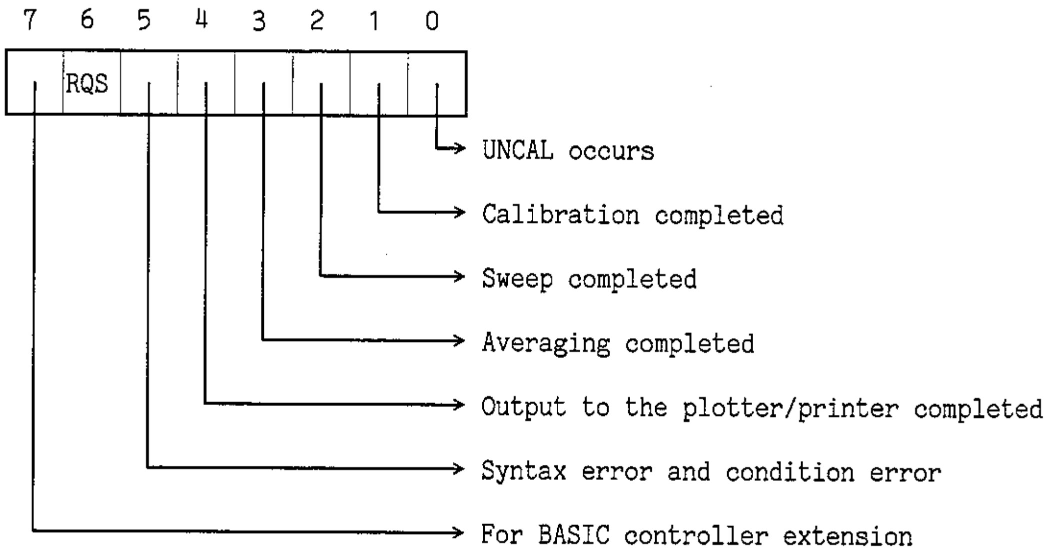


Figure 4 - 4 SRQ Bit Assignment for the Spectrum Analyzer Side of the R3265A/3271A

The figure above shows the SRQ bit information for the spectrum analyzer side of the R3265A/3271A. The MSB is defined as a bit for the R3265A/3271A controller and set to ON or OFF depending on the condition of the R3265A/3271A controller. The SRQ bit information is set or reset at the following timings:

1. When the BASIC program ends normally or abnormally (excluding the time of BASIC execution and idle condition) or when the LOAD operation of the BASIC program is completed.

2. When the condition of any bit is specified by the REQUEST instruction. (For example, the end of an event can be specified by the BASIC program.)

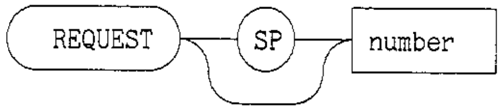
The bit information regarding the condition of the R3265A/3271A controller can be cleared by issuing PRINT @8;"@INFO CLR" from the host computer. The SRQ bit of the spectrum analyzer side of the R3265A/3271A can be cleared by issuing PRINT @8;"S2".
When reading a variable, the R3265A/3271A holds the GPIB bus upon issuance of PRINT @8;"@variable-name?" and releases it upon allocation of the variable value. Therefore, re-polling is not necessary with respect to the variable read-out enable/disable information.

4.2.4 R3265A/3271A Controller Control Commands

The BASIC programs in this material are written by N88-BASIC, excluding some portions.

(1) REQUEST

[Syntax]



[Description]

The REQUEST command is used together with the @INFO? command to notify the host computer of occurrence or completion of a user event. This command is executed on the R3265A/3271A controller. The following is an example of synchronization procedure.

1. When the R3265A/3271A controller executes the REQUEST command, it notifies the R3265A/3271A of occurrence of the event.

2. In response, the R3265A/3271A sends SRQ (Service Request) to the host computer.

3. The host computer issues the @INFO? command to request the bit information of controller status from the R3265A/3271A.

4. The R3265A/3271A sends the current controller status, i.e., the value indicated by the REQUEST command, back to the host computer.

[Parameters]

number — Specifies a user event with a number from 0 to 7. This value is reflected to bit Nos 2 to 4 of the R3265A/3271A controller status shown in Figure 4.3, and read out by the host computer using the @INFO? command.

[Sample program]

• Host computer side

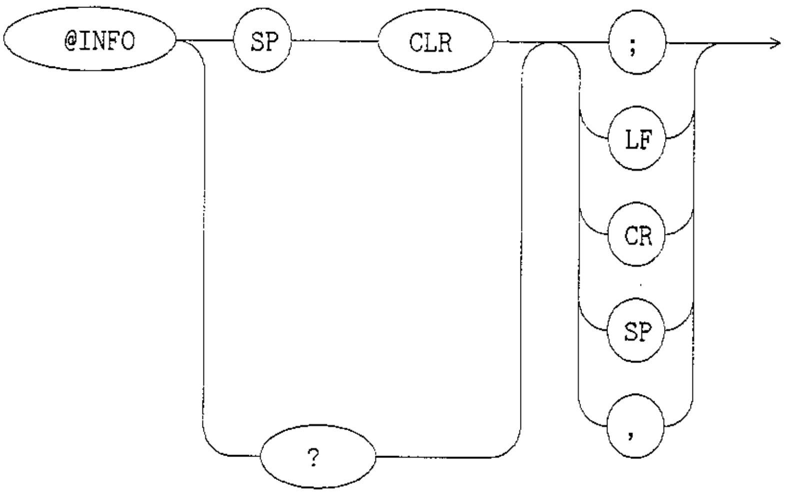
```
1000   ISET IFC:ISET REN
1010   SPA=8
1020   PRINT @SPA;"S0;RQS128"          ' Declares use of SRQ from
                                         controller.
1030   PRINT @SPA;"S2"
1040   POLL SPA,S
1050   ON SRQ GOSUB *READSRQ
1060   SRQ ON                          ' Enables SRQ interrupt.
1070   PRINT @SPA;"@RUN"               ' Activates R3265A/3271A controller.
1080   EVENT=0
1090 *READXMAX
1100   IF EVENT=0 THEN GOTO *READXMAX  ' Waits for end of processing of
                                         R3265A/3271A controller.
1110   PRINT @SPA;"@XMAX?"             ' Requests read-out of variable XMAX.
1120   INPUT @SPA;XMAX                 ' Reads out variable XMAX.
1130   PRINT XMAX
1140   PRINT @SPA;"@INFO CLR"          ' Clears R3265a/3271A controller
                                         status.
1150   PRINT @SPA;"@CR"                ' Informs R3265A/3271A controller of
                                         end of read-out.
1160   EVENT=0
1170   GOTO *READXMAX
1180 '
1190 *READSRQ
1200   POLL SPA,S
1210   PRINT @SPA;"@INFO?"             ' Reads out R3265A/3271A controller
                                         status and confirms end of
                                         processing.
1220   INPUT @SPA;INFO
1230   IF (INFO AND 4)=4 THEN EVENT=1
1240   SRQ ON:RETURN
1250   END
```

• R3265A controller side

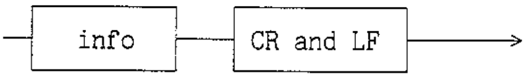
```
SCREEN 1
*MEAS_START
  OUTPUT 31;"TS"              ! take sweep
  XMAX=MAX(0,700,0)           ! Searches for maximum level position.
  REQUEST 1                   ! Informs end of MAX function execution.
  INPUT TIMING                ! Waits for end of read-out from host.
  CURSOR 0,0
  GOTO *MEAS_START
```

(2) @INFO?(@INFO CLR)

[Syntax]



[Query Response]



[Description]

The @INFO? command returns the internal status of the R3265A/3271A controller to the host computer. The bit information of the internal status is as follows:

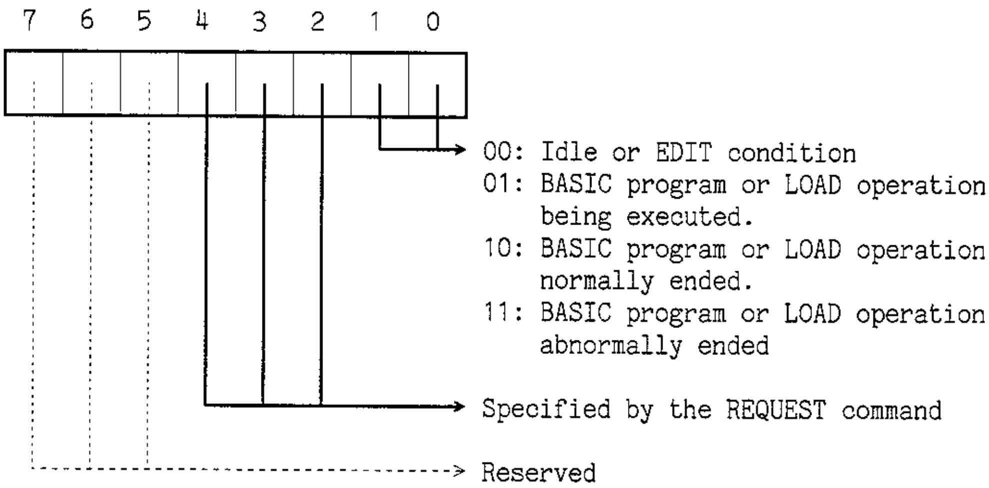


Figure 4 - 5 Bit Assignment of the R3265A/3271A Controller Status

The @INFO CLR command clears the bit specified by the REQUEST command. The bits Nos 0 and 1 which indicate BASIC program execution status are not affected.

[Parameters]

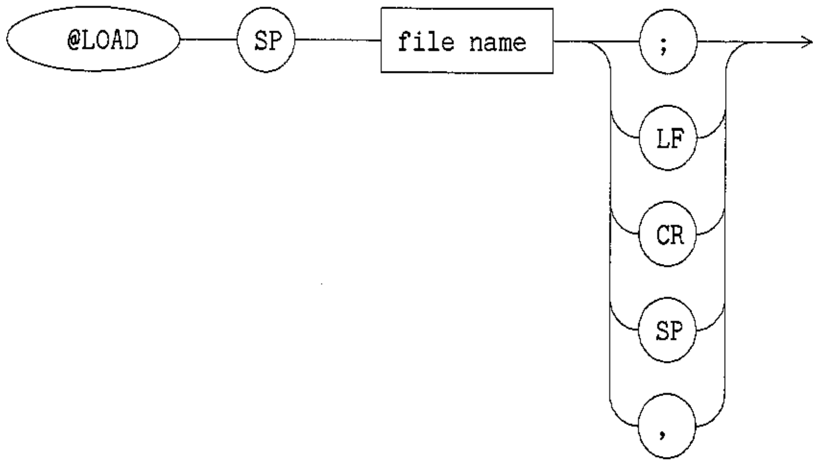
info   Returns the internal status of the R3265A/3271A controller.

[Sample program]

See the REQUEST command.

(3) @LOAD

[Syntax]



[Description]

The @LOAD command loads the specified BASIC program from an IC card.

[Parameters]

file name   Specifies the name of the BASIC program to be loaded.

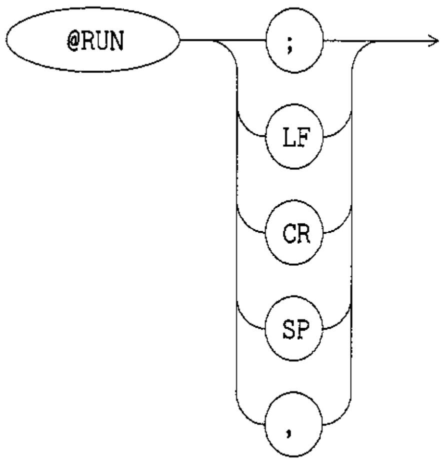
[Sample program]

- Host computer side

```
1000  ISET IFC:ISET REN
1010  SPA=8:LOADEND=0
1020  PRINT @SPA;"S0;RQS128"          ' Declares use of SRQ from
                                        controller.
1030  PRINT @SPA;"S2"
1040  PRINT @SPA;"@INFO CLR;@INFO?"
1050  PRINT @SPA;"@LOAD XMAX"         ' Request loading of file XMAX from
                                        card.
1060  ON SRQ GOSUB *READSRQ
1070  SRQ ON
1080 *WAITEND
1090  IF LOADEND=0 THEN GOTO *WAITEND
                                      ' Waits for end of loading.
1100 *READINFO
1110  INPUT @SPA;INFO                 ' When loading is completed, returns
                                        2; if an error occurs, returns 3.
1120  IF (INFO AND 3)=3 THEN PRINT "Load Error !!":STOP
1130  IF (INFO AND 3)<>2 THEN GOTO *READINFO
1140  PRINT @SPA;"@RUN"               ' When loading ended, requests
                                        execution.
1150  STOP
1160  '
1170 *READSRQ
1180  POLL SPA,S
1190  LOADEND=1
1200  RETURN
1210  END
```

(4) @RUN
(@CNTRLR/@CONT/@CR/@EXIT/@STOP/@SF[1-7]/@numeric)

[Syntax]

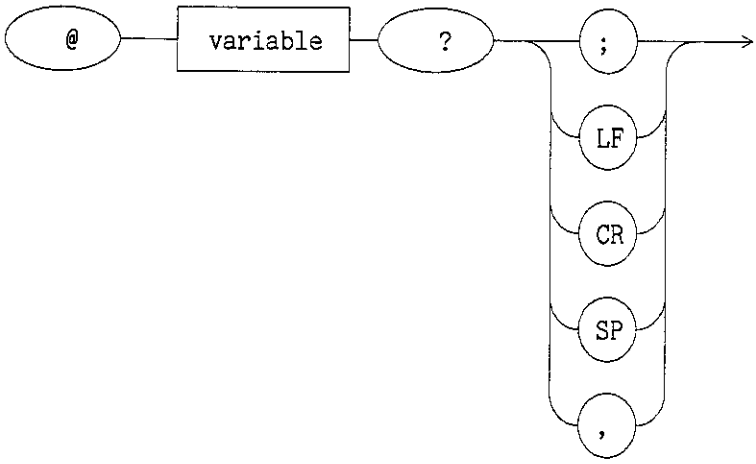


[Description]

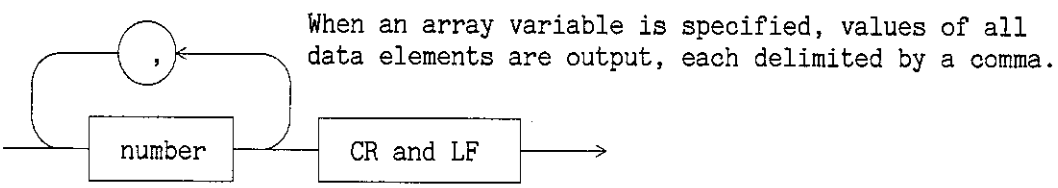
The @RUN command executes the BASIC program loaded on the R3265A/3271A controller.
The @CNTRLR command displays the user-defined menu only during execution of the BASIC program.
The @CONT command continues execution of the stopped BASIC program.
The @CR and @numeric commands are used when the R3265A/3271A controller is in the input mode for the INPUT statement.
The @EXIT command returns the R3265A/3271A from the controller mode to the spectrum mode.
The @STOP command stops the BASIC program currently being executed.
The @SF[1-7] command executes the user-defined menu only during execution of the BASIC program.

(5) @variable?

[Syntax]



[Query Response]



[Description]

The @variable? command returns the value of the specified variable in the BASIC program executed on the R3265A/3271A controller. For integer-type variables, an 11-digit value is returned; for real-type variables, a 23-digit value with a 15-digit mantissa is returned.
When an array variable is specified, values of all data elements are output in succession, each delimited by a comma.

[Parameters]

variable — Specifies the name of the variable to be read out. For array variables, supply "(*)" to the end of the variable name.

example) PRINT @8;"@ABC(*)?"

[Sample program]

• Host computer side

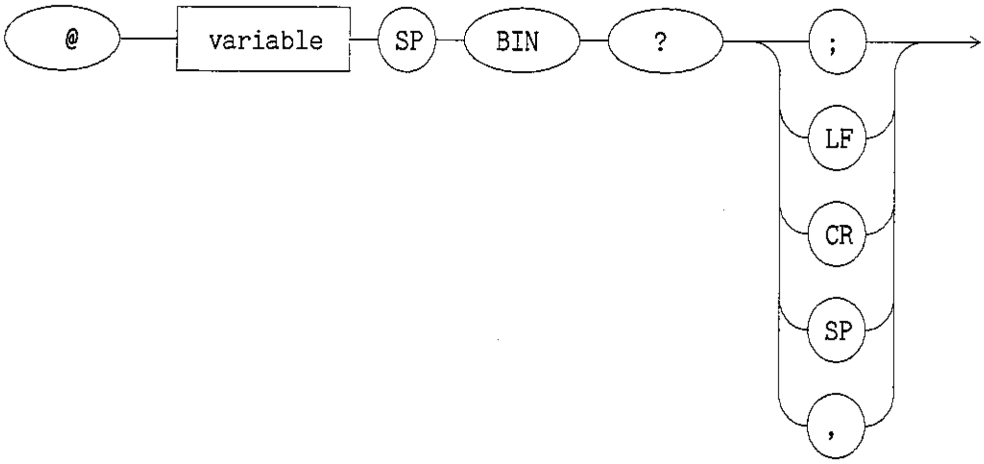
```
1000   ISET IFC:ISET REN
1010   DIM ABC(8)
1020   SPA=8
1030   PRINT @SPA;"S0";RQS128
1040   PRINT @SPA;"S2"
1050   PRINT @SPA;"@RUN"
1060   POLL SPA,S
1070   ON SRQ GOSUB *READSRQ
1080   PRINT @SPA;"@INFO CLR"
1090   EVENT=0
1100   SRQ ON
1110 *READXMAX
1120   IF EVENT=0 THEN GOTO *READXMAX ' Waits for end of measurement.
1130   PRINT @SPA;"@ABC(*)?"          ' Requests read-out of array
                                        variable ABC.
                                      ' Reads out CSV-format data.
1140   INPUT @SPA;ABC(1),ABC(2),ABC(3),ABC(4),ABC(5),ABC(6),ABC(7),ABC(8)
1150   FOR I=1 TO 8
1160     PRINT ABC(I)
1170   NEXT I
1180   STOP
1190 '
1200 *READSRQ
1210   POLL SPA,S
1220   PRINT @SPA;"@INFO?"
1230   INPUT @SPA;INFO
1240   IF (INFO AND 8)=8 THEN EVENT=1
1250   SRQ ON:RETURN
1260 '
1270 END
```

• R3265A controller side

```
DIM ABC(8)
!
SCREEN 1
FOR I=1 TO 8
  OUTPUT 31;"TS"             ! take sweep
  ABC(I)=MAX(0,700,0)        ! Searches for the maximum level position.
NEXT I
REQUEST 2                    ! Informs end of execution.
END
```

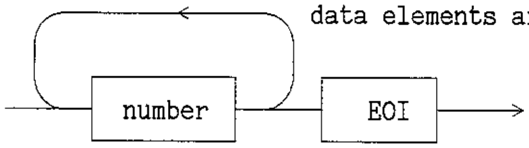
(6) @variable BIN?

[Syntax]



[Query Response]

When an array variable is specified, values of all data elements are output, each delimited by a comma.



[Description]

The @variable BIN? command returns the value of the specified variable in the BASIC program executed on the R3265A/3271A controller in binary form. For integer-type variables, a 32-bit value is returned; for real-type variables, a 64-bit value with the IEEE floating point format is returned. The EOI signal is output following the last byte.
When an array variable is specified, values of all data elements are output in succession, each delimited by a comma.
For host computers not recognizing the IEEE 64-bit floating point format, it is necessary to convert the format into an internal format after read-out of data.

[Parameters]

variable Specifies the name of the variable to be read out. For array variables, supply "(*)" to the end of the variable name.

example) PRINT @8;"@ABC(*)?"

[Sample program]

The following sample program is written by HP-BASIC and therefore cannot be executed by N88-BASIC.

- Host computer side

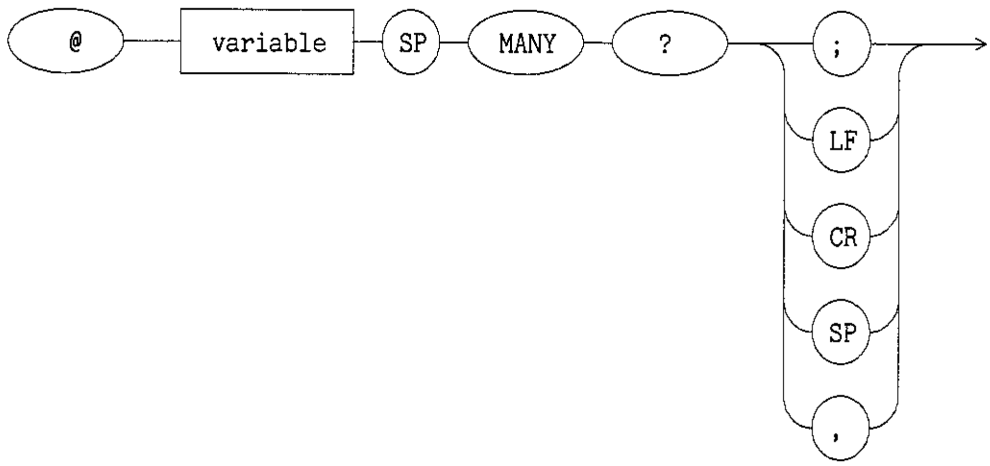
```
1000   OPTION BASE 1
1010   Spa=708
1020   ASSIGN @Device TO Spa;FORMAT OFF  ! Specifies IEEE 64-bit floating
                                           point format.
1030   DIM Abc(8)
1040 !
1050   ON INTR 7 GOSUB Srq_intr
1060   OUTPUT Spa;"S0;S2;RQS128"
1070   S=SPOLL(Spa)
1080   OUTPUT Spa;"@RUN"
1090   Event=0
1100   OUTPUT Spa;"@INFO CLR"
1110   ENABLE INTR 7;2
1120 !
1130 Wait_end:!
1140   IF Event=0 THEN GOTO Wait_end     ! Waits for end of measurement.
1150   OUTPUT Spa;"DL2"                  ! Requests EOI as delimiter.
1160   OUTPUT Spa;"@ABC(*) BIN?"         ! Requests read-out of array
                                           variable ABC in binary form.
1170   ENTER @Device;Abc(*)              ! Reads out all data of array
                                           variable at one time.
1180   PRINT Abc(*)
1190   STOP
1200 !
1210 Srq_intr:!
1220   S=SPOLL(Spa)
1230   OUTPUT Spa;"@INFO?"
1240   ENTER Spa;Info
1250   IF BINAND(Info,8)=8 THEN Event=1
1260   ENABLE INTR 7;2
1270   RETURN
1280 !!
1290   END
```

• R3265A controller side

```
DIM ABC(8)
!
SCREEN 1
FOR I=1 TO 8
  OUTPUT 31;"TS"                     ! take sweep
  ABC(I)=MAX(0,700,0)                ! Searches for the maximum level
                                       position.
NEXT I
REQUEST 2                            ! Informs end of execution.
END
```

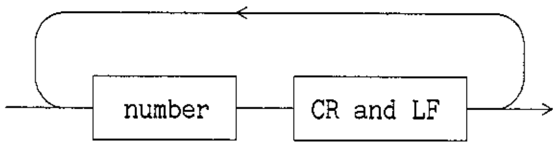
(7) @variable MANY?

[Syntax]



[Query Response]

Data are output in multiple times.



[Description]

The @variable MANY? command returns the value of the specified variable in the BASIC program executed on the R3265A/3271A controller in multiple times. For integer-type variables, an 11-digit value is returned; for real-type variables, a 23-digit value with a 15-digit mantissa is returned. A terminator is appended at the end of data.
The host computer reads out data elements of such an array variable using the FOR statement.
This command is effective only for output of data elements of an array variable.

[Parameters]

variable Specifies the name of the variable to be read out. Since this command is effective only for array variables, supply "(*)" to the end of the variable name.

example) PRINT @8;"@ABC(*)?"

[Sample program]

- Host computer side

```
1000    ISET IFC:ISET REN
1010    DIM ABC(8)
1020    SPA=8
1030    PRINT @SPA;"S0;RQS128"
1040    PRINT @SPA;"S2"
1050    PRINT @SPA;"@RUN"
1060    POLL SPA,S
1070    ON SRQ GOSUB *READSRQ
1080    PRINT @SPA;"@INFO CLR"
1090    EVENT=0
1100    SRQ ON
1110 *READXMAX
1120    IF EVENT=0 THEN GOTO *READXMAX     ' Waits for end of measurement.
1130    PRINT @SPA;"@ABC(*) MANY?"         ' Requests read-out of array
                                             variable ABC in multiple times.
                                           ' Reads out in units of data
                                             element.
1140    FOR I=1 TO 8
1150      INPUT @SPA;ABC(I)
1160      PRINT ABC(I)
1170    NEXT I
1180    STOP
1190 '
1200 *READSRQ
1210    POLL SPA,S
1220    PRINT @SPA;"@INFO?"
1230    INPUT @SPA;INFO
1240    IF (INFO AND 8)=8 THEN EVENT=1
1250    SRQ ON:RETURN
1260 '
1270 END
```

- R3265A controller side

```
DIM ABC(8)
!
SCREEN 1
FOR I=1 TO 8
  OUTPUT 31;"TS"                     ! take sweep
  ABC(I)=MAX(0,700,0)                ! Searches for the maximum level
                                       position.
NEXT I
REQUEST 2                            ! Informs end of execution.
END
```

4.3 MASTER/SLAVE Mode

4.3.1 Outline

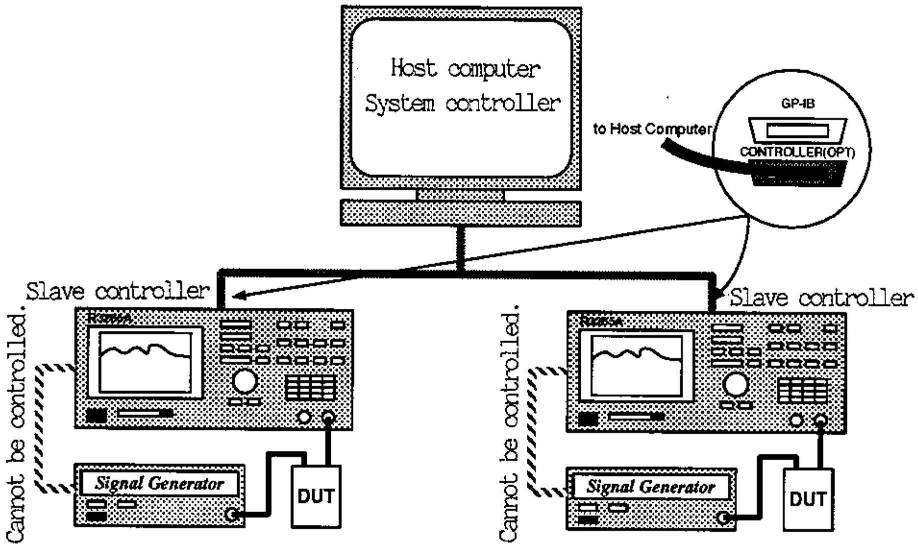


Figure 4 - 6 Connecting the R3265A/3271A and External Devices

The figure above shows an example of connection of the R3265A/3271A and the host computer, i.e., external controller in the [MASTER/ SLAVE] mode. When the host computer is connected to the GPIB port on the controller side (lower side) of the R3265A/3271A, the host computer becomes a system controller and the R3265A/3271A a slave controller. (Switching of the master and slave controllers is made by means of the [MASTER/ SLAVE] soft key or the CONTROL command.)

With the above system configuration, multiple controllers exist on the same bus, and therefore the R3265A/3271A controller operates as a controlled device. Therefore, the R3265A/3271A controller can transfer and receive variable value used in the BASIC program data to and from the host computer using a dedicated command. However, it is not possible to control GPIB devices excluding the host computer. Since a signal source (SG) or plotter cannot be connected to the bus, these GPIB devices must be controlled by the host computer.
When multiple R3265A/3271A's are connected as shown above, only one of them can operate as a controller.

4.3.2 BASIC Command

The operation of the BASIC command varies depending on each of the master/slave modes.

BASIC command	Master mode	Slave mode
CLEAR	Device clear	Not function *2
DELIMITER	Setting of delimiter Sets the delimmiter of the OUTPUT, GPRINT, and GLIST.	
ENTER	Sets the specified unit to the talker and inputs the ASCII data from the GPIB port.	Inputs the ASCII data from the GPIB port when the external controller specifies the system as the listener. *1
INTERFACE CLAR	Interface clear	Not function *2
LOCAL	Local	Not function *2
LOCAL LOCKOUT	Local lockout	Not function *2
OUTPUT	Sets the specified unit to the listener and outputs the ASCII data from the GPIB port.	Outputs the ASCII data from the GPIB port when the external controller specifies the system as the talker. *1
REMOTE	Remote	Not function *2
REQUEST	Not function *2	Outputs SRQ to the external controller.
SEND-DATA-CMD -TALK-LISTEN-UNT -UNL	Operation of ATN line	Not function *2
SPOLL	Serial poll	Not function Always returns "0".
TRIGGER	Trigger	Not function *2
CONTROL	Switches over between the GPIB address and the master/slave in the BASIC program of the Controller function.	

*1: Ignores the addresses of the OUTPUT and ENTER commands in the slave mode.
*2: "Not function" means that the program jumps to the next command without executing the indicated command.

4.3.3 GPIB Command of the Slave Mode

(1) OUTPUT

Changes the numeric representation to the ASCII data and sends it to the GPIB port when the external controller specifies the system to the listener. The OUTPUT command format of the slave mode is identical with that of the master mode. However, the address of the GPIB is ignored.

(2) ENTER

Stores the input ASCII data into the specified variable when the external controller specifies the system to the talker.
The ENTER command format of the slave mode is identical with that of the master mode. However, the address of the GPIB is ignored.

CAUTION

After the OUTPUT and ENTER commands in the slave mode terminate their processing, they go to the next command. (The system stays in the command waiting condition until the external controller specifies the next command after the completion of command processing.)

(3) REQUEST

Outputs the SRQ to the external controller.

REQUEST <value 0-255>

128	64	32	16	8	4	2	1
	RSV						

When sending RSQ interruption to the host.

Example: REQUEST 64+1 or REQUEST 65

Note: Using method of the REQUEST command differs from that when the $\boxed{\text{CONNECTED HOST}}$ mode is selected.

(4) Controller mode switchover command

The factory setting default vlues are:

Controller function GPIB address : 30
Master/slave mode: master mode
(After the setting is changed, the value is kept effective.)

Switchover by BASIC command (CONTROL command is used.)

Change of GPIB address : CONTROL 4; [0 to 30]
Change of master/slave mode: CONTROL 5; [0, 1]
0: slave mode
1: master mode

The slave mode cannot be seledted when the $\boxed{\text{CONNECTED HOST}}$ mode has been selected.

Example:

```
CONTROL 4;5 ········· Changes to GPIB address 5.
CONTROL 5;0 ········· Slave mode

CONTROL 4;20········· Changes to GPIB address 20.
CONTROL 5;1 ········· Master mode
```

4.3.4 Control by External Controller

If the external controller starts the BASIC program of R3265A/3271A Controller function, the following commands are available except when the OUTPUT or ENTER command are running.

Command	Function
"@MOVERUN"	COMPILE & RUN
"@RUN"	RUN
"@STOP"	Program stop
"@CR"	Carriage return

In the commands above, sequentially write the commands following the @ mark without a space. If the command is sent without the @ mark, it will cause system down of the GPIB bus. (To recover the system down, press STOP key of the R3265A/3271A.)

CAUTION

1. The commands above are not available while running the OUTPUT or ENTER command.
2. When using a program to communicate with the external controller, first start the program on the R3265A/3271A manually or by using the commands above.

Program example 1:

External controller (example: HP200 series)

```
1000 Spa=708
1010 OUTPUT Spa;"@MOVERUN"
1020 OUTPUT Spa;"START"
1030 ENTER Spa;A
1040 PRINT A
1050 GOTO 1030
1060 END
```

R3265A/3271A (slave mode address 9)

```
ENTER 0;A$
PRINT A$
*L
X=MAX(0,700,0)
OUTPUT 0;X
GOTO *L
```

Start the program on the external controller.

When "@MOVERUN" is entered, the BASIC program is started on the R3265A/3271A.

When "ENTER 0;A$" command of the R3265A/3271A program is entered, the system synchronizes with the program on the external controller.
("START" is entered in A$. The system stays in the waiting condition until the external controller sends data.)

When "OUTPUT 0:X" is entered, R3265A/3271A is ready to send the maximum value. When the external controller specifies the R3265A/3271A to the talker by entering "INPUT @9;A" command, the R3265A/3271A sends its maximum value. After that, the system repeats processing.

CAUTION

The addresses of OUTPUT and ENTER are set to "0" in the slave mode. Since this setting is ignored, it does not affect the operation.

Program example 2:

External controller (example: HP200 series)

```
1000 Spa=709
1010 S=SPOLL(Spa)
1020 ON INTR 7 GOSUB Srsub
1030 OUTPUT Spa;"@MOVERUN"
1040 OUTPUT Spa;"START"
1050 Lp: !
1060   S=-94
1070   W=.5
1080   OUTPUT Spa;S
1090   OUTPUT Spa;W
1100   F=1
1110   ENABLE INTR 7;2
1120 Lp2: !
1130   IF F=1 THEN Lp2
1140   GOTO Lp
1150 !
1160 Srsub: !
1170   Sr=SPOLL(Spa)
1180   IF Sr-64 THEN
1190                ENTER Spa;Lv
1200                PRINT "FAIL LEVEL = ";Lv
1210           ELSE
1220                PRINT "PASS"
1230           END IF
1240   F=0
1250   RETURN
1260   END
```

Description of program

1000 to 1020	Initial setting
1030	Starts the BASIC program on the R3265A/3271A Controller function.
1040	Communicates with Controller function for synchronization.
1060 to 1070	Sets the reference and tolerance values.
1080 to 1090	Sends the reference and tolerance values to Controller function.
1110 to 1140	Service request interruption waiting loop
1160	Service request interruption processing
1170	Serial poll
1180 to 1230	If the serial poll value is 64, receives PASS as the level value From the Controller function and displays it; otherwise, receive receives FAIL and Displays it.
1240	Loop flag OFF
1250	Interruption permission: RETURN

R3265A/3271A (slave mode address 9)

```
INTEGER I
OUTPUT 31;"VSO"                "VSO" sets the waveform screen.
ENTER 0;A$
*L
 ENTER 0;S                     Substitutes the reference value into the variable S.
 ENTER 0;W                     Substitutes the tolerance value into the variable W.
 M=0
 FOR I=1 TO 10          ┐
   OUTPUT 31;"TS"       │      Measures the maximum value ten times and adds together
   M += MAX(0,700,0)    │      all of the maximum values by using TS command.
 NEXT I                 ┘
 M /= 10                       Averages all of the maximum values.
 J=LMTMD(M,S,W)                Judges if the average is within the reference value ±
 IF J THEN                     tolerance.
       REQUEST 64+J            If the average is out of range, REQUEST 64+J
       OUTPUT 0;M              (judgement value), level output.
 ELSE
       REQUEST 64              If the average is permissible, REQUEST 64.
 END IF
 GOTO *L
```

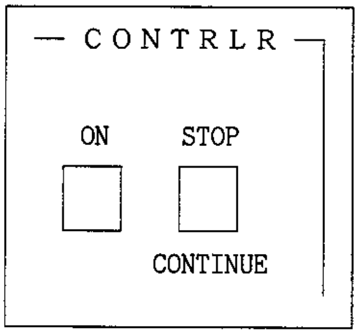
5. Resume Function

Stores the compiled program into the back-up memory when executing the BASIC program. After the the completion program, this function enables to keep the compiled program in the internal memory if the power is turned off. Therefore, the quickly start can be provided after turning the power on due to this function.

CAUTION

If the power is turned off when the program is running, the program cannot re-start after power-on. Be sure to turn off the power by confirming that program stops.

6. Controller Key



Upper right section
of main-body panel

ON

Opens (activates) the BASIC editor of the controller. User-defined menu is displayed during the BASIC operation.

STOP / CONTINUE

Stops or re-starts the BASIC operation.

APPENDIX

A.1 List of Commands and Statements

Function	Command and Statement	Description
① Commands	CONT	Resumes the execution of the program after it has stopped.
	CONTROL	Sets values for each control.
	LIST	Displays a program list.
	LLIST	Displays a program list. (RS-232C)
	LISTN	Displays a program list.
	LLISTN	Displays a program list. (RS-232C)
	RUN	Executes a program.
	SCRATCH	Deletes a program in BASIC.
	STEP	Executes a line of a program.
② Arithmetic functions	ABS	Produces the absolute value of the given value.
	ATN	Produces the arc tangent of the given value.
	COS	Produces the cosine of the given value.
	LOG	Produces the natural logarithm of the given value.
	SIN	Produces the sine of the given value.
	SQR	Produces the square root of the given value.
	TAN	Produces the tangent of the given value.
③ Bitwise operations	BAND	Produces a bit AND.
	BNOT	Produces a bit NOT.
	BOR	Produces a bit OR.
	BXOR	Produces a bit XOR.
④ Interrupt controls	ENABLE INTR	Enables interrupts to be received.
	DISABLE INTR	Disables interrupts to be received.
	ON END	Defines the branch of an EOF interrupt.
	ON KEY	Defines the branch of a key interrupt.
	ON ISRQ	Defines the branch of a SRQ interrupt of the main measurement section.
	ON SRQ	Defines the branch of a SRQ interrupt of GPIB.
	ON ERROR	Defines the branch of an error occurrence interrupt.
	OFF END	Releases the branch of an EOF interrupt.
	OFF KEY	Releases the branch of a key interrupt.
	OFF ISRQ	Releases the branch of a SRQ interrupt of the main measurement section.
	OFF SRQ	Releases the branch of a SRQ interrupt of GPIB.
	OFF ERROR	Releases the branch of an error occurrence interrupt.

Note: See section 2.3 for details of each command and statement.

(cont'd)

Function	Command and Statement	Description
⑤ Character-string manipulations	NUM	Converts the first character of a character string to the ASCII code.
	CHR$	Converts a numeric character to an ASCII character.
	LEN	Obtains the length of a character string.
	POS	Positions character string 1 in character string 2.
	SPRINTF	Formats a string and assigns it to a character-string variable.
⑥ Memory card controls	CAT	Displays the contents of a memory card.
	CLOSE #	Close a file.
	ENTER #	Reads data from a file.
	OPEN #	Open a file.
	OUTPUT #	Writes data into a file.
	INITIALIZE (or INIT)	Initializes a memory card.
	PURGE	Deletes the specified file.
	RENAME	Rename a file.
⑦ Screen controls	CURSOR(or CSR)	Moves the cursor to the specified position.
	CLS	Clears the screen.
⑧ Statements	BUZZER	Sounds the buzzer.
	DIM	Declares array variables.
	FOR TO STEP NEXT	Sets an iteration.
	BREAK	Exits from the current iteration.
	CONTINUE	Returns to the beginning of the current iteration.
	GOSUB	Branches to a subroutine.
	RETURN	Returns from the current subroutine.
	GOTO	Branches to the specified statement.
	IF THEN ELSE END IF	Executes the statements after evaluating conditions.
	INPUT (or INP)	Inputs a value to a variable.
	INTEGER	Declares integer-type variables.
	LPRINT	Outputs data on a printer (RS-232C).
	LPRINT USING (or USE)	Outputs formatted data on a printer (RS-232C).
	PAUSE	Stops execution temporarily.
	PRINT (or ?)	Displays characters on the screen.
	PRINT USING (or USE)	Displays formatted characters on the screen.

Note: See section 2.3 for details of each command and statement.

(cont'd)

Function	Command and Statement	Description
⑧ Statements (cont'd)	PRINTER	Addresses a GPIB printer device.
	PRINTF (or PRF)	Displays formatted characters on the scree.
	READ DATA	Reads data from a DATA statement and assigns it to a variable.
	RESTORE	Specifies the DATA statement to read by the READ DATA statement.
	REM (or !)	Provides a comments.
	SELECT CASE END SELCT	Executes statements after evaluating condition.
	STOP	Stops program execution.
	WAIT	Holds the program execution for the specified periond.
⑨ GPIB commands	CLEAR	Transfers DCL and SDC.
	DELIMITER	Sets a delimiter.
	ENTER (or ENT)	Inputs GPIB data.
	GLIST	Outputs the program list to a GPIB printer.
	GLISTN	Ouuputs the program list to a GPIB printer.
	GPRINT	Ouputs data to a GPIB printer.
	GPRINT USING (or USE)	Outputs formatted data to a GPIB printer.
	INTERFACE CLEAR	Transfers IFC.
	LOCAL	Places the specified device in the local status.
	LOCAL LOCKOUT	Places the specified device in the local lokced-out status.
	OUTPUT (or OUT)	Outputs data to GPIB.
	REMOTE	Places the specified device in the remote status.
	REQUEST	Outputs SRQ to the standard GPIB.
	SEND	Outputs a set of GPIB data.
	SPOLL	Provides serial polling to the specified device.
	TRIGGER	Outputs GET.

Note: See section 2.3 for details of each command and statement.

(cont'd)

Function	Command and Statement	Description
⑩ R3265A/3271A controller control command	@LOAD∆file name	Loads the program.
	@RUN	Executes the program.
	@STOP	Stops the program.
	@CONT	Restarts the program.
	@EXIT	Exits the BASIC (editor) mode.
	@CR	Carriage return Used as an input to the INPUT statement.
	@numeric-value	Enters a numeric value. Used as an input to the INPUT statement.
	@CNTRLR	Displays a user-defined menu.
	@SF numeric-value	Executes a user-defined menu.
	@INFO?	Returns the R3265A controller status. Combination with SRQ recommended.
	@INFO∆CLR	Clears the R3265A controller status.
	@variable-name?	Outputs variable value (ASCII type) to the host computer.
	@variable-name∆ BIN?	Outputs variable value (BINARY type) to the host computer. Conforms to the IEEE 64-bit floating point format.
	@variable-name∆ MANY?	Outputs array variable in multiple times to the host computer.

Note 1: ∆ : Denotes a space.
Note 2: See section 2.3 for details of each command and statement.

A. 2 List of Built-in Function and Graphic Function

【Frequency/point (horizontal axis) operation】

No.	Function	Contents
1	FREQ	Calculates a frequency from a point value.
2	DFREQ	Calculates a frequecny from a width between points.
3	POINT	Calculates a point (horizontal axis).
4	DPOINT	Calculates a point between specified frequencies.

【Level/point (vertical axis) operation】

No.	Function	Contents
5	LEVEL	Calculates a level of trace data specified with a point value (vertical axis).
6	DLEVEL	Calculates a level between points (vertical axis).
7	LVPOINT	Calculates the point (vertical axis) of trace data from a level.
8	LVDPOINT	Calculates the point (vertical axis) of trace data between levels.
9	VALUE	Calculates a level at a frequency position specified with a point value.
10	DVALUE	Calculates a difference of levels at two frequency positions specified with point values.
11	CVALUE	Calculates a level at a frequency position.
12	DCVALUE	Calculates the level difference between two specified frequency positions.

【Maximum/minimum operation】

No.	Function	Contents
13	FMAX	Calculates the frequency at the maximum level position between two positions specified with point value.
14	FMIN	Calculates the frequency at the minimum level position between two positions specified with point value.
15	PMAX	Calculates the frequency point (horizontal axis) maximum level position between two positions at the specified with point values.
16	PMIN	Calculates the frequency point (horizontal axis) at the minimum level position between two positions specified with point values.
17	MAX	Calculates the maximum level between two positions specified with point values.
18	MIN	Calculates the minimum level between two positions specified with point values.

【Bandwidth operation】

No.	Function	Contents
19	BND	Calculates the frequency bandwidth of a LOSS level at a position specified with point values.
20	BNDL	Calculates the low frequency bandwidth of a LOSS level at a position specified with point values.
21	BNDH	Calculates the high frequency bandwidth of a LOSS level at a position specified with point values.
22	CBND	Calculates the frequency bandwidth of a LOSS level at a position specified with a frequency.
23	CBNDL	Calculates the low frequency bandwidth of a LOSS level at a position specified with a frequency.
24	CBNDH	Calculates the high frequency bandwidth of a LOSS level at a position specified with a frequency.

【Maximum/minimum (ripple) operation】

No.	Function	Contents
25	NRPLH	Set the number of every maximum point.
26	NRPLL	Set the number of every minimum point.
26	PRPLHN	Set horizontal axis point for maximum point of N's turn from the left.
28	PRPLLN	Set horizontal axis point for minimum point of N's turn from the left.
29	FRPLHN	Set frequency for maximum point of N's turn from the left.
30	FRPLLN	Set frequency for minimum point of N's turn from the left.
31	VRPLHN	Set level for maximum point of N's turn from the left.
32	VRPLLN	Set level for minimum point of N's turn from the left.
33	RPL1	Set level difference between maximum value of maximum point and minimum value of minimum point.

【Decision for upper and lower limit】

No.	Function	Contents
34	LMTMD1	Decide specified data with standard value and width of upper and lower
35	LMTMD2	Decide waveform data for horizontal axis-point position with standard value and width of upper and lower.
36	LMTUL1	Decide specified data with upper limit value and lower limit value.
37	LMTUL2	Decide waveform data for horizontal axis-point position with upper limit value and lower limit value.

【Electric power operation】

No.	Function	Contents
38	POWER	Set total electric power between horizontal axis points.

【Trace data】

No.	Function	Contents
39	RTRACE	Read trace data for appointed point.
40	WTRACE	Write trace data for appointed point.

【Graphic function】

No.	Function	Contents
1	GADRS	Specify absolute address/view-point address for graphic point.
2	GFLRECT	Paint out rectangle which includes diagonal between appointed 2 point.
3	GLINE	Draw line between appointed 2 points.
4	GMKR	Draw marker normal/delta) at appointed position.
5	GPOINT	Draw dot at appointed position.
6	GRECT	Draw rectangle which includes diagonal between appointed 2 points.
7	GSTR	Draw character line.
8	GSTYLE	Specify the length for factor of short dashes line, dotted line and alternate long and short dash line.

A. 3 List of Parameter

<Built-in structure>

Function	No.	Structure
Frequency/point operation	1	F=FREQ (P)
	2	F=DFREQ (P1, P2)
	3	P=POINT (F)
	4	P=DPOINT (F1, F2)
Level/point operation	5	L=LEVEL (T)
	6	L=DLEVEL (T1, T2)
	7	T=LVPOINT (L)
	8	T=LVDPOINT (L1, L2)
	9	L=VALUE (P, M)
	10	L=DVALUE (P1, P2, M)
	11	L=CVALUE (F, M)
	12	L=DCVALUE (F1, F2, M)
Maximum/minimum operation	13	F=FMAX (P1, P2, M)
	14	F=FMIN (P1, P2, M)
	15	P=PMAX (P1, P2, M)
	16	P=PMIN (P1, P2, M)
	17	L=MAX (P1, P2, M)
	18	L=MIN (P1, P2, M)
Bandwidth operation	19	F=BND (P, X, M)
	20	F=BNDL (P, X, M)
	21	F=BNDH (P, X, M)
	22	F=CBND (F, X, M)
	23	F=CBNDL (F, X, M)
	24	F=CBNDH (F, X, M)
Maximum/minimum operation	25	N=NRPLH (P1, P2, Dx, Dy, M)
	26	N=NRPLL (P1, P2, Dx, Dy, M)
	27	P=PRPLHN (N, M)
	28	P=PRPLLN (N, M)
	29	F=FRPLHN (N, M)
	30	F=FRPLLN (N, M)
	31	L=VRPLHN (N, M)
	32	L=VRPLLN (N, M)
	33	L=RPL1 (P1, P2, Dx, Dy, M)
Decision for upper and lower limit	34	C=LMTMD1 (Dd, S, Ds)
	35	C=LMTMD2 (P, S, Ds, M)
	36	C=LMTUL1 (Dd, Up, Lo)
	37	C=LMTUL2 (P, Up, Lo, M)

Function	No.	Structure
Electric power operation	38	W=POWER (P1, P2, M)
Read/write of trace data	39 40	T=RTRACE (P, M) WTRACE (T, P, M) Note: This function returns no value.

● Graphic

Function	No.	Structure
Graphic	1 2 3 4 5 6 7 8	GADRS (Mo, X, Y) GFLRECT (D, X1, Y1, X2, Y2) GLINE (S, D, X1, Y1, X2, Y2) GMKR (MK, D, X, Y) GPOINT (D, X, Y) GRECT (S, D, X1, Y1, X2, Y2) GSTR (C, X, Y, STR) GSTYLE (dash, space, dot)

C:	haracter size	0 - 16×20 dot 1 - 18×24 dot
D:	Set/Erase	0 - Erase 1 - Set (Draw)
MK:	Marker	0 - Normal marker 1 - Δ marker
Mo:	Address mode	0 - Absolute address 1 - Viewport address
S:	Line style	0 - Solid line 1 - Broken line 2 - Dotted line 3 - Chain line

STR: Character expression
X: Coordinate (Horizontal axis)
Y: Coordinate (Vertical axis)
dash: Dash part
dot: Dot part
space: Space part

A. 4 List of Error Message

(1) Ate editor error message list

Note: ○○: byte number
△△: line number
xxx : Character strings
yy : Numeric

Error message	Description
Already auto line no. mode	Try to duplicate setting for the auto line numbering mode.
Cannot allocate ○○ bytes	No memory exists in the editor.
Cannot allocate memory	Cannot renumber for no memory remains in the editor.
Cannot allocate WINDOW block	Cannot open a new window for no memory remains in the editor.
Cannot create buffer	No memory is allocated space in the editor.
Cannot find error line	No error line when BASIC is executed is in the program in the ate editor.
Cannot open file for writing	Cannot open a file for no memory card or WRITE PROTECT is on.
Cannot sprit a △△ line window	Cannot sprit for window lines are insufficient.
Line no. is out of range	Line numbers are over 65535.
No file name	File has no name when saved into a memory card.
No mark set in this window	No region specification mark for delete or copy is specified.
Not found	No character strings for retrieval is specified.
Not line no. mode	Renumbering was executed without no auto line numbering mode.
Too large region	Too large region for delete or copy.
Write I/O error	Cannot access a memory card for no memory card or out of battery.

(2) System controller error message list

Error message	Description
yy error(s) appeared	Error for label or line number.
"xxx" file cannot be opened.	No file to open exist.
"xxx" file is already opened with another PATH.	Try duplicate file opening.
"xxx" file is already exist.	Try a different instruction from the mode used at opening.
"xxx" read error.	Reading error.
0 divide	Divided by 0.
Array's range error	The subscript of an array variable is bigger than a declaration.
Bad free call	Error on memory management
CANNOT assigned into this token	Cannot assign into character variable.
cannot read data from "xxx" file.	No file exists to read.
cannot specify "USING"	Read byte number is different from write byte number.
cannot write data into "xxx" file.	No file exists to write.
end of "xxx" file	Read up to the EOF (end of file).
expression format error	Invalid format.
file format error	No terminator exists in 256 characters.
file is NOT open.	Read and write are executed without opening.
FOR <init value> does NOT exist	No initial value exists in a FOR statement.
FOR variable does NOT exist.	No counter variable exists in a FOR statement.
FOR's nest is abnormal.	Cannot nest a FOR statement.
Invalid dimension parameter	Invalid parameter exists in an array variable.

(cont'd)

Error message	Description
Invalid string constant	Double quotation marks do not match each other.
invalid type in xxx	Invalid type are detected in xxx.
label not found	No specified label exists.
Label xxx is already exists	Try a duplicate specification of label xxx.
Line No.yy is out of range.	Line number assignment is out of range.
memory space full	No memory space is allocated.
NO operand in xxx	Expression xxx is missed.
NOT available ASCII char(xx)	Invalid ASCII code.
Not found DATA statement	No DATA statement to where RESTORE is executed.
Not found THEN in xxx	No THEN statement exists after a IF statement.
Only one INPUT file can be opened.	Try to open more than one files at one time in read mode.
Only one OUTPUT file can be opened.	Try to open more than one files at one time in write mode.
Overflow value	Numeric is out of range to handle.
parameter error	Invalid parameter.
Program CANNOT be continued.	Try to rerun a terminated program.
Program NOT exist	Try to execute without a program.
SELECT nesting overflow	Too much nests for a SELECT statement exist.
string declaration error	Double quotation marks do not match each other.
string length is too long	Too long a character string decraration. (Up to 128 characters)
Substring error	Invalid substring specification.
Unbalanced BREAK	No BREAKE statement between FOR and NEXT statements.

(cont'd)

Error message	Description
Unbalanced FOR variable in NEXT	For statement and NEXT statement do not match correctly each other.
Unbalanced line No.	No line specified by LIST statement exists.
Unbalanced NEXT statement	No NEXT statement even though FOR statement exists.
Unbalanced xxx	Unmatched expression (parentheses, bracket).
Unbalanced xxx block	Unmatched xxx block (FOR, IF statements)
Undefined LABEL	No label exists.
undefined ON condition	On condition arises without no determination for ON condition.
Uninstalled type (xxx)	Invalid variable format.
Unknown line No.	No specified line exists.
Unmatched DATA's values and READ variable	No DATA statement for READ exists.
Unmatched IMAGE-spec in USING	Invalid image use of USING.
xxx function error	Error in built-in function.
xxx nest overflow	Too much nests exist.
xxx(xxx) error	No PURGE command specified file exists.
xxx(xxx,xxx) error	No RENAME command specified file exists.
xxx: "xxx" file was opened with xxx mode.	File descriptor mode (read/write) is different from specified one.
xxx: CANNOT convert into string	Cannot convert into character strings.
xxx: invalid first type in xxx	Invalid first type in command is detected.
xxx: invalid second type in xxx	Invalid second type in command is detected.
xxx: invalid source type in xxx	Source type is invalid to assign into an expression.

(cont'd)

Error message	Description
xxx: invalid target type in xxx	Variable type is invalid to assign.
xxx: Invalid TERGET operand in XXX	Invalid format is detected in xxx.
xxx: Syntax error	Syntax is missed.
You cannot use POKE command	Try to execute POKE command.
yy is invalid value in xxx	yy in xxx is invalid.
yy: Undefined Control Register	The register number in a CONTROL command is missed.
yy: UNIT addr error in xxx	GPIB address specification is invalid.

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6. **THE REMEDY SET FORTH HEREIN SHALL BE THE SOLE AND EXCLUSIVE REMEDY OF THE PURCHASER FOR BREACH OF WARRANTY WITH RESPECT TO THE PRODUCT.**

7. **ADVANTEST WILL NOT HAVE ANY LIABILITY TO THE PURCHASER FOR ANY INDIRECT, INCIDENTAL, SPECIAL, CONSEQUENTIAL OR PUNITIVE DAMAGES, INCLUDING, WITHOUT LIMITATION, LOSS OF ANTICIPATED PROFITS OR REVENUES, IN ANY AND ALL CIRCUMSTANCES, EVEN IF ADVANTEST HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES AND WHETHER ARISING OUT OF BREACH OF CONTRACT, WARRANTY, TORT (INCLUDING, WITHOUT LIMITATION, NEGLIGENCE), STRICT LIABILITY, INDEMNITY, CONTRIBUTION OR OTHERWISE. TORT (INCLUDING, WITHOUT LIMITATION, NEGLIGENCE), STRICT LIABILITY, INDEMNITY, CONTRIBUTION OR OTHERWISE.**

8. **OTHER THAN THE REMEDY FOR THE BREACH OF WARRANTY SET FORTH HEREIN, ADVANTEST SHALL NOT BE LIABLE FOR, AND HEREBY DISCLAIMS TO THE FULLEST EXTENT PERMITTED BY LAW ANY LIABILITY FOR, DAMAGES FOR PRODUCT FAILURE OR DEFECT, WHETHER ARISING OUT OF BREACH OF CONTRACT, TORT (INCLUDING, WITHOUT LIMITATION, NEGLEGENCE), STRICT LIABILITY, INDEMNITY, CONTRIBUTION OR OTHERWISE.**

CUSTOMER SERVICE DESCRIPTION

In order to maintain safe and trouble-free operation of the Product and to prevent the incurrence of unnecessary costs and expenses, Advantest recommends a regular preventive maintenance program under its maintenance agreement.

Advantest's maintenance agreement provides the Purchaser on-site and off-site maintenance, parts, maintenance machinery, regular inspections, and telephone support and will last a maximum of ten years from the date the delivery of the Product. For specific details of the services provided under the maintenance agreement, please contact the nearest Advantest office listed at the end of this Operation Manual or Advantest 's sales representatives.

Some of the components and parts of this Product have a limited operating life (such as, electrical and mechanical parts, fan motors, unit power supply, etc.). Accordingly, these components and parts will have to be replaced on a periodic basis. If the operating life of a component or part has expired and such component or part has not been replaced, there is a possibility that the Product will not perform properly. Additionally, if the operating life of a component or part has expired and continued use of such component or part damages the Product, the Product may not be repairable. Please contact the nearest Advantest office listed at the end of this Operation Manual or Advantest's sales representatives to determine the operating life of a specific component or part, as the operating life may vary depending on various factors such as operating condition and usage environment.

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