Agilent 4287A RF LCR Meter

Programming Manual

Seventh Edition

FIRMWARE REVISIONS/SERIAL NUMBERS

This manual applies directly to instruments that have the firmware revision 1.3x and serial number prefix JP1KG. For additional important information on firmware revisions and serial numbers, see Appendix A.

Agilent Technologies

Agilent Part No. 04287-90071

May 2003

Printed in Japan

Notices

Agilent Technologies Japan, Ltd.

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Manual Printing History

The manual’s printing date and part number indicate its current edition. The printing date changes whenever a new edition is printed (minor corrections and updates incorporated at reprint do not cause the date to change). The manual part number changes when extensive technical changes are incorporated.

January 2000	Preliminary (Agilent P/N: 04287-90001)
February 2000	First Edition (Agilent P/N: 04287-90011)
March 2000	Second Edition (Agilent P/N: 04287-90021)
April 2000	Third Edition (Agilent P/N: 04287-90031)
August 2000	Fourth Edition(Agilent P/N: 04287-90041)
January 2001	Fifth Edition (Agilent P/N: 04287-90051)
November 2002	Sixth Edition (Agilent P/N: 04287-90061)
May 2003	Seventh Edition (Agilent P/N: 04287-90071)

Typeface Conventions

Bold	Boldface type is used for terms that are defined. For example: **icons** are symbols.
Italic	Italic type is used for emphasis and for titles of manuals and other publications.
[Hardkey]	Indicates a hardkey labeled “Hardkey.”
Softkey	Indicates a softkey labeled “Softkey.”
[Hardkey] - **Softkey1** - **Softkey2**	Indicates keystrokes **[Hardkey]** - **Softkey1** - **Softkey2**.

Sample Program Disk

A sample program disk (Agilent Part Number 04287-18030) is furnished with this manual. The disk contains the sample programs used in this manual.

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4287A Documentation Map

The following manuals are available for the 4287A.

- ***Operation Manual* (Agilent P/N: 04287-900x4)**

  Basic information needed for using the 4287A is given in this manual. It includes guidelines for installation, preparation, and measurement operations, including calibration, performances (specifications), key definitions, and error messages. For GPIB programming, see the *Programming Manual*.

- ***Programming Manual* (Agilent P/N: 04287-900x1)**

  The Programming Manual shows how to write and use BASIC programs to control the 4287A.

1 To Make Effective Use of This Manual

This chapter provides an overview of this manual as well as useful information to help you navigate through the manual. It also briefly describes how to use this manual, focusing on how you can look up particular commands.

Contents of This Manual

This manual is a programming guide for the Agilent 4287A RF LCR meter. In addition to explanations of how to remotely control the 4287A from BASIC programs, it provides listings and in-depth descriptions of sample HP BASIC programs. The chapter-by-chapter contents of this manual are as follows.

Chapter 1 "To Make Effective Use of This Manual"

This chapter provides an overview of this manual as well as useful information to help you navigate through the manual. It also briefly describes how to use this manual, focusing on how you can look up particular commands.

Chapter 2 "Overview of Remote Control"

This chapter gives an overview of the GPIB remote control system and GPIB commands.

Chapter 3 "Specifying Measurement Conditions"

This chapter explains how to set measurement conditions and configure the instrument's display of measurement results.

Chapter 4 "Preparing for Accurate Measurement"

This chapter explains how to carry out calibration, compensation, and test fixture selection (port extension compensation).

Chapter 5 "Starting Measurement Cycle (Triggering) and Detecting End of Measurement"

This chapter explains how to trigger the instrument to start a new measurement cycle and how to detect the end of a measurement cycle.

Chapter 6 "Retrieving Measurement Results"

This chapter explains how to retrieve the results of impedance measurement, test signal level monitoring, and Rdc measurement. It also describes how the Agilent 4287A internally processes the data.

Chapter 7 "Sorting DUTs Based on Measurement Results"

This chapter explains how to use the bin sorting function to sort DUTs into a number of configured bins based on measurement results.

Chapter 8 "Statistical Analysis of Measurement Results"

This chapter explains how to use the statistical analysis function.

Chapter 9 "Saving and Recalling Files"

This chapter explains how to save or recall instrument settings and measurement results to or from a file.

Chapter 10 “Error Handling”

This chapter explains how to handle errors that may occur in the Agilent 4287A while running a program.

Chapter 11 “Shutting Down the Instrument”

This chapter explains how to shut down the Agilent 4287A.

Chapter 12 “Connecting the Instrument to a Handler with the Handler Interface”

You can use the handler interface of the Agilent 4287A to communicate with an external handler; for example, the 4287A can send end-of-measurement signals or bin-sorting results and receive external trigger or key lock signals. This chapter provides the information needed to set up an auto-sorting system that combines the 4287A with a handler by taking advantage of the handler interface and bin sorting.

Chapter 13 “Using LAN”

This chapter describes LAN (Local Area Network)-based file transfer and remote control.

Chapter 14 “Using Printer”

This chapter explains how to use a printer to produce hard copies of your measurement results and images displayed on the LCD screen.

Chapter 15 “Sample Application Programs”

This chapter provides sample measurements (sample programs).

Chapter 16 “Command Reference”

This chapter provides a GPIB command reference for the Agilent 4287A. The shorthand names of the commands, without the parts that are normally omitted, appear in alphabetical order in this chapter. If you want to search for commands by their full names, see “GPIB commands” in the index. If you want to search for commands by their functionality, see Appendix C, “GPIB Command Table.”

Appendix A “Manual Changes”

This appendix contains the information required to adapt this manual to earlier versions or configurations of the Agilent 4287A than that indicated by the current printing date of this manual. The information in this manual applies directly to the 4287A model that has the serial number prefix listed on the title page of this manual.

Appendix B “Status Reporting System”

This appendix describes the status reporting system of the Agilent 4287A.

Appendix C “GPIB Command Table”

This appendix provides the Agilent 4287A GPIB command list sorted according to function.

Appendix D “GPIB Command Tree”

This appendix provides the Agilent 4287A GPIB command tree.

Appendix E “4286A vs. 4287A GPIB Commands Correspondence Table.”

This appendix gives the correspondence between the Agilent 4287A GPIB commands and those of the Agilent 4286A.

Appendix F “List of Responses to Measurement Failure”

This appendix summarizes how the Agilent 4287A responds when a measurement fails (an overloading or exceeding the Rdc limit range is detected).

Appendix G “Initial Settings”

This appendix provides initial settings, settings that can be saved/recalled, and settings that can be backed up.

Appendix H “Error messages”

The Agilent 4287A provides error messages to indicate its operating status. This appendix describes the error messages of the 4287A in order of error number. To search error messages alphabetically, refer to the Operation Manual.

How To Use This Manual

Chapters 3 to 11 provide task-based descriptions of GPIB commands that are useful for programming and explain how you can utilize them. These chapters contain explanations and sample program listings that you can use to develop your custom programs. For more information on individual commands, see Chapter 16 "Command Reference."

Looking up GPIB commands

Chapter 16, "Command Reference," contains a complete reference of GPIB commands. You can look up a particular GPIB command in any of the following ways:

Lookup by Abbreviated Command Name

The command reference is organized alphabetically according to the abbreviated name used as the title of each command.

Lookup by Full Command Name

You can use the index at the end of the manual to find full command names along with the page numbers where they appear.

Lookup by Command Function

Appendix C , "GPIB Command Table," provides a complete list of commands by function and indicates the page numbers where the commands appear in the command reference.

NOTE Some GPIB commands supported by the 4287A have optional syntax elements. In the command reference conventions, these elements are enclosed between square brackets ([ ]) or printed in lowercase letters. See "Syntax" on page 202 for more information.

Using sample programs

This manual comes with a sample program disk, which contains the source files of sample programs used in the manual. The disk is DOS-formatted and the files are saved in the ASCII format.

Loading a sample program

To load a sample program into the HP BASIC interpreter, use the GET command. For example, you can load setup.bas, one of the sample programs, by the following procedure:

In the HP BASIC screen, type the following command and press the Return key.

```
GET "setup.bas"
```

Looking up a sample program

To look up the description of a sample program you are interested in, see "Sample program" in the index.

2 Overview of Remote Control

This chapter gives an overview of the GPIB remote control system and GPIB commands.

Setting Up a GPIB Remote Control System

This section describes how to set up a GPIB remote control system.

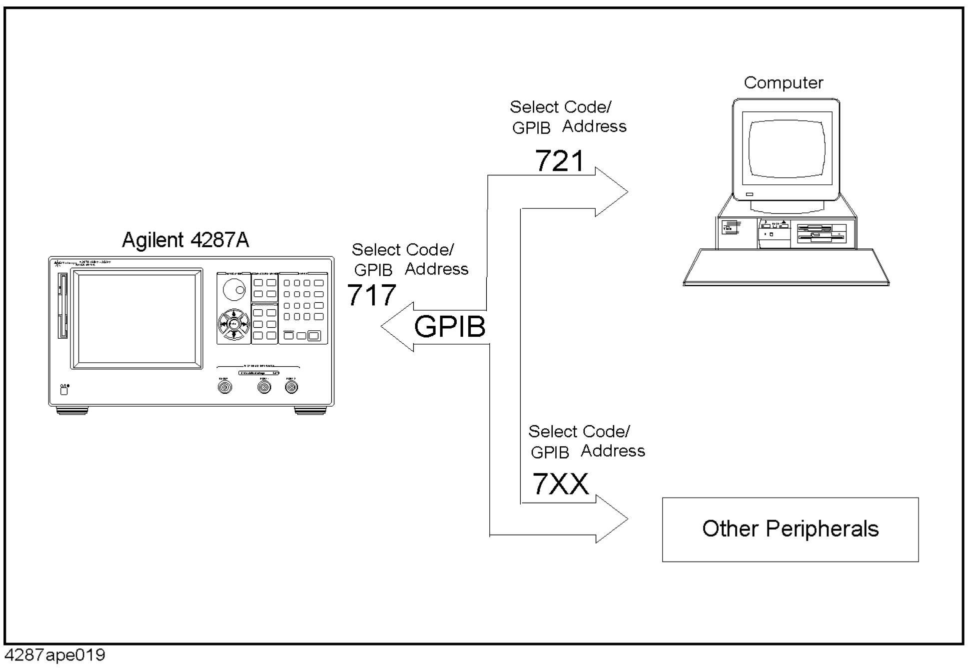
What is GPIB?

GPIB (General Purpose Interface Bus) is an interface standard for connecting a computer with peripherals. It complies with these international standards: IEEE 488.1, IEC-625, IEEE 488.2, and JIS-C1901. With the GPIB interface, you can set up a GPIB remote control system in which an external computer remotely controls the Agilent 4287A by sending commands to and receiving data from the unit through the GPIB bus.

How to set up a GPIB remote control system

Use GPIB cables to connect the 4287A to an external controller (computer) and any necessary peripherals. Figure 2-1 shows a typical GPIB remote control system.

Figure 2-1 **Setting up a GPIB remote control system**



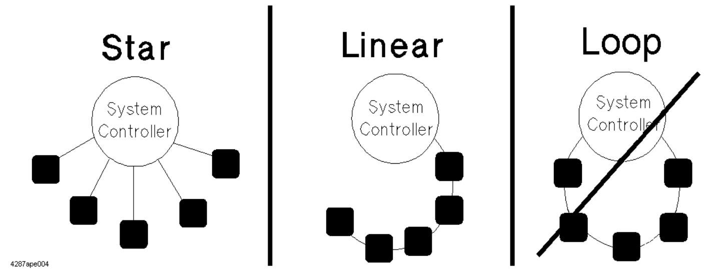
Required equipment

1. 4287A with accessories for measuring DUTs
2. External controller (computer)

   The external controller can be any personal computer or workstation with a GPIB interface card and the appropriate software (such as HP BASIC for Windows) for controlling the instrument via the GPIB interface.
3. Other hardware as needed (extra instruments and/or peripherals)
4. GPIB cables for connecting the 4287A to the external controller and other hardware

Possible sizes and configurations of your remote control system

- One GPIB system can host up to 15 devices.
- Device-to-device cables should be no longer than 4 m. The total length of connection cables used in one GPIB system should not exceed 2 m × N, where N is the number of connected devices (including controller). In any case, do not construct a system whose total cable length exceeds 20 m.
- Do not connect any single device with more than four connectors. Doing so exposes the connectors to excessive strain, possibly causing a failure.
- The topology of device connections can be star, linear, or a combination of them. Loop connections are not supported.



Device selector

Each device is assigned a unique identifier called the “device selector.” When the controller attempts to control (communicate messages with) one of the devices connected over the GPIB remote control system, it selects that device with the appropriate device selector.

A device selector consists of a select code (normally 7) and a GPIB address. For example, when the select code is 7 and the GPIB address is 17, the device selector is 717. The select code is system-global. Each device in the same system is assigned a GPIB address that uniquely identifies it. When this document refers to a device selector in descriptive text or sample programs, it is always assumed to be 717. Use the following procedure to set the GPIB address of the 4287A.

Setting the GPIB address (17) for the Agilent 4287A

Step 1. Press the [System] key on the front panel.

Step 2. From the softkey menu along the right-hand edge of the screen, select the softkey labeled **GPIB ADDR [XX]** (where XX indicates the current address) by pressing the ⇧ or ⇩ key. Then, press the Enter key.

Step 3. When you see the GPIB address entry screen, enter the address (17) by pressing **[1]** and **[7]** on the numeric keypad. Then press the **[×1]** key or the Enter key.

Sending GPIB Command Messages

Types and structure of GPIB commands

GPIB commands available with the 4287A can be divided into two groups:

4287A specific commands

These commands are specific to the 4287A. They provide access to all measurement features and some generic features built into the 4287A. Commands in this group have a hierarchical (multi-level) structure called the “command tree” (see Appendix D, “GPIB Command Tree”). Each command consists of multi-level strings (mnemonics) and colons (:) that delimit the levels of the hierarchy.

IEEE common commands

These are commands that provide access to generic features defined by IEEE488.2. They are accepted by any instrument that complies with IEEE488.2. Each command in this group is prefixed with an asterisk (*). These commands have no hierarchical levels.

Command tree concept

The topmost command in the command tree is referred to as the “root command,” or simply the “root.” To access a lower-level command in the command tree, you must specify the appropriate path, which looks like a directory path in the DOS file system. Turning on the power or resetting the instrument changes the current path to the root. Also, different path settings are used depending on the special symbols contained in messages:

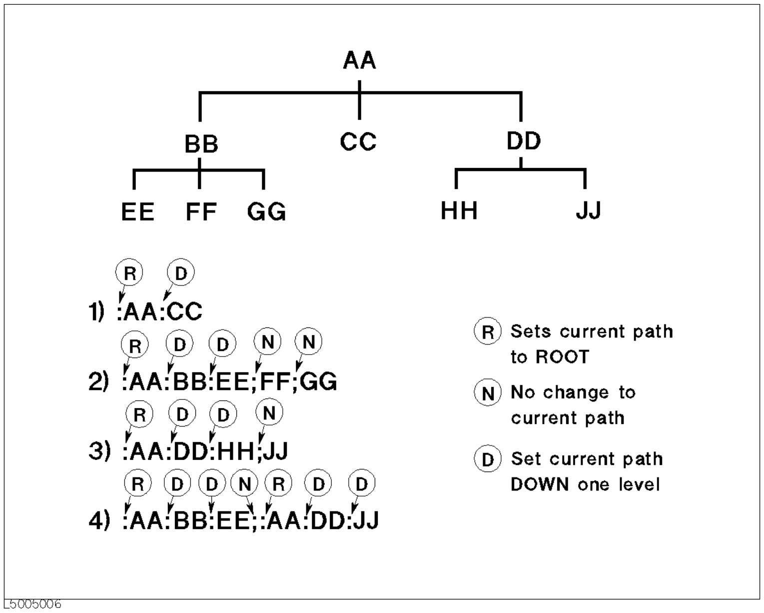
Message terminators
: When a message terminator such as <new line> is detected, the current path is set to the root.

Colons (:)
: When a colon is detected between two command mnemonics, the current path is changed to the next lower level. When a colon is detected at the beginning of a command, the command mnemonic that follows is specified as the root level command.

Semicolons (;)
: A semicolon is used to delimit two commands contained in the same message without changing the current path.

Figure 2-2 illustrates how colons and semicolons can be used to efficiently access various commands in the command tree.

Figure 2-2 **Using colons and semicolons**



Message syntax

This section describes the syntax for sending program messages via GPIB. Program messages are sent by the user from an external controller to the instrument to control the instrument. A program message contains one or more commands along with any required parameters.

Case sensitivity

Program messages are not case sensitive.

Program message terminators

A program message must be terminated with one of three program message terminators: <new line>, <^END>, or <new line><^END>. The <^END> terminator ensures that the immediately preceding data byte is sent out and that EOI is set to the active level on the GPIB interface. For example, the OUTPUT command (HP BASIC) automatically sends a message terminator following the last data byte.

Parameters

You must put a space character (ASCII code 32) between the command and the first parameter. When you send a command with two or more parameters, you must delimit the parameters with commas (,).

Multi-command messages

When you send a message that contains two or more commands, you must delimit the commands with semicolons (;). The following HP BASIC example shows how to send a message that contains ***CLS** and **:INIT** commands.

```
OUTPUT 717;"*CLS;:INIT"
```

Remote mode

The 4287A does not have a remote mode. Therefore, the 4287A is not automatically set to the remote mode when it receives a GPIB command. Furthermore, there is no local key to clear the remote mode on the 4287A's front panel.

Use the key lock function to prevent mis-input from the front panel keys. To lock the front panel, the keyboard or the mouse, use the following commands.

- **:SYST:KLOC** on page 305
- **:SYST:KLOC:KBD** on page 305
- **:SYST:KLOC:MOUS** on page 306

3 Specifying Measurement Conditions

This chapter explains how to set measurement conditions and configure the instrument's display of measurement results.

Setting Measurement Parameters

You can assign measurement parameters 1 through 4 (:PAR1, :PAR2, :PAR3, and :PAR4) independently of the other parameter settings. To set measurement parameters, use the following command:

- **:CALC:PAR{1-4}:FORM** on page 230

You can configure the instrument to measure the parameters shown in the table below:

Parameter	Parameter label on screen	Description
Z	|Z|	Impedance amplitude (absolute value)
Y	|Y|	Admittance amplitude (absolute value)
LS	Ls	Equivalent series inductance
LP	Lp	Equivalent parallel inductance
CS	Cs	Equivalent series capacitance
CP	Cp	Equivalent parallel capacitance
RS	Rs	Equivalent series resistance
RP	Rp	Equivalent parallel resistance
Q	Q	Q value (inverse of dissipation factor)
D	D	Dissipation factor
X	X	Equivalent series reactance
G	G	Equivalent parallel conductance
B	B	Equivalent parallel susceptance
TZR	θz (rad)	Impedance phase (in radians)
TZD	θz (deg)	Impedance phase (in degrees)
TYR	θy (rad)	Admittance phase (in radians)
TYD	θy (deg)	Admittance phase (in degrees)

Setting Measurement Point Setup Tables (Signal Source and Averaging Factor)

You can use up to eight measurement point setup tables (Tables 1 through 8) to define the signal source frequency and averaging factor for each measurement point. Each measurement point setup table can contain up to 32 measurement points.

When you set measurement points, new settings are applied to the active table. To configure the active table, use the following command:

- **:SOUR:LIST:TABL** on page 297

When you manually configure a measurement point setup table, you must add each measurement point to the table and define the various conditions that apply to the specific measurement point. On the other hand, when you use an external controller to configure a measurement point setup table, you can use the following command to define all the measurement points in the active table at once:

- **:SOUR:LIST** on page 294

You can use the following command to set the unit for the signal source level:

- **:SOUR:UNIT** on page 298

To change only the averaging factor after completion of calibration/compensation, you may execute the **:SOUR:LIST** command by specifying the parameter so that only the averaging factor will change with the frequency and signal source level identical to the current settings. In this case, calibration and compensation will be turned off automatically; you will need to rerun calibration and compensation.

If you need to change only the averaging factor after completion of calibration or compensation, use the following command:

- **:AVER:COUN** on page 210

Execution of the **:AVER:COUN** command does not turn off calibration or compensation automatically.

To delete all entries from each table, issue the following command:

- **:SOUR:LIST:CLE** on page 295

NOTE Issuing this command initializes all of the tables (Tables 1 through 8), regardless of which table is currently active.

To check the number of measurement points defined in the active table, use the following command:

- **:SOUR:LIST:SIZE?** on page 296

Choosing Whether to Measure the DUT at a Single Point or Multiple Points

Before starting a measurement session with the 4287A, you need to choose whether to measure the DUT at all points defined in the table or at a single point, that is, list measurement versus single-point measurement. To make this selection, use the following command:

- **:SOUR:LIST:STAT** on page 297

When you choose single-point measurement, you must specify the measurement point, which must be one of the measurement points defined in the active table. To specify the single measurement point, use the following command:

- **:SOUR:LIST:POIN** on page 295

Configuring the Instrument for R_{dc} Measurement

Turning on/off the R_{dc} measurement function

To specify whether to perform R_{dc} measurement, use the following command:

- **:SOUR:LIST:RDC** on page 296

When the bin sorting function is enabled, turning on R_{dc} measurement enables the test function that determines whether the result of R_{dc} measurement falls within the limit range.

Turning on/off the offset cancel function

You can instruct the instrument to turn on or off the offset cancel function by using the following command:

- **:SOUR:LIST:RDC:OFSC** on page 296

NOTE To use the offset cancel function, turn ON the offset cancel function before measuring calibration/compensation data.

Setting the limit range for R_{dc} measurement

To set a limit range for R_{dc} measurement, use the following command:

- **:CALC:COMP:RDC:LIM** on page 224

Setting How the Instrument Displays Measurement Results (Enabling/Disabling Deviation Measurement Mode)

You can have the instrument display measurement results as absolute values or as deviations relative to the reference value (deviation measurement mode). You can change this setting for each of the measurement parameters 1 through 4 (:PAR1 through :PAR4). To make this selection, use the following command:

- **:CALC:PAR{1-4}:EXPR:STAT** on page 229

In deviation mode, you can set the instrument to display deviations as they are or as percentages relative to the reference value. To make this selection, use the following command:

- **:CALC:PAR{1-4}:EXPR:NAME** on page 229

To set the reference value for deviation mode, use the following command:

- **:CALC:PAR{1-4}:EXPR:CENT** on page 228

How the instrument displays measurement results differs according to the settings made with the above two commands, as summarized in the table below.

Setting with the **:CALC:PAR{1-4}:EXPR:STAT** command	OFF or 0	ON or 1	
Setting with the **:CALC:PAR{1-4}:EXPR:NAME** command	———	DEV	PCNT
How measurement results are displayed	$Meas$	$Meas - Ref$	$\frac{Meas - Ref}{Ref} \times 100$

where $Meas$ and Ref mean the following:

$Meas$: Measured value

Ref : Reference value (set with the **:CALC:PAR{1-4}:EXPR:CENT** command)

NOTE

When you use a GIPB command, such as the **:FETC?** command on page 280, to retrieve measurement values, the above settings are applied to the values displayed on screen.

When you are testing DUTs while using the bin sorting function, the instrument always displays measurement results as they are, regardless of the above settings. See Figure 6-5, “4287A's data processing flow,” on page 77.

Configuring Screen Display

Configuring the display of measurement results

Showing/hiding all measurement results

You can instruct the instrument to show or hide the entire set of measurement results, which includes the measurement results for measurement parameters 1 through 4, test signal level monitoring, and R_{dc} measurement). To do so, use the following command:

- **:DISP:TEXT1** on page 269

Configuring the display of Individual values

You can set the following display attributes for each value:

- Number of digits
- Whether to fix the decimal point
- Most significant digit when the value is displayed with the decimal point fixed
- Whether to show or hide the value

To set the above display attributes, use the commands listed in the table below.

	Results for measurement parameters **:CALC1: parameter 1** **:CALC2: parameter 2** **:CALC3: parameter 3** **:CALC4: parameter 4**	**Result of test signal level monitoring** **:CALC11: current level** **:CALC12: voltage level**	**Result of R_{dc} measurement**
Number of digits	**:DISP:TEXT1:CALC{1-4}:DIG** on page 270	**:DISP:TEXT1:CALC{11-12}:DIG** on page 272	**:DISP:TEXT1:CALC13:DIG** on page 274
Whether to fix decimal point	**:DISP:TEXT1:CALC{1-4}:FIX** on page 271	**:DISP:TEXT1:CALC{11-12}:FIX** on page 273	**:DISP:TEXT1:CALC13:FIX** on page 274
Most significant digit when decimal point is fixed	**:DISP:TEXT1:CALC{1-4}:MSD** on page 271	**:DISP:TEXT1:CALC{11-12}:MSD** on page 273	**:DISP:TEXT1:CALC13:MSD** on page 275
Whether to show or hide value	**:DISP:TEXT1:CALC{1-4}** on page 270	**:DISP:TEXT1:CALC{11-12}** on page 272	**:SOUR:LIST:RDC** on page 296[*1]

*1. This command not only sets whether to show or hide the result of R_{dc} measurement but also whether to turn on or off the R_{dc} measurement function. You cannot use the command to only show or hide the R_{dc} result.

Setting the display items on the list measurement screen

To define each of the four display items (:LAB1 through :LAB4) that appear on the list measurement screen, use the following command:

- **:DISP:TEXT2:LAB{1-4}** on page 278

Turning on/off the display

You can instruct the instrument to show or hide all of the displayed items except the menu bar by using the following command:

- **:DISP** on page 268

Turning on/off the update of the display

You can instruct the instrument to turn on or off the update of the display by using the following command:

- **:DISP:UPD** on page 279

The advantage of the off status is that it allows faster processing speeds of GPIB comannds than does the on status; on the other hand, its disadvantage is that there is limited update of the items displayed on the screen.

Turning on/off the backlight of the LCD screen

You can instruct the instrument to turn on or off the backlight of the LCD screen by using the following command:

- **:DISP:BACK** on page 268

If the backlight is off, you cannot read displayed information on the screen.

Showing or hiding the title

To choose whether to show or hide the title display area (the topmost area on the screen), use the following command:

- **:DISP:TEXT10** on page 276

To define the title string that appears in the title display area, use the following command:

- **:DISP:TEXT10:DATA** on page 276

Turning on/off the date display

To choose whether to show or hide the current date and time in the rightmost part of the status display area, use the following command:

- **:DISP:TEXT11** on page 277

Also, you can choose whether to automatically update the time display in increments of 1 minute as time elapses or keep the day, hour, and minute set to the date/time when you turned on the display. To make this selection, use the following command:

- **:DISP:TEXT11:MODE** on page 277

Sample Program

Example 3-1 shows a sample program that demonstrates how to configure measurement conditions. You can find the source file of this program, named setup.bas, on the sample program disk.

This program resets the instrument and then configures it with the following conditions:

- Active table number: 3
- Point number for single-point measurement: 1
- Measurement point setup table:

Point number	Measuring frequency	Averaging factor	Signal source level
1	1 MHz	2	-10 dBm
2	10 MHz	2	-10 dBm
3	100 MHz	2	-10 dBm
4	1 GHz	2	-10 dBm

- Settings of Measurement Parameters 1 through 4:

	Parameter	Display	Deviation mode		
			On/off	How parameter is displayed	Reference value
Measurement parameter 1	Ls	On	On	Percentage	100 nH
Measurement parameter 2	Rs	On	On	Absolute value	100 nH
Measurement parameter 3	Q	On	Off	——	——
Measurement parameter 4	——	Off	——	——	——

- List measurement: On
- Display parameters for list measurement screen
  Display item 1: Measuring frequency
  Display item 2: Measurement parameter (Ls)
  Display item 3: Measurement parameter (Rs)
  Display item 4: Measurement parameter (Q)
- Result of test signal current level monitoring: On
- Result of test signal voltage level monitoring: On
- R_{dc} measurement: On
- R_{dc} measurement limit range
  Lower limit: -5 Ω
  Upper limit: 5 Ω
- Title display area: On (title: "Example 3-1")
- Time and date display: On (auto update)

The program is described in detail below:

Line 50	Sets the GPIB address.
Lines 70 to 100	Stores the active table number, the point number for single-point measurement, the unit of the signal source level, and the number of measurement points into the Act_tab, Point_no, Unit$, and Nop variables, respectively.
Lines 110 to 220	Stores the frequency, averaging factor, and signal source level at each point into the Freq(*), Ave(*), and Pow(*) variables, respectively.
Lines 230 to 340	Stores the parameter settings, deviation mode settings, and reference values for measurement parameters 1 through 4 into the Para$(*), Dev$(*), and Cent(*) arrays, respectively.
Line 350	Stores the on/off setting of list measurement into the List$ variable.
Lines 360 to 390	Stores the parameter selections for display items 1 through 4 on the list measurement screen into the List_lab$(*) array.
Lines 400 to 410	Stores the on/off settings for the results of test signal current and voltage monitoring into the Imon_disp$ and Vmon_disp$ variables.
Lines 420 to 440	Stores the on/off setting of R_{dc} measurement and the upper and lower limits for the R_{dc} measurement limit range into the Rdc$, Rdc_l_lim, and Rdc_u_lim variables, respectively.
Lines 450 to 470	Stores the on/off setting of the title display, title string, and the setting of the time display into the Title_disp$, Title$, and Clock_disp$ variables, respectively.
Line 490	Resets the instrument.
Lines 530 to 540	Sets the active table number to Act_tab and the unit of the signal source level to Unit$.
Lines 550 to 590	Configures the measurement point setup table.
Lines 630 to 770	Configures the instrument with the various settings related to measurement parameters 1 through 4.
Lines 810 to 820	Turns on/off list measurement based on List$ and sets the point number for single-point measurement to Point_no.
Lines 860 to 870	Turns on/off the results of test signal level current and voltage monitoring based on Imon_disp$ and Vmon_disp$.
Lines 910 to 920	Turns on/off R_{dc} measurement based on Rdc$ and set the limit range for R_{dc} measurement to the range between Rdc_l_lim and Rdc_u_lim.
Lines 960 to 970	Configures display items 1 through 4 on the list measurement screen.
Lines 1020 to 1030	Turns on/off the title display based on Title_disp$ and sets the title to Title$.
Lines 1070 to 1120	Configures the date and time display.

Example 3-1 **Setting Measurement Conditions (setup.bas)**

```
10      DIM Unit$[9],List$[9],Rdc$[9],Para$(1:4)[9],Dev$(1:4)[9]
20      DIM List_lab$(1:4)[9],Title$[30],Title_disp$[9],Clock_disp$[9]
30      REAL Freq(1:4),Pow(1:4),Cent(1:4),Rdc_l_lim,Rdc_u_lim
40      INTEGER Ave(1:4),Act_tab,Nop,Point_no,I
50      ASSIGN @Agt4287a TO 717
60      !
70      Act_tab=3                ! Active Table Number: 3
80      Point_no=1               ! Selected Point No.: 1
90      Unit$="DBM"              ! Power Level unit: dBm
100     Nop=4                    ! Number of Points: 4
110     Freq(1)=1.0E+6           ! Point No.1  Frequency: 1 MHz
120     Ave(1)=2                 !             Averaging Factor: 2
130     Pow(1)=-10               !             OSC Level: -10 dBm
140     Freq(2)=1.0E+7           ! Point No.2  Frequency: 10 MHz
150     Ave(2)=2                 !             Averaging Factor: 2
160     Pow(2)=-10               !             OSC Level: -10 dBm
170     Freq(3)=1.0E+8           ! Point No.3  Frequency: 100 MHz
180     Ave(3)=2                 !             Averaging Factor: 2
190     Pow(3)=-10               !             OSC Level: -10 dBm
200     Freq(4)=1.0E+9           ! Point No.4  Frequency: 1 GHz
210     Ave(4)=2                 !             Averaging Factor: 2
220     Pow(4)=-10               !             OSC Level: -10 dBm
230     Para$(1)="LS"            ! Measurement           Para.1: Ls
240     Para$(2)="RS"            !   Parameter           Para.2: Rs
250     Para$(3)="Q"             !                       Para.3: Q
260     Para$(4)="OFF"           !                       Para.4 Display Off
270     Dev$(1)="PCNT"           ! Deviation Mode        Para.1: ON (Pcnt)
280     Dev$(2)="DEV"            !                       Para.2: ON (Dev)
290     Dev$(3)="OFF"            !                       Para.3: OFF
300     Dev$(4)="OFF"            !                       Para.4: OFF
310     Cent(1)=1.0E-7           ! Reference Value       Para.1: 100 nH
320     Cent(2)=10               !   for Deviation Mode  Para.2: 10 ohm
330     Cent(3)=0                !                       Para.3: Dummy
340     Cent(4)=0                !                       Para.4: Dummy
350     List$="ON"               ! List Measurement: ON
360     List_lab$(1)="FREQ"      ! Displayed Parameter     Label-1: Freq.
370     List_lab$(2)="PAR1"      !  for List Measurement   Label-2: Para.1
380     List_lab$(3)="PAR2"      !                         Label-3: Para.2
390     List_lab$(4)="PAR3"      !                         Label-4: Para.3
400     Imon_disp$="ON"          ! Test Signal        Current Display: On
410     Vmon_disp$="ON"          !   Level Monitor    Voltage Display: On
420     Rdc$="ON"                ! Rdc Measurement: ON
430     Rdc_l_lim=-5             ! Rdc Measurement       Lower Limit: -0.5 ohm
440     Rdc_u_lim=5              !   Comparator Function Upper Limit: +0.5 ohm
450     Title_disp$="ON"         ! Title Display Area      Display: On
460     Title$="Example 3-1"     !                         Title: "Example 3-1"
470     Clock_disp$="LIVE"       ! Time and Date Display: ON (Live)
480     !
490     OUTPUT @Agt4287a;":SYST:PRES"
500     !
510     ! Measurement Point Setup Table
520     !
530     OUTPUT @Agt4287a;":SOUR:LIST:TABL ";Act_tab
540     OUTPUT @Agt4287a;":SOUR:UNIT "&Unit$
550     OUTPUT @Agt4287a;":SOUR:LIST ";Nop;",";
560     FOR I=1 TO Nop-1
570       OUTPUT @Agt4287a;Freq(I);",";Ave(I);",";Pow(I);",";
580     NEXT I
590     OUTPUT @Agt4287a;Freq(Nop);",";Ave(Nop);",";Pow(Nop)
600     !
610     ! Measurement Parameter
```

```
620    !
630    FOR I=1 TO 4
640      IF Para$(I)="OFF" THEN
650        OUTPUT @Agt4287a;":DISP:TEXT1:CALC"&VAL$(I)&" OFF"
660      ELSE
670        OUTPUT @Agt4287a;":DISP:TEXT1:CALC"&VAL$(I)&" ON"
680        OUTPUT @Agt4287a;":CALC:PAR"&VAL$(I)&":FORM "&Para$(I)
690        IF Dev$(I)="OFF" THEN
700          OUTPUT @Agt4287a;":CALC:PAR"&VAL$(I)&":EXPR:STAT OFF"
710        ELSE
720          OUTPUT @Agt4287a;":CALC:PAR"&VAL$(I)&":EXPR:STAT ON"
730          OUTPUT @Agt4287a;":CALC:PAR"&VAL$(I)&":EXPR:NAME "&Dev$(I)
740          OUTPUT @Agt4287a;":CALC:PAR"&VAL$(I)&":EXPR:CENT ";Cent(I)
750        END IF
760      END IF
770    NEXT I
780    !
790    ! Measurement Point(s)
800    !
810    OUTPUT @Agt4287a;":SOUR:LIST:POIN ";Point_no
820    OUTPUT @Agt4287a;":SOUR:LIST:STAT "&List$
830    !
840    ! Test Signal Level Monitor Result Display
850    !
860    OUTPUT @Agt4287a;":DISP:TEXT1:CALC11 "&Imon_disp$
870    OUTPUT @Agt4287a;":DISP:TEXT1:CALC12 "&Vmon_disp$
880    !
890    ! Rdc Measurement
900    !
910    OUTPUT @Agt4287a;":SOUR:LIST:RDC "&Rdc$
920    OUTPUT @Agt4287a;":CALC:COMP:RDC:LIM ";Rdc_l_lim;",";Rdc_u_lim
930    !
940    ! Displayed Parameter in List Measurement Display
950    !
960    FOR I=1 TO 4
970      OUTPUT @Agt4287a;":DISP:TEXT2:LAB"&VAL$(I)&" "&List_lab$(I)
980    NEXT I
990    !
1000   ! Title Display Area
1010   !
1020   OUTPUT @Agt4287a;":DISP:TEXT10 "&Title_disp$
1030   OUTPUT @Agt4287a;":DISP:TEXT10:DATA """&Title$&""""
1040   !
1050   ! Clock (Data/Time) Display
1060   !
1070   IF Clock_disp$="OFF" THEN
1080     OUTPUT @Agt4287a;":DISP:TEXT11 OFF"
1090   ELSE
1100     OUTPUT @Agt4287a;":DISP:TEXT11 ON"
1110     OUTPUT @Agt4287a;":DISP:TEXT11:MODE "&Clock_disp$
1120   END IF
1130   END
```

4 Preparing for Accurate Measurement

This chapter explains how to carry out calibration, compensation, and test fixture selection (port extension compensation).

Performing Calibration

Setting calibration kit values

You can select either the 4287A option 700 (16195B 7-mm calibration kit) or a user-defined calibration kit. To make this selection, use the following command:

- **:CORR1:CKIT** on page 231

If you opt to use a user-defined calibration kit, you need to specify how you define the calibration kit and then enter the definitions.

Choosing the definition method (fixed or point-by-point)

- **:CORR1:CKIT:LIST** on page 232

Entering definitions

To define the OPEN, SHORT, and LOAD standards, use the commands listed in the table below.

	Impedance value	R_{dc} value	Offset delay time
OPEN	**:CORR1:CKIT:STAN1:LIST** on page 235	**:CORR1:CKIT:STAN1:DC** on page 233	**:CORR1:CKIT:STAN1:EDEL** on page 234
SHORT	**:CORR1:CKIT:STAN2:LIST** on page 238	**:CORR1:CKIT:STAN2:DC** on page 236	**:CORR1:CKIT:STAN2:EDEL** on page 237
LOAD	**:CORR1:CKIT:STAN3:LIST** on page 242	**:CORR1:CKIT:STAN3:DC** on page 239	**:CORR1:CKIT:STAN3:EDEL** on page 240

When you define the impedance value for the LOAD standard, you can choose one of the available parameter types by using the following command:

- **:CORR1:CKIT:STAN3:FORM** on page 241

Measuring data for calculating calibration coefficients and turning on calibration function

To measure the data for calculating the calibration coefficients, use the following command:

- **:CORR1:COLL** on page 244

This command obtains the data needed for calculating the calibration coefficients for both impedance and R_{dc} measurements. If you want to obtain the data for either impedance or R_{dc} measurement alone, use one of the following commands instead:

- **:CORR1:COLL:RF** on page 246
- **:CORR1:COLL:DC** on page 245

NOTE Issuing the **:CORR1:COLL**, **:CORR1:COLL:RF**, or **:CORR1:COLL:DC** command does not trigger the instrument to begin data measurement. Therefore, unless the trigger source is Internal trigger, you must trigger the instrument after issuing the command.

After obtaining the data for calculating the calibration coefficients for all of the OPEN, SHORT, and LOAD standards (including the data for both impedance and R_{dc} measurements), issue the following command to calculate the calibration coefficients and turn on the calibration function:

- **:CORR1:COLL:SAVE** on page 246

NOTE

You cannot directly turn on or off the calibration function.

Instead, the calibration function is automatically turned on when you issue the **:CORR1:COLL:SAVE** command after measuring the data required for calculating the calibration coefficients.

Also, the calibration function is automatically turned off when you reset the instrument with the **:SYST:PRES** command on page 306 or the ***RST** command on page 206 or when you configure the measurement point setup table with the **:SOUR:LIST** command on page 294.

To check whether the calibration function is currently on or off, use the following command:

- **:CORR1?** on page 231

To define the standard values with the commands described so far, follow these steps:

If you use the same standards for both impedance and R_{dc} measurements or you omit R_{dc} measurement:

Step 1. Connect the OPEN standard and then issue the **:CORR1:COLL** command, which designates "STAN1" as the parameter. If the trigger source is not Internal trigger, you must trigger the instrument after issuing the command. This applies to steps 2 through 4 as well.

Step 2. Connect the S7HORT standard and then issue the **:CORR1:COLL** command, which designates "STAN2" as the parameter.

Step 3. Connect the LOAD standard and then issue the **:CORR1:COLL** command, which designates "STAN3" as the parameter.

Step 4. To measure a low-loss capacitor, connect the low-loss capacitor and then issue the **:CORR1:COLL** or **:CORR1:COLL:RF** command, which designates "STAN4" as the parameter.

Step 5. Issue the **:CORR1:COLL:SAVE** command.

If you use different standards for impedance and R_{dc} measurements:

Step 1. Connect the OPEN standard for impedance measurement and then issue the **:CORR1:COLL** or **:CORR1:COLL:RF** command, which designates "STAN1" as the parameter. If the trigger source is not Internal trigger, you must trigger the instrument after issuing the command. This applies to steps 2 through 7 as well.

Step 2. Connect the SHORT standard for impedance measurement and then issue the **:CORR1:COLL** or **:CORR1:COLL:RF** command, which designates "STAN2" as the parameter.

Step 3. Connect the LOAD standard for impedance measurement and then issue the **:CORR1:COLL** or **:CORR1:COLL:RF** command, which designates "STAN3" as the parameter.

Step 4. To measure a low-loss capacitor, connect the low-loss capacitor and then issue the **:CORR1:COLL** or **:CORR1:COLL:RF** command, which designates “STAN4” as the parameter.

Step 5. Connect the OPEN standard for R_{dc} measurement and then issue the **:CORR1:COLL:DC** command, which designates “STAN1” as the parameter.

Step 6. Connect the SHORT standard for R_{dc} measurement and then issue the **:CORR1:COLL:DC** command, which designates “STAN2” as the parameter.

Step 7. Connect the LOAD standard for R_{dc} measurement and then issue the **:CORR1:COLL:DC** command, which designates “STAN3” as the parameter.

Step 8. Issue the **:CORR1:COLL:SAVE** command.

Preventing operational errors when measuring data for calculating calibration coefficients

To retrieve each standard’s measurement data for calculating the calibration coefficients for R_{dc} measurement, use the following command:

- **:DATA:RCAD{1-3}?** on page 265

Since this command returns the R_{dc} measurement value for each standard, you can check whether this value is normal (within the limit range) to prevent operational errors (such as connecting the wrong standard) that may arise when measuring the data for calculating the calibration coefficients.

NOTE The measurement data for the standards cannot be used for evaluating slight differences in measured values because it is raw measurement data that has not been calibrated and may differ from the specification value. For example, when the LOAD standard is an inductor, it exhibits an R_{dc} value quite similar to that of the SHORT standard; you should be careful not to inadvertently interchange the LOAD and SHORT standards because they are difficult to distinguish by their measured values.

The following table provides guidelines for determining the limit range (upper and lower limits) for testing:

	Lower limit (LowerLimit)	Upper limit (UpperLimit)
SHORT	None	$UpperLimit = (Short + Load)/2$
LOAD	$LowerLimit = (Short + Load)/2$	$\frac{1}{UpperLimit} = \left(\frac{1}{Load} + \frac{1}{Open}\right)/2$
OPEN	$\frac{1}{LowerLimit} = \left(\frac{1}{Load} + \frac{1}{Open}\right)/2$	None

In the table above, Short represents the R_{dc} value for the SHORT standard, Load represents the R_{dc} value for the LOAD standard, and Open represents the R_{dc} value for the OPEN standard.

For example, when the LOAD standard is a 50 Ω resistor, the limit ranges for the respective standards should typically be the following:

SHORT standard: 25 Ω or lower

LOAD standard: 25 to 100 Ω
OPEN standard: 100 Ω or higher

NOTE

When you validate the R_{dc} measurement results returned by the **:DATA:RCAD{1-3}?** command, you should use the absolute value for the following reasons.

When you measure the SHORT standard, whose resistance is extremely low (nearly zero) and susceptible to disturbance during measurement, the command may return a small negative R_{dc} value. On the other hand, when you measure the OPEN standard, whose conductance is extremely low (nearly zero) and susceptible to disturbance during measurement, the command may return a large negative R_{dc} value (an inverse to a negative small conductance value).

The measurement data of the respective standards used for calculating the calibration coefficients for impedance measurement are stored in the calibration data array (see “Calibration Data Arrays” on page 80). You can retrieve this data with the following command:

- **:DATA:CAD{1-8}?** on page 259

Note that the command shown above returns raw RF measurement data. Unlike DC measurement, you cannot simply compare the raw RF measurement data with the standard values to detect operational errors that may have occurred when measuring the calibration data.

Saving or recalling calibrated state (retrieving or writing calibration coefficients)

You can retrieve the calibration coefficients and save them to a file. Later, you can retrieve the calibration coefficients from the file and load them into the 4287A to restore the calibrated state at the time you saved the file.

The calibration coefficients for impedance measurement are stored in the calibration coefficient array (see “Calibration Coefficient Arrays” on page 80). To read or write the calibration coefficient array, use the following command:

- **:DATA:CCO{1-6}** on page 260

To read or write the calibration coefficients for R_{dc} measurement, use the following command:

- **:DATA:RCCO{1-3}** on page 265

NOTE

When setting calibration coefficients, note the following:

- To ensure that the instrument will provide correct measurement results, you must configure the instrument to use the same measurement points (point setup table settings) as when you obtained measurement data for calibration and then set all the coefficients.
- You must turn on the calibration functions before you set the calibration coefficients. To do so, follow the steps shown in “Measuring data for calculating calibration coefficients and turning on calibration function” on page 38 before setting the calibration coefficients. This procedure includes only measuring tentative data and does not require you to connect the standard before issuing the data measurement command.

Sample program

Example 4-1 shows a sample program that demonstrates how to obtain the measurement data for calculating the calibration coefficients. You can find the source file of this program, named calib.bas, on the sample program disk.

The sample program begins by configuring the measurement point setup table and calibration kit. After measuring the necessary data, it then calculates the calibration coefficients and turns on the calibration function. Finally, it saves the obtained calibration coefficients to a file named CAL_DATA.

The program is described in detail below.

Lines 100 to 110 Sets the GPIB address and select code.

Line 120 Stores the name of the calibration coefficients file (CAL_DATA) into the File$ variable.

Line 130 Resets the instrument.

Line 140 Sets the data transfer format to ASCII.

Lines 180 to 230 Configures the measurement point setup table as follows:

Point number	Measuring frequency	Averaging factor	Signal source level
1	10 MHz	4	0 dBm
2	100 MHz	4	0 dBm
3	1 GHz	4	0 dBm

Line 260 Passes control to a subprogram named Set_cal_kit to configure the calibration kit.

Lines 290 to 320 Passes control to a subprogram named Inp_data, which prompts the user to enter the limit values for each standard. Then the program stores the R_{dc} measurement lower limit for the OPEN standard into the Open_l_lim variable, the R_{dc} measurement upper limit for the SHORT standard into the Short_u_lim variable, and the R_{dc} measurement lower and upper limits for the LOAD standard into the Load_l_lim and Load_u_lim variables, respectively.

Lines 350 to 420 Passes control to a subprogram named FNCal, which measures the data for OPEN, SHORT, and LOAD standard.

Lines 440 to 450 Prompts the user to confirm whether to measure a low-loss capacitor and waits until the user presses the y or n key.

Lines 460 to 490 If the user presses the y key in response to line 450, the program passes control to the FNCal subprogram to obtain the measurement data for the low-loss capacitor.

Lines 420 to 440 Calculates the calibration coefficients and turns on the calibration function.

Lines 570 to 610 Retrieves the number of measurement points and resizes the arrays Cal_coef_a1, Cal_coef_a2, Cal_coef_b1, Cal_coef_b2, Cal_coef_c1, and Cal_coef_c2 accordingly.

Lines 630 to 740	Retrieves the calibration coefficients for impedance measurement, A1, B1, C1, A2, B2, and C2, and then stores them into the arrays Cal_coef_a1, Cal_coef_b1, Cal_coef_c1, Cal_coef_a2, Cal_coef_b2, and Cal_coef_c2, respectively.
Lines 760 to 810	Retrieves the calibration coefficients for R_{dc} measurement, A, B, and C, and then stores them into the Cal_coef_dc array, retaining the original order.
Lines 860 to 880	If File$ matches the name of an existing file, deletes the file.
Lines 890 to 920	Creates a new file using the file name identified by the File$ variable and saves the data from the arrays Cal_coef_a1, Cal_coef_b1, Cal_coef_c1, Cal_coef_a2, Cal_coef_b2, Cal_coef_c2, and Cal_coef_dc to the new file.
Lines 940 to 970	Terminates program after displaying a closing message along with the name of the file that contains the calibration coefficients.

The FNCal subprogram in lines 1010 to 1680, which measures the data for calculating the calibration coefficients, is described below.

Lines 1050 to 1060	Retrieves the current trigger source setting and stores the setting into the Trig_sour$ variable.
Lines 1070 to 1090	After measurement is stopped (the trigger system is stopped), the program sets the trigger source to GPIB/LAN trigger and turns on the continuous activation of the trigger system.
Lines 1100 to 1130	Configures the instrument to generate an SRQ upon completion of measurement.
Lines 1150 to 1160	Prompts the user to set up the connection for measuring the standard identified by Standard$ and waits until the user presses the y key followed by the return key.
Lines 1180 to 1200	Clears the status byte register and operation status event register.
Lines 1210 to 1220	Sets the branch target for an SRQ interrupt to enable SRQ interrupts.
Lines 1230 to 1320	Sends the commands to measure the standard identified by Standard$.
Lines 1330 to 1350	Triggers the instrument and waits until the measurement cycle finishes.
Line 1370	Sets the Err_flag variable to 0.
Lines 1380 to 1540	When the standard is OPEN, SHORT, or LOAD, the subprogram checks whether the R_{dc} value falls within the limit range. If the limit range is exceeded, it sets the Err_flag variable to 1.
Line 1560	If Err_flag is 0, which means that the R_{dc} value is within the limit range, the subprogram notifies the user of successful measurement.
Lines 1580 to 1590	If Err_flag is 1, which means that the R_{dc} value is not within the limit range, the subprogram notifies the user of failed measurement and returns to the line where it starts measuring the standard.
Lines 1610 to 1620	Finally, the subprogram returns 0 after restoring the original trigger source by changing the trigger source to Trig_sour$.
Lines 1640 to 1660	If the key the user pressed in line 1160 is not the y key, this statement block is executed and the subprogram returns -1.

The Set_cal_kit subprogram in lines 1720 to 2750, which configures the calibration kit, is described below.

Line 1790	Allows the user to return to the entry start line and re-enter the data if an error (such as an invalid entry) occurs while entering the number that identifies the calibration kit.
Lines 1810 to 1840	Displays the list of supported calibration kits and prompts the user to choose one of the items by typing in the appropriate number.
Line 1850	Converts the entered value into an integer and stores it into the Kit variable.
Line 1860	If Kit is neither 1 nor 2, the program returns to the entry start line.
Line 1900	If Kit is 1, the program configures the instrument to use the 7 mm calibration kit.
Line 1920	If Kit is 2, the program configures the instrument to use a user-defined calibration kit. The description below assumes that Kit is 2.
Lines 1940 to 2020	Displays the list of modes for defining the calibration kit and prompts the user to choose one of the items by typing in the appropriate number. Then the program converts the entered value into an integer and stores it into the Def variable.
Lines 2050 to 2060	If Def is 1, the program configures the instrument so that the user can define the calibration kit in fixed mode and stores "1" into the Nop variable, which indicates the number of measurement points that require definitions.
Lines 2080 to 2100	If Def is 2, the program configures the instrument so that the user can define the calibration kit in point-by-point mode, and then retrieves the number of points and stores the number into the Nop variable.
Lines 2130 to 2220	Displays the list of parameter types that can be used to define the LOAD standard and prompts the user to choose one of the items by typing in the appropriate number. Then the program converts the entered value into an integer and stores it into the Load_para variable.
Lines 2230 to 2360	Sets the parameter type for defining the LOAD standard based on Load_para and stores the parameter names into the Para1$ andPara2$ variables.
Lines 2380 to 2510	Iterates the following steps Nop times. 1. Lines 2390 to 2410: If Nop is 2 or greater, the program displays each measurement point that requires a definition. 2. Lines 2420 to 2470: Passes control to the Inp_data subprogram to acquire the OPEN, SHORT, or LOAD standard values from user input. 3. Lines 2480 to 2500: Configures each standard with the entered values.
Lines 2530 to 2540	Prompts the user to confirm whether to define the standards for R_{dc} measurement and waits until the user presses the y or n key.
Lines 2550 to 2620	If the user presses the y key in response to line 2540, the program acquires the definitions for R_{dc} measurement from user input and configures the standards accordingly.

Lines 2640 to 2650 Prompts the user to confirm whether to define the delay time and waits until the user presses the y or n key.

Lines 2660 to 2730 If the user presses the y key in response to line 2650, the program acquires the delay time from user input and configures the standards accordingly.

The Inp_data subprogram in lines 2790 to 2900, which lets the user enter the necessary data, is described below.

Line 2810 Returns to the start line of input if an error occurs due to an invalid entry or similar reason. This allows the user to make an entry again.

Lines 2830 to 2840 Prompts the user to enter a data value specified by Mes$ and waits until the user actually enters the value.

Lines 2860 to 2870 Displays the value entered and waits until the user confirms the entry by pressing the y or n key.

Line 2880 Returns to the entry start line if the key the user pressed in line 2870 is not the y key.

Example 4-1 **Calibration (calib.bas)**

```
10      DIM Buff$[9],File$[20],Inp_char$[9]
20      DIM Cal_coef_a1(1:32,1:2),Cal_coef_a2(1:32,1:2)
30      DIM Cal_coef_b1(1:32,1:2),Cal_coef_b2(1:32,1:2)
40      DIM Cal_coef_c1(1:32,1:2),Cal_coef_c2(1:32,1:2)
50      DIM Cal_coef_dc(1:3)
60      REAL Open_l_lim,Short_u_lim,Load_l_lim,Load_u_lim
70      INTEGER Scode,Nop,Result
80      !
90      CLEAR SCREEN
100     ASSIGN @Agt4287a TO 717
110     Scode=7
120     File$="CAL_DATA"
130     OUTPUT @Agt4287a;":SYST:PRES"
140     OUTPUT @Agt4287a;":FORM ASC"
150     !----------------------------------------
160     ! Measurement Point Setup Table Setting
170     !----------------------------------------
180     OUTPUT @Agt4287a;":SOUR:LIST:TABL 1"
190     OUTPUT @Agt4287a;":SOUR:UNIT DBM"
200     OUTPUT @Agt4287a;":SOUR:LIST 3,";
210     OUTPUT @Agt4287a;"10E6,4,0,";
220     OUTPUT @Agt4287a;"100E6,4,0,";
230     OUTPUT @Agt4287a;"1E9,4,0"
240     !
250     PRINT "## Calibration Kit Setting ##"
260     CALL Set_cal_kit(@Agt4287a)
270     !
280     PRINT "## Rdc Limit Setting ##"
290     CALL Inp_data("Open Lower Limit",Open_l_lim)
300     CALL Inp_data("Short Upper Limit",Short_u_lim)
310     CALL Inp_data("Load Lower Limit",Load_l_lim)
320     CALL Inp_data("Load Upper Limit",Load_u_lim)
330     !
340     PRINT "## Measurement ##"
350     Result=FNCal(@Agt4287a,Scode,"Open",Open_l_lim,1.E+9)
360     IF Result<>0 THEN Prog_end
370     !
380     Result=FNCal(@Agt4287a,Scode,"Short",-1.E+9,Short_u_lim)
390     IF Result<>0 THEN Prog_end
400     !
410     Result=FNCal(@Agt4287a,Scode,"Load",Load_l_lim,Load_u_lim)
420     IF Result<>0 THEN Prog_end
430     !
440     PRINT "Do you want to measure Low Loss Capacitor"
450     INPUT "[Y]es/[N]o",Inp_char$
460     IF UPC$(Inp_char$)="Y" OR UPC$(Inp_char$)="YES" THEN
470       Result=FNCal(@Agt4287a,Scode,"Low Loss C",-1.E+9,1.E+9)
480       IF Result<>0 THEN Prog_end
490     END IF
500     !
510     OUTPUT @Agt4287a;":CORR1:COLL:SAVE"
520     OUTPUT @Agt4287a;"*OPC?"
530     ENTER @Agt4287a;Buff$
540     !----------------------------------------
550     ! Calibration Coefficient Array Reading
560     !----------------------------------------
570     OUTPUT @Agt4287a;":SOUR:LIST:SIZE?"
580     ENTER @Agt4287a;Nop
590     REDIM Cal_coef_a1(1:Nop,1:2),Cal_coef_a2(1:Nop,1:2)
600     REDIM Cal_coef_b1(1:Nop,1:2),Cal_coef_b2(1:Nop,1:2)
610     REDIM Cal_coef_c1(1:Nop,1:2),Cal_coef_c2(1:Nop,1:2)
```

```
620    !
630    OUTPUT @Agt4287a;":DATA:CCO1?"
640    ENTER @Agt4287a;Cal_coef_a1(*)
650    OUTPUT @Agt4287a;":DATA:CCO2?"
660    ENTER @Agt4287a;Cal_coef_b1(*)
670    OUTPUT @Agt4287a;":DATA:CCO3?"
680    ENTER @Agt4287a;Cal_coef_c1(*)
690    OUTPUT @Agt4287a;":DATA:CCO4?"
700    ENTER @Agt4287a;Cal_coef_a2(*)
710    OUTPUT @Agt4287a;":DATA:CCO5?"
720    ENTER @Agt4287a;Cal_coef_b2(*)
730    OUTPUT @Agt4287a;":DATA:CCO6?"
740    ENTER @Agt4287a;Cal_coef_c2(*)
750    !
760    OUTPUT @Agt4287a;":DATA:RCCO1?"
770    ENTER @Agt4287a;Cal_coef_dc(1)
780    OUTPUT @Agt4287a;":DATA:RCCO2?"
790    ENTER @Agt4287a;Cal_coef_dc(2)
800    OUTPUT @Agt4287a;":DATA:RCCO3?"
810    ENTER @Agt4287a;Cal_coef_dc(3)
820    !---------------------------------------
830    ! Calibration Coefficient Saving
840    !---------------------------------------
850    Data_size=(Nop*2*6+3)*8
860    ON ERROR GOTO Skip_purge
870    PURGE File$
880 Skip_purge: OFF ERROR
890    CREATE File$,Data_size
900    ASSIGN @File TO File$;FORMAT OFF
910    OUTPUT @File;Cal_coef_a1(*),Cal_coef_b1(*),Cal_coef_c1(*),
Cal_coef_a2(*),Cal_coef_b2(*),Cal_coef_c2(*),Cal_coef_dc(*)
920    ASSIGN @File TO *
930    !
940    PRINT "## Done ##"
950    PRINT "Save file name: "&File$
960    !
970 Prog_end: END
980    !=============================================
990    ! Calibration Data Measurement Function
1000   !=============================================
1010 DEF FNCal(@Agt4287a,INTEGER Scode,Standard$,REAL L_lim,REAL U_lim)
1020   DIM Inp_char$[9],Trig_sour$[9],Buff$[9]
1030   REAL Meas_data
1040   INTEGER Err_flag
1050   OUTPUT @Agt4287a;":TRIG:SOUR?"
1060   ENTER @Agt4287a;Trig_sour$
1070   OUTPUT @Agt4287a;":ABOR"
1080   OUTPUT @Agt4287a;":TRIG:SOUR BUS"
1090   OUTPUT @Agt4287a;":INIT:CONT ON"
1100   OUTPUT @Agt4287a;":STAT:OPER:PTR 0"
1110   OUTPUT @Agt4287a;":STAT:OPER:NTR 16"
1120   OUTPUT @Agt4287a;":STAT:OPER:ENAB 16"
1130   OUTPUT @Agt4287a;"*SRE 128"
1140 Cal_meas:!
1150   PRINT "Set "&Standard$&"-Connection."
1160   INPUT "OK? [Y/N]",Inp_char$
1170   IF UPC$(Inp_char$)="Y" THEN
1180     OUTPUT @Agt4287a;"*CLS"
1190     OUTPUT @Agt4287a;"*OPC?"
1200     ENTER @Agt4287a;Buff$
1210     ON INTR Scode GOTO Meas_end
1220     ENABLE INTR Scode;2
1230     SELECT Standard$
1240       CASE "Open"
```

```
1250          OUTPUT @Agt4287a;":CORR1:COLL STAN1"
1260        CASE "Short"
1270          OUTPUT @Agt4287a;":CORR1:COLL STAN2"
1280        CASE "Load"
1290          OUTPUT @Agt4287a;":CORR1:COLL STAN3"
1300        CASE "Low Loss C"
1310          OUTPUT @Agt4287a;":CORR1:COLL STAN4"
1320      END SELECT
1330      OUTPUT @Agt4287a;":TRIG"
1340      PRINT "Now measuring..."
1350 Meas_wait:  GOTO Meas_wait
1360 Meas_end: OFF INTR Scode
1370      Err_flag=0
1380      SELECT Standard$
1390        CASE "Open"
1400          OUTPUT @Agt4287a;":DATA:RCAD1?"
1410          ENTER @Agt4287a;Rdc
1420          PRINT "Rdc =";ABS(Rdc)
1430          IF ABS(Rdc)<L_lim THEN Err_flag=1
1440        CASE "Short"
1450          OUTPUT @Agt4287a;":DATA:RCAD2?"
1460          ENTER @Agt4287a;Rdc
1470          PRINT "Rdc =";ABS(Rdc)
1480          IF ABS(Rdc)>U_lim THEN Err_flag=1
1490        CASE "Load"
1500          OUTPUT @Agt4287a;":DATA:RCAD3?"
1510          ENTER @Agt4287a;Rdc
1520          PRINT "Rdc =";ABS(Rdc)
1530          IF ABS(Rdc)<L_lim OR ABS(Rdc)>U_lim THEN Err_flag=1
1540      END SELECT
1550      IF Err_flag=0 THEN
1560        PRINT Standard$&" Data Measurement Complete"
1570      ELSE
1580        PRINT "ERROR!!"
1590        GOTO Cal_meas
1600      END IF
1610      OUTPUT @Agt4287a;":TRIG:SOUR "&Trig_sour$
1620      RETURN 0
1630    ELSE
1640      OUTPUT @Agt4287a;":TRIG:SOUR "&Trig_sour$
1650      PRINT "Program Interruption"
1660      RETURN -1
1670    END IF
1680 FNEND
1690    !============================================
1700    ! Calibration Kit Setup Function
1710    !============================================
1720 SUB Set_cal_kit(@Agt4287a)
1730    DIM Inp_char$[9],Para1$[9],Para2$[9]
1740    INTEGER Def,Nop,Load_para,Point
1750    REAL Open1,Open2,Open_dc,Open_del
1760    REAL Shor1,Shor2,Shor_dc,Shor_del
1770    REAL Load1,Load2,Load_dc,Load_del
1780    !
1790    ON ERROR GOTO Kit_select
1800 Kit_select:  !
1810    PRINT "Select Calibration Kit"
1820    PRINT " 1: 7 mm Standard"
1830    PRINT " 2: User Defined"
1840    INPUT "Input 1 or 2",Inp_char$
1850    Kit=IVAL(Inp_char$,10)
1860    IF Kit<1 OR Kit>2 THEN Kit_select
1870    OFF ERROR
1880    !
```

```
1890   IF Kit=1 THEN
1900     OUTPUT @Agt4287a;":CORR1:CKIT DEF"
1910   ELSE
1920     OUTPUT @Agt4287a;":CORR1:CKIT USER"
1930     !
1940     ON ERROR GOTO Def_select
1950 Def_select:!
1960     PRINT "Select Definition Type"
1970     PRINT " 1: Fixed"
1980     PRINT " 2: Not Fixed"
1990     INPUT "Input 1 or 2",Inp_char$
2000     Def=IVAL(Inp_char$,10)
2010     IF Def<1 OR Def>2 THEN Def_select
2020     OFF ERROR
2030     SELECT Def
2040       CASE 1
2050         OUTPUT @Agt4287a;":CORR1:CKIT:LIST OFF"
2060         Nop=1
2070       CASE 2
2080         OUTPUT @Agt4287a;":CORR1:CKIT:LIST ON"
2090         OUTPUT @Agt4287a;":SOUR:LIST:SIZE?"
2100         ENTER @Agt4287a;Nop
2110     END SELECT
2120     !
2130     ON ERROR GOTO Load_select
2140 Load_select:!
2150     PRINT "Select Load Definition Parameters"
2160     PRINT " 1: Rs and Ls"
2170     PRINT " 2: Ls and Q"
2180     PRINT " 3: Cp and D"
2190     INPUT "Input 1 to 3",Inp_char$
2200     Load_para=IVAL(Inp_char$,10)
2210     IF Load_para<1 OR Load_para>3 THEN Load_select
2220     OFF ERROR
2230     SELECT Load_para
2240       CASE 1
2250         OUTPUT @Agt4287a;":CORR1:CKIT:STAN3:FORM RL"
2260         Para1$="Rs"
2270         Para2$="Ls"
2280       CASE 2
2290         OUTPUT @Agt4287a;":CORR1:CKIT:STAN3:FORM LQF"
2300         Para1$="Ls"
2310         Para2$="Q"
2320       CASE 3
2330         OUTPUT @Agt4287a;":CORR1:CKIT:STAN3:FORM CDF"
2340         Para1$="Cp"
2350         Para2$="D"
2360     END SELECT
2370     !
2380     FOR Point=1 TO Nop
2390       IF Nop>1 THEN
2400         PRINT "[Point No."&VAL$(Point)&"]"
2410       END IF
2420       CALL Inp_data("Open(G) Value",Open1)
2430       CALL Inp_data("Open(Cp) Value",Open2)
2440       CALL Inp_data("Short(Rs) Value",Shor1)
2450       CALL Inp_data("Short(Ls) Value",Shor2)
2460       CALL Inp_data("Load("&Para1$&") Value",Load1)
2470       CALL Inp_data("Load("&Para2$&") Value",Load2)
2480      OUTPUT @Agt4287a;":CORR1:CKIT:STAN1:LIST ";Point;",";Open1;","
;Open2
2490      OUTPUT @Agt4287a;":CORR1:CKIT:STAN2:LIST ";Point;",";Shor1;","
;Shor2
2500      OUTPUT @Agt4287a;":CORR1:CKIT:STAN3:LIST ";Point;",";Load1;","
```

```
;Load2
2510      NEXT Point
2520      !
2530      PRINT "Do you want to define standard values for Rdc measurement?"
2540      INPUT "[Y]es/[N]o",Inp_char$
2550      IF UPC$(Inp_char$)="Y" OR UPC$(Inp_char$)="YES" THEN
2560        CALL Inp_data("Open(G) Value for Rdc Measurement",Open_dc)
2570        CALL Inp_data("Short(R) Value for Rdc Measurement",Shor_dc)
2580        CALL Inp_data("Load(R) Value for Rdc Measurement",Load_dc)
2590        OUTPUT @Agt4287a;":CORR1:CKIT:STAN1:DC ";Open_dc
2600        OUTPUT @Agt4287a;":CORR1:CKIT:STAN2:DC ";Shor_dc
2610        OUTPUT @Agt4287a;":CORR1:CKIT:STAN3:DC ";Load_dc
2620      END IF
2630      !
2640      PRINT "Do you want to define standard delay values?"
2650      INPUT "[Y]es/[N]o",Inp_char$
2660      IF UPC$(Inp_char$)="Y" OR UPC$(Inp_char$)="YES" THEN
2670        CALL Inp_data("Open Delay Time",Open_del)
2680        CALL Inp_data("Short Delay Time",Shor_del)
2690        CALL Inp_data("Load Delay Time",Load_del)
2700        OUTPUT @Agt4287a;":CORR1:CKIT:STAN1:EDEL ";Open_del
2710        OUTPUT @Agt4287a;":CORR1:CKIT:STAN2:EDEL ";Shor_del
2720        OUTPUT @Agt4287a;":CORR1:CKIT:STAN3:EDEL ";Load_del
2730      END IF
2740    END IF
2750  SUBEND
2760    !=============================================
2770    ! Data Input Function
2780    !=============================================
2790  SUB Inp_data(Mes$,Inp_val)
2800    DIM Inp_char$[30]
2810    ON ERROR GOTO Inp_start
2820  Inp_start:!
2830    PRINT "Input "&Mes$
2840    INPUT "Value?",Inp_char$
2850    Inp_val=VAL(UPC$(Inp_char$))
2860    PRINT "Input Value: ";Inp_val
2870    INPUT "OK? [Y/N]",Inp_char$
2880    IF UPC$(Inp_char$)<>"Y" THEN Inp_start
2890    OFF ERROR
2900  SUBEND
```

Selecting a Test Fixture (Port Extension Compensation)

Using port extension compensation function

To compensate for the delay due to the test fixture that holds the DUT (port extension compensation), you must tell the instrument which test fixture is used in your measurement. This can be done by selecting data for electrical length compensation, which is predefined and specific to each test fixture. To specify the test fixture, use the following command:

- **:CORR2:FIXT** on page 256

NOTE Before running the compensation process, you must specify the fixture or, if using a custom fixture, set the compensation values for the fixture.

Configuring the instrument to use your custom test fixture

When you use a custom test fixture, you must set the compensation value for the delay due to the fixture's electrical length. In addtion, you can optionally specify the fixture’s name.

To set the compensation value for the delay due to the fixture's electrical length, use the following command:

- **:CORR2:FIXT:EDEL:DIST** on page 257

If you opt to specify the fixture’s name so that it will be shown on the selection screen when selecting the test fixture, use the following command:

- **:CORR2:FIXT:LAB** on page 258

Running the Compensation Process

NOTE

You must turn on the calibration function before using it. In other words, when the calibration function is off, you cannot perform any of the compensation related operations, including measuring the data for calculating the compensation coefficients, calculating the compensation coefficients, turning on or off the compensation function, and retrieving or setting the compensation coefficients. However, you can configure the compensation kit even when the calibration function is off.

Setting compensation kit values

You can either use the 4287A's predefined compensation kit values or directly enter other compensation kit values. To choose how the compensation kit values are defined, use the following command:

- **:CORR2:CKIT** on page 247

If you opt to enter the values, you need to specify how the compensation kit itself is defined and then enter the definitions.

Choosing definition method (Fixed or Point-by-Point)

- **:CORR2:CKIT:LIST** on page 247

Entering definitions

To define the OPEN and SHORT standards, use the commands listed in the following table:

	Impedance value	R_{dc} value
OPEN	**:CORR2:CKIT:STAN1:LIST** on page 249	**:CORR2:CKIT:STAN1:DC** on page 248
SHORT	**:CORR2:CKIT:STAN2:LIST** on page 251	**:CORR2:CKIT:STAN2:DC** on page 250

Measuring data for calculating compensation coefficients

To measure the data for calculating the compensation coefficients, use the following command:

- **:CORR2:COLL** on page 252

The command shown above returns the data for calculating the compensation coefficients for both impedance and R_{dc} measurements. If you want to obtain the data for either impedance or R_{dc} measurement alone, use one of the following commands instead:

- **:CORR2:COLL:RF** on page 254
- **:CORR2:COLL:DC** on page 253

NOTE

Issuing the **:CORR2:COLL**, **:CORR2:COLL:RF**, or **:CORR2:COLL:DC** command does not trigger the instrument to begin measuring the data. This means that if the trigger source is not Internal trigger, you must trigger the instrument after issuing the command.

To define the OPEN and SHORT compensation standards using the commands described so far, follow these steps:

If you use the same standards for both impedance and R_{dc} measurements or you omit R_{dc} measurement:

Step 1. Connect the OPEN standard and then issue the **:CORR2:COLL** command, which designates "STAN1" as the parameter. If the trigger source is not Internal trigger, you must trigger the instrument after issuing the command. This applies to step 2 as well.

Step 2. Connect the SHORT standard and then issue the **:CORR2:COLL** command, which designates "STAN2" as the parameter.

Step 3. Issue the **:CORR2:COLL:SAVE** command.

If you use different standards for impedance and R_{dc} measurements:

Step 1. Connect the OPEN standard for impedance measurement and then issue the **:CORR2:COLL** or **:CORR2:COLL:RF** command, which designates "STAN1" as the parameter. If the trigger source is not Internal trigger, you must trigger the instrument after issuing the command. This applies to steps 2 through 4 as well.

Step 2. Connect the SHORT standard for impedance measurement and then issue the **:CORR2:COLL** or **:CORR2:COLL:RF** command, which designates "STAN2" as the parameter.

Step 3. Connect the OPEN standard for R_{dc} measurement and then issue the **:CORR2:COLL:DC** command, which designates "STAN1" as the parameter.

Step 4. Connect the SHORT standard for R_{dc} measurement and then issue the **:CORR2:COLL:DC** command, which designates "STAN2" as the parameter.

Step 5. Issue the **:CORR2:COLL:SAVE** command.

Calculating compensation coefficients and turning on/off compensation function

After measuring the data for calculating the compensation coefficients, issue the following commands to calculate the compensation coefficients and turn on the compensation function:

Measured data	GPIB command	Status of compensation function after calculation	
		OPEN	SHORT
OPEN and SHORT	**:CORR2:COLL:SAVE** on page 255	On	On
	:CORR2:COLL:OPEN on page 254*1	On	Unchanged
	:CORR2:COLL:SHOR on page 255*1	Unchanged	On
OPEN only	**:CORR2:COLL:SAVE** on page 255	On	Off
	:CORR2:COLL:OPEN on page 254*1	On	Off
	:CORR2:COLL:SHOR on page 255	Not supported	
SHORT only	**:CORR2:COLL:SAVE** on page 255	Off	On
	:CORR2:COLL:OPEN on page 254	Not supported	
	:CORR2:COLL:SHOR on page 255*1	Off	On

*1. Issue the command, which designates “ON” (or “1”) as the parameter.

When the OPEN compensation function is currently on, you can issue the **:CORR2:COLL:OPEN** command by specifying “OFF” (or “0”) as the parameter to turn off the OPEN compensation function.

Similarly, when the SHORT compensation function is currently on, you can issue the **:CORR2:COLL:SHOR** command by specifying “OFF” (or “0”) as the parameter to turn off the SHORT compensation function.

Preventing operational errors when measuring data for calculating compensation coefficients

To retrieve each standard’s measurement data for calculating the compensation coefficients for R_{dc} measurement, use the following command:

- **:DATA:RCMD{1-2}?** on page 266

Since this command returns the R_{dc} measurement value (without compensation) for each of the OPEN and SHORT standards, you can check whether this value is normal to prevent operational errors (such as connecting the wrong standard) that may arise when measuring the data.

NOTE When you validate the R_{dc} measurement results returned by the command **:DATA:RCMD{1-2}?** on page 266, you should use the absolute value for the same reasons as shown in “Preventing operational errors when measuring data for calculating calibration coefficients” on page 40.

The measurement data of the OPEN and SHORT standards used for calculating the compensation coefficients for impedance measurement are stored in the calibration data array (see “Compensation Data Arrays” on page 81). You can retrieve this data with the following command:

- **:DATA:CMD{1-2}?** on page 261

This command returns RF measurement data without compensation, which require more complex handling than R_{dc} values.To detect operational errors that may have occurred while measuring the compensation data, it is best to use R_{dc} values instead.

Saving or recalling compensated state (retrieving or writing compensation coefficients)

You can retrieve the compensation coefficients and save them to a file. Later, you can retrieve the compensation coefficients from the file and load them into the 4287A to restore the compensated state at the time you saved the file.

The compensation coefficients for impedance measurement are stored in the compensation coefficient array (see “Compensation Coefficient Arrays” on page 81). To read or write the compensation coefficient array, use the following command:

- **:DATA:CMP{1-3}** on page 262

To read or write the compensation coefficients for R_{dc} measurement, use the following command:

- **:DATA:RCMP{1-3}** on page 266

NOTE When setting compensation coefficients, note these precautions:

- To ensure that the instrument will provide correct measurement results, you must configure the instrument to use the same measurement points (point setup table settings) as when you obtained measurement data for compensation and turn on the calibration function before you set the coefficients.
- You must turn on the compensation function before setting the compensation coefficients. To do so, follow the steps shown in “Measuring data for calculating compensation coefficients” on page 52. This procedure includes only measuring tentative data, and does not require you to connect the standard before issuing the data measurement command.

Sample program

Example 4-2 shows a sample program that demonstrates how to obtain the measurement data for calculating the compensation coefficients. You can find the source file of this program, named compen.bas, on the sample program disk.

The sample program begins by configuring the measurement point setup table, retrieving the calibration coefficients determined in Example 4-1 from the file, and configuring the instrument accordingly. It lets the user select a test fixture and configure the compensation kit. Finally, it measures the data for calculating the compensation coefficients.

The program is described in detail below.

Lines 100 to 110 Sets the GPIB address and select code.

Line 120 Stores the name of the calibration coefficients file (CAL_DATA) into the File$ variable.

Lines 130 to 140 Stores the R_{dc} measurement lower limit for the OPEN standard (100 Ω) into the Open_l_lim variable and the R_{dc} measurement upper limit for the SHORT standard (25Ω) into the Short_u_lim variable.

Line 150 Resets the instrument.

Line 160 Sets the data transfer format to ASCII.

Lines 200 to 250 Configures the measurement point setup table as shown below (with the same settings as Example 4-1).

Point number	Measuring frequency	Averaging factor	Signal source level
1	10 MHz	4	0 dBm
2	100 MHz	4	0 dBm
3	1 GHz	4	0 dBm

Lines 290 to 500 Turns on the calibration function by issuing two commands in sequence to obtain the calibration data and then calculate the calibration coefficients. The calibration coefficients acquired here will be used to overwrite those retrieved from the file (lines 680 to 770) but will not be used for measurement.

Lines540to580 Retrieves the number of measurement points and resizes the arrays Cal_coef_a1, Cal_coef_a2, Cal_coef_b1, Cal_coef_b2, Cal_coef_c1, and Cal_coef_c2 accordingly.

Line 620 Points to the statement block to be executed if an error occurs in retrieving the calibration coefficients from the file (for example, if no file matches File$).

Lines 630 to 650 Retrieves the calibration coefficients for impedance measurement, A1, B1, C1, A2, B2, and C2, as well as those for R_{dc} measurement, and then stores them into the arrays Cal_coef_a1, Cal_coef_b1, Cal_coef_c1, Cal_coef_a2, Cal_coef_b2, Cal_coef_c2, and Cal_coef_dc, respectively.

Lines 680 to 770 Sets the calibration coefficients.

Line 820 Passes control to a subprogram named Set_fixture, which configures

	the test fixture.
Line 850	Passes control to a subprogram named Set_comp_kit to configure the compensation kit.
Lines 880 to 920	Passes control to a subprogram named FNCompen, which measures the OPEN and SHORT data.
Lines 940 to 960	Calculates the compensation coefficients and turns on the compensation function.
Line 980	Displays a closing message.
Lines 1020 to 1050	This statement block is executed if an error occurs in retrieving the calibration coefficients from the file.

The FNCompen subprogram in lines 1110 to 1690, which measures the data for calculating the compensation coefficients, is described below.

Lines 1150 to 1160	Retrieves the current trigger source setting, and stores the setting into the Trig_sour$ variable.
Lines 1170 to 1190	After measurement is stopped (the trigger system is stopped), sets the trigger source to GPIB/LAN trigger and turns on the continuous activation of the trigger system.
Lines 1200 to 1230	Configures the instrument to generate an SRQ upon completion of measurement.
Lines 1250 to 1260	Prompts the user to set up the connection for measuring the standard identified by Standard$ and waits until the user presses the y key followed by the return key.
Lines 1280 to 1300	Clears the status byte register and operation status event register.
Lines 1310 to 1320	Sets the branch target for an SRQ interrupt to enable SRQ interrupts.
Lines 1330 to 1380	Sends the commands that measure the standard identified by Standard$.
Lines 1390 to 1410	Triggers the instrument, and waits until the measurement cycle finishes.
Line 1430	Sets the Err_flag variable to 0.
Lines 1440 to 1550	Checks whether the R_{dc} value falls within the limit range. If the limit range is exceeded, it sets the Err_flag variable to 1 again.
Line 1570	If Err_flag is 0, which means that the R_{dc} value is within the limit range, the subprogram notifies the user of successful measurement.
Lines 1590 to 1600	If Err_flag is 1, which means that the R_{dc} value is not within the limit range, the subprogram notifies the user of failed measurement and returns to the line where it starts measuring the standard.
Lines 1620 to 1630	Finally, The subprogram returns 0 after restoring the original trigger source by changing the trigger source to Trig_sour$.
Lines 1650 to 1670	If the key the user pressed in line 1260 is not the y key, this statement block is executed and the subprogram returns -1.

The Set_comp_kit subprogram in lines 1730 to 2350, which configures the compensation kit, is described below.

Line 1790 — Allows the user to return to the entry start line and re-enter the data if an error (such as an invalid entry) occurs while entering the number that identifies the calibration kit definitions (4287A's predefined values or custom settings).

Lines 1810 to 1840 — Displays the list of compensation kit definitions and prompts the user to choose one of the items by typing in the appropriate number.

Line 1850 — Converts the entered value into an integer and stores it into the Kit variable.

Line 1860 — If Kit is neither 1 nor 2, the program returns to the entry start line.

Line 1900 — If Kit is 1, the subprogram configures the 4287A to use its built-in definition for the compensation kit values.

Line 1920 — If Kit is 2, the subprogram configures the instrument to use a user-defined compensation kit. The description below assumes that Kit is 2.

Lines 1940 to 2020 — Displays the list of modes for defining the compensation kit and prompts the user to choose one of the items by typing in the appropriate number. Then the program converts the entered value into an integer and stores it into the Def variable.

Lines 2050 to 2060 — If Def is 1, the program configures the instrument so that the user can define the compensation kit in fixed mode and stores “1” into the Nop variable, which indicates the number of measurement points that require definitions.

Lines 2080 to 2100 — If Def is 2, the program configures the instrument so that the user can define the compensation kit in point-by-point mode and then retrieves the number of points and stores the number into the Nop variable.

Lines 2130 to 2230 — Iterates the following steps Nop times.

1. Lines 2140 to 2160: If Nop is 2 or greater, the program displays each measurement point that requires definition.
2. Lines 2170 to 2200: Passes control to the Inp_data subprogram to acquire the OPEN and standard values from user input.
3. Lines 2210 to 2220: Configures each standard with the entered values.

Lines 2250 to 2260 — Prompts the user to confirm whether to define the standards for R_{dc} measurement and waits until the user presses the y or n key.

Lines 2270 to 2320 — If the user presses the y key in response to line 2260, the program acquires the definitions for R_{dc} measurement from the user input and configures the standards accordingly.

The Set_fixture subprogram in lines 2390 to 2820, which configures the test fixture, is described below.

Line 2440	Allows the user to return to the entry start line and re-enter the data if an error (such as an invalid entry) occurs while entering the number that identifies the test fixture.
Lines 2460 to 2560	Displays the list of supported test fixtures and prompts the user to choose one of the items by typing in the appropriate number.
Line 2570	Converts the entered value into an integer and stores it into the Fixture variable.
Line 2580	If Fixture is not an integer between 1 and 9, the program returns to the entry start line.
Lines 2600 to 2810	Configures the test fixture based on Fixture. If Fixture is 9, which means that the user opted to use a user-defined fixture, the subprogram acquires the delay compensation value (electrical length) from the user input and configures the test fixture accordingly.

For more information on the Inp_data subprogram (lines 2860 to 2970), refer to the description in Example 4-1 on page 46.

Example 4-2 **Compensation (compen.bas)**

```
10     DIM Buff$[9],File$[20],Inp_char$[9]
20     DIM Cal_coef_a1(1:32,1:2),Cal_coef_a2(1:32,1:2)
30     DIM Cal_coef_b1(1:32,1:2),Cal_coef_b2(1:32,1:2)
40     DIM Cal_coef_c1(1:32,1:2),Cal_coef_c2(1:32,1:2)
50     DIM Cal_coef_dc(1:3)
60     REAL Open_l_lim,Short_u_lim
70     INTEGER Scode,Nop,Result,I
80     !
90     CLEAR SCREEN
100    ASSIGN @Agt4287a TO 717
110    Scode=7
120    File$="CAL_DATA"
130    Open_l_lim=100
140    Short_u_lim=25
150    OUTPUT @Agt4287a;":SYST:PRES"
160    OUTPUT @Agt4287a;":FORM ASC"
170    !----------------------------------------
180    ! Measurement Point Setup Table Setting
190    !----------------------------------------
200    OUTPUT @Agt4287a;":SOUR:LIST:TABL 1"
210    OUTPUT @Agt4287a;":SOUR:UNIT DBM"
220    OUTPUT @Agt4287a;":SOUR:LIST 3,";
230    OUTPUT @Agt4287a;"10E6,4,0,";
240    OUTPUT @Agt4287a;"100E6,4,0,";
250    OUTPUT @Agt4287a;"1E9,4,0"
260    !----------------------------------------
270    ! Dummy Measurement
280    !----------------------------------------
290    OUTPUT @Agt4287a;":ABOR"
300    OUTPUT @Agt4287a;":TRIG:SOUR BUS"
310    OUTPUT @Agt4287a;":INIT:CONT ON"
320    OUTPUT @Agt4287a;":STAT:OPER:PTR 0"
330    OUTPUT @Agt4287a;":STAT:OPER:NTR 16"
340    OUTPUT @Agt4287a;":STAT:OPER:ENAB 16"
350    OUTPUT @Agt4287a;"*SRE 128"
360    FOR I=1 TO 3
370      OUTPUT @Agt4287a;"*CLS"
380      OUTPUT @Agt4287a;"*OPC?"
390      ENTER @Agt4287a;Buff$
400      ON INTR Scode GOTO Dummy_meas_end
410      ENABLE INTR Scode;2
420      OUTPUT @Agt4287a;":CORR1:COLL STAN"&VAL$(I)
430      OUTPUT @Agt4287a;":TRIG"
440 Dummy_meas_wait: GOTO Dummy_meas_wait
450 Dummy_meas_end: OFF INTR Scode
460    NEXT I
470    OUTPUT @Agt4287a;":CORR1:COLL:SAVE"
480    OUTPUT @Agt4287a;"*OPC?"
490    ENTER @Agt4287a;Buff$
500    OUTPUT @Agt4287a;":TRIG:SOUR INT"
510    !----------------------------------------
520    ! Download Calibration Coeficient
530    !----------------------------------------
540    OUTPUT @Agt4287a;":SOUR:LIST:SIZE?"
550    ENTER @Agt4287a;Nop
560    REDIM Cal_coef_a1(1:Nop,1:2),Cal_coef_a2(1:Nop,1:2)
570    REDIM Cal_coef_b1(1:Nop,1:2),Cal_coef_b2(1:Nop,1:2)
580    REDIM Cal_coef_c1(1:Nop,1:2),Cal_coef_c2(1:Nop,1:2)
590    !
600    PRINT "Downloading Calibration Coeficient..."
610    !
```

```
620    ON ERROR GOTO File_error
630    ASSIGN @File TO File$
640    ENTER @File;Cal_coef_a1(*),Cal_coef_b1(*),Cal_coef_c1(*),
Cal_coef_a2(*),Cal_coef_b2(*),Cal_coef_c2(*),Cal_coef_dc(*)
650    ASSIGN @File TO *
660    OFF ERROR
670    !
680    OUTPUT @Agt4287a;":DATA:CCO1 ";Cal_coef_a1(*)
690    OUTPUT @Agt4287a;":DATA:CCO2 ";Cal_coef_b1(*)
700    OUTPUT @Agt4287a;":DATA:CCO3 ";Cal_coef_c1(*)
710    OUTPUT @Agt4287a;":DATA:CCO4 ";Cal_coef_a2(*)
720    OUTPUT @Agt4287a;":DATA:CCO5 ";Cal_coef_b2(*)
730    OUTPUT @Agt4287a;":DATA:CCO6 ";Cal_coef_c2(*)
740    !
750    OUTPUT @Agt4287a;":DATA:RCCO1 ";Cal_coef_dc(1)
760    OUTPUT @Agt4287a;":DATA:RCCO2 ";Cal_coef_dc(2)
770    OUTPUT @Agt4287a;":DATA:RCCO3 ";Cal_coef_dc(3)
780    !----------------------------------------
790    ! Compensation
800    !----------------------------------------
810    PRINT "## Test Fixture Setting ##"
820    CALL Set_fixture(@Agt4287a)
830    !
840    PRINT "## Compensation Kit Setup ##"
850    CALL Set_comp_kit(@Agt4287a)
860    !
870    PRINT "## Measurement ##"
880    Result=FNCompen(@Agt4287a,Scode,"Open",Open_l_lim)
890    IF Result<>0 THEN Prog_end
900    !
910    Result=FNCompen(@Agt4287a,Scode,"Short",Short_u_lim)
920    IF Result<>0 THEN Prog_end
930    !
940    OUTPUT @Agt4287a;":CORR2:COLL:SAVE"
950    OUTPUT @Agt4287a;"*OPC?"
960    ENTER @Agt4287a;Buff$
970    !
980    PRINT "## Done ##"
990    GOTO Prog_end
1000   !
1010 File_error:OFF ERROR
1020   PRINT "################# ERROR ##################"
1030   PRINT "The CAL_DATA (cal. coef. file) is NOT exist."
1040   PRINT "                    or"
1050   PRINT "The CAL_DATA's size is UNSUITABLE."
1060   !
1070 Prog_end:END
1080   !=============================================
1090   ! Compensation Data Measurement Function
1100   !=============================================
1110 DEF FNCompen(@Agt4287a,INTEGER Scode,Standard$,REAL Limit)
1120   DIM Inp_char$[9],Trig_sour$[9],Buff$[9]
1130   REAL Rdc
1140   INTEGER Err_flag
1150   OUTPUT @Agt4287a;":TRIG:SOUR?"
1160   ENTER @Agt4287a;Trig_sour$
1170   OUTPUT @Agt4287a;":ABOR"
1180   OUTPUT @Agt4287a;":TRIG:SOUR BUS"
1190   OUTPUT @Agt4287a;":INIT:CONT ON"
1200   OUTPUT @Agt4287a;":STAT:OPER:PTR 0"
1210   OUTPUT @Agt4287a;":STAT:OPER:NTR 16"
1220   OUTPUT @Agt4287a;":STAT:OPER:ENAB 16"
1230   OUTPUT @Agt4287a;"*SRE 128"
1240 Compen_meas: !
```

```
1250   PRINT "Set "&Standard$&"-Connection."
1260   INPUT "OK? [Y/N]",Inp_char$
1270   IF UPC$(Inp_char$)="Y" THEN
1280     OUTPUT @Agt4287a;"*CLS"
1290     OUTPUT @Agt4287a;"*OPC?"
1300     ENTER @Agt4287a;Buff$
1310     ON INTR Scode GOTO Meas_end
1320     ENABLE INTR Scode;2
1330     SELECT Standard$
1340       CASE "Open"
1350         OUTPUT @Agt4287a;":CORR2:COLL STAN1"
1360       CASE "Short"
1370         OUTPUT @Agt4287a;":CORR2:COLL STAN2"
1380     END SELECT
1390     OUTPUT @Agt4287a;":TRIG"
1400     PRINT "Now measuring..."
1410 Meas_wait:  GOTO Meas_wait
1420 Meas_end:  OFF INTR Scode
1430     Err_flag=0
1440     SELECT Standard$
1450       CASE "Open"
1460         OUTPUT @Agt4287a;":DATA:RCMD1?"
1470         ENTER @Agt4287a;Rdc
1480         PRINT "Rdc =";ABS(Rdc)
1490         IF ABS(Rdc)<Limit THEN Err_flag=1
1500       CASE "Short"
1510         OUTPUT @Agt4287a;":DATA:RCMD2?"
1520         ENTER @Agt4287a;Rdc
1530         PRINT "Rdc =";ABS(Rdc)
1540         IF ABS(Rdc)>Limit THEN Err_flag=1
1550     END SELECT
1560     IF Err_flag=0 THEN
1570       PRINT Standard$&" Data Measurement Complete"
1580     ELSE
1590       PRINT "ERROR!!"
1600       GOTO Compen_meas
1610     END IF
1620     OUTPUT @Agt4287a;":TRIG:SOUR "&Trig_sour$
1630     RETURN 0
1640   ELSE
1650     OUTPUT @Agt4287a;":TRIG:SOUR "&Trig_sour$
1660     PRINT "Program Interruption"
1670     RETURN -1
1680   END IF
1690 FNEND
1700   !=============================================
1710   ! Compensation Kit Setup Function
1720   !=============================================
1730 SUB Set_comp_kit(@Agt4287a)
1740   DIM Inp_char$[30],Para1$[9],Para2$[9]
1750   INTEGER Def,Nop,Load_para,Point
1760   REAL Open1,Open2,Open_dc
1770   REAL Shor1,Shor2,Shor_dc
1780   !
1790   ON ERROR GOTO Kit_select
1800 Kit_select:  !
1810   PRINT "Select Compensation Kit Value"
1820   PRINT " 1: Default"
1830   PRINT " 2: User Defined"
1840   INPUT "Input 1 or 2",Inp_char$
1850   Kit=IVAL(Inp_char$,10)
1860   IF Kit<1 OR Kit>2 THEN Kit_select
1870   OFF ERROR
1880   !
```

```
1890   IF Kit=1 THEN
1900     OUTPUT @Agt4287a;":CORR2:CKIT DEF"
1910   ELSE
1920     OUTPUT @Agt4287a;":CORR2:CKIT USER"
1930     !
1940     ON ERROR GOTO Def_select
1950 Def_select:!
1960     PRINT "Select Definition Type"
1970     PRINT " 1: Fixed"
1980     PRINT " 2: Not Fixed"
1990     INPUT "Input 1 or 2",Inp_char$
2000     Def=IVAL(Inp_char$,10)
2010     IF Def<1 OR Def>2 THEN Def_select
2020     OFF ERROR
2030     SELECT Def
2040       CASE 1
2050         OUTPUT @Agt4287a;":CORR2:CKIT:LIST OFF"
2060         Nop=1
2070       CASE 2
2080         OUTPUT @Agt4287a;":CORR2:CKIT:LIST ON"
2090         OUTPUT @Agt4287a;":SOUR:LIST:SIZE?"
2100         ENTER @Agt4287a;Nop
2110     END SELECT
2120     !
2130     FOR Point=1 TO Nop
2140       IF Nop>1 THEN
2150         PRINT "[Point No."&VAL$(Point)&"]"
2160       END IF
2170       CALL Inp_data("Open(G) Value",Open1)
2180       CALL Inp_data("Open(Cp) Value",Open2)
2190       CALL Inp_data("Short(Rs) Value",Shor1)
2200       CALL Inp_data("Short(Ls) Value",Shor2)
2210      OUTPUT @Agt4287a;":CORR2:CKIT:STAN1:LIST ";Point;",";Open1;","
;Open2
2220      OUTPUT @Agt4287a;":CORR2:CKIT:STAN2:LIST ";Point;",";Shor1;","
;Shor2
2230     NEXT Point
2240     !
2250    PRINT "Do you want to define standard values for Rdc measurement?"
2260     INPUT "[Y]es/[N]o",Inp_char$
2270     IF UPC$(Inp_char$)="Y" OR UPC$(Inp_char$)="YES" THEN
2280       CALL Inp_data("Open(G) Value for Rdc Measurement",Open_dc)
2290       CALL Inp_data("Short(R) Value for Rdc Measurement",Shor_dc)
2300       OUTPUT @Agt4287a;":CORR2:CKIT:STAN1:DC ";Open_dc
2310       OUTPUT @Agt4287a;":CORR2:CKIT:STAN2:DC ";Shor_dc
2320     END IF
2330   END IF
2340   !
2350 SUBEND
2360   !============================================
2370   ! Test Fixture Setting Function
2380   !============================================
2390 SUB Set_fixture(@Agt4287a)
2400   DIM Inp_char$[30]
2410   INTEGER Fixture
2420   REAL E_len
2430   !
2440   ON ERROR GOTO Fixture_select
2450 Fixture_select:  !
2460   PRINT "Select Test Fixture"
2470   PRINT " 1: None"
2480   PRINT " 2: 16191A"
2490   PRINT " 3: 16192A"
2500   PRINT " 4: 16193A"
```

```
2510   PRINT " 5: 16194A"
2520   PRINT " 6: 16196A"
2530   PRINT " 7: 16196B"
2540   PRINT " 8: 16196C"
2550   PRINT " 9: USER"
2560   INPUT "Input 1 to 9",Inp_char$
2570   Fixture=IVAL(Inp_char$,10)
2580   IF Fixture<1 OR Fixture>8 THEN Fixture_select
2590   OFF ERROR
2600   SELECT Fixture
2610     CASE 1
2620       OUTPUT @Agt4287a;":CORR2:FIXT NONE"
2630     CASE 2
2640       OUTPUT @Agt4287a;":CORR2:FIXT FXT16191A"
2650     CASE 3
2660       OUTPUT @Agt4287a;":CORR2:FIXT FXT16192A"
2670     CASE 4
2680       OUTPUT @Agt4287a;":CORR2:FIXT FXT16193A"
2690     CASE 5
2700       OUTPUT @Agt4287a;":CORR2:FIXT FXT16194A"
2710     CASE 6
2720       OUTPUT @Agt4287a;":CORR2:FIXT FXT16196A"
2730     CASE 7
2740       OUTPUT @Agt4287a;":CORR2:FIXT FXT16196B"
2750     CASE 8
2760       OUTPUT @Agt4287a;":CORR2:FIXT FXT16196C"
2770     CASE 9
2780       OUTPUT @Agt4287a;":CORR2:FIXT USER"
2790       CALL Inp_data("Electrical Length of the User Fixture",E_len)
2800       OUTPUT @Agt4287a;":CORR2:FIXT:EDEL:DIST ";E_len
2810   END SELECT
2820 SUBEND
2830   !=============================================
2840   ! Data Input Function
2850   !=============================================
2860 SUB Inp_data(Mes$,Inp_val)
2870   DIM Inp_char$[30]
2880   ON ERROR GOTO Inp_start
2890 Inp_start:!
2900   PRINT "Input "&Mes$
2910   INPUT "Value?",Inp_char$
2920   Inp_val=VAL(UPC$(Inp_char$))
2930   PRINT "Input Value: ";Inp_val
2940   INPUT "OK? [Y/N]",Inp_char$
2950   IF UPC$(Inp_char$)<>"Y" THEN Inp_start
2960   OFF ERROR
2970 SUBEND
```

5 Starting Measurement Cycle (Triggering) and Detecting End of Measurement

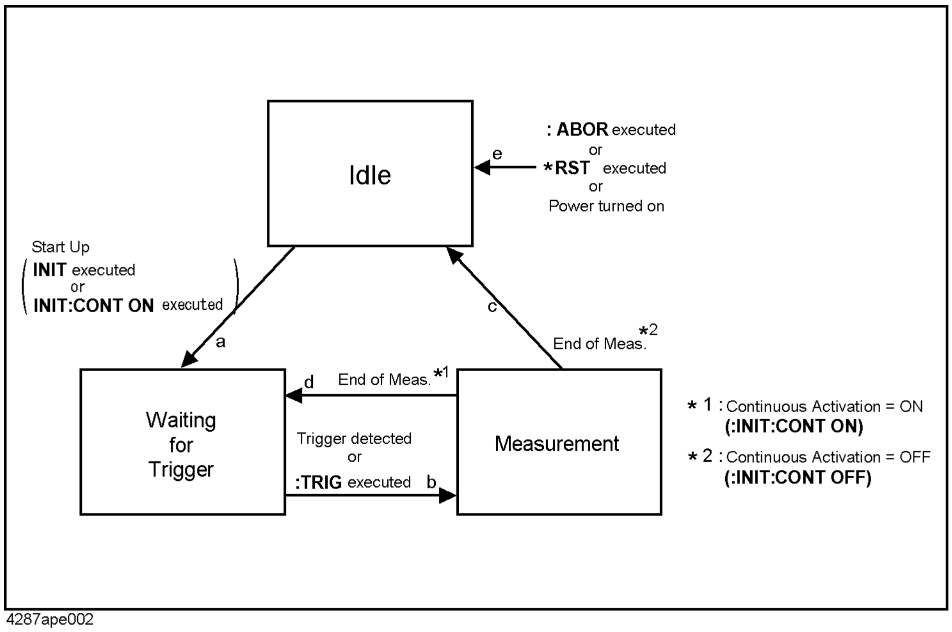
This chapter explains how to trigger the instrument to start a new measurement cycle and how to detect the end of a measurement cycle.

Starting a New Measurement Cycle (Triggering)

Trigger system

The trigger system is responsible for such tasks as detecting the start of a measurement cycle (triggering) and controlling the pre-measurement delay time. As shown in Figure 5-1, the trigger system has three states: Idle, Waiting for Trigger, and Measurement.

Figure 5-1 **Trigger system**



The following subsections describe each state and how the trigger system switches among the three states.

Idle state

The trigger system is put into Idle state (arrow e in Figure 5-1) when you power on the instrument or issue one of the following commands:

- ***RST** on page 206
- **:ABOR** on page 209

The trigger system is put into Waiting for Trigger state (arrow a in Figure 5-1) when you activate it with one of the following commands:

- **:INIT** on page 287
- **:INIT:CONT** on page 287 (“ON” specified)

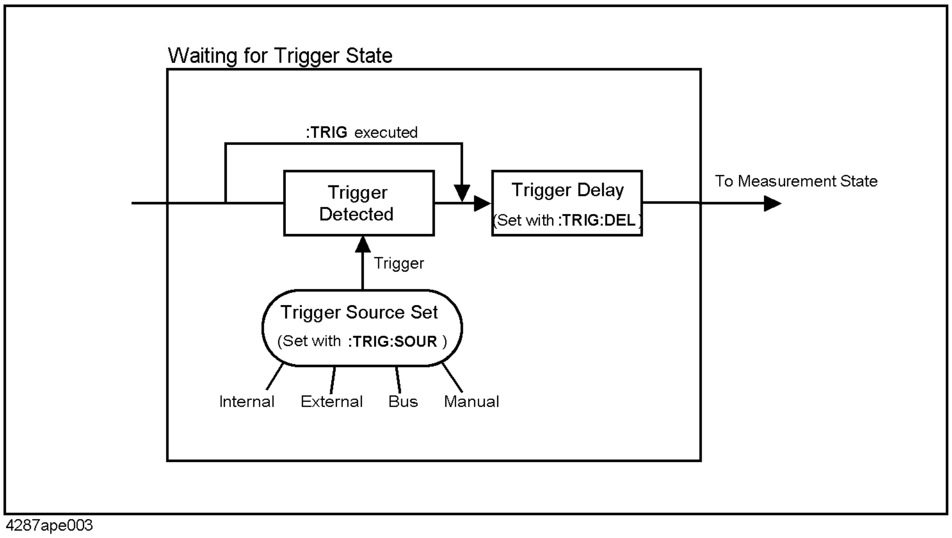
Waiting for Trigger state (Trigger Event Detect state)

The trigger system is put into Measurement state (arrow b in Figure 5-1) after the elapse of the trigger delay time (set with the **:TRIG:DEL** command on page 308) if the instrument is triggered (a trigger is detected) or the **:TRIG** command on page 308 is issued while the trigger system is in Waiting for Trigger state.

As shown in the table below, how the instrument is triggered differs depending on which trigger source is specified. To specify the trigger source, use the **:TRIG:SOUR** command on page 310.

Trigger source	How the instrument is triggered
Internal trigger	The instrument is automatically triggered within itself.
External trigger	The instrument is triggered when a trigger signal is input through the Ext TRIGGER terminal or handler interface.
GPIB/LAN trigger (Bus)	The instrument is triggered when the ***TRG** command on page 208 or TRGGER command of HP BASIC is issued.
Manual trigger	The instrument is triggered when the **[Trigger]** key on the front panel is pressed.

Figure 5-2 **Transition from Waiting for Trigger state to Measurement state**



5. Starting Measurement Cycle (Triggering) and Detecting End of Measurement

Measurement state (sequence operation state)

In Measurement state, the trigger system waits until the measurement point delay time (set with the **:TRIG:SEQ2:DEL** command on page 309) elapses and then starts measurement for each measurement point.

When the instrument has finished measuring the DUT at the single specified point (for single-point measurement) or at all the points defined in the active table (for list measurement), the trigger system switches to either Idle or Waiting for Trigger state depending on whether continuous activation is off or on (set with the **:INIT:CONT** command on page 287):

If continuous activation is off:

Switches to Idle state (arrow c in Figure 5-1).

If continuous activation is on:

Switches to Waiting for Trigger state (arrow d in Figure 5-1).

Starting a measurement cycle (Triggering the instrument)

Configuring the instrument to automatically perform continuous measurement (initial setting):

Step 1. Issue the **:TRIG:SOUR** command on page 310 to set the trigger source to Internal trigger.

Step 2. If the trigger system is in Idle state (that is, it is not currently active), issue the **:INIT:CONT** command on page 287 to turn on continuous activation of the trigger system.

Starting measurement on demand:

1) To trigger the instrument on demand, follow the steps below.

Step 1. Issue the **:TRIG:SOUR** command on page 310 to set the trigger source to GPIB/LAN trigger.

Step 2. If the trigger system is in Idle state (that is, it is not currently active), issue the **:INIT:CONT** command to turn on continuous activation of the trigger system.

Step 3. Trigger the instrument whenever you want to perform measurement. An external controller can trigger the instrument with one of the following two commands:

Command	Query response	Applicable trigger source
***TRG** on page 208	Yes (returns measurement results)	GPIB/LAN trigger
:TRIG on page 308	No	All

Step 4. To start the next measurement cycle, repeat step 3.

2) To activate the trigger system on demand, follow the steps below.

Step 1. If the trigger system is active (that is, not in Idle state), issue the **:ABOR** command on page 209 to stop the trigger system.

Step 2. Issue the **:TRIG:SOUR** command on page 310 to set the trigger source to Internal trigger.

Step 3. You can activate the trigger system using the **:INIT** command on page 287 at any time. Consequently, the instrument will be automatically triggered by Internal trigger and perform one measurement cycle.

Step 4. To start the next measurement cycle, repeat step 3.

Waiting for (Detecting) End of Measurement

The status of the 4287A can be detected through the status registers. This section describes how to detect the end of measurement by using the status registers. For a complete description of the status report mechanism, including the specifications of each bit, see Appendix B, “Status Reporting System.”

End of measurement is reported by the operation status condition register. An SRQ (service request) is useful when you create a program that uses the information reported by this register to detect the end of measurement.

To detect the end of measurement via an SRQ, use one of the following commands:

- ***SRE** on page 207
- **:STAT:OPER:ENAB** on page 299
- **:STAT:OPER:PTR** on page 300
- **:STAT:OPER:NTR** on page 300

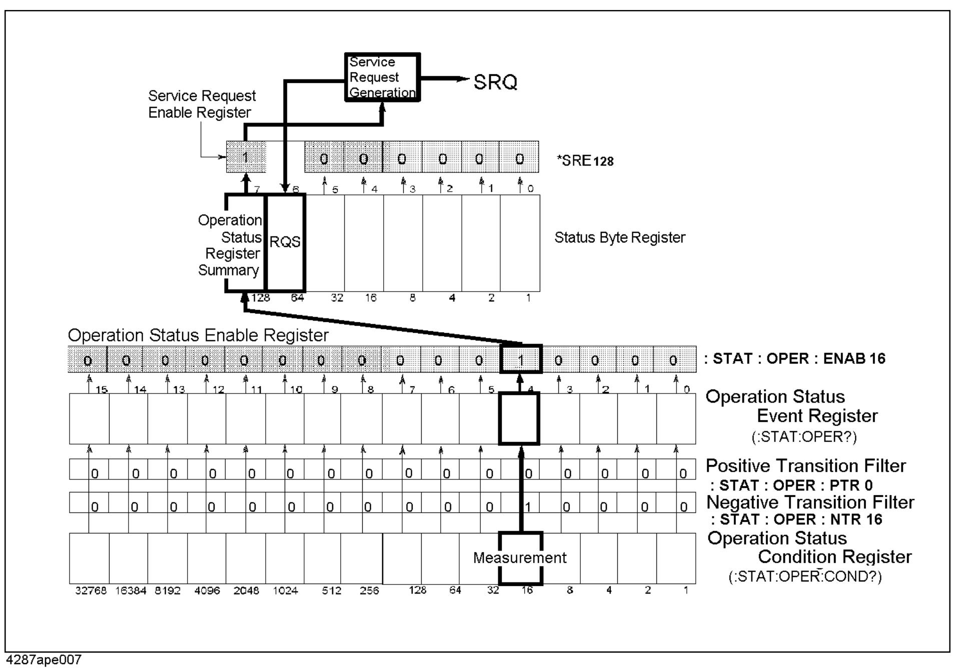
Follow these steps:

Step 1. Configure the 4287A to generate an SRQ when the bit 4 value of the operation status condition register is changed form 1 to 0.

Step 2. Trigger the instrument to start a measurement cycle.

Step 3. When an SRQ is generated, the program interrupts the measurement cycle.

Figure 5-3 **SRQ generation sequence (at end of list measurement)**



Sample program

Example 5-1 is a sample program using an SRQ to detect the end of measurement. This program is given the file name srq_meas.bas and stored on the sample program disk.

This program aborts the trigger system, makes the SRQ setting, and then initiates the trigger system one time. When an SRQ is generated at the end of measurement, the program displays the end message and then finishes.

Details of the program are as follows.

Lines 30 to 40	Sets the GPIB address and the select code.
Lines 60 to 70	Aborts the trigger system and sets the trigger source to the internal trigger.
Lines 90 to 100	Sets the positive transition filter to 0 and the negative transition filter to 1 so that the operation status event register at bit 4 is set to 1 only when the operation status condition register at bit 4 is changed from 1 to 0.
Lines 110 to 120	Enables bit 4 in the operation status event register and bit 8 in the status byte register.
Lines 130 to 150	Clears the operation status event register and the status byte register.
Lines 170 to 180	Sets the branch destination for the SRQ interrupt and enables the SRQ interrupt.
Lines 190 to 210	Initiates the trigger system one time and then waits for the end of measurement.

Example 5-1 **Detecting the end of measurement using an SRQ (srq_meas.bas)**

```
10      DIM Buff$[9]
20      INTEGER Scode
30      ASSIGN @Agt4287a TO 717
40      Scode=7
50      !
60      OUTPUT @Agt4287a;":ABOR"
70      OUTPUT @Agt4287a;":TRIG:SOUR INT"
80      !
90      OUTPUT @Agt4287a;":STAT:OPER:PTR 0"
100     OUTPUT @Agt4287a;":STAT:OPER:NTR 16"
110     OUTPUT @Agt4287a;":STAT:OPER:ENAB 16"
120     OUTPUT @Agt4287a;"*SRE 128"
130     OUTPUT @Agt4287a;"*CLS"
140     OUTPUT @Agt4287a;"*OPC?"
150     ENTER @Agt4287a;Buff$
160     !
170     ON INTR Scode GOTO Meas_end
180     ENABLE INTR Scode;2
190     OUTPUT @Agt4287a;":INIT"
200     PRINT "Waiting..."
210 Meas_wait:  GOTO Meas_wait
220 Meas_end:  OFF INTR Scode
230     PRINT "Measurement Complete"
240     END
```

6 Retrieving Measurement Results

This chapter explains how to retrieve the results of impedance measurement, test signal level monitoring, and R_{dc} measurement. It also describes how the Agilent 4287A internally processes the data.

Data Transfer Format

When you transfer data with the following commands, you can select either the ASCII format or binary format.

NOTE When you transfer data with commands other than the following, you cannot select the data transfer format because it is fixed as the ASCII format.

- **:FETC?** on page 280
- **:READ?** on page 293
- ***TRG** on page 208
- Commands that begin with **:DATA**

:DATA:CAD{1-8}? on page 259	**:DATA:CCO{1-6}** on page 260
:DATA:CMD{1-2}? on page 261	**:DATA:CMP{1-3}** on page 262
:DATA:RCAD{1-3}? on page 265	**:DATA:RCCO{1-3}** on page 265
:DATA:RCMD{1-2}? on page 266	**:DATA:RCMP{1-3}** on page 266
:DATA:FDAT{1-4}? on page 263	**:DATA:RAW?** on page 264
:DATA:IMON? on page 263	**:DATA:VMON?** on page 267
:DATA:RDC? on page 267	

To set the data transfer format, use the following commands:

- **:FORM** on page 282

NOTE Executing the **:SYST:PRES** on page 306 does not affect the setting of the data transfer format.

ASCII format

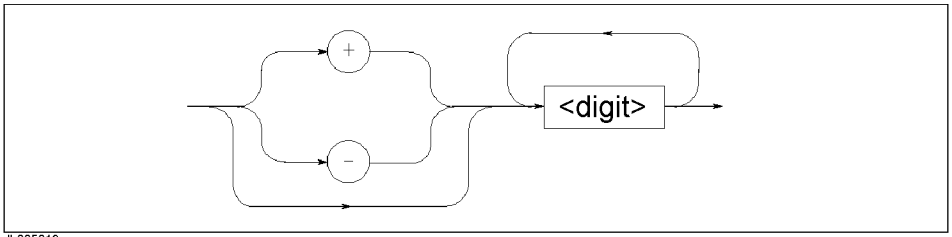
When you select the ASCII format as the data transfer format, numbers are transferred as ASCII bytes, each of which corresponds to one of the formats shown below. Note that numbers are separated by a comma (,) in accordance with the IEEE 488.2 specification.

NOTE Since numeric data strings vary in length, commas appear at varying points in the data. Keep this in mind as you extract data from retrieved numeric data strings in your program.

- Integer format

  Numbers are expressed as integers in this format (Figure 6-1). For example, 201 is expressed as "+201" or "201."

Figure 6-1 Integer format



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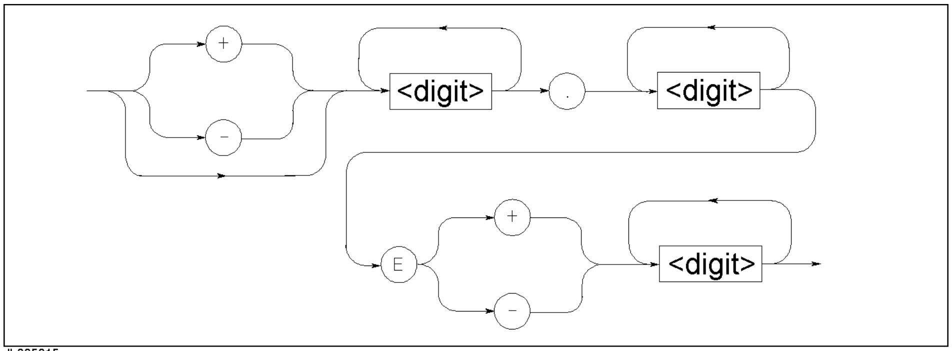
- Floating-point number format

  Numbers are expressed with floating points in this format (Figure 6-2). For example, 1000 is expressed as "1.0E+3" or "+1.0E+3."

Figure 6-2 Floating-point number format



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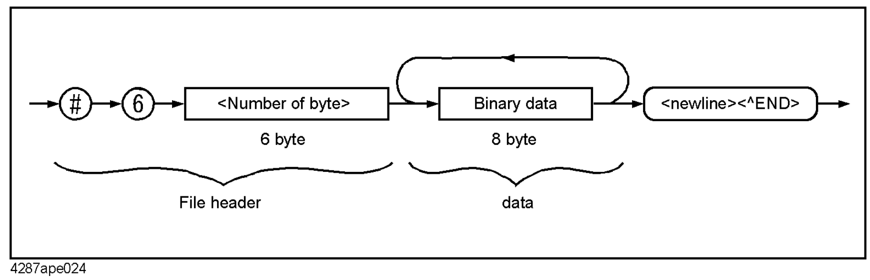
Binary format

When you select the binary format as the data transfer format, numerical data (binary data) are transferred in the format shown in Figure 6-3.

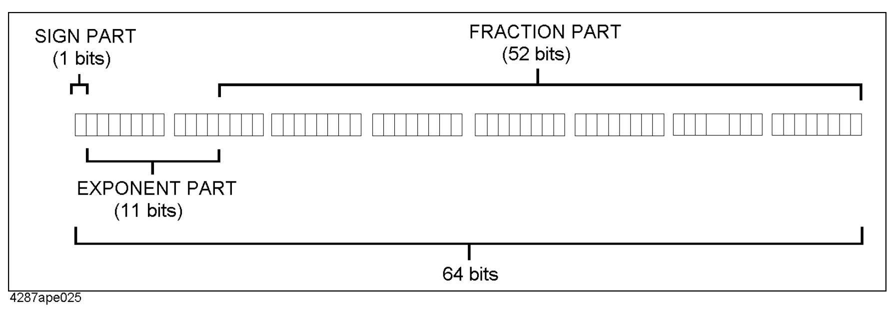
Figure 6-3 Binary Format



In this format, the data is represented with a hash (#) mark, the number 6 (indicating that <Number of bytes> is 6 bytes), the number of the binary data to be transferred (<Number of bytes>), the binary data itself, and finally the message terminator <new line>^END.

Binary data is in IEEE 754 floating point format of 64-bit configuration as shown in Figure 6-4.

Figure 6-4 64-bit Floating Point Data



Byte Order

In the binary format, you can select either of the following transfer orders for each byte comprising an 8-byte data string:

NORMal	Data transfer begins from the byte containing MSB (Most Significant Bit, the leftmost byte shown in Figure 6-4).
SWAPped	Data transfer begins from the byte containing LSB (Least Significant Bit, the rightmost byte shown in Figure 6-4).

To set the byte order, use the following command:

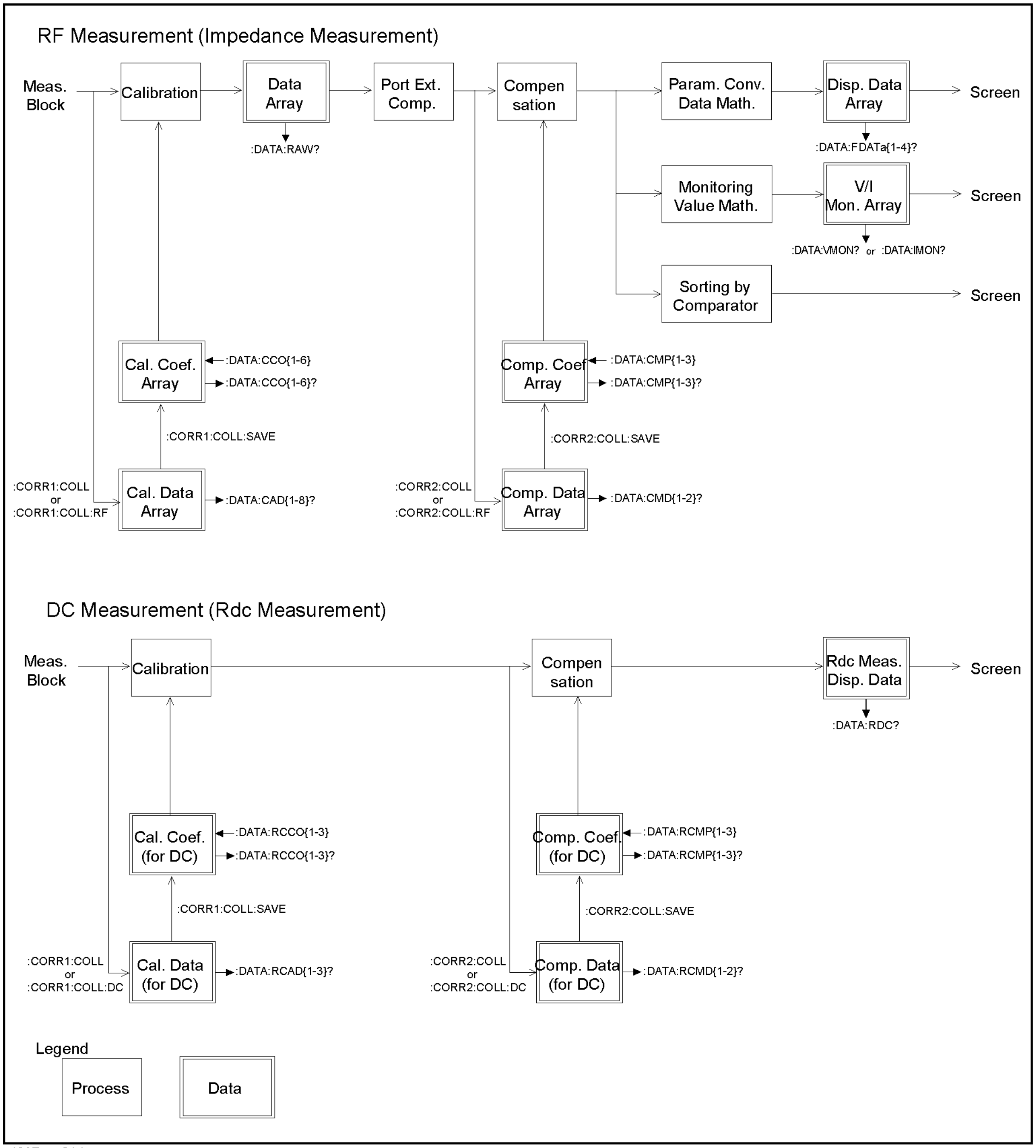
- **:FORM:BORD** on page 283

Internal Data Processing

Data flow

Figure 6-5 gives an overview of the 4287A's internal data processing flow.

Figure 6-5 **4287A's data processing flow**



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Internal data arrays

The instrument has a number of internal data arrays/sets that can be read and/or written and contain either real or complex numbers (Table 6-1).

Table 6-1 **Internal data arrays/sets**

Name of data array/set	Read	Write	Data format
Data array	Allowed	Not allowed	Complex number
Display data arrays	Allowed	Not allowed	Real number
Calibration Data Arrays	Allowed	Not allowed	Complex number
Calibration Coefficient Arrays	Allowed	Allowed	Complex number
Compensation Data Arrays	Allowed	Not allowed	Complex number
Compensation Coefficient Arrays	Allowed	Allowed	Complex number
Current/Voltage Monitor Array	Allowed	Not allowed	Real number
R_{dc} Display Data	Allowed	Not allowed	Real number
R_{dc} Calibration Data	Allowed	Not allowed	Real number
R_{dc} Calibration Coefficients	Allowed	Allowed	Real number
R_{dc} Compensation Data	Allowed	Not allowed	Real number
R_{dc} Compensation Coefficients	Allowed	Allowed	Real number

NOTE Each table has its own calibration/compensation-related internal data arrays and data sets (including Calibration/Compensation Coefficient Arrays, Calibration/Compensation Data Arrays, R_{dc}Calibration/Compensation Coefficients, and R_{dc}Calibration/Compensation Data). When you perform command-based read/write operations on these data arrays and sets, the instrument assumes that the active table is the target.

NOTE A complex-number array has two values (real and imaginary parts) for each measurement point, thus containing Nop×2 elements in all, where Nop represents the number of measurement points.

Data Array

The Data Array contains complex numbers (R-X) that indicate the results of calibrating raw measurement data. To retrieve the Data Array, use the following command:

- **:DATA:RAW?** on page 264

Display Data Arrays

As shown in the table below, the instrument has four Display Data Arrays corresponding to parameters 1 through 4. Each Display Data Array contains real numbers that indicate the results of performing port extension, compensation, measurement parameter conversion, and data math operations on the Data Array (on-screen values).

Array number[*1]	Indicated data
1	Data to be displayed as the measurement results for measurement parameter 1
2	Data to be displayed as the measurement results for measurement parameter 2
3	Data to be displayed as the measurement results for measurement parameter 3
4	Data to be displayed as the measurement results for measurement parameter 4

*1. Use this number as the suffix to the command.

To retrieve one of the Display Data Arrays, use the following command:

- **:DATA:FDAT{1-4}?** on page 263

Calibration Data Arrays

As shown in the table below, the instrument has eight Calibration Data Arrays corresponding to two measurement passes for each of the OPEN, SHORT, LOAD, and LOW LOSS CAPACITOR standards. Each Calibration Data Array contains the standard measurement data (complex numbers) necessary for calculating the calibration coefficients.

Array number*1	Indicated data
1	First OPEN measurement data for calculating the calibration coefficients
2	First SHORT measurement data for calculating the calibration coefficients
3	First LOAD measurement data for calculating the calibration coefficients
4	First LOW LOSS CAPACITOR measurement data for calculating the calibration coefficients
5	Second OPEN measurement data for calculating the calibration coefficients
6	Second SHORT measurement data for calculating the calibration coefficients
7	Second LOAD measurement data for calculating the calibration coefficients
8	Second LOW LOSS CAPACITOR measurement data for calculating the calibration coefficients

*1. Use this number as the suffix to the command.

To retrieve one of the Calibration Data Arrays, use the following command:

- **:DATA:CAD{1-8}?** on page 259

Calibration Coefficient Arrays

As shown in the table below, the instrument has six Calibration Coefficient Arrays corresponding to calibration coefficients A1, B1, C1, A2, B2, and C2. Each Calibration Coefficient Array contains the calibration coefficients (complex numbers) calculated based on the Calibration Data Array.

Array number*1	Indicated data
1	Calibration coefficient A1
2	Calibration coefficient B1
3	Calibration coefficient C1
4	Calibration coefficient A2
5	Calibration coefficient B2
6	Calibration coefficient C2

*1. Use this number as the suffix to the command.

To retrieve one of the Calibration Coefficient Arrays, use the following command:

- **:DATA:CCO{1-6}** on page 260

NOTE

When setting calibration coefficients, note the following:

- To ensure that the instrument will provide correct measurement results, you must first configure the instrument to use the same measurement points (point setup table settings) as when you obtained measurement data for calibration and then set all the coefficients.
- You must turn on the calibration functions before setting the calibration coefficients.

Compensation Data Arrays

As shown in the table below, the instrument has two Compensation Data Arrays corresponding to the OPEN and SHORT standards. Each Compensation Data Array contains the standard measurement data (complex numbers) necessary for calculating the compensation coefficients.

Array number*1	Indicated data
1	OPEN measurement data for calculating the compensation coefficients
2	SHORT measurement data for calculating the compensation coefficients

*1. Use this number as the suffix to the command.

To retrieve one of the Compensation Data Arrays, use the following command:

- **:DATA:CMD{1-2}?** on page 261

Compensation Coefficient Arrays

As shown in the table below, the instrument has three Compensation Coefficient Arrays corresponding to compensation coefficients A, B, and C. Each Compensation Coefficient Array contains the compensation coefficients (complex numbers) calculated based on the Compensation Data Array.

Array number*1	Indicated data
1	Compensation coefficient A
2	Compensation coefficient B
3	Compensation coefficient C

*1. Use this number as the suffix to the command.

To retrieve one of the Compensation Coefficient Arrays, use the following command:

- **:DATA:CMP{1-3}** on page 262

NOTE

When setting compensation coefficients, note the following:

- To ensure that the instrument will provide correct measurement results, you must first configure the instrument to use the same measurement points (point setup table settings) as when you obtained measurement data for compensation and then turn on the calibration functions before setting the coefficients.
- You must turn on the compensation functions before setting the compensation coefficients.

Current/Voltage Monitor Arrays

The Current/Voltage Monitor Arrays contain the real numbers to be displayed as the monitored values of the test signal voltage and current levels. Each value contained in these arrays is calculated based on the test signal level setting and the impedance value determined by performing port extension and compensation on the Data Array.

To retrieve the Voltage or Current Monitor Array, use one of the following commands:

Command	Description
:DATA:VMON? on page 267	Retrieves the Voltage Monitor Array.
:DATA:IMON? on page 263	Retrieves the Current Monitor Array.

R_{dc} Display Data

The R_{dc} Display Data is the data obtained by performing R_{dc}-specific calibration and compensation on the results of R_{dc} measurement. To retrieve this data, use the following command:

- **:DATA:RDC?** on page 267

Calibration coefficients and calibration data for R_{dc} measurement

When the instrument performs R_{dc} measurement (DC measurement), it uses a specific set of calibration coefficients (real numbers) that are different from those used for impedance measurement. This means that the standard measurement data (real numbers) necessary for calculating the calibration coefficients are measured and retained separately from those for impedance measurement.

The instrument has three calibration coefficients, A, B, and C, for R_{dc} measurement. To set or retrieve one of these coefficients, use one of the following commands:

- **:DATA:RCCO{1-3}** on page 265

Data number*1	Data to retrieve
1	R_{dc} Calibration Coefficients
2	R_{dc} Calibration Coefficients
3	R_{dc} Calibration Coefficients

*1. Use this number as the suffix to the command.

To obtain the OPEN, SHORT, or LOAD measurement data for calculating the calibration coefficients for R_{dc} measurement, use one of the following commands:

- **:DATA:RCAD{1-3}?** on page 265

Data number*1	Data to retrieve
1	OPEN measurement data for calculating the calibration coefficients for R_{dc} measurement
2	SHORT measurement data for calculating the calibration coefficients for R_{dc} measurement
3	LOAD measurement data for calculating the calibration coefficients for R_{dc} measurement

*1. Use this number as the suffix to the command.

R_{dc} compensation coefficients and compensation data

When the instrument performs R_{dc} measurement (DC measurement), it uses a specific set of compensation coefficients (real numbers) that are different from those used for impedance measurement. This means that the standard measurement data (real numbers) necessary for calculating the compensation coefficients is measured and retained separately from those for impedance measurement.

The instrument has three compensation coefficients, A, B, and C, for R_{dc} measurement. To set or retrieve one of these coefficients, use one of the following commands:

- **:DATA:RCMP{1-3}** on page 266

Data number*1	Data to retrieve
1	R_{dc} Calibration Coefficient A
2	R_{dc} Calibration Coefficient B
3	R_{dc} Calibration Coefficient C

*1. Use this number as the suffix to the command.

To obtain the OPEN or SHORT measurement data for calculating the compensation coefficients for R_{dc} measurement, use one of the following commands:

- **:DATA:RCMD{1-2}?** on page 266

Data number*1	Data to retrieve
1	OPEN measurement data for calculating the compensation coefficients for R_{dc} measurement
2	SHORT measurement data for calculating the compensation coefficients for R_{dc} measurement

*1. Use this number as the suffix to the command.

Retrieving the Measurement Results for Measurement Parameters 1 through 4

This section describes how to retrieve the measurement results for each of the measurement parameters 1 through 4.

In addition to the **:DATA:FDAT{1-4}?** command on page 263 that retrieves the measurement results for the four measurement parameters directly from the internal Data Array, you can use the following three commands to retrieve these measurement results as well as the measurement status, the results of test signal monitoring, R_{dc}measurement, and bin sorting.

- ***TRG** on page 208
- **:FETC?** on page 280
- **:READ?** on page 293

The following table summarizes how to retrieve the measurement results for measurement parameters 1 through 4:

	Applicable trigger source	Retrieval steps
***TRG** command	GPIB/LAN trigger (bus)	Issue the ***TRG** command. ↓ The command returns the data.
:FETC? command or **:DATA:FDAT{1-4}?** command	All	Trigger the instrument. ↓ **:FETC?** or **:DATA:FDAT{1-4}?** command.[*1] ↓ The command returns the data.
:READ? command	External trigger Manual trigger Internal trigger	Issue the **:READ?** command. ↓ Trigger the instrument. ↓ The command returns the data.

*1. The end-of-measurement signal must be detected before the **:FETC?** or **:DATA:FDAT{1-4}?** command is issued.

NOTE The TRIGGER command of HP BASIC has the same function as the ***TRG** command.

Using the *TRG command to retrieve measurement results

This command actually performs two tasks: it triggers the instrument and returns the results. It is useful, for example, when you want to retrieve measurement results immediately after triggering the instrument from an external controller.

To retrieve measurement results using the ***TRG** command, follow these steps:

Step 1. Issue the **:TRIG:SOUR** command on page 310 to set the trigger source to “Bus.”

Step 2. Issue the ***TRG** command (or the TRIGGER command of HP BASIC).

Step 3. Retrieve the measurement results. You can repeat steps 2 and 3 as needed.

Example 6-1 and Example 6-2 are sample programs that demonstrates the use of the ***TRG** command. Example 6-1 uses the ASCII format, and Example 6-2 uses the binary format. These programs are given the file names trg.bas and trg_real.bas and are stored on the sample program disk.

These sample programs retrieve and display the measurement status as well as the measurement results for parameters 1 and 2 and the result of test signal current level monitoring.

Example 6-1 is described in detail below:

Line 40	Sets the GPIB address.
Line 50	Sets the Point variable to the number of measurement points for single-point measurement.
Line 60	Sets the data transfer format to ASCII.
Lines 80 to 130	Instructs the instrument to show the results for measurement parameters 1 and 2 as well as the result of test signal current level monitoring while hiding the measurement results of measurement parameters 3 and 4 as well as the result of test signal voltage level monitoring.
Lines 150 to 180	Retrieves the parameter names of measurement parameters 1 and 2 and stores the names into the Para1$ and Para2$ variables, respectively.
Lines 200 to 210	Instructs the instrument to perform single-point measurement at the point identified by the Point variable.
Lines 220 to 230	Turns off the bin sorting and Rdc measurement functions.
Lines 270 to 280	Sets the trigger source to GPIB/LAN trigger and turns on the continuous activation of the trigger system.
Lines 320 to 360	Triggers the instrument after the trigger system is put into trigger wait state.
Line 370	Retrieves the measurement status, the measurement results for parameters 1 and 2, and the result of test signal current level monitoring and then stores the data into the Stat, Res1, Res2, and Imon variables.
Lines 410 to 420	Displays the measurement results.

Example 6-1 **Using the *TRG Command to Retrieve Measurement Results in the ASCII Format (trg.bas)**

```
10     DIM Para1$[9],Para2$[9]
20     REAL Res1,Res2,Imon
30     INTEGER Point,Stat,Cond_reg
40     ASSIGN @Agt4287a TO 717
50     Point=1
60     OUTPUT @Agt4287a;":FORM ASC"
70     !
80     OUTPUT @Agt4287a;":DISP:TEXT1:CALC1 ON"
90     OUTPUT @Agt4287a;":DISP:TEXT1:CALC2 ON"
100    OUTPUT @Agt4287a;":DISP:TEXT1:CALC3 OFF"
110    OUTPUT @Agt4287a;":DISP:TEXT1:CALC4 OFF"
120    OUTPUT @Agt4287a;":DISP:TEXT1:CALC11 ON"
130    OUTPUT @Agt4287a;":DISP:TEXT1:CALC12 OFF"
140    !
150    OUTPUT @Agt4287a;":CALC:PAR1:FORM?"
160    ENTER @Agt4287a;Para1$
170    OUTPUT @Agt4287a;":CALC:PAR2:FORM?"
180    ENTER @Agt4287a;Para2$
190    !
200    OUTPUT @Agt4287a;":SOUR:LIST:STAT OFF"
210    OUTPUT @Agt4287a;":SOUR:LIST:POIN ";Point
220    OUTPUT @Agt4287a;":CALC:COMP OFF"
230    OUTPUT @Agt4287a;":SOUR:LIST:RDC OFF"
240    !
250    ! Trigger source setting
260    !
270    OUTPUT @Agt4287a;":TRIG:SOUR BUS"
280    OUTPUT @Agt4287a;":INIT:CONT ON"
290    !
300    ! Triggering and data read
310    !
320    REPEAT
330      OUTPUT @Agt4287a;":STAT:OPER:COND?"
340      ENTER @Agt4287a;Cond_reg
350    UNTIL BIT(Cond_reg,5)
360    OUTPUT @Agt4287a;"*TRG"
370    ENTER @Agt4287a;Stat,Res1,Res2,Imon
380    !
390    ! Display results
400    !
410    PRINT "### Result ###"
420    PRINT "Meas. Status:";Stat,Para1$&":";Res1,Para2$&":";Res2,"Imon
:";Imon
430    !
440    END
```

Retrieving the Measurement Results for Measurement Parameters 1 through 4

Example 6-2 is described in detail below:

Lines 40 to 50	Sets the GPIB address.
Line 60	Sets the Point variable to the number of measurement points for single-point measurement.
Lines 70 to 80	Sets the data transfer format to binary and sets the byte order to normal.
Lines 100 to 150	Instructs the instrument to show the results for measurement parameters 1 and 2 as well as the result of test signal current level monitoring while hiding the measurement results of measurement parameters 3 and 4 as well as the result of test signal voltage level monitoring.
Lines 170 to 200	Retrieves the parameter names of measurement parameters 1 and 2 and stores the names into the Para1$ and Para2$ variables, respectively.
Lines 220 to 230	Instructs the instrument to perform single-point measurement at the point identified by the Point variable.
Lines 240 to 250	Turns off the bin sorting and Rdc measurement functions.
Lines 290 to 300	Sets the trigger source to GPIB/LAN trigger and turns on the continuous activation of the trigger system.
Lines 340 to 380	Triggers the instrument after the trigger system is put into trigger wait state.
Line 390	Retrieves the header.
Line 400	Retrieves the measurement status, the measurement results for parameters 1 and 2, and the result of test signal current level monitoring and then stores the data into the Stat, Res1, Res2, and Imon variables, respectively. Binary data must be read without being formatted; therefore, the I/O path (@Binary) is set to retrieve data without formatting them.
Line 410	Retrieves the message terminator provided at the end of the data.
Lines 450 to 460	Displays the measurement results.

Example 6-2 **Using the *TRG Command to Retrieve Measurement Results in a Binary Format (trg_real.bas)**

```
10     DIM Para1$[9],Para2$[9],Buff$[9]
20     REAL Stat,Res1,Res2,Imon
30     INTEGER Point,Cond_reg
40     ASSIGN @Agt4287a TO 717
50     ASSIGN @Binary TO 717;FORMAT OFF
60     Point=1
70     OUTPUT @Agt4287a;":FORM REAL"
80     OUTPUT @Agt4287a;":FORM:BORD NORM"
90     !
100    OUTPUT @Agt4287a;":DISP:TEXT1:CALC1 ON"
110    OUTPUT @Agt4287a;":DISP:TEXT1:CALC2 ON"
120    OUTPUT @Agt4287a;":DISP:TEXT1:CALC3 OFF"
130    OUTPUT @Agt4287a;":DISP:TEXT1:CALC4 OFF"
140    OUTPUT @Agt4287a;":DISP:TEXT1:CALC11 ON"
150    OUTPUT @Agt4287a;":DISP:TEXT1:CALC12 OFF"
160    !
170    OUTPUT @Agt4287a;":CALC:PAR1:FORM?"
180    ENTER @Agt4287a;Para1$
190    OUTPUT @Agt4287a;":CALC:PAR2:FORM?"
200    ENTER @Agt4287a;Para2$
210    !
220    OUTPUT @Agt4287a;":SOUR:LIST:STAT OFF"
230    OUTPUT @Agt4287a;":SOUR:LIST:POIN ";Point
240    OUTPUT @Agt4287a;":CALC:COMP OFF"
250    OUTPUT @Agt4287a;":SOUR:LIST:RDC OFF"
260    !
270    ! Trigger source setting
280    !
290    OUTPUT @Agt4287a;":TRIG:SOUR BUS"
300    OUTPUT @Agt4287a;":INIT:CONT ON"
310    !
320    ! Triggering and data read
330    !
340    REPEAT
350      OUTPUT @Agt4287a;":STAT:OPER:COND?"
360      ENTER @Agt4287a;Cond_reg
370    UNTIL BIT(Cond_reg,5)
380    OUTPUT @Agt4287a;"*TRG"
390    ENTER @Agt4287a USING "#,8A";Buff$
400    ENTER @Binary;Stat,Res1,Res2,Imon
410    ENTER @Agt4287a USING "#,A";Buff$
420    !
430    ! Display results
440    !
450    PRINT "### Result ###"
460    PRINT "Meas. Status:";Stat;" "&Para1$&":";Res1;" "&Para2$&":";
Res2;" Imon:";Imon
470    !
480    END
```

Using the :FETC? or :DATA:FDAT{1-4}? command to retrieve measurement results

These two commands are useful when you trigger the instrument without using an external controller or when you need to perform a particular task between triggering and retrieval.

To retrieve measurement results using the **:FETC?** or **:DATA:FDAT{1-4}?** command, follow these steps:

Step 1. Set the trigger source as necessary.

Step 2. Trigger the instrument using the method specific to the trigger source.

NOTE To trigger the instrument from an external controller, use the **:TRIG** command on page 308 instead.

Step 3. Issue the **:FETC?** or **:DATA:FDAT{1-4}?** command upon completion of measurement.

Step 4. Retrieve the measurement results. You can repeat steps 2 through 4 as needed.

Example 6-3 is a sample program that demonstrates the use of the **:FETC?** command. This program is given the file name fetch.bas and is stored on the sample program disk.

This program checks the measurement conditions at run time, counts the data items to retrieve, and then puts the instrument into trigger wait state. Finally, after the user presses the **[Trigger]** key on the front panel and the instrument completes the measurement cycle, the program retrieves and displays the measurement results.

The program is described in detail below:

Lines 50 to 60	Sets the GPIB address and select code.
Line 70	Sets the data transfer format to ASCII.
Lines 110 to 160	Retrieves the display on/off (1/0) settings and parameter names for measurement parameters 1 through 4 and stores the settings and names into the variables Stat(1) through Stat(4) and Title$(1) through Title$(4).
Lines 180 to 200	Retrieves the display on/off (0/1) setting for the result of test signal current level monitoring and stores the setting into the Stat(5) variable; stores the title (Imon) for current level monitoring into the Title$(5) variable.
Lines 220 to 240	Retrieves the display on/off (0/1) setting for the result of test signal voltage level monitoring and stores the setting into the Stat(6) variable; stores the title (Vmon) for voltage level monitoring into the Title$(6) variable.
Lines 260 to 280	Retrieves the on/off (0/1) setting for the result of R_{dc}measurement and stores the setting into the Stat(7) variable; stores the title (Rdc) for R_{dc}measurement into the Title$(7) variable.
Lines 300 to 310	Retrieves the on/off (0/1) setting of bin sorting and stores the setting into the Bin_stat variable.
Lines 330 to 340	Retrieves the list/single-point (0/1) measurement setting and stores the setting into the List_stat variables.

Lines 360 to 370 If list measurement is specified (List_stat variable = 1), the program retrieves the number of measurement points and stores the data into the Stop_no variable while storing "1" into the Star_no variable.

Lines 360 to 370 If single-point measurement is specified (List_stat is not equal to 1), the program retrieves the identification number of the specific measurement point and stores the data into the Stop_no and Star_no variables.

Lines 450 to 460 Calculates the data size and resizes the Res array.

Lines 500 to 520 After measurement is stopped (the trigger system is stopped), the program sets the trigger source to Manual trigger and turns on the continuous activation of the trigger system.

Lines 560 to 620 Instructs the instrument to generate an SRQ upon completion of measurement and clears the status byte register and operation status event register.

Lines 660 to 670 Sets the branch target for an SRQ interrupt to enable SRQ interrupts.

Lines 680 to 690 Prompts the user to press the **[Trigger]** key. The program waits until the user presses the **[Trigger]** key and the instrument completes the measurement cycle.

Lines 710 to 720 Retrieves the measurement results and stores them into the Res array.

Lines 760 to 830 Displays the title portions of the retrieved measurement results.

Lines 860 to 960 Iterates the following steps for each of the measurement points from Star_no to Stop_No.

1. Lines 870 to 880: Displays the measurement status and proceeds to the next data position.
2. Lines 890 to 940: Displays the results for measurement parameters 1 through 4, test signal current/voltage level monitoring, and R_{dc}measurement if the corresponding array element, Stat(*), is 1; then proceeds to the next data position.

Lines 970 to 990 If Bin_stat is 1 and bin sorting is on, the program displays the results of bin sorting.

Example 6-3 **Using the :FETC? Command to Retrieve Measurement Results (fetch.bas)**

```
10      DIM Title$(1:7)[9],Buff$[9]
20      REAL Res(1:257)
30      INTEGER Stat(1:7),Bin_stat,List_stat,Star_no,Stop_no,Data_size,
Loc,I,J
40      CLEAR SCREEN
50      ASSIGN @Agt4287a TO 717
60      Scode=7
70      OUTPUT @Agt4287a;":FORM ASC"
80      !
90      ! Check Condition
100     !
110     FOR I=1 TO 4
120       OUTPUT @Agt4287a;":DISP:TEXT1:CALC"&VAL$(I)&"?"
130       ENTER @Agt4287a;Stat(I)
140       OUTPUT @Agt4287a;":CALC:PAR"&VAL$(I)&":FORM?"
150       ENTER @Agt4287a;Title$(I)
160     NEXT I
170     !
180     OUTPUT @Agt4287a;":DISP:TEXT1:CALC11?"
190     ENTER @Agt4287a;Stat(5)
200     Title$(5)="Imon"
210     !
220     OUTPUT @Agt4287a;":DISP:TEXT1:CALC12?"
230     ENTER @Agt4287a;Stat(6)
240     Title$(6)="Vmon"
250     !
260     OUTPUT @Agt4287a;":SOUR:LIST:RDC?"
270     ENTER @Agt4287a;Stat(7)
280     Title$(7)="Rdc"
290     !
300     OUTPUT @Agt4287a;":CALC:COMP?"
310     ENTER @Agt4287a;Bin_stat
320     !
330     OUTPUT @Agt4287a;":SOUR:LIST:STAT?"
340     ENTER @Agt4287a;List_stat
350     IF List_stat=1 THEN
360       OUTPUT @Agt4287a;":SOUR:LIST:SIZE?"
370       ENTER @Agt4287a;Stop_no
380       Star_no=1
390     ELSE
400       OUTPUT @Agt4287a;":SOUR:LIST:POIN?"
410       ENTER @Agt4287a;Stop_no
420       Star_no=Stop_no
430     END IF
440     !
450     Data_size=(1+Stat(1)+Stat(2)+Stat(3)+Stat(4)+Stat(5)+Stat(6)+Stat
(7))*(Stop_no-Star_no+1)+Bin_stat
460     REDIM Res(1:Data_size)
470     !
480     ! Trigger source setting
490     !
500     OUTPUT @Agt4287a;":ABOR"
510     OUTPUT @Agt4287a;":TRIG:SOUR MAN"
520     OUTPUT @Agt4287a;":INIT:CONT ON"
530     !
540     ! Status register setting (For SRQ)
550     !
560     OUTPUT @Agt4287a;":STAT:OPER:PTR 0"
570     OUTPUT @Agt4287a;":STAT:OPER:NTR 16"
580     OUTPUT @Agt4287a;":STAT:OPER:ENAB 16"
590     OUTPUT @Agt4287a;"*SRE 128"
```

```
600    OUTPUT @Agt4287a;"*CLS"
610    OUTPUT @Agt4287a;"*OPC?"
620    ENTER @Agt4287a;Buff$
630    !
640    ! Triggering and data read
650    !
660    ON INTR Scode GOTO Meas_end
670    ENABLE INTR Scode;2
680    PRINT "Push Trigger Key!"
690 Meas_wait:  GOTO Meas_wait
700 Meas_end:  OFF INTR Scode
710    OUTPUT @Agt4287a;":FETC?"
720    ENTER @Agt4287a;Res(*)
730    !
740    ! Display results
750    !
760    PRINT "### Result ###"
770    PRINT "No. Stat";
780    FOR J=1 TO 7
790      IF Stat(J)=1 THEN
800        PRINT USING "3X,5A,2X,#";Title$(J)
810      END IF
820    NEXT J
830    PRINT ""
840    !
850    Loc=1
860    FOR I=Star_no TO Stop_no
870      PRINT USING "2D,4X,D,#";I,Res(Loc)
880      Loc=Loc+1
890      FOR J=1 TO 7
900        IF Stat(J)=1 THEN
910          PRINT USING "X,MD.2DE,#";Res(Loc)
920          Loc=Loc+1
930        END IF
940      NEXT J
950      PRINT ""
960    NEXT I
970    IF Bin_stat=1 THEN
980      PRINT "BIN Sort:";Res(Loc)
990    END IF
1000   !
1010 Prog_end:END
```

Retrieving the Measurement Results for Measurement Parameters 1 through 4

Example 6-4 is a sample program that demonstrates the use of the **:DATA:FDAT{1-4}?** command. This program is given the file name data.bas and is stored on the sample program disk.

The sample program retrieves and displays the measurement results for parameters 1 and 2 and the result of test signal current level monitoring when the instrument receives an external trigger and completes the measurement cycle. The program is described in detail below:

Lines 40 to 50	Sets the GPIB address and select code.
Line 60	Sets the Point variable to the number of measurement points for single-point measurement.
Line 70	Sets the data transfer format to ASCII.
Lines 90 to 120	Retrieves the parameter names of measurement parameters 1 and 2 and stores the names into the Para1$ and Para2$ variables, respectively.
Lines 140 to 150	Instructs the instrument to perform single-point measurement at the point identified by the Point variable.
Lines 190 to 210	After measurement is stopped (the trigger system is stopped), the program sets the trigger source to External trigger and turns on the continuous activation of the trigger system.
Lines 250 to 310	Instructs the instrument to generate an SRQ upon completion of measurement and clears the status byte register and operation status event register.
Lines 350 to 360	Sets the branch target for an SRQ interrupt to enable SRQ interrupts.
Lines 370 to 380	Prompts the user to input an external trigger. The program waits until the instrument receives an external trigger and completes the measurement cycle.
Lines 400 to 450	Retrieves the measurement results for parameters 1 and 2 and the result of test signal current level monitoring and stores the data into the Res1, Res2, and Imon variables, respectively.
Lines 490 to 500	Displays the measurement results.

Example 6-4 Using the :DATA:FDAT{1-4}? Command to Retrieve Measurement Results (data.bas)

```
10     DIM Para1$[9],Para2$[9],Buff$[9]
20     REAL Res1,Res2,Imon
30     INTEGER Point,Scode
40     ASSIGN @Agt4287a TO 717
50     Scode=7
60     Point=1
70     OUTPUT @Agt4287a;":FORM ASC"
80     !
90     OUTPUT @Agt4287a;":CALC:PAR1:FORM?"
100    ENTER @Agt4287a;Para1$
110    OUTPUT @Agt4287a;":CALC:PAR2:FORM?"
120    ENTER @Agt4287a;Para2$
130    !
140    OUTPUT @Agt4287a;":SOUR:LIST:STAT OFF"
150    OUTPUT @Agt4287a;":SOUR:LIST:POIN ";Point
160    !
170    ! Trigger source setting
180    !
190    OUTPUT @Agt4287a;":ABOR"
200    OUTPUT @Agt4287a;":TRIG:SOUR EXT"
210    OUTPUT @Agt4287a;":INIT:CONT ON"
220    !
230    ! Status register setting (For SRQ)
240    !
250    OUTPUT @Agt4287a;":STAT:OPER:PTR 0"
260    OUTPUT @Agt4287a;":STAT:OPER:NTR 16"
270    OUTPUT @Agt4287a;":STAT:OPER:ENAB 16"
280    OUTPUT @Agt4287a;"*SRE 128"
290    OUTPUT @Agt4287a;"*CLS"
300    OUTPUT @Agt4287a;"*OPC?"
310    ENTER @Agt4287a;Buff$
320    !
330    ! Triggering and data read
340    !
350    ON INTR Scode GOTO Meas_end
360    ENABLE INTR Scode;2
370    PRINT "Waiting for External Trigger!"
380 Meas_wait:  GOTO Meas_wait
390 Meas_end:  OFF INTR Scode
400    OUTPUT @Agt4287a;":DATA:FDAT1?"
410    ENTER @Agt4287a;Res1
420    OUTPUT @Agt4287a;":DATA:FDAT2?"
430    ENTER @Agt4287a;Res2
440    OUTPUT @Agt4287a;":DATA:IMON?"
450    ENTER @Agt4287a;Imon
460    !
470    ! Display results
480    !
490    PRINT "### Result ###"
500    PRINT Para1$&":";Res1,Para2$&":";Res2,"Imon:";Imon
510    !
520    END
```

Using the :READ? command to retrieve measurement results

This command retrieves the measurement results synchronously with the transition from trigger wait state to end of measurement, without detecting trigger timing in the program. It is useful, for example, when you want to trigger the instrument from an external device, such as a handler, and immediately pass the measurement results to an external controller.

To retrieve measurement results using the **:READ?** command, follow these steps:

Step 1. Issue the **:TRIG:SOUR** command to set the trigger source to Internal, External or Manual trigger.

Step 2. Issue the **:READ?** command.

Step 3. Trigger the instrument using the method specific to the trigger source.

Step 4. Retrieve the measurement results. You can repeat steps 2 through 4 as needed.

Example 6-5 shows a sample program. This program is given the file name read.bas and is stored on the sample program disk.

The sample program retrieves and displays the measurement status, the measurement results for parameters 1 and 2, and the result of test signal current level monitoring when the instrument receives an external trigger and completes the measurement cycle. The program is described in detail below:

Line 40	Sets the GPIB address.
Line 50	Sets the Point variable to the number of measurement points for single-point measurement.
Line 60	Sets the data transfer format to ASCII.
Lines 80 to 130	Instructs the instrument to show the results for measurement parameters 1 and 2 as well as the result of test signal current level monitoring while hiding the measurement results of measurement parameters 3 and 4 as well as the result of test signal voltage level monitoring.
Lines 150 to 180	Retrieves the parameter names of measurement parameters 1 and 2 and stores the names into the Para1$ and Para2$ variables, respectively.
Lines 200 to 210	Instructs the instrument to perform single-point measurement at the point identified by the Point variable.
Lines 220 to 230	Turns off the bin sorting and Rdc measurement functions.
Lines 270 to 280	After measurement is stopped (the trigger system is stopped), the program sets the trigger source to External trigger.
Lines 320 to 330	After issuing the **:READ?** command, the program prompts the user to input an external trigger. The program waits until the instrument receives an external trigger and completes the measurement cycle.
Line 340	Retrieves the measurement status, the measurement results for parameters 1 and 2, and the result of test signal current level monitoring, then stores the data into the Stat, Res1, Res2, and Imon variables, respectively.
Lines 380 to 390	Displays the measurement results.

Example 6-5 **Using the :READ? Command to Retrieve Measurement Results (read.bas)**

```
10      DIM Para1$[9],Para2$[9]
20      REAL Res1,Res2,Imon
30      INTEGER Point,Stat
40      ASSIGN @Agt4287a TO 717
50      Point=1
60      OUTPUT @Agt4287a;":FORM ASC"
70      !
80      OUTPUT @Agt4287a;":DISP:TEXT1:CALC1 ON"
90      OUTPUT @Agt4287a;":DISP:TEXT1:CALC2 ON"
100     OUTPUT @Agt4287a;":DISP:TEXT1:CALC3 OFF"
110     OUTPUT @Agt4287a;":DISP:TEXT1:CALC4 OFF"
120     OUTPUT @Agt4287a;":DISP:TEXT1:CALC11 ON"
130     OUTPUT @Agt4287a;":DISP:TEXT1:CALC12 OFF"
140     !
150     OUTPUT @Agt4287a;":CALC:PAR1:FORM?"
160     ENTER @Agt4287a;Para1$
170     OUTPUT @Agt4287a;":CALC:PAR2:FORM?"
180     ENTER @Agt4287a;Para2$
190     !
200     OUTPUT @Agt4287a;":SOUR:LIST:STAT OFF"
210     OUTPUT @Agt4287a;":SOUR:LIST:POIN ";Point
220     OUTPUT @Agt4287a;":CALC:COMP OFF"
230     OUTPUT @Agt4287a;":SOUR:LIST:RDC OFF"
240     !
250     ! Trigger source setting
260     !
270     OUTPUT @Agt4287a;":ABOR"
280     OUTPUT @Agt4287a;":TRIG:SOUR EXT"
290     !
300     ! Triggering and data read
310     !
320     OUTPUT @Agt4287a;":READ?"
330     PRINT "Waiting for External Trigger!"
340     ENTER @Agt4287a;Stat,Res1,Res2,Imon
350     !
360     ! Display results
370     !
380     PRINT "### Result ###"
390     PRINT "Meas. Status:";Stat,Para1$&":";Res1,Para2$&":";Res2,"Imon
:";Imon
400     !
410     END
```

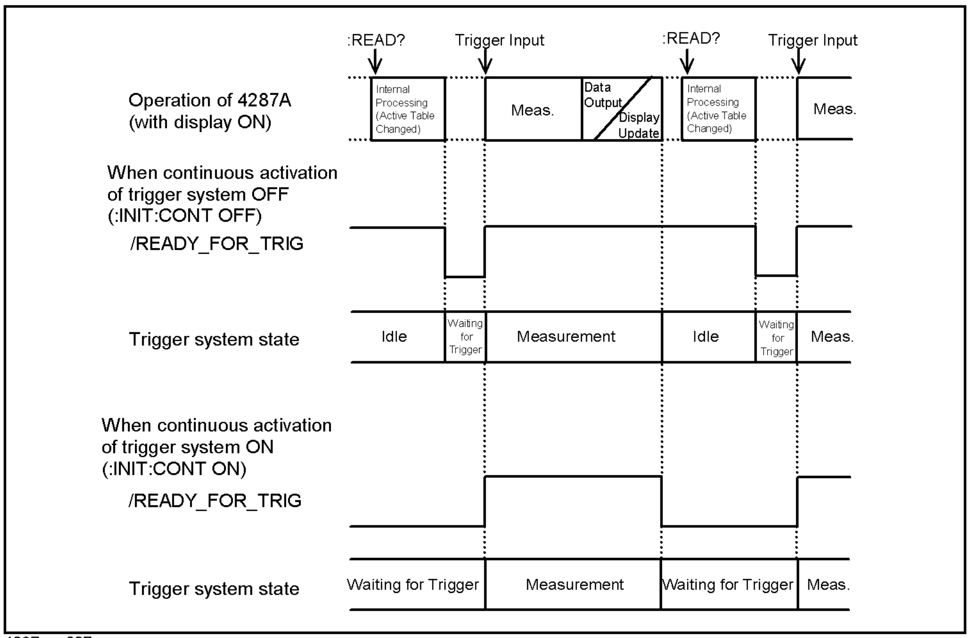
Trigger Input Timing When Using the :READ? Command

When executing the **:READ?** command while specifying its parameter (specifying the active table), you must start measurement (provide a trigger) after changing the table to obtain a correct measurement result.

Even if you execute the **:READ?** command without specifying its parameter when the controller outputting the trigger is different from the controller executing the **:READ?** command, you must provide the trigger output controller with the information on whether the **:READ?** command has been executed in order to control the timing of the trigger output appropriately (i.e., provide a trigger after the execution of the **:READ?** command).

As shown in Figure 6-6, you can obtain this information from the /READY_FOR_TRIG signal of the handler interface.

Figure 6-6 **Operation of the /READY_FOR_TRIG signal when executing the :READ? command**



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If you execute the **:READ?** command while the trigger system is in idle state, as shown in Figure 6-6, after the internal processing (including change processing of the active table) that follows the reception of the command is completed, the /READY_FOR_TRIG signal of the handler interface changes from the High level to the Low level.

However, if continuous activation of the trigger system is turned on, as shown in Figure 6-6, when display update finishes after the completion of the measurement, the /READY_FOR_TRIG signal changes from the High level to the Low level because the trigger system goes into Waiting for Trigger state instead of idle state. Therefore, you cannot obtain the information on whether the **:READ?** command has been executed. For this reason, you must first turn off continuous activation of the trigger system (execute **:INIT:CONT** command on page 287 specifying OFF or execute **:ABOR** command on page 209).

NOTE In Figure 6-6, the **:READ?** command is executed after the display is updated, but it can also be executed before the update, provided that data output has finished (the query of the previous **:READ?** command has finished). Note that the internal processing still starts after the completion of the update.

Retrieving the Monitored Values of Test Signal Levels

To retrieve only the monitored values of test signal levels, use the following commands:

- **:DATA:IMON?** on page 263
- **:DATA:VMON?** on page 267

As described in “Retrieving the Measurement Results for Measurement Parameters 1 through 4” on page 85, you can also use the following three commands to retrieve the monitoring results along with other data such as the measurement results for measurement parameters 1 through 4:

- ***TRG** on page 208
- **:FETC?** on page 280
- **:READ?** on page 293

Example 6-6 is a sample program that demonstrates the use of the **:DATA:IMON?** and **:DATA:VMON?** commands. This program is given the file name lvl_mon.bas and is stored on the sample program disk.

The sample program retrieves and displays the test signal current and voltage levels monitored during the last measurement cycle.

The program is described in detail below:

Line 30	Sets the GPIB address.
Lines 50 to 60	Retrieves the list/single-point (0/1) measurement setting and stores the setting into the List_stat variables.
Lines 80 to 90	If list measurement is specified (List_stat variable = 1), the program retrieves the number of measurement points and stores the data into the Nop variable.
Line 110	If single-point measurement is specified (List_stat is not equal to 1), the program stores 1 into the Nop variable.
Line 130	Resizes the I_mon and V_mon arrays based on the value of the Nop variable.
Line 150	Sets the data transfer format to ASCII.
Lines 160 to 170	Reads the test signal current level and stores it into the I_mon array.
Lines 180 to 190	Reads the test signal voltage level and stores it into the V_mon array.
Lines 230 to 320	Converts the monitored current and voltage levels into the corresponding mA and mV values and displays them on screen.

Example 6-6 **Retrieving the Monitored Values of Test Signal Levels (lvl_mon.bas)**

```
10      REAL I_mon(1:32),V_mon(1:32)
20      INTEGER List_stat,Nop,I
30      ASSIGN @Agt4287a TO 717
40      !
50      OUTPUT @Agt4287a;":SOUR:LIST:STAT?"
60      ENTER @Agt4287a;List_stat
70      IF List_stat=1 THEN
80        OUTPUT @Agt4287a;":SOUR:LIST:SIZE?"
90        ENTER @Agt4287a;Nop
100     ELSE
110       Nop=1
120     END IF
130     REDIM I_mon(1:Nop),V_mon(1:Nop)
140     !
150     OUTPUT @Agt4287a;":FORM ASC"
160     OUTPUT @Agt4287a;":DATA:IMON?"
170     ENTER @Agt4287a;I_mon(*)
180     OUTPUT @Agt4287a;":DATA:VMON?"
190     ENTER @Agt4287a;V_mon(*)
200     !
210     ! Display results
220     !
230     PRINT "[Test Signal Monitor Value]"
240     IF List_stat=1 THEN
250       PRINT "No.  Current[mA]  Voltage[mV]"
260       FOR I=1 TO Nop
270         PRINT USING "2D,4X,2D.4D,6X,2D.4D";I,I_mon(I)*1000,V_mon(I)*1000
280       NEXT I
290     ELSE
300       PRINT " Current[mA]:";I_mon(1)*1000
310       PRINT " Voltage[mV]:";V_mon(1)*1000
320     END IF
330     !
340     END
```

Retrieving the Results of R_{dc} Measurement

Retrieving measurement results

To retrieve only the results of R_{dc} measurement, use the following command:

- **:DATA:RDC?** on page 267

As described in "Retrieving the Measurement Results for Measurement Parameters 1 through 4" on page 85, you can also use the following three commands to retrieve the Rdc measurement results along with other data such as the measurement results for measurement parameters 1 through 4:

- ***TRG** on page 208
- **:FETC?** on page 280
- **:READ?** on page 293

Retrieving limit test results

To determine whether the R_{dc} measurement results fall within the limit range (defined with the **:CALC:COMP:RDC:LIM** command), use the following command:

- **:CALC:COMP:DATA:RDC?** on page 222

Also, you can use the ***TRG** or similar command to retrieve the measurement results as well as the measurement status and then obtain the R_{dc} measurement limit test results from that measurement status.

As shown below, the measurement status is 0 or 1 when the R_{dc} measurement results fall within the limit range and 2 or 3 when the R_{dc} measurement results do NOT fall within the limit range.

Value of Measurement Status

0: Normal
1: Measurement failure (overload)
2: R_{dc} measurement result did not fall within the limit range
3: Measurement failed and DUT did not fall within R_{dc} limit.

Sample program

Example 6-7 shows a sample program. This program is given the file name rdc.bas and is stored on the sample program disk.

The sample program sets the limit range for R_{dc} measurement, turns on the R_{dc} measurement function, and then puts the instrument into trigger wait state. Finally, when the user presses the **[Trigger]** key on the front panel and the instrument completes the measurement cycle, the program retrieves and displays the R_{dc} measurement and limit test results.

The program is described in detail below:

Lines 30 to 40	Sets the GPIB address and select code.
Lines 50 to 60	Stores the upper and lower limits for R_{dc} measurement into the L_lim and U_lim variables.
Line 70	Sets the data transfer format to ASCII.
Line 110	Sets the limit range for R_{dc} measurement values to the range between L_lim and U_lim
Lines 120 to 130	Turns on the bin sorting and R_{dc} measurement functions.
Lines 170 to 190	After measurement is stopped (the trigger system is stopped), the program sets the trigger source to External trigger and turns on the continuous activation of the trigger system.
Lines 230 to 290	Instructs the instrument to generate an SRQ upon completion of measurement and clears the status byte register and operation status event register.
Lines 330 to 340	Sets the branch target for an SRQ interrupt to enable SRQ interrupts.
Lines 350 to 360	Prompts the user to press the **[Trigger]** key. The program waits until the user presses the **[Trigger]** key and the instrument completes the measurement cycle.
Lines 380 to 390	Retrieves the R_{dc} measurement result and stores it into the Rdc variable.
Lines 400 to 410	Retrieves the R_{dc} measurement limit test result and stores it into the Rdc_test variable.
Lines 450 to 500	Displays the R_{dc} measurement value as well as the R_{dc} measurement limit test results.

Example 6-7 **Retrieving the Results of R_{dc} Measurement (rdc.bas)**

```
10     REAL L_lim,U_lim,Rdc
20     INTEGER Scode,Rdc_test
30     ASSIGN @Agt4287a TO 717
40     Scode=7
50     L_lim=-5
60     U_lim=5
70     OUTPUT @Agt4287a;":FORM ASC"
80     !
90     ! Rdc measurement setting
100    !
110    OUTPUT @Agt4287a;":CALC:COMP:RDC:LIM ";L_lim;",";U_lim
120    OUTPUT @Agt4287a;":CALC:COMP ON"
130    OUTPUT @Agt4287a;":SOUR:LIST:RDC ON"
140    !
150    ! Trigger source setting
160    !
170    OUTPUT @Agt4287a;":ABOR"
180    OUTPUT @Agt4287a;":TRIG:SOUR MAN"
190    OUTPUT @Agt4287a;":INIT:CONT ON"
200    !
210    ! Status register setting (For SRQ)
220    !
230    OUTPUT @Agt4287a;":STAT:OPER:PTR 0"
240    OUTPUT @Agt4287a;":STAT:OPER:NTR 16"
250    OUTPUT @Agt4287a;":STAT:OPER:ENAB 16"
260    OUTPUT @Agt4287a;"*SRE 128"
270    OUTPUT @Agt4287a;"*CLS"
280    OUTPUT @Agt4287a;"*OPC?"
290    ENTER @Agt4287a;Buff$
300    !
310    ! Triggering and data read
320    !
330    ON INTR Scode GOTO Meas_end
340    ENABLE INTR Scode;2
350    PRINT "Push Trigger Key!"
360 Meas_wait:  GOTO Meas_wait
370 Meas_end:  OFF INTR Scode
380    OUTPUT @Agt4287a;":DATA:RDC?"
390    ENTER @Agt4287a;Rdc
400    OUTPUT @Agt4287a;":CALC:COMP:DATA:RDC?"
410    ENTER @Agt4287a;Rdc_test
420    !
430    ! Display results
440    !
450    PRINT "Rdc measurement value:";Rdc;
460    IF Rdc_test=1 THEN
470      PRINT " (LIMIT IN)"
480    ELSE
490      PRINT " (LIMIT OUT)"
500    END IF
510    !
520    END
```

7 Sorting DUTs Based on Measurement Results

This chapter explains how to use the bin sorting function to sort DUTs into a number of configured bins based on measurement results.

Setting Up the Bin Sorting Function

Turning on/off the bin sorting function (comparator)

To enable or disable the bin sorting function (comparator), use the following command:

- **:CALC:COMP** on page 211

Setting the beep condition

You can configure the instrument to beep under one of the following two conditions:

- When a DUT has failed to pass the bin sorting criteria (i.e., sorted into a bad bin or not sorted into any bin).
- When a DUT has passed the bin sorting criteria (i.e., sorted into a good bin).

To set the beep condition, use the following command:

- **:CALC:COMP:BEEP:COND** on page 211

You can also disable the beep function. To turn on or off the beep, use the following command:

- **:SYST:BEEP2:STAT** on page 303

Setting the sorting conditions for each bin

You can define up to 4 sorting conditions for each bin. When two or more conditions are specified, the instrument tests the DUT's characteristics to the AND of those conditions.

Resetting the sorting conditions

You can initialize the on/off setting, sorting conditions, and OUT_OF_GOOD_BINS line setting for all bins by issuing the following command:

- **:CALC:COMP:CLE** on page 214

Enabling or disabling individual bins

You can enable or disable each bin separately. When a bin is disabled, the bin's sorting conditions are ignored and no DUT is sorted into the bin. To enable or disable a single bin, use the following command:

- **:CALC:COMP:BIN{1-13}** on page 212

Setting the boundary between good and bad bins (OUT_OF_GOOD_BINS line)

You can classify bins as good or bad. When a DUT is sorted into a bad bin, the handler interface output signal /OUT_OF_GOOD_BINS becomes active (Low). A bad bin is useful, for example, when you want to eject defective DUTs into a separate location.

NOTE Also, the /OUT_OF_GOOD_BINS signal becomes active when a DUT is not sorted into any of bins 1 through 13. For more information, refer to Table 12-2, “Mapping between Bin Sort Results and Handler Interface Output Signals,” on page 145.

You can specify the boundary between good and bad bins (the OUT_OF_GOOD_BINS line) with the number of the good bin that is to be adjacent to the boundary. All bin numbers that are equal to or smaller than the specified bin number represent good bins, while those that are larger than the specified number represent bad bins. To set the boundary, use the following command:

- **:CALC:COMP:OGB** on page 223

Defining individual sorting conditions

When you define a sorting condition, you must specify the limit range as well as the measurement point number and measurement parameter that correspond to the measured values to which the limit range is applied. You can define the boundary of the limit range by specifying the boundary value either as an absolute value (“absolute mode”) or as a value relative to a reference value (“tolerance mode”). Tolerance mode is further divided into two modes: “deviation tolerance mode,” where you can specify the relative boundary value as the difference from the reference value, and “percent tolerance mode,” where you can specify the boundary value as a percentage of the reference value. Use the commands listed in the table below to define sorting conditions:

Item			Command
Applies to all bins	Information needed to identify the measured value to which the limit range is applied	Point number	**:CALC:COMP:COND{1-4}:SNUM** on page 218
		Measurement parameter	**:CALC:COMP:COND{1-4}:PAR** on page 217
	Limit range	Mode of boundary definition (Limit mode)	**:CALC:COMP:COND{1-4}:MODE** on page 215
		Reference value*1	**:CALC:COMP:COND{1-4}:NOM** on page 216
For each bin		Boundary value	**:CALC:COMP:BIN{1-13}:COND{1-4}:LIM** on page 213
		Mode of bin range definition (BIN range mode)	**:CALC:COMP:BIN{1-13}:COND{1-4}:LTYP** on page 214

*1. Available in deviation tolerance mode and percent tolerance mode.

Figure 7-1 **Commands for defining sorting conditions**

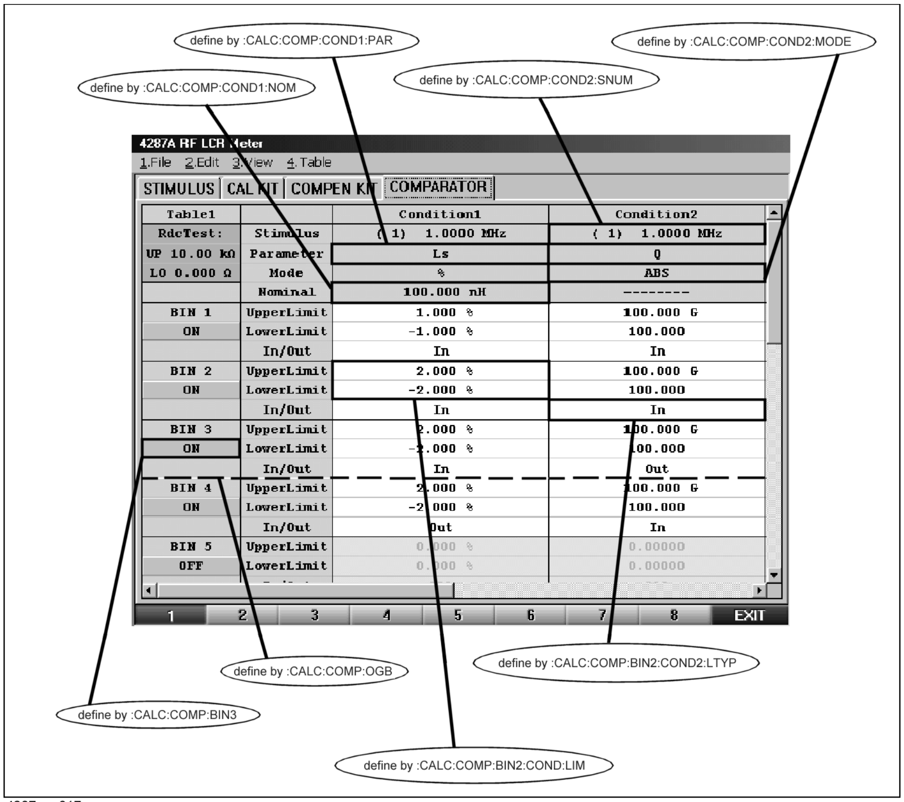

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Table 7-1 Relationship between limit mode and measured value used for sorting

Limit mode	Absolute mode (ABS)	Deviation tolerance mode (DEV)	Percent tolerance mode (PCNT)
Measured value	$Meas$	$Meas - Nom$	$\dfrac{Meas - Nom}{Nom} \times 100$

where $Meas$ and Nom mean the following:

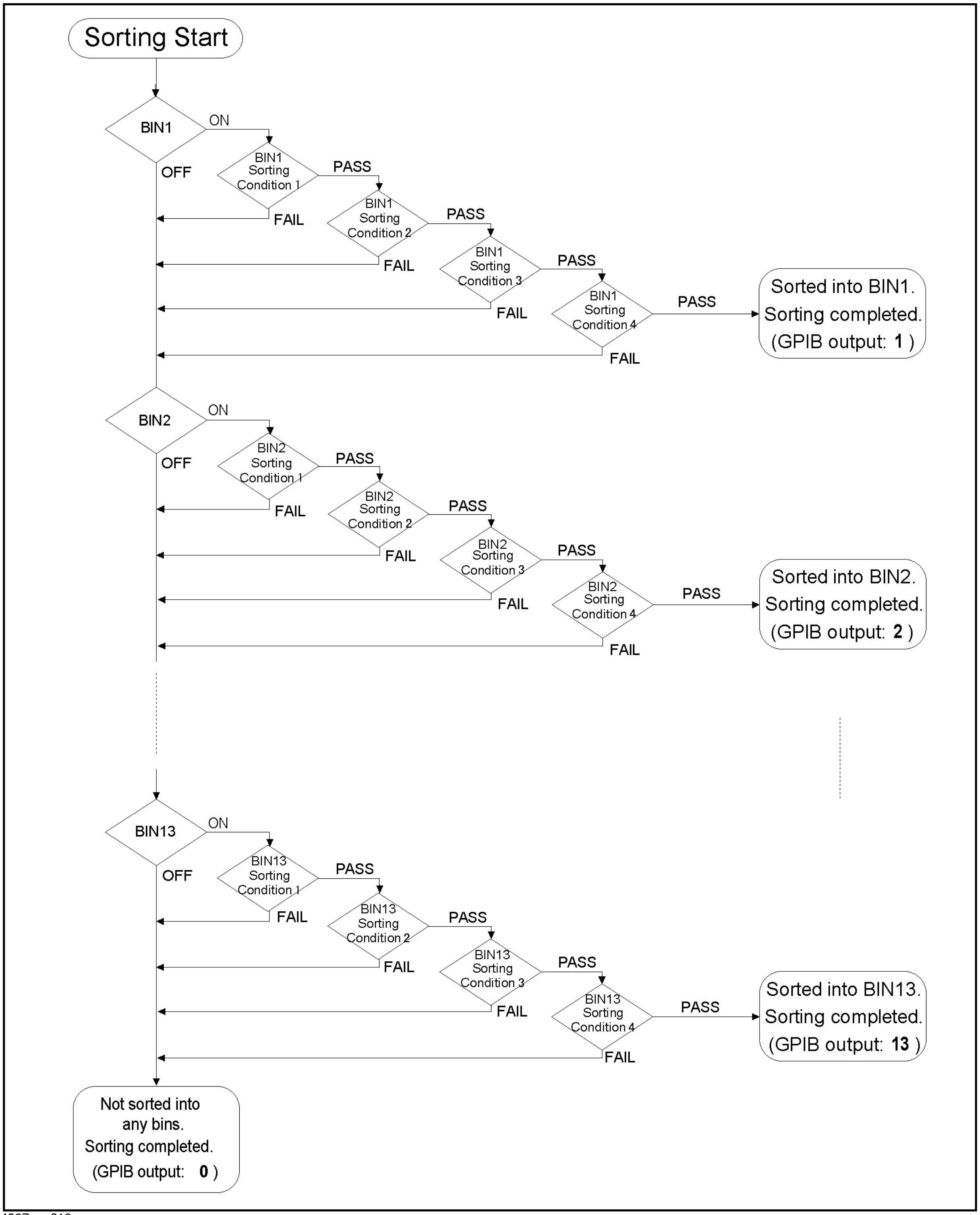
$Meas$: A value obtained by converting the impedance value measured at the point specified via the **:CALC:COMP:COND{1-4}:SNUM** command into the measurement parameter value specified via the **:CALC:COMP:COND{1-4}:PAR** command.

Nom : The reference value specified via the **:CALC:COMP:COND{1-4}:NOM** command.

Table 7-2 Relationship between BIN range mode and test result (PASS/FAIL)

Range of measured value	BIN range mode		
	In	Out	All
Measured value < lower limit	FAIL	PASS	PASS
Lower limit ≤ measured value ≤ upper limit	PASS	FAIL	
Measured value > upper limit	FAIL	PASS	

Figure 7-2 **Sorting flow**



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Retrieving the Results of Bin Sorting

To retrieve the results of bin sorting, use the following command:

- **:CALC:COMP:DATA:BIN?** on page 221

When the bin sorting function is on (that is, after you have issued the **:CALC:COMP** command on page 211 by specifying "ON"), you can use the following command to retrieve the bin sorting results as well as the measurement status and measured values.

- ***TRG** on page 208
- **:FETC?** on page 280
- **:READ?** on page 293

Whichever command you use, the result of bin sorting is represented as an integer between 0 and 14, as shown below:

0: Indicates a DUT not sorted into any of bins 1 through 13
1: Sorted into bin 1
2: Sorted into bin 2
3: Sorted into bin 3
4: Sorted into bin 4
5: Sorted into bin 5
6: Sorted into bin 6
7: Sorted into bin 7
8: Sorted into bin 8
9: Sorted into bin 9
10: Sorted into bin 10
11: Sorted into bin 11
12: Sorted into bin 12
13: Sorted into bin 13
14: Sort failed (due to measurement error)

NOTE When the bin sorting function is off (that is, after you have issued the **:CALC:COMP** command by specifying "OFF"), you can use the **:CALC:COMP:DATA:BIN?** command to retrieve the result of the last bin sorting that was carried out when the bin sorting function was on. Note that this command returns 1 if no bin sorting has been performed or 0 if the instrument was reset after the last bin sorting.

Retrieving the Number of the DUTs Sorted into Each Bin (Using the Bin Count Function)

You can use the bin count function to count the number of DUTs sorted into each bin. You can count up to 2,147,483,647 (2^{31}-1) DUTs. If this limit is exceeded, the counter value remains at the maximum without being updated.

To turn on or off the bin count function, use the following command:

- **:CALC:COMP:COUN** on page 219

To retrieve the counter value, use the following command:

- **:CALC:COMP:DATA:BCOU?** on page 220

Also, you can clear the counter value so that you can re-count DUTs from 0 by issuing the following command:

- **:CALC:COMP:COUN:CLE** on page 219

Sample Program

Example 7-1 shows a sample program that demonstrates the use of the bin sorting function. You can find the source file of this program, named bin_sort.bas, on the sample program disk.

The sample program first configures the bin sorting conditions as shown in Figure 7-3 and then performs 50 measurement cycles; each time the instrument completes one measurement cycle, the program retrieves and displays the bin sorting results. Finally, after the instrument has completed the last measurement cycle, the program retrieves and displays the number of DUTs sorted into each bin.

Figure 7-3 **Configuring bin sorting conditions for Example 7-1 (where frequency at point 1 is set to 10 MHz)**

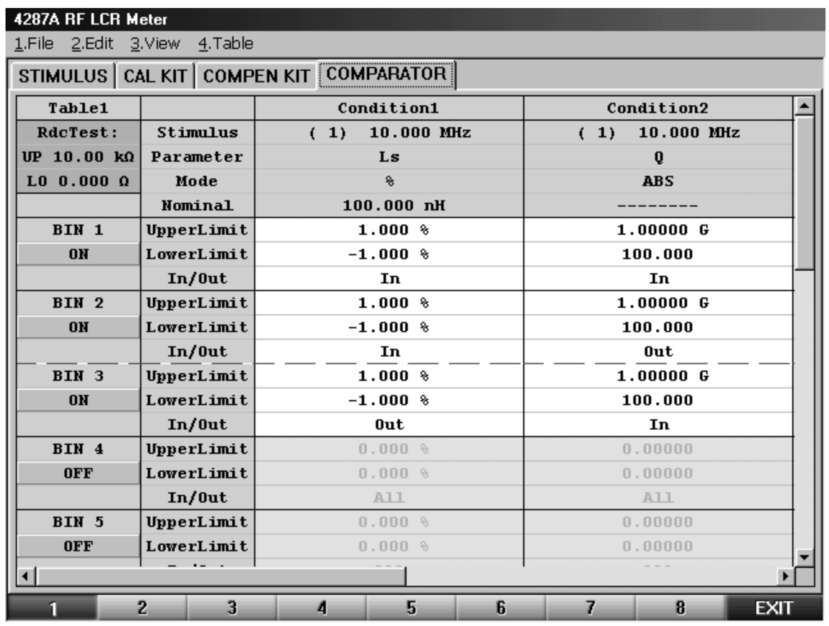


Table1		Condition1	Condition2
RdcTest:	Stimulus	(1) 10.000 MHz	(1) 10.000 MHz
UP 10.00 kΩ	Parameter	Ls	Q
LO 0.000 Ω	Mode	%	ABS
	Nominal	100.000 nH	--------
BIN 1	UpperLimit	1.000 %	1.00000 G
ON	LowerLimit	-1.000 %	100.000
	In/Out	In	In
BIN 2	UpperLimit	1.000 %	1.00000 G
ON	LowerLimit	-1.000 %	100.000
	In/Out	In	Out
BIN 3	UpperLimit	1.000 %	1.00000 G
ON	LowerLimit	-1.000 %	100.000
	In/Out	Out	In
BIN 4	UpperLimit	0.000 %	0.00000
OFF	LowerLimit	0.000 %	0.00000
	In/Out	All	All
BIN 5	UpperLimit	0.000 %	0.00000
OFF	LowerLimit	0.000 %	0.00000

The program is described in detail below:

Line 60 — Sets the GPIB address.

Lines 80 to 90 — Stores the highest sorting condition number into the Max_cond variable and the highest bin number into the Max_bin variable.

Line 100 — Stores the highest good bin number, which serves as the boundary between the good and bad bins, into the Ogbin variable.

Lines 120 to 210 — Stores the settings for sorting conditions 1 and 2 that apply to all bins into the corresponding arrays: Point_no(*) contains the measurement points; Para$(*) contains the selected measurement parameters; Lim_mode$(*) contains the modes of boundary definition; Nominal(*) contains the reference values.

Lines 220 to 300 — Stores the bin 1 specific settings for sorting conditions 1 and 2 into the corresponding arrays: L_lim(1,*) contains the lower limits; U_lim(1,*) contains the upper limits; L_type$(1,*) contains the modes of bin range definition.

Lines 310 to 390	Stores the bin 2 specific settings for sorting conditions 1 and 2 into the corresponding arrays: L_lim(2,*) contains the lower limits; U_lim(2,*) contains the upper limits; L_type$(2,*) contains the modes of bin range definition.
Lines 400 to 480	Stores the bin 3 specific settings for sorting conditions 1 and 2 into the corresponding arrays: L_lim(3,*) contains the lower limits; U_lim(3,*) contains the upper limits; L_type$(3,*) contains the modes of bin range definition.
Lines 520 to 540	Configures the instrument to perform single-point measurement at the specific measurement point (point 1) defined in active table (Table 1).
Lines 550 to 560	Configures the instrument to display Ls and Q as parameters 1 and 2, respectively.
Lines 570 to 620	Instructs the instrument to show the results for measurement parameters 1 and 2 while hiding the measurement results for measurement parameters 3 and 4 as well as the results of test signal current and voltage level monitoring.
Line 630	Turns off the R_{dc} measurement function.
Lines 670 to 680	Resets the bin sorting setup table and turns ON the bin sorting function.
Lines 690 to 830	Iterates the following steps for each of sorting conditions 1 through Meas_cond.

1. Lines 700 to 720: Sets the point number to Point_no(*), measurement parameter to Para$(*), and limit mode to Lim_mode$(*).
2. Lines 730 to 750: Sets the reference value to Nominal(*). Note that these statements are skipped if the boundary is defined in absolute mode.
3. Lines 720 to 820: Iterates the following steps for each bin (bin1 through Max_bin):
    a. Enables the bin and sets the BIN range mode to L_type$(*,*).
    b. Sets the lower and upper limits of the bin range to L_lim(*,*) and U_lim(*,*), respectively. Note that these statements are skipped if the bin range is defined in the ALL mode.

Lines 840 to 850	Assigns all bins with their numbers greater than Ogbin as good bins and turns on the bin count function.
Line 890	Sets the data transfer format to ASCII.
Lines 900 to 920	After measurement is stopped (the trigger system is stopped), the program sets the trigger source to GPIB/LAN trigger and turns on the continuous activation of the trigger system.
Lines 930 to 950	Clears the bin counter value.
Lines 980 to 1010	Stores the result display format into the Img$ variable and shows the title part of the result display.

Lines 1020 to 1100 Loops through the following steps 50 times:

1. Lines 1030 to 1070: Triggers the instrument after the trigger system is put into trigger wait state.
2. Lines 1080 to 1090: Retrieves the measurement results and displays them according to Img$.

Lines 1110 to 1200 Retrieves and displays the bin count.

Example 7-1 **Using the Bin Sorting Function to Sort DUTs (bin_sort.bas)**

```
10      DIM Para$(1:4)[9],Lim_mode$(1:4)[9],L_type$(1:13,1:4)[9],Img$[50]
20      REAL Point_no(1:4),L_lim(1:13,1:4),U_lim(1:13,1:4),Nominal(1:13)
30      REAL Stat,Ls,Q,Bin_res
40      INTEGER Max_cond,Max_bin,Ogbin,Bin(1:14),I,J,Cond_reg
50      !
60      ASSIGN @Agt4287a TO 717
70      !
80      Max_cond=2
90      Max_bin=3
100     Ogbin=2
110     !
120     !====[ALL BIN]====
130     !-- Condition 1 --
140     Point_no(1)=1
150     Para$(1)="LS"
160     Lim_mode$(1)="PCNT"
170     Nominal(1)=1.0E-7
180     !-- Condition 2 --
190     Point_no(2)=1
200     Para$(2)="Q"
210     Lim_mode$(2)="ABS"
220     !=====[BIN1]======
230     !-- Condition 1 --
240     L_lim(1,1)=-1.0
250     U_lim(1,1)=1.0
260     L_type$(1,1)="IN"
270     !-- Condition 2 --
280     L_lim(1,2)=100.0
290     U_lim(1,2)=1.0E+9
300     L_type$(1,2)="IN"
310     !=====[BIN2]======
320     !-- Condition 1 --
330     L_lim(2,1)=-1.0
340     U_lim(2,1)=1.0
350     L_type$(2,1)="IN"
360     !-- Condition 2 --
370     L_lim(2,2)=100.0
380     U_lim(2,2)=1.0E+9
390     L_type$(2,2)="OUT"
400     !=====[BIN3]======
410     !-- Condition 1 --
420     L_lim(3,1)=-1.0
430     U_lim(3,1)=1.0
440     L_type$(3,1)="OUT"
450     !-- Condition 2 --
460     L_lim(3,2)=100.0
470     U_lim(3,2)=1.0E+9
480     L_type$(3,2)="IN"
490     !
500     ! Measurement Condition Setting
510     !
```

```
520    OUTPUT @Agt4287a;":SOUR:LIST:TABL 1"
530    OUTPUT @Agt4287a;":SOUR:LIST:STAT OFF"
540    OUTPUT @Agt4287a;":SOUR:LIST:POIN 1"
550    OUTPUT @Agt4287a;":CALC:PAR1:FORM LS"
560    OUTPUT @Agt4287a;":CALC:PAR2:FORM Q"
570    OUTPUT @Agt4287a;":DISP:TEXT1:CALC1 ON"
580    OUTPUT @Agt4287a;":DISP:TEXT1:CALC2 ON"
590    OUTPUT @Agt4287a;":DISP:TEXT1:CALC3 OFF"
600    OUTPUT @Agt4287a;":DISP:TEXT1:CALC4 OFF"
610    OUTPUT @Agt4287a;":DISP:TEXT1:CALC11 OFF"
620    OUTPUT @Agt4287a;":DISP:TEXT1:CALC12 OFF"
630    OUTPUT @Agt4287a;":SOUR:LIST:RDC OFF"
640    !
650    ! Bin Sort Setup Table Setting
660    !
670    OUTPUT @Agt4287a;":CALC:COMP:CLE"
680    OUTPUT @Agt4287a;":CALC:COMP ON"
690    FOR I=1 TO Max_cond
700      OUTPUT @Agt4287a;":CALC:COMP:COND"&VAL$(I)&":SNUM ";Point_no(I)
710      OUTPUT @Agt4287a;":CALC:COMP:COND"&VAL$(I)&":PAR "&Para$(I)
720      OUTPUT @Agt4287a;":CALC:COMP:COND"&VAL$(I)&":MODE "&Lim_mode$(
I)
730      IF Lim_mode$(I)<>"ABS" THEN
740        OUTPUT @Agt4287a;":CALC:COMP:COND"&VAL$(I)&":NOM ";Nominal(I)
750      END IF
760      FOR J=1 TO Max_bin
770        OUTPUT @Agt4287a;":CALC:COMP:BIN"&VAL$(J)&" ON"
780        OUTPUT @Agt4287a;":CALC:COMP:BIN"&VAL$(J)&":COND"&VAL$(I)&":L
TYP "&L_type$(J,I)
790          IF L_type$(J,I)<>"ALL" THEN
800            OUTPUT @Agt4287a;":CALC:COMP:BIN"&VAL$(J)&":COND"&VAL$(I)&"
:LIM ";L_lim(J,I);",";U_lim(J,I)
810        END IF
820      NEXT J
830    NEXT I
840    OUTPUT @Agt4287a;":CALC:COMP:OGB ";Ogbin
850    OUTPUT @Agt4287a;":CALC:COMP:COUN ON"
860    !
870    ! Measurement
880    !
890    OUTPUT @Agt4287a;":FORM ASC"
900    OUTPUT @Agt4287a;":ABOR"
910    OUTPUT @Agt4287a;":TRIG:SOUR BUS"
920    OUTPUT @Agt4287a;":INIT:CONT ON"
930    OUTPUT @Agt4287a;":CALC:COMP:COUN:CLE"
940    OUTPUT @Agt4287a;"*OPC?"
950    ENTER @Agt4287a;Buff$
960    !
970    CLEAR SCREEN
980    Img$="3D,3X,D,4X,MD.4DE,2X,MD.4DE,2X,2D"
990    PRINT "[MEASUREMENT and BIN SORT RESULT]"
1000   PRINT "    Status     Ls          Q        BIN"
1010   PRINT " ----------------------------------------"
1020   FOR I=1 TO 50
1030     REPEAT
1040       OUTPUT @Agt4287a;":STAT:OPER:COND?"
1050       ENTER @Agt4287a;Cond_reg
1060     UNTIL BIT(Cond_reg,5)
1070     OUTPUT @Agt4287a;"*TRG"
1080     ENTER @Agt4287a;Stat,Ls,Q,Bin_res
1090     PRINT USING Img$;I,Stat,Ls,Q,Bin_res
1100   NEXT I
1110   OUTPUT @Agt4287a;":CALC:COMP:DATA:BCOU?"
1120   ENTER @Agt4287a;Bin(*)
```

```
1130   Img$="2X,17A,5D"
1140   PRINT "[BIN COUNT RESULT]"
1150   PRINT "   BIN             Count"
1160   PRINT " ------------------------"
1170   FOR I=1 TO 13
1180     PRINT USING Img$;"BIN"&VAL$(I)&":",Bin(I)
1190   NEXT I
1200   PRINT USING Img$;"OUT OF GOOD BINS:",Bin(14)
1210   !
1220   END
```

8 Statistical Analysis of Measurement Results

This chapter explains how to use the statistical analysis function.

Capturing the Measurement Data for Statistical Analysis

Before performing statistical analysis, you must capture the necessary measurement data.

Setting the number of data segments to capture

To set the maximum number of the measurement data segments stored in the volatile memory, use the following command:

- **:CALC:EXAM:SIZE** on page 227

The number of data segments captured per measurement cycle is *Param* × *Nop*. Accordingly, when you want to capture the measurement data for *Times* cycles, you must set the maximum number to *Param* × *Nop* × *Times*. *Param* and *Nop* represents the following:

Param — The number of measurement items currently displayed on screen. Each measurement item can be one of measurement parameters 1 through 4, the results of test signal current/voltage level monitoring, or the result of R_{dc} measurement.

Nop — The number of measurement points per measurement cycle. The number should be "1" for single-point measurement or, for list measurement, the number of points defined in the active table.

Starting data capture

You can begin capturing the measurement data for statistical analysis by issuing the command shown below. Once you have issued the command, each measured value (for measurement parameters 1 through 4, test signal current/voltage level monitoring, or R_{dc} measurement) is stored in the volatile memory (RAM) provided that the measured value is currently shown on screen.

- **:CALC:EXAM:STAR** on page 228

If previously captured data is still in the volatile memory and you issue the command, the instrument clears the existing data and then begins capturing new data.

Completion of data capture

The instrument finishes capturing the data when:

- The number of captured data segments reaches the maximum number.
- The **:CALC:EXAM:GET?** command starts another session of statistical analysis.

To check the progress of data capture, examine the number of data segments stored in the volatile memory (RAM) by issuing the following command:

- **:CALC:EXAM:POIN?** on page 226

Saving the captured data

To save the measurement data for statistical analysis from the volatile memory to a file, use the following command. See "Saving data to a file" on page 126 for more information.

- **:MMEM:STOR** on page 291

Performing Statistical Analysis

To perform statistical analysis and retrieve the results, use the following command:

- **:CALC:EXAM:GET?** on page 225

NOTE

Once you have started capturing the data for statistical analysis, changing the number of data segments to be captured per measurement cycle (for example, through switching between single-point measurement and list measurement) can generate an error. Even if no error occurs, changing the number of data segments during data capture would produce incorrect results.

Do not change the number of data segments captured per measurement cycle once you have started capturing the data for statistical analysis. If you have inadvertently changed the number of data segments, re-capture the data (by issuing the **:CALC:EXAM:STAR** command again) and then issue the command shown above.

The command shown above returns the statistics based on the measurement results at the measurement point(s) specified for each specific measurement item. The statistics include the following 10 items:

- Statistics on the measurement data set from successful measurements (i.e., measurements that were detected as neither showing an overload nor exceeding the R_{dc} limit range). These include the following:

  1. Average
  2. Standard deviation σ
  3. 3×σ/average
  4. Minimum value
  5. Maximum value

- Count data that include the following:

  6. Number of successful measurements (number of samples used for statistical analysis)
  7. Number of measurements that were detected to exceed the R_{dc} limit range
  8. Number of measurements that were detected to show an overload
  9. Number of measurements that were detected as either exceeding the R_{dc} limit range or showing an overload or both.
  10. Total number of measurements

You can perform statistical analysis only on those measurement items that are currently displayed on screen with their underlying measurement data stored in memory. These items can include the following:

- Measurement parameter 1
- Measurement parameter 2
- Measurement parameter 3
- Measurement parameter 4
- Monitored value of the test signal current level
- Monitored value of the test signal voltage level
- Result of R_{dc} measurement

Sample Program

Example 8-1 shows a sample program that demonstrates how to perform statistical analysis. You can find the source file of this program, named stat.bas, on the sample program disk.

The sample program performs statistical analysis on the specified measurement items and then retrieves and displays the results of the analysis.

The program is described in detail below:

Line 60	Sets the GPIB address.
Lines 80 to 130	Checks the number of measurement data segments for statistical analysis stored in the volatile memory. If no such data exists, the program displays a message and terminates.
Lines 150 to 470	Checks whether each measurement item is currently shown or hidden and stores the names of the currently shown items into the Title(*) array and the number of the shown items into the Number variable. The measurement items include measurement parameters 1 through 4, the monitored values of the test signal current and voltage levels, and the result of R_{dc} measurement.
Lines 490 to 520	If Number is 0, the program displays a message and terminates.
Line 540	Allows the user to return to the entry start line and re-enter the data if an error (such as an invalid entry) occurs while selecting the numbers identifying the measurement items on which to perform statistical analysis.
Lines 560 to 630	Displays the list of items that can be statistically analyzed and prompts the user to choose one of the items by typing in the appropriate number.
Line 640	Converts the entered value into an integer and stores it into the Item variable.
Line 650	If the Item is not an integer between 1 and Number, returns to the entry start line.
Lines 690 to 700	Displays the names of the measurement items selected for statistical analysis and then passes control to a subprogram named Stat_ana to perform statistical analysis and display the results.

The Stat_ana subprogram in lines 760 to 1260, which performs statistical analysis, is described below.

Lines 810 to 820	Retrieves the list (1)/single-point (0) measurement setting and stores the setting into the List_stat variables.
Lines 840 to 850	If list measurement is specified (List_stat variable = 1), the program retrieves the number of measurement points and stores the data into the Nop variable.
Line 870	If single-point measurement is specified (List_stat 1 variable not equal to 1), the program stores 1 into the Nop variable.
Lines 900 to 930	Performs the measurement items identified by the Item variable and

then retrieves the results and stores them into the Res(*) array. The subprogram repeats these steps for all of the measurement points.

Lines 950 to 1260 Displays the results of the statistical analysis.

Example 8-1 **Statistical analysis (stat.bas)**

```
10      DIM Title$(1:7)[20],Para$[9]
20      REAL Point
30      INTEGER Number,Disp_status,Item,I
40      CLEAR SCREEN
50      !
60      ASSIGN @Agt4287a TO 717
70      !
80      OUTPUT @Agt4287a;":CALC:EXAM:POIN?"
90      ENTER @Agt4287a;Point
100     IF Point<1 THEN
110       PRINT "NO DATA!!"
120       GOTO Prog_end
130     END IF
140     !
150     Number=1
160     FOR I=1 TO 4
170       OUTPUT @Agt4287a;":DISP:TEXT1:CALC"&VAL$(I)&"?"
180       ENTER @Agt4287a;Disp_status
190       IF Disp_status=1 THEN
200         OUTPUT @Agt4287a;":CALC:PAR"&VAL$(I)&":FORM?"
210         ENTER @Agt4287a;Para$
220         Title$(Number)="Parameter "&VAL$(I)&" ("&Para$&")"
230         Number=Number+1
240       END IF
250     NEXT I
260     !
270     OUTPUT @Agt4287a;":DISP:TEXT1:CALC11?"
280     ENTER @Agt4287a;Disp_status
290     IF Disp_status=1 THEN
300       Title$(Number)="I Level Monitor"
310       Number=Number+1
320     END IF
330     !
340     OUTPUT @Agt4287a;":DISP:TEXT1:CALC12?"
350     ENTER @Agt4287a;Disp_status
360     IF Disp_status=1 THEN
370       Title$(Number)="V Level Monitor"
380       Number=Number+1
390     END IF
400     !
410     OUTPUT @Agt4287a;":SOUR:LIST:RDC?"
420     ENTER @Agt4287a;Disp_status
430     IF Disp_status=1 THEN
440       Title$(Number)="Rdc Measurement"
450       Number=Number+1
460     END IF
470     Number=Number-1
480     !
490     IF Number=0 THEN
500       PRINT "NO ANALYSIS ITEM!!"
510       GOTO Prog_end
520     END IF
530     !
540     ON ERROR GOTO Item_select
550 Item_select:!
560     PRINT "[Statistical Analysis]"
570     PRINT " Select Analysis Item!"
580     FOR I=1 TO Number
590       PRINT "  "&VAL$(I)&": "&Title$(I)
600     NEXT I
610     PRINT ""
```

```
620     PRINT "Input 1 to "&VAL$(Number)
630     INPUT "Number? ",Inp_char$
640     Item=IVAL(Inp_char$,10)
650     IF Item<1 OR Item>Number THEN Item_select
660     OFF ERROR
670     !
680     CLEAR SCREEN
690     PRINT "Analysis Item: "&Title$(Item)
700     CALL Stat_ana(@Agt4287a,Item)
710     !
720 Prog_end: END
730     !==============================================
740     ! Statistical Analysis Function
750     !==============================================
760   SUB Stat_ana(@Agt4287a,INTEGER Item)
770     DIM Img1$[100],Img2$[100]
780     REAL Res(1:32,1:10)
790     INTEGER List_stat,Nop,I
800     !
810     OUTPUT @Agt4287a;":SOUR:LIST:STAT?"
820     ENTER @Agt4287a;List_stat
830     IF List_stat=1 THEN
840       OUTPUT @Agt4287a;":SOUR:LIST:SIZE?"
850       ENTER @Agt4287a;Nop
860     ELSE
870       Nop=1
880     END IF
890     !
900     FOR I=1 TO Nop
910       OUTPUT @Agt4287a;":CALC:EXAM:GET? ";Item;",";I
920       ENTER @Agt4287a;Res(I,1),Res(I,2),Res(I,3),Res(I,4),Res(I,5),
Res(I,6),Res(I,7),Res(I,8),Res(I,9),Res(I,10)
930     NEXT I
940     !
950     IF Nop>1 THEN
960       Img1$="3D,2X,MD.4DE,X,MD.4DE,X,MD.4DE,X,MD.4DE,X,MD.4DE"
970       Img2$="3D,2X,10D,2X,10D,2X,10D,2X,10D,2X,10D"
980      PRINT "      ----------- Statistical Value for Normal Data ------
------"
990       PRINT "Point    Mean        Sigma    3*Sigma/Mean Min.        Ma
x."
1000      FOR I=1 TO Nop
1010        PRINT USING
Img1$;I,Res(I,1),Res(I,2),Res(I,3),Res(I,4),Res(I,5)
1020      NEXT I
1030      PRINT ""
1040     PRINT "      ------------------- Occurrence Count --------------
-------"
1050     PRINT "Point    Normal    Rdc Fail    Overload    Abnormal
 All"
1060      FOR I=1 TO Nop
1070        PRINT USING Img2$;I,Res(I,6),Res(I,7),Res(I,8),Res(I,9),
Res(I,10)
1080      NEXT I
1090    ELSE
1100      OUTPUT @Agt4287a;":SOUR:LIST:POIN?"
1110      ENTER @Agt4287a;Meas_point
1120      PRINT "[ Point No.";Meas_point;"]"
1130      PRINT "Statistical Value for Normal Measurement Data"
1140      PRINT " Mean        :";Res(1,1)
1150      PRINT " Sigma       :";Res(1,2)
1160      PRINT " 3*Sigma/Mean:";Res(1,3)
1170      PRINT " Minimum     :";Res(1,4)
1180      PRINT " Maximum     :";Res(1,5)
```

```
1190      PRINT "Occurrence Count"
1200      PRINT " Normal        :";Res(1,6)
1210      PRINT " Rdc Fail      :";Res(1,7)
1220      PRINT " Overload      :";Res(1,8)
1230      PRINT " Abnormal      :";Res(1,9)
1240      PRINT " All           :";Res(1,10)
1250    END IF
1260  SUBEND
```

9 Saving and Recalling Files

This chapter explains how to save or recall instrument settings and measurement results to or from a file.

Saving and Recalling Files

Specifying the file

When you save or recall a file, you must specify the file name with the extension. When you specify a file on the floppy disk drive, precede the file name with “A:”; when you specify a file under a directory, delimit the directory and file names with a slash (/).

Saving data to a file

You can use the following command to save the instrument setting, images on the LCD, measurement data for statistical analysis, list measurement results, and the contents of the setup table into a file:

- **:MMEM:STOR** on page 291

The contents to be saved depend on the extension of the filename and the parameters specified when the command is executed. The table below lists the extensions, parameters, and corresponding contents to be saved.

Exten-sion	Parameter	Contents to be saved
.sta	Not needed	Instrument state (instrument settings, calibration and compensation state) are saved. For the instrument settings to be saved, see Appendix G, “Initial Settings.”
.bmp	Not needed	Images stored on the volatile memory*1 are saved in the bitmap format. If no images exist on the clipboard, the images of the LCD are stored on the clipboard when the command is executed, then they are saved.
.csv	LOG or omitted	Measurement data for statistical analysis stored on the volatile memory (RAM) are saved in the ASCII format (as comma-delimited data). If the frequency of data measurement stored on the volatile memory exceeds 65,536, only the data acquired from the first 65,536 measurements are saved and the remaining data are ignored.
	LIST	Measurement results of list measurement at all measurement points are saved in the ASCII format as comma-delimited data. Measurement results of single-point measurement cannot be saved.
	SETup	The contents of all of the measurement point (stimulus) setup tables, the contents of all of the calibration kit setup tables, and the contents of all of the compensation kit setup tables are saved in the ASCII format as comma-delimited data.
	COMParator	The contents of all of the BIN sorting setup tables are saved in the ASCII format as comma-delimited data.
.dta	Not needed	Measurement data for statistical analysis stored on the volatile memory (RAM) are saved in the binary format. Regardless of how many times measurement is executed, all of the stored measurement data are saved.

*1. Images on the LCD when the **[Capture]** key (**[Display]** key) is pressed

Recalling a file

To recall an .sta file that contains previously saved instrument settings, use the following command:

- **:MMEM:LOAD** on page 290

By recalling an instrument settings file, you can restore the instrument to the state it was in when you saved the file. Note that some of the instrument settings cannot be saved.

Automatically recalling a file

When the 4287A is turned on, it looks for an instrument settings file named “autorec.sta” and, if the file exists, automatically recalls the settings from the file.

Managing a file

To manage files, use the following command:

Copies a file	**:MMEM:COPY** on page 289
Creates a new directory (folder)	**:MMEM:CRE:DIR** on page 289
Deletes an existing file or directory	**:MMEM:DEL** on page 290
Reads the following information about the storage device built in the 4287A	**:MMEM:CAT?** on page 288

Sample Program

Example 9-1 shows a sample program that demonstrates how to save data to a file. You can find the source file of this program, named file_sav.bas, on the sample program disk.

The sample program saves the selected type of data to the specified target file.

The program is described in detail below:

Line 40	Sets the GPIB address.
Lines 60 to 70	Retrieves the list/single-point (0/1) measurement setting and stores the setting into the List_stat variables.
Lines 80 to 90	Counts the data segments for statistical analysis that are residing on the volatile memory and stores the count into the Point variable.
Line 110	Allows the user to return to the entry start line and re-enter the data if an error (such as an invalid entry) occurs while selecting the type of data to save.
Lines 130 to 310	Displays the list of items that can be saved and prompts the user to choose one of the items by typing in the appropriate number.
Line 320	Converts the entered value into an integer and stores it into the Content variable.
Line 330	If Content is not within the valid range, the program returns the user to the entry start line.
Lines 360 to 630	Determines the file extension based on Content and stores the extension into the Extension$ variable. If the extension is ".csv," determines the second parameter for the command to save and stores the parameter into the Par$ variable.
Line 650	Passes control to a subprogram named Inp_file_name, which lets the user input a file name without an extension, and then stores the returned file name into the File$ variable.
Lines 670 to 730	Saves the data and displays the name of the target file.

The Inp_file_name subprogram in lines 790 to 900, which is used to enter a save filename, is described below.

Line 810	Allows the user to return to the entry start line and re-enter the data if an error (such as an invalid entry) occurs while entering the target file name.
Lines 830 to 850	Prompts the user to enter the target file name. The program does not continue until the user actually enters the file name.
Lines 860 to 870	Displays the entered file name and waits for a confirmation entry (y/n key).
Line 880	Returns to the start line of input if any key other than the y key is pressed in response to line 870.

Example 9-1 **File save (file_sav.bas)**

```
10      DIM File$[300],Inp_char$[30],Extension$[9],Par$[9]
20      INTEGER List_stat,Point,Content,Max_no
30      CLEAR SCREEN
40      ASSIGN @Agt4287a TO 717
50      !
60      OUTPUT @Agt4287a;":SOUR:LIST:STAT?"
70      ENTER @Agt4287a;List_stat
80      OUTPUT @Agt4287a;":CALC:EXAM:MEM:POIN?"
90      ENTER @Agt4287a;Point
100     !
110     ON ERROR GOTO Content_select
120 Content_select: !
130     PRINT "## Save Content Selection ##"
140     PRINT "Select Content"
150     PRINT " 1: State"
160     PRINT " 2: Screen"
170     PRINT " 3: Setup Table"
180     PRINT " 4: Comparator"
190     Max_no=4
200     IF List_stat=1 THEN
210       PRINT " 5: List Measurement Results"
220       Max_no=Max_no+1
230     END IF
240     IF Point>1 THEN
250       PRINT " "&VAL$(Max_no+1)&": Data for Statistical Analysis
(ASCII)"
260       PRINT " "&VAL$(Max_no+2)&": Data for Statistical Analysis
(Binary)"
270       Max_no=Max_no+2
280     END IF
290     PRINT ""
300     PRINT "Input 1 to "&VAL$(Max_no)
310     INPUT "Number?",Inp_char$
320     Content=IVAL(Inp_char$,10)
330     IF Content<1 OR Content>Max_no THEN Content_select
340     OFF ERROR
350     !
360     SELECT Content
370       CASE 1
380         Extension$=".sta"
390       CASE 2
400         Extension$=".bmp"
410       CASE 3
420         Extension$=".csv"
430         Par$="SET"
440       CASE 4
450         Extension$=".csv"
460         Par$="COMP"
470       CASE 5
480         Extension$=".csv"
490         IF Max_no=5 OR Max_no=7 THEN
500           Par$="LIST"
510         ELSE
520           Par$="LOG"
530         END IF
540       CASE 6
550         IF Max_no=7 THEN
560           Extension$=".csv"
570           Par$="LOG"
580         ELSE
590           Extension$=".dta"
```

```
600        END IF
610      CASE 7
620        Extension$=".dta"
630    END SELECT
640    !
650    CALL Inp_file_name(File$)
660    !
670    IF Extension$=".csv" THEN
680      OUTPUT @Agt4287a;":MMEM:STOR """&File$&Extension$&""","&Par$
690    ELSE
700      OUTPUT @Agt4287a;":MMEM:STOR """&File$&Extension$&""""
710    END IF
720    PRINT "## Done ##"
730    PRINT "Save file name: "&File$&Extension$
740    !
750    END
760    !============================================
770    ! File Name Input Function
780    !============================================
790  SUB Inp_file_name(Inp_name$)
800    DIM Inp_char$[9]
810    ON ERROR GOTO Inp_start
820 Inp_start: !
830    PRINT "## File Name Input ##"
840    PRINT "Input Save File Name (without Extension)"
850    INPUT "Name?",Inp_name$
860    PRINT "Input Name: "&Inp_name$
870    INPUT "OK? [Y/N]",Inp_char$
880    IF UPC$(Inp_char$)<>"Y" THEN Inp_start
890    OFF ERROR
900  SUBEND
```

Example 9-2 shows a sample program that uses the **:MMEM:CAT?** command to list information about the files. You can find the source file of this program, named filelist.bas, on the sample program disk.

Figure 9-1 shows an example of the listing resulting from execution of this program.

Figure 9-1 **Example of the listing resulting from execution of this program**

```
Used size: 276.50[MB] ( 289931264[Byte])
Free size: 798.22[MB] ( 836993024[Byte])
File information:
  Name                 Size[Byte]
====================  ==========
"\STATE1.STA"             148616
"\STATE2.STA"             148616
"\SCREEN.BMP"             921654
```

Program details are listed below:

Line 50	Set the GPIB address.
Lines 70 to 80	Read information about the 4287A built-in storage and assign it to the Disk_info$ variable.
Lines 100 to 200	From the Disk_info$ character string, fetch the already used capacity, free capacity, and file information (names and sizes) separated by commas (,) and then store them in the Disk_data$(*) array.
Lines 240 to 250	Convert into the values in megabytes, the already used capacity and free capacity values in bytes that were read.
Lines 260 to 390	List the information that was read.

Example 9-2 **File listing (filelist.bas)**

```
10     DIM Disk_info$[25000],Disk_data$(1:500)[255],Img$[20]
20     REAL Used_size,Free_size,Used_size_m,Free_size_m
30     INTEGER Info_len,Loc,N,I
40     !
50     ASSIGN @Agt4287a TO 717
60     !
70     OUTPUT @Agt4287a;":MMEM:CAT?"
80     ENTER @Agt4287a;Disk_info$
90     !
100    Info_len=LEN(Disk_info$)
110    Loc=1
120    N=1
130    FOR I=1 TO Info_len
140      IF Disk_info$[I;1]="," THEN
150        Disk_data$(N)=Disk_info$[Loc,I-1]
160        Loc=I+1
170        N=N+1
180      END IF
190    NEXT I
200    Disk_data$(N)=Disk_info$[Loc,Info_len]
210    !
220    Used_size=VAL(Disk_data$(1))
230    Free_size=VAL(Disk_data$(2))
240    Used_size_m=Used_size/1048576   ! 1MB = 1024KB = 1048576Byte
250    Free_size_m=Free_size/1048576   ! 1MB = 1024KB = 1048576Byte
260    Img$="10A,4D.2D,6A,10D,7A"
270    PRINT USING Img$;"Used size:",Used_size_m,"[MB] (",Used_size,"[By
te])"
280    PRINT USING Img$;"Free size:",Free_size_m,"[MB] (",Free_size,"[By
te])"
290    PRINT "File information:"
300    IF N<3 THEN
310      PRINT "Nothing!!"
320    ELSE
330      PRINT "  Name                Size[Byte]"
340      PRINT "====================  =========="
350      Img$="20A,2X,10D"
360      FOR I=3 TO N STEP 3
370        PRINT USING Img$;Disk_data$(I),VAL(Disk_data$(I+2))
380      NEXT I
390    END IF
400    !
410    END
```

10 Error Handling

This chapter explains how to handle errors that may occur in the Agilent 4287A while running a program.

Using the Error Queue

When an error occurs, its number and message will be stored in the error queue. Thus, you can determine which error has occurred by reading the contents of the error queue. Use the folowing command to read the contents of the error queue:

- **:SYST:ERR?** on page 304

You can also use the following command to check how many errors are contained in the error queue:

- **:SYST:ERR:COUN?** on page 304

Some examples of using the error queue are given below:

1. Use the error queue for branching control of the program in response to an error. If no error has occurred, the contents read out from the error queue are 0 for the number and "No error" for the message. This can be used to verify the occurrence of any error and is thus useful for the branch processing flow of your program. This is also used to handle a specific error that may be predefined in the program. This method, however, is not suitable for performing tasks synchronized with the occurrence of errors.
2. Use the error queue to identify an error that is detected via an SRQ (service request) (see Example 10-1).

Using the Status Reporting System

The status of the 4287A can be detected through the status registers. This section explains how to use the status registers to detect the occurrence of an error. For a complete description of the status report mechanism, including the specifications of each bit, see Appendix B, “Status Reporting System.”

Occurrence of an error will be reflected in the standard event status register. An SRQ is useful when you create a program that uses the information reported by this register to detect the occurrence of an error.

Use the following commands to detect the end of sweep via SRQ:

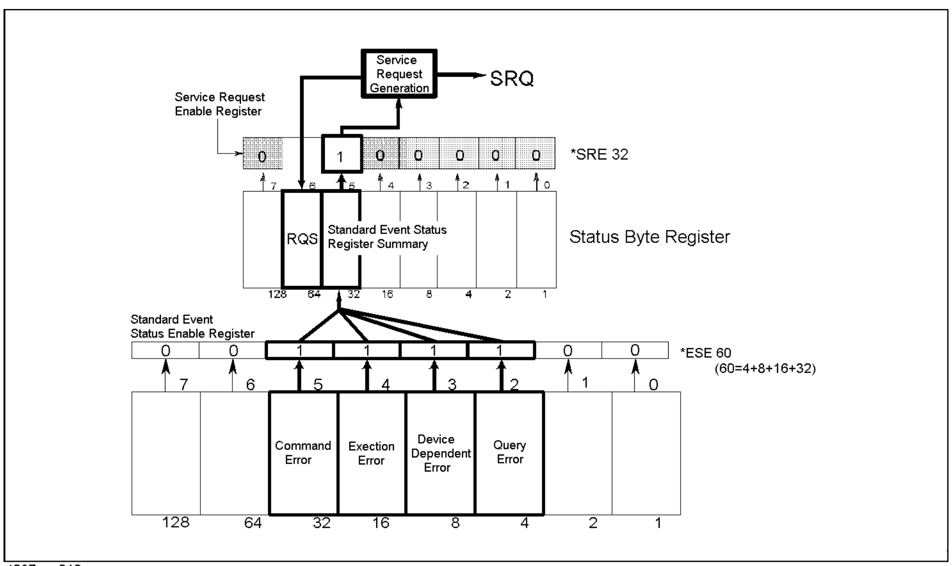
- ***SRE** on page 207
- ***ESE** on page 204

Follow these steps:

Step 1. Set the 4287A to generate an SRQ when “1” is assigned to one of the error occurrence bits of the standard event status register.

Step 2. Describe the program so that it executes interruption processing as soon as an SRQ is generated.

Figure 10-1 **SRQ generation sequence (in response to an error)**



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Sample Program

Example 10-1 is a sample program for detecting an error via an SRQ. This program is given the file name srq_err.bas and is stored on the sample program disk.

This program performs the necessary SRQ settings, intentionally sends a command that is not supported by the 4287A to cause an error, and then handles the error after it occurs. In the error handling, the error is identified and its error number and message are displayed followed by a message showing that the program is aborted.

Lines 40 to 50	Sets the GPIB address and select code.
Lines 70 to 80	Sets bits 2, 3, 4 and 5 of the standard event status register to be enabled and sets bit 5 of the service request enable register to 1.
Lines 90 to 110	Clears the status byte register, standard event status register, and error queue.
Lines 130 to 140	Sets the branch target for an SRQ interrupt to enable SRQ interrupts.
Lines 150 to 240	Sets measurement parameters 1 through 4, intentionally specifying an incorrect command for parameter 4 to cause an error.
Lines 270 to 280	Performs error handling. The number and message of the error are read out.
Lines 290 to 310	Displays a message showing that an error has occurred, the error number, error message, and another message indicating that the program is aborted.
Line 330	Displays a message for normal termination of the program. Note that this will not be displayed unless the program is modified to employ the appropriate command for measurement parameter 4.

Example 10-1 **Detecting an Error via an SRQ (srq_err.bas)**

```
10     DIM Buff$[9],Err_mes$[50]
20     INTEGER Scode,Err_no
30     !
40     ASSIGN @Agt4287a TO 717
50     Scode=7
60     !
70     OUTPUT @Agt4287a;"*ESE 60"
80     OUTPUT @Agt4287a;"*SRE 32"
90     OUTPUT @Agt4287a;"*CLS"
100    OUTPUT @Agt4287a;"*OPC?"
110    ENTER @Agt4287a;Buff$
120    !
130    ON INTR Scode GOTO Err_proc
140    ENABLE INTR Scode;2
150    OUTPUT @Agt4287a;":CALC:PAR1:FORM LS"
160    PRINT "Meas Para 1 Setting: Ls"
170    OUTPUT @Agt4287a;":CALC:PAR2:FORM RS"
180    PRINT "Meas Para 2 Setting: Rs"
190    OUTPUT @Agt4287a;":CALC:PAR3:FORM Q"
200    PRINT "Meas Para 3 Setting: Q"
210    OUTPUT @Agt4287a;":CALC:PAR4:FOR D"
220    PRINT "Meas Para 4 Setting: D"
230    OUTPUT @Agt4287a;"*OPC?"
240    ENTER @Agt4287a;Buff$
250    GOTO Skip_err_proc
260 Err_proc: OFF INTR Scode
270    OUTPUT @Agt4287a;";:SYST:ERR?"
280    ENTER @Agt4287a;Err_no,Err_mes$
290    PRINT "Error occurred!!"
300    PRINT "  No:";Err_no,"Description: "&Err_mes$
310    PRINT "PROGRAM INTERRUPT!!"
320    GOTO Prog_end
330 Skip_err_proc: PRINT "PROGRAM DONE."
340 Prog_end: END
```

11 Shutting Down the Instrument

This chapter explains how to shut down the Agilent 4287A.

Shutdown Procedure

When you use a GPIB command to shut down the Agilent 4287A, the power is turned off and the LED next to the standby switch goes off, but the standby switch remains in the ON (depressed) position. To shut down the 4287A, use the following command:

- **:SYST:POFF** on page 306

Issuing this command to shut down the 4287A causes the standby switch to remain in the ON (depressed) position. In this case, you can later turn on the power to the 4287A by one of the following two methods:

- Release the standby switch to the OFF position and then depress it to the ON position.
- Turn off the power to the 4287A and then turn on the power again. For example, you can disconnect the power cable from the rear panel and then reconnect it.

WARNING **After issuing the command shown above, be sure to wait until the LED beside the standby switch goes off to indicate that the 4287A is completely shut down. Do not turn off the power to the 4287A (or, if the 4287A belongs to a handler system, the power to that system) or disconnect the power cable from the rear panel while the LED is lit.**

12 Connecting the Instrument to a Handler with the Handler Interface

You can use the handler interface of the Agilent 4287A to communicate with an external handler; for example, the 4287A can send end-of-measurement signals or bin-sorting results and receive external trigger or key lock signals. This chapter provides the information needed to set up an auto-sorting system that combines the 4287A with a handler by taking advantage of the handler interface and bin sorting.

Input/Output Signal Pin Layout

Figure 12-1 illustrates the layout of the input/output signal pins on the handler interface connector while Table 12-1 briefly describes these signals.

Figure 12-1 **Handler Interface Connector Pin Layout**

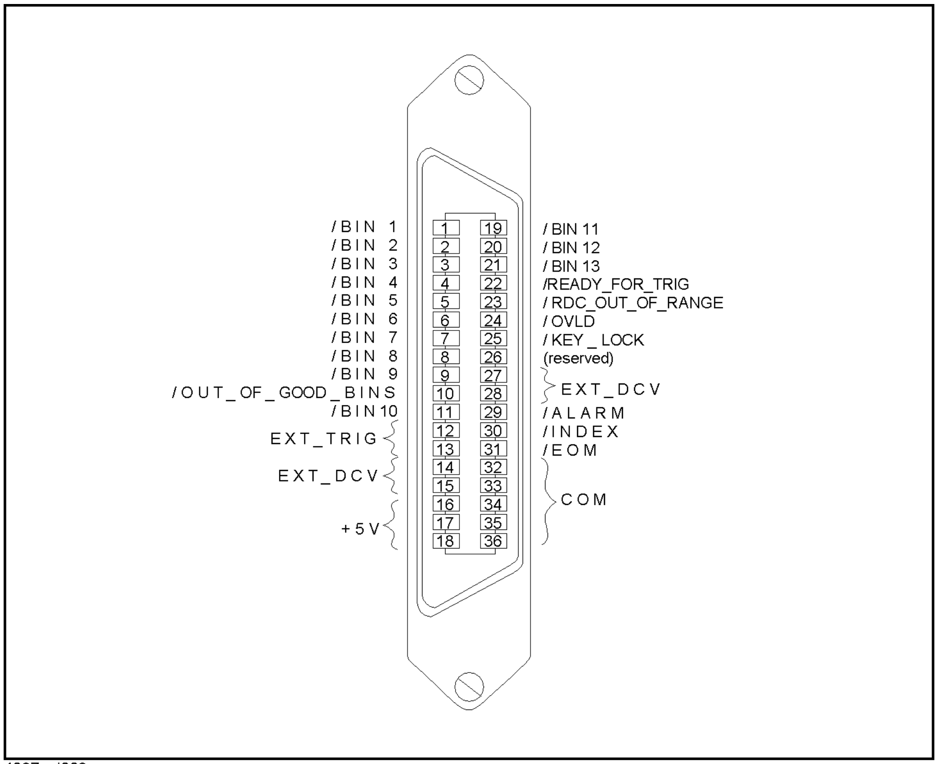

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Table 12-1 **Description of the handler Interface Input/Output Signals**

Pin number	Signal name	Input/ output	Description
1	/BIN1	Output	These signals indicate the result of sorting. When a DUT is sorted into a bin, the corresponding signal (one of pins 1 through 11 and 19 through 21) changes to the Low level. However, none of the signals changes to the Low level for a DUT that does not fall within the R_{dc} limit or cannot be measured (overload).
2	/BIN2		
3	/BIN3		
4	/BIN4		
5	/BIN5		
6	/BIN6		
7	/BIN7		
8	/BIN8		
9	/BIN9		
10	/OUT_OF_GOOD_BINS		
11	/BIN10		

Table 12-1 Description of the handler Interface Input/Output Signals

Pin number	Signal name	Input/ output	Description
12, 13	EXT_TRIG	Input	An external trigger signal. Available when the trigger mode is set to Ext (external trigger source). The instrument is triggered when the pulse reaches a rising/falling[*1] edge.
14, 15	EXT_DCV	Input	External DC voltage. Supplies voltage necessary for driving input signals. The pin accepts input voltage within the range between +9 V and +15 V.
16, 17, 18	+5V	Output	Internal DC voltage.
19	/BIN11	Output	These signals indicate the result of sorting. For more information, refer to the description of pins 1 through 11.
20	/BIN12	Output	These signals indicate the result of sorting. For more information, refer to the description of pins 1 through 11.
21	/BIN13	Output	These signals indicate the result of sorting. For more information, refer to the description of pins 1 through 11.
22	/READY_FOR_TRIG	Output	The /READY_FOR_TRIG signal changes to the Low level when the instrument can be triggered. When the handler receives this signal, it can input an external trigger signal to the instrument.
23	/RDC_OUT_OF_RANGE	Output	The /RDC_OUT_OF_RANGE signal changes to the Low level when the result of R_{dc} measurement does not fall within the specified limit range.
24	/OVLD	Output	The /OVLD signal changes to the Low level when analog measurement cannot be performed (overload).
25	/KEY_LOCK	Input	Key lock signal. Changing this signal to the Low level locks the 4287A's front panel (keys and rotary knobs), keyboard, and mouse.
26	(Reserved).	———	Currently not in use. Leave this pin unconnected.
27, 28	EXT_DCV	Input	External DC voltage. For more information, refer to the description of pins 14 and 15.
29	/ALARM	Output	The /ALARM signal changes to the Low level when an alarm condition is detected; for example, when the instrument does not satisfy a self-test item, or a particular circuit malfunctions.
30	/INDEX	Output	The /INDEX signal changes to the Low level when analog measurement is complete. When the handler receives the signal, it assumes that it is ready to connect the next DUT. However, no measurement data is available until the /EOM signal is received.
31	/EOM	Output	The /EOM signal changes to the Low level when the instrument is ready to return measurement data and sort results after performing one complete cycle of measurement.
32, 33, 34, 35, 36	COM	———	Common for output signal pull-up voltage.

*1. The **:TRIG:SLOP** command on page 309 sets the polarity (rising or falling).

NOTE A signal prefixed with a slash (/) is a negative logic signal (i.e., changes to Low when activated).

Outputting Bin Sort Results

When the bin sort feature is on (i.e., after you have issued the **:CALC:COMP** command on page 211 by specifying "ON"), the instrument outputs the result of bin sorting through the handler interface. Table 12-2 shows how bin sort results are mapped to the sort result signals /BIN1 through /BIN13 and /OUT_OF_GOOD_BINS) of the handler interface. The table assumes that you have issued the **:CALC:COMP:OGB** command on page 223 by specifying 10 so that bins 1 through 10 serve as good bins while bins 11 through 13 serve as bad bins.

NOTE When the bin sort feature is off, the instrument does not output signals except the /INDEX, /EOM, /ALARM, /OVLD and /READY_FOR_TRIG. The EXT_TRIG is valid regardless of the on/off status of the bin sort feature if the trigger mode is set to External. The /KEY_LOCK is also valid regardless of on/off status of the bin sort feature.

Table 12-2 Mapping between Bin Sort Results and Handler Interface Output Signals

<table>
<tr><th rowspan="2">Measurement status</th><th rowspan="2" colspan="2">Bin sort results</th><th rowspan="2">Handler interface signal(s) that is (are) activated</th><th colspan="3">GPIB output</th></tr>
<tr><th>Measurement status</th><th>Measured value</th><th>Bin sort result</th></tr>
<tr><td rowspan="14">Normal</td><td colspan="2">Indicates a DUT that was not sorted into any of bins 1 through 13</td><td>/OUT_OF_GOOD_BINS</td><td rowspan="14">0</td><td rowspan="14">Measured value</td><td>0</td></tr>
<tr><td rowspan="10">Good bin *1</td><td>BIN1</td><td>/BIN1</td><td>1</td></tr>
<tr><td>BIN2</td><td>/BIN2</td><td>2</td></tr>
<tr><td>BIN3</td><td>/BIN3</td><td>3</td></tr>
<tr><td>BIN4</td><td>/BIN4</td><td>4</td></tr>
<tr><td>BIN5</td><td>/BIN5</td><td>5</td></tr>
<tr><td>BIN6</td><td>/BIN6</td><td>6</td></tr>
<tr><td>BIN7</td><td>/BIN7</td><td>7</td></tr>
<tr><td>BIN8</td><td>/BIN8</td><td>8</td></tr>
<tr><td>BIN9</td><td>/BIN9</td><td>9</td></tr>
<tr><td>BIN10</td><td>/BIN10</td><td>10</td></tr>
<tr><td rowspan="3">Bad bin *1</td><td>BIN11</td><td>/BIN11, /OUT_OF_GOOD_BINS</td><td>11</td></tr>
<tr><td>BIN12</td><td>/BIN12, /OUT_OF_GOOD_BINS</td><td>12</td></tr>
<tr><td>BIN13</td><td>/BIN13, /OUT_OF_GOOD_BINS</td><td>13</td></tr>
<tr><td>Overload *2</td><td rowspan="3" colspan="2">Sort failure</td><td>/OVLD</td><td>1</td><td>9.9E37</td><td rowspan="3">14</td></tr>
<tr><td>R_{dc} out of range</td><td>/RDC_OUT_OF_RANGE</td><td>2</td><td>Measured value *3</td></tr>
<tr><td>Simultaneous detection of overload and R_{dc} out of range</td><td>/OVLD, /RDC_OUT_OF_RANGE</td><td>3</td><td>9.9E37</td></tr>
</table>

*1. This table assumes that you have issued the **:CALC:COMP:OGB** command on page 223 by specifying 10 so that bins 1 through 10 serve as good bins while bins 11 through 13 serve as bad bins.

*2. When overload is detected at a measurement point that is not used for bin sorting, bin sorting is operated normally. Therefore the bin sort result is not 14 in this case.

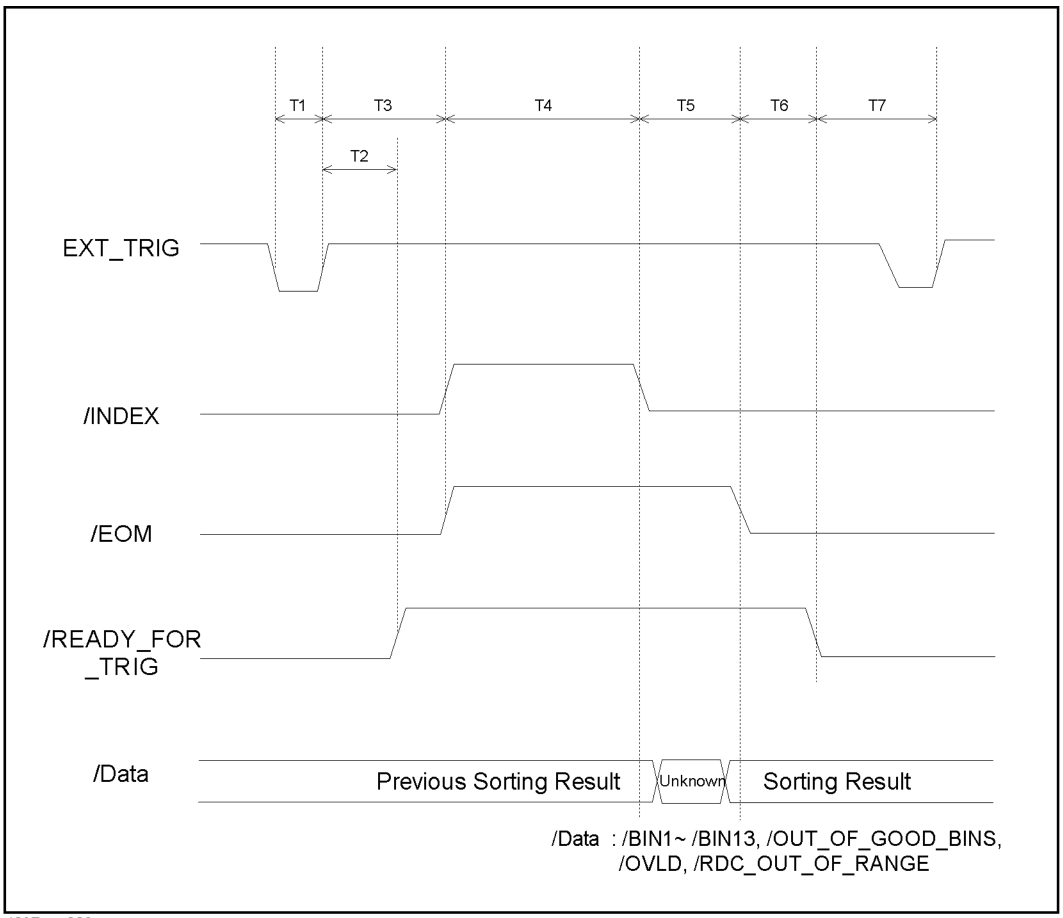
*3. The instrument outputs a measured value normally. However, the output may be an invalid value that was measured while there was a bad contact.

Timing Chart

The timing chart in Figure 12-2 shows the timing and duration of each handler signal. During the interval where /DATA is unknown, no output signal is available because the 4287A is processing the result of analog measurement. For the meanings of T1 through T7 in this chart, see “Specifications and Supplemental Performance Characteristics” in *Operation Manual*.

NOTE Design a handler-based auto-sorting system so that the measurement cycle must be synchronized with the operation status of the 4287A using the status report system or the timing signals (/READY_FOR_TRIG, /INDEX, or /EOM). Don’t synchronize by inserting a wait time in the control program for a handler-based auto-sorting system.

Figure 12-2 **Handler interface timing chart**



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Electrical Characteristics

Output signals

Each output signal is generated as open collector output of a photocoupler and obtained as voltage output applied to an external pull-up resistor connected to the 4287A (Table 12-4). Table 12-3 shows the electrical characteristics of the output signals. A typical circuit diagram for the handler output signals (an example of pull-up resistor connections) is shown in Figure 12-3.

Table 12-3 **Electrical characteristics of handler interface output signals**

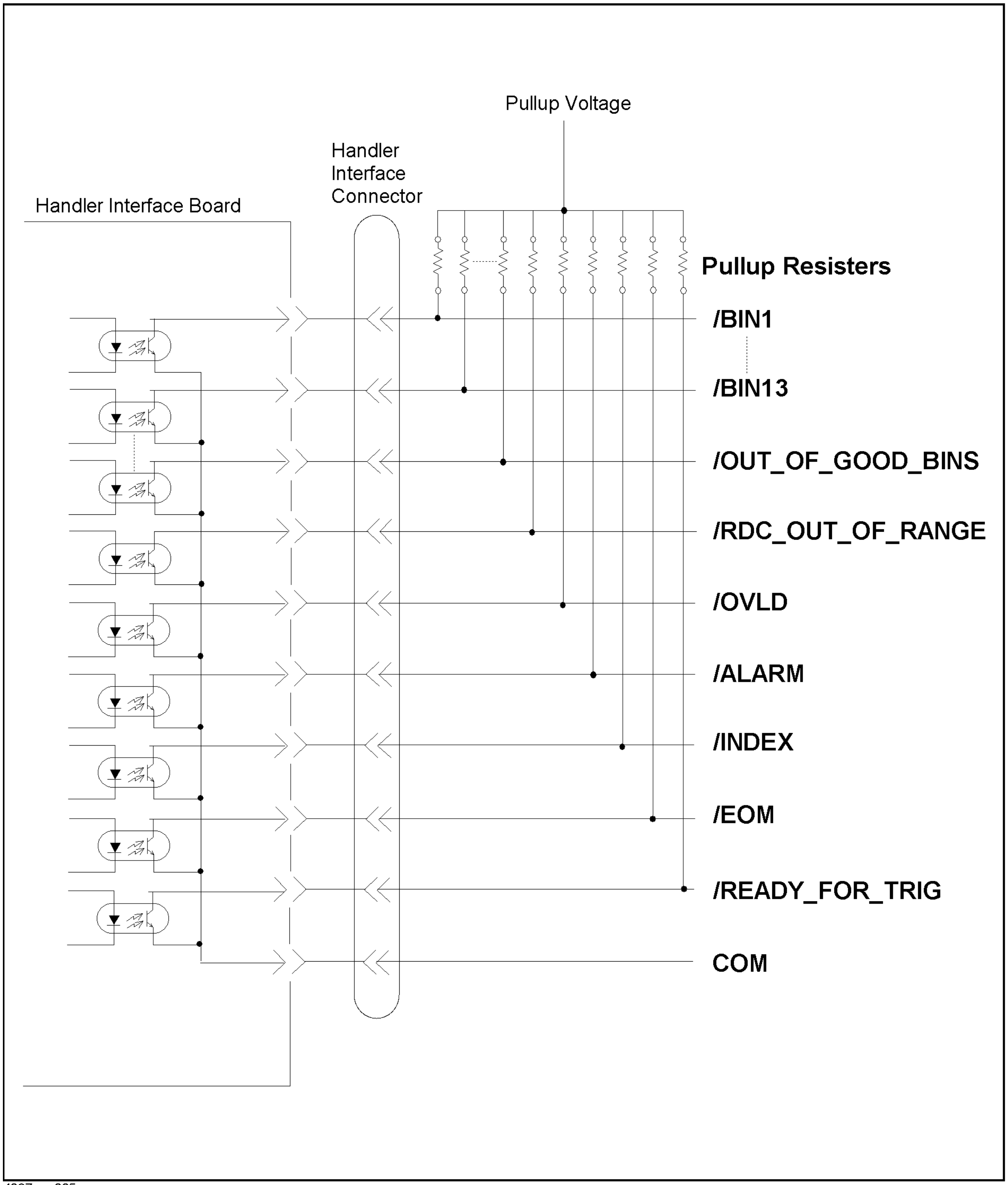
Output voltage [V]		Maximum current [mA]
Low	High	
0 to 0.5	Pull-up voltage (5 to 24)	6

Table 12-4 **Guidelines for pull-up resistance values**

Pull-up voltage [V]	Resistance value [Ω]	Typical resistors	
		Resistance value [Ω]	Agilent Part No.
5	1.7k (5 V / 3 mA)	1.78k	0757-0278
9	3.0k (9 V / 3 mA)	3.16k	0757-0279
12	4.0k (12 V / 3 mA)	4.22k	0698-3154
15	5.0k (15 V / 3 mA)	5.11k	0757-0438
24	8.0k (24 V / 3 mA)	8.25k	0757-0441

The 4287A can also contain internal pull-up resistors. For more information, contact your distributor or the Agilent Technologies sales office nearest your site.

Figure 12-3 Circuit diagram for handler interface output signals



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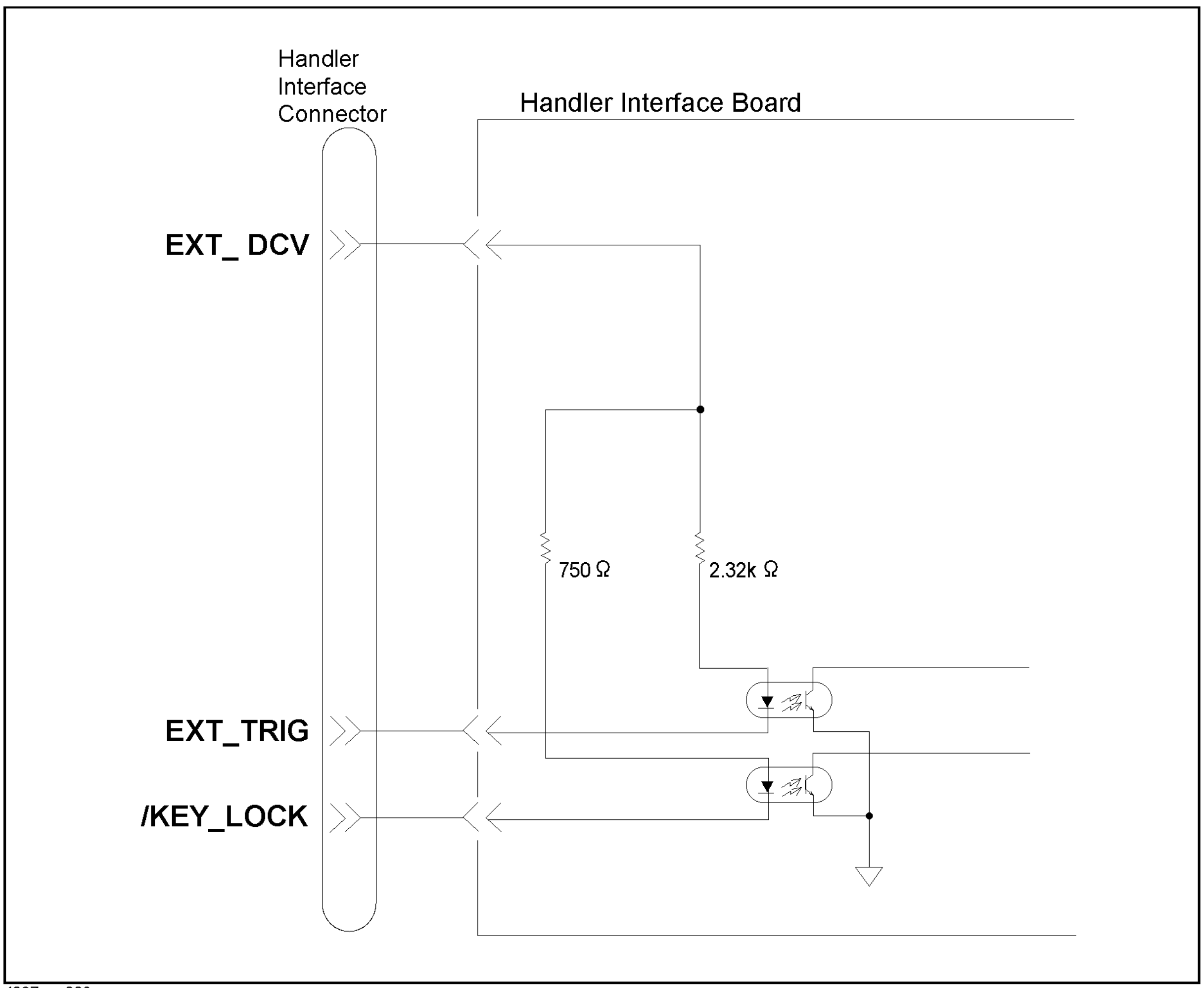
Input signals

Each input signal is connected to a photocoupler's LED (cathode side). The LED (anode side) is connected with drive voltage (EXT_DCV). Table 12-4 shows the electrical characteristics of the input signals. Figure 12-4 also shows the circuit diagram for the input signals. The amperage of the current fed through the LED depends on the drive voltage.

Table 12-5 Electrical characteristics of handler interface input signals

Input Signals	Input voltage [V]		Input current (at Low level) [mA] (typical value)	
	Low	High	When drive voltage = 12 V	When drive voltage = 15 V
EXT_TRIG	0 to 1	Drive voltage (EXT_DCV)	4.6	5.9
/KEY_LOCK			14	18

Figure 12-4 Circuit diagram for handler interface input signals



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Output signal pull-up/input signal drive voltage

The following table shows the valid range for each of the output signal pull-up voltage and input signal drive voltage (EXT_DCV).

Table 12-6 Valid ranges for output signal pull-up/input signal drive voltage

	Valid voltage range [V]
Output signal pull-up voltage	5 to 24
Input signal drive voltage	9 to 15

The 4287A can be modified so that the input drive voltage can be used within the range between 5 V and 9 V or 15 V and 24 V or so that the output signal pull-up voltage and input signal drive voltage can be connected to the 4287A’s internal 5 V power supply. For more information, contact your distributor or the Agilent Technologies sales office nearest your site.

Modification of the Handler Interface

This section explains how to make the following modifications to the inside of the instrument:

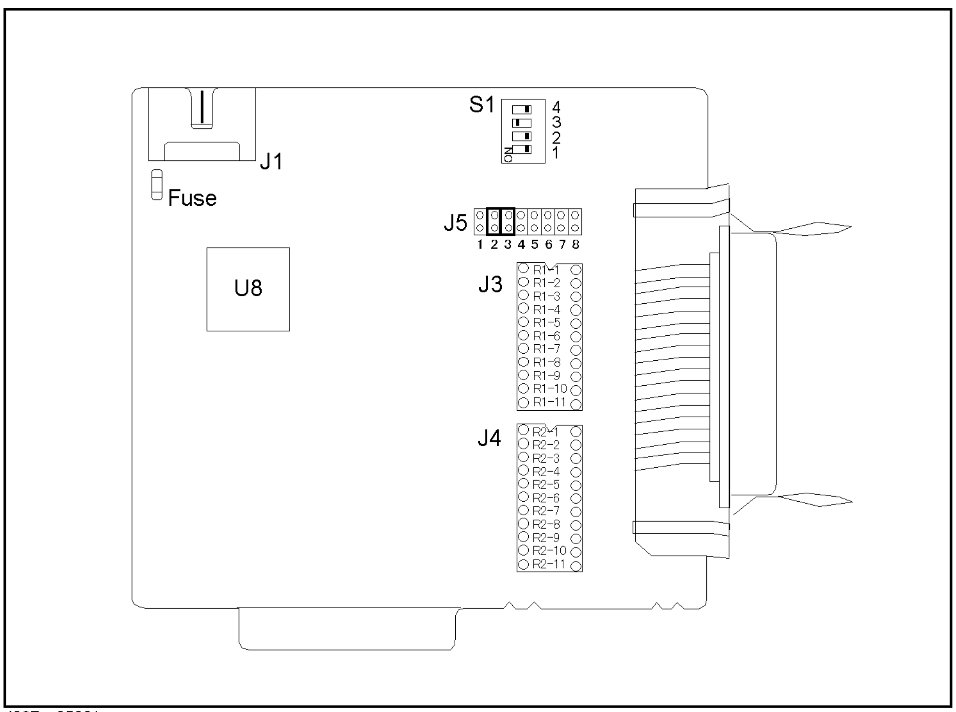
- Setting the drive/pull-up power supply between 5 V and 9 V or 15 V and 24 V.
- Mounting the pull-up resistors on the inside of the instrument.

NOTE The information given here is designed for Agilent Technologies service centers.

Setting the drive/pull-up power supply

The drive/pull-up power supply is set by using the jumper (J5) and DIP switch (S1) on the A23 Handler Interface Board. For the location and socket numbers of J5 and the location and switch numbers of S1, refer to Figure 12-5.

Figure 12-5 **A23 Handler Interface Board**



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Setting the jumper (J5)

J5 lets you set the output signal pull-up and input signal drive power supply and its common. Setting one of the following jumpers selects external power supply (EXT_DCV) or internal power supply (+5 V).

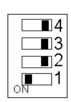
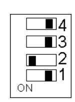
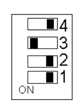
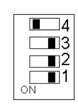
Socket number	Power supply setting when the jumper is set (shorted)	Factory setting
J5-1	For the output signal pull-up and input signal drive power supply, internal power supply (+5 V) is specified.	Open
J5-2	For the output signal pull-up and input signal drive power supply, external power supply (EXT_DCV) is specified.	Short
J5-8	Short external common of handler interface to internal common of 4287A.	Open

NOTE Set (short) only one from among J5-1 and J5-2. Do not set (short) two at the same time.

NOTE J5-3, J5-4, J5-5, J5-6, and J5-7 are not used at present. Do not connect anything to them.

Setting the switches (S1)

Each switch of the DIP switch (S1) must be set as follows, depending on the voltage setting of the output signal pull-up and the input signal drive power supply (DCV).

Voltage setting of output signal pull-up and input signal drive power supply (DCV)			
5V ≤ DCV ≤ 6V	**6V < DCV ≤ 9V**	**9V < DCV ≤ 15V**	**15V < DCV ≤ 24V**
		(factory setting) 	

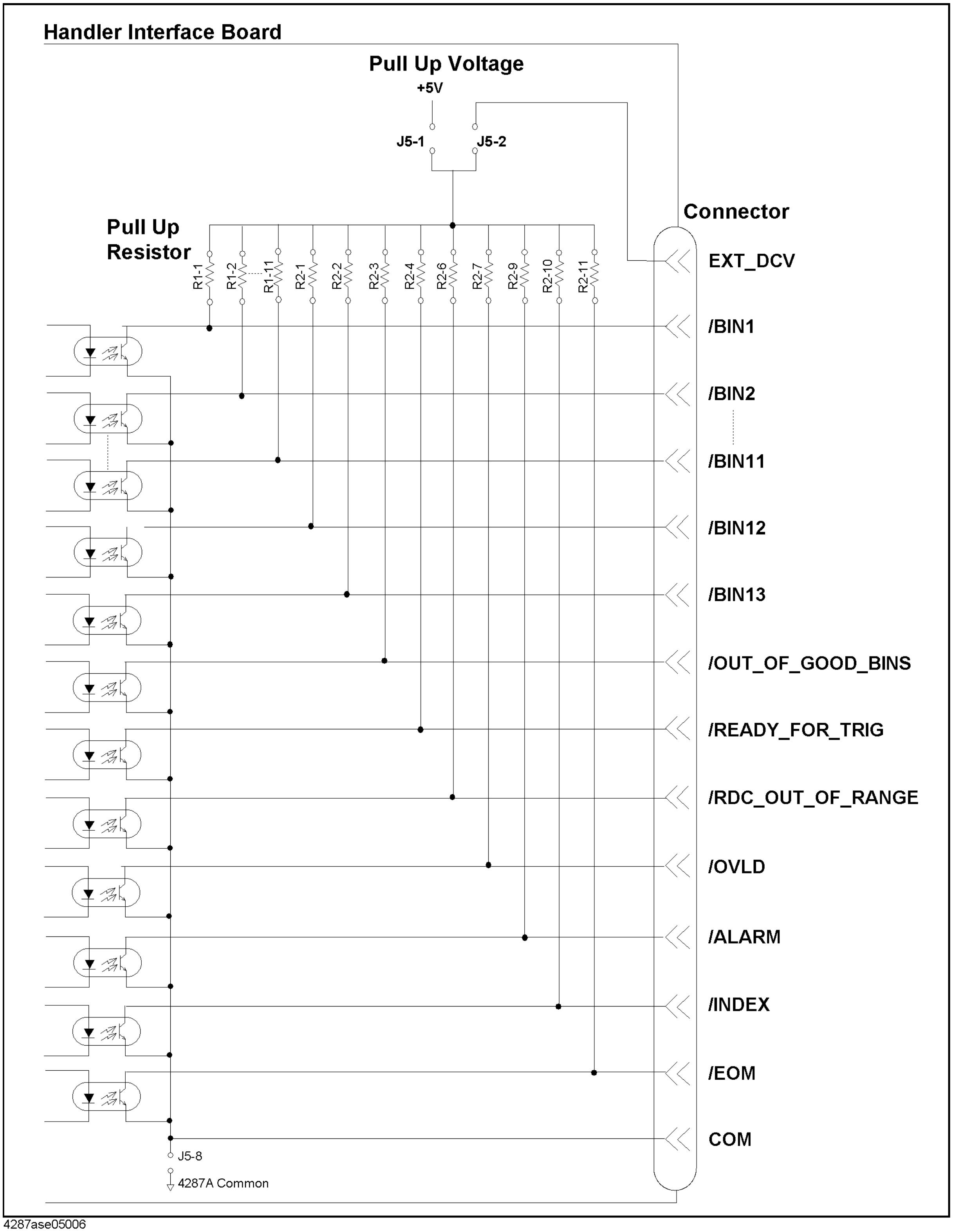
Setting the pull-up resistors

The pull-up resistors for the output signals can be set using J3 and J4 on the A23 handler interface board. Figure 12-6 shows the location of the pull-up resistors on the circuit diagram where the resistor for each signal should be mounted. The location on the handler interface board is shown in Figure 12-5. Refer to Table 12-4 for typical resistance values.

NOTE The resistors are not factory-mounted.

NOTE R2-5 and R2-8 are reserved; do not connect anything to them.

Figure 12-6 Pull-up resistor setting on handler interface board



Procedure for removing the handler interface board

This section describes how to remove the handler interface board when setting the drive/pull-up power supply or mounting the pull-up resistors.

WARNING **Allow at least 10 minutes to elapse after disconnecting the power cable before performing this work. While the 4287A is operating or immediately after the power is turned off, dangerous electrical energy or voltage exists. Therefore, sufficient time is required after disconnecting the power cable to discharge the internal capacitor.**

NOTE While removing the cover, setting the drive/pull-up power supply, and mounting the pull-up resistors, be sure to perform the work in an area with static protection and to wear a ground strap.

Step 1. Disconnect power cable and wait for 10 minutes.

Step 2. Remove side straps from both sides of the 4287A.

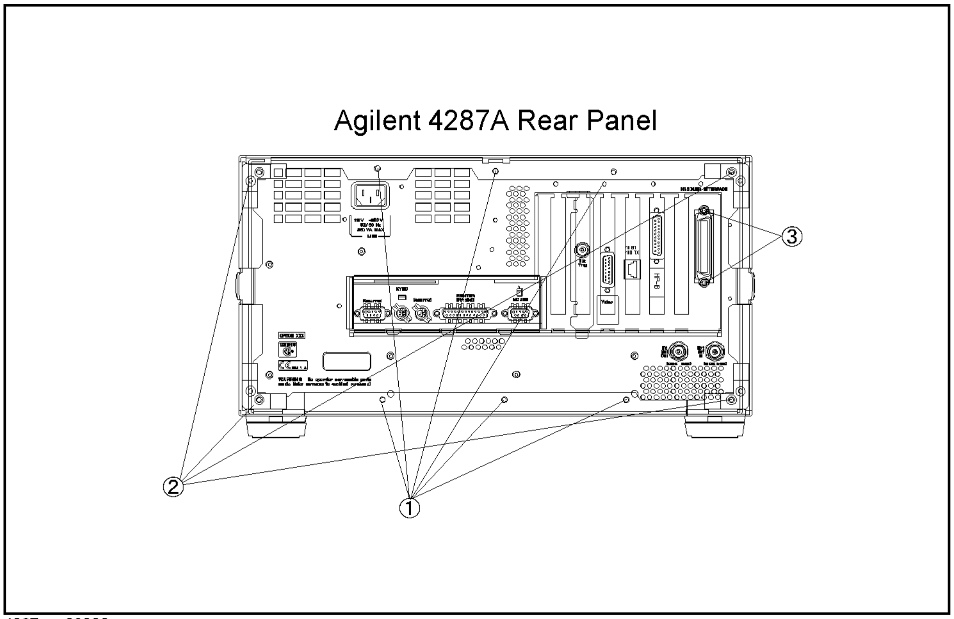
Step 3. Turn the 4287A upside-down.

Step 4. Remove the eight screws and four feet from the bottom of the 4287A .

Step 5. Turn the 4287A rightside-up to its normal position.

Step 6. Remove the six screws (item 1 in Figure 12-7) and four standoffs (item 2 in Figure 12-7) from the rear panel.

Figure 12-7 **4287A Rear Panel**



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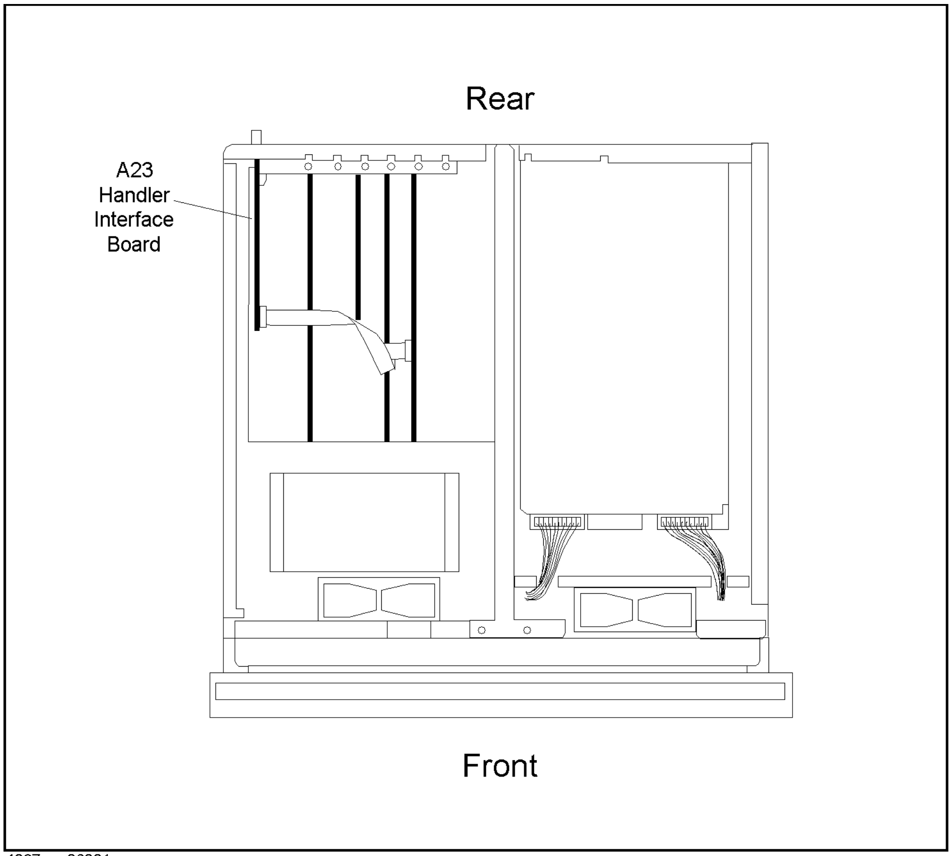
Step 7. Remove the two screws securing the A23 handler interface (item 3 in Figure 12-7) from the rear panel.

Step 8. Slide the cover toward the back to remove it.

Step 9. Disconnect the flat cable from the A23 handler interface board. For the location of the A23, see Figure 12-8

Figure 12-8 **4287A Top View**



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Step 10. Gently pull the A23 handler interface board upward and out.

13 Using LAN

This chapter describes LAN (Local Area Network)-based file transfer and remote control.

Advantages of LAN Connections

You can connect the Agilent 4287A to a LAN, which allows you to take advantage of several additional functions:

- You can transfer files in the 4287A to an external computer, or vice versa, without having to use floppy disks.
- You can use an external computer, regardless of whether it's equipped with a GPIB interface card, to interactively send GPIB commands to the 4287A, thereby achieving simple remote control.

NOTE Programs cannot control the 4287A through LAN connections.

Preparing to Use a LAN

Setting up LAN connections

Before connecting the instrument to a LAN, you need to set an IP address (a unique address assigned to a device to uniquely identify it over the LAN), a gateway IP address (the IP address of a routing device that connects the LAN to other physical networks), a sub-net mask (a numerical value used to determine whether to route communications through the gateway), and a computer name (a unique name assigned to a device to identify it over the LAN).

NOTE Obtain the proper settings for IP address, gateway address, sub-net mask, and computer name from your network administrator.

NOTE If your network does not need to be connected to devices on different physical networks, you usually do not need to set the gateway IP address or the sub-net mask.

NOTE For your specified IP address, gateway IP address, sub-net mask, and computer name to take effect, you need to reboot the 4287A (turn it off and back on).

Setting the IP address, gateway IP address, and sub-net mask

To set the IP address, gateway IP address, and sub-net mask, follow these steps:

Step 1. Press the **[System]** key on the front panel.

Step 2. From the softkey menu along the right-hand edge of the screen, select the softkey labeled **LAN SETUP** by pressing the or key. Then, press the key.

Step 3. From the softkey menu along the right-hand edge of the screen, select the softkey labeled **SETUP IP ADDRESS** by pressing the or key. Then, press the key.

Step 4. A configuration window appears, where you can set the IP address, gateway IP address, and sub-net mask. Select each item by moving the cursor with the key and enter the desired value through numeric keys. Finally, move the cursor to the [OK] button (highlighted when the cursor is placed over it) and press the key.

Setting the computer name

To set the computer name, follow these steps:

Step 1. Press the **[System]** key on the front panel.

Step 2. From the softkey menu along the right-hand edge of the screen, select (highlight) the softkey labeled **LAN SETUP** by pressing the or key. Then press the key.

Step 3. From the softkey menu along the right-hand edge of the screen, select (highlight) the softkey labeled **COMPUTER NAME** by pressing the or key. Then press the key.

Step 4. A window appears that lets you enter the computer name. Use the key or mouse to set the computer name.

Connecting to a LAN

Enabling/disabling the LAN port

Before connecting the 4287A to a LAN, make sure that the LAN port on the rear panel is enabled. To enable/disable the LAN port, follow these steps:

Step 1. Press the **[System]** key on the front panel.

Step 2. From the softkey menu along the right-hand edge of the screen, select (highlight) the softkey labeled **LAN SETUP** by pressing the or key. Then press the key.

Step 3. If the **NETWORK DEVICE [ ]** softkey label displays **ENABLE** between the square brackets ([ ]), the LAN port is already enabled; in this case, leave the current setting unchanged. If the softkey label displays **DISABLE** between the square brackets ([ ]), select (highlight) the **NETWORK DEVICE [ ]** softkey label using the or key and then press the key.

NOTE It takes more than 10 seconds for the new setting to take effect. Therefore, if you have changed the setting from **DISABLE** to **ENABLE**, you should wait at least 20 seconds before using the LAN connection. However, if the LAN port was disabled when the 4287A was turned on, you must wait at least 20 seconds after chaining the setting and then reboot the 4287A before using the LAN connection.

Connecting cables

Connect the LAN port (RJ-45 connector) in the lower left area of the 4287A's rear panel to an available port on your LAN with a 10Base-T twisted pair (Ethertwist) cable.

Transferring Files

You can use FTP (file transfer protocol) to transfer files from the 4287A to an external computer connected to the same LAN or vice versa.

NOTE The description given below assumes that you are familiar with basic operations in a Windows environment, such as Windows 98 or Windows NT and that you have basic knowledge of MS-DOS operation. For more information on Windows 98 or other Windows operating systems, see the appropriate documentation.

File transfer procedure using ftp

A file transfer procedure that uses ftp (an FTP-based file transfer program) is described here through a simple example in which a file named “file_ins.sta” on an external computer running a Windows operating system is transferred to the non-volatile memory of the 4287A (IP address: 1.10.100.50, host name: 4287a) while a file named “ex_ins.sta” in the flash memory of the 4287A is transferred to the external computer.

NOTE You cannot establish more than one ftp connection at a time. If your 4287A is already connected through ftp, do not perform the following procedure until the existing connection is disconnected.

Step 1. Start up the external computer's screen to show the MS-DOS prompt.

Step 2. Move to the directory where file_com.sta resides.

Step 3. At the MS-DOS prompt, type either “ftp 1.10.100.50” or “ftp 4287a” and press the Return key.

Step 4. Press the Return key once to bring up the ftp prompt.

NOTE The file system of the 4287A is provided with neither user name protection nor password protection. Therefore, you can login with any user name and no password for the account.

Step 5. Type “binary” at the ftp prompt and press the Return key. This step sets the file transfer mode to binary format.

NOTE Choose the file transfer mode to conform with the file you transfer. That is, you should use the ASCII format for .csv files, or the binary format for any other file types.

Step 6. Type “put file_com.sta” at the ftp prompt and press the Return key. This completes the transfer from an external computer to the 4287A.

Step 7. Move to the directory where file_ins.sta resides.

NOTE You cannot move to a directory whose name contains one or more spaces.

Step 8. Type “get file_com.sta” at the ftp prompt and press the Return key. This completes the transfer from an external computer to the 4287A.

Step 9. Type “quit” at the ftp prompt and press the Return key to quit the ftp session.

Ftp commands

This section briefly describes commands that are frequently used in ftp transfer.

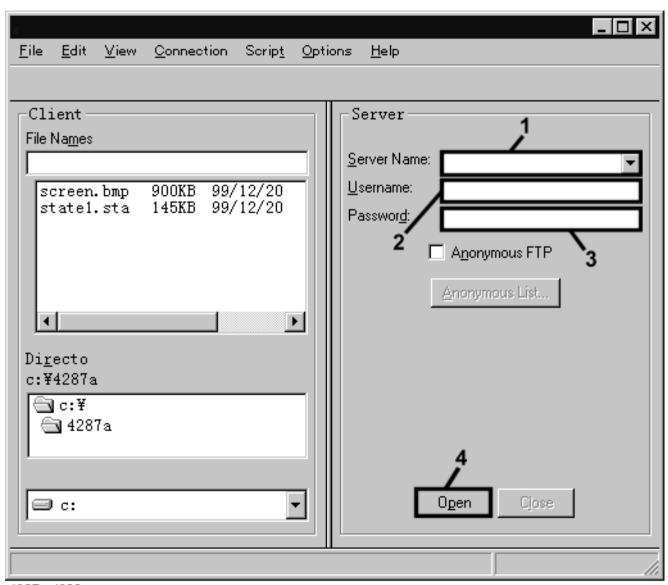
get	Transfers (copies) a specified file from the current directory of the ftp server (the 4287A in the example above) to the ftp client (an external computer in the example above).
put	Transfers (copies) a specified file from the ftp client to the ftp server's current directory.
binary	Sets file transfer mode to binary format.
ascii	Sets file transfer mode to ASCII format.
cd	Changes the current directory.
dir	Lists the contents of the current directory.
quit	Quits the ftp session.

File transfer procedure using a file transfer application

Using a file transfer application in a Windows environment allows you to easily transfer files by mouse operations. A general procedure for using such an application is briefly given below.

Step 1. Start up a suitable file transfer application. A screen showing the status before connecting the 4287A (for example, Figure 13-1) appears.

Figure 13-1 **Sample screen of file transfer application (before connecting 4287A)**

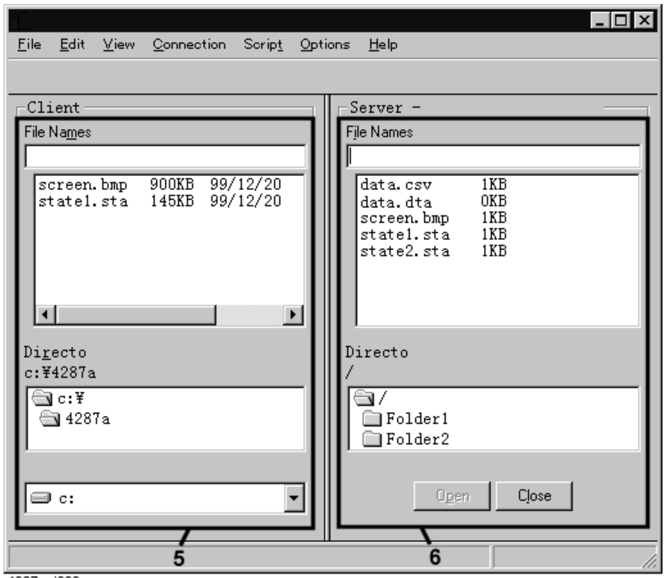


4287apj022

Step 2. Enter the IP address of the 4287A in the Server Name field (the field labeled 1 in Figure 13-1) and then enter suitable character(s) (any character(s) other than space(s)) in the User Name field (the field labeled 2 in Figure 13-1). You can leave the Password field (the field labeled 3 in Figure 13-1) blank.

Step 3. To start a connection with the server (the 4287A), click the button labeled 4 in Figure 13-1, and then the contents of the file system of the 4287A appear as shown in Figure 13-2.

Figure 13-2 **Sample screen of file transfer application (after connecting 4287A)**



4287apj023

Step 4. Copy files using standard procedures for copying files within Windows 98 Explorer, from the external computer side (the window labeled 5 in Figure 13-2) to the 4287A side (the window labeled 6 in Figure 13-2), or from the 4287A side to the external computer.

Interactive Control by Telnet

When connected to a LAN, the 4287A supports interactive control that uses telnet (an interface program for the telnet protocol).

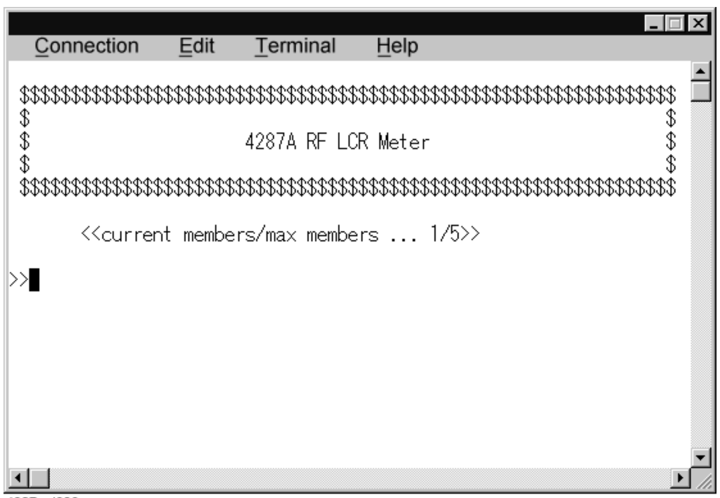
A control procedure that uses telnet is described below through a simple example in which the 4287A (IP address: 1.10.100.50, host name: 4287a) is controlled from an external computer running a Windows operating system.

Step 1. Start up the external computer’s screen to show the MS-DOS prompt.

Step 2. At the MS-DOS prompt, type either “telnet 1.10.100.50” or “telnet 4287a” and press the Return key.

Step 3. After the telnet terminal window opens, the computer connects to the 4287A, and the terminal window shows a welcome message as shown in Figure 13-3. (In a UNIX environment, a welcome message appears under the line in which you typed “telnet 1.10.100.50”.)

Figure 13-3 **Sample screen of telnet-based control (immediately after connection)**

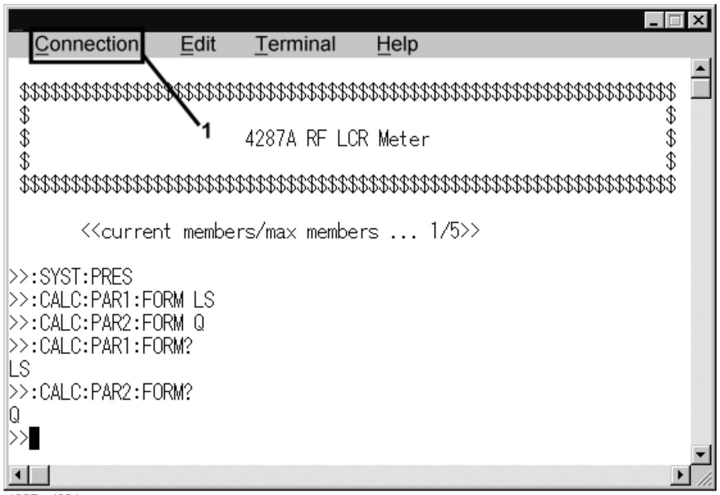


4287api020

Step 4. Enter a command below the welcome message and press the Return key. The command is then sent to the 4287A, where it is actually executed. Also, when you type a Query command and press the Return key, the Query response appears below the line where you entered the command. For example, if you reset the instrument using the **:SYST:PRES** command on page 306 and set measurement parameters 1 and 2 to Ls and Q using the **:CALC:PAR{1-4}:FORM** command on page 230, you would be presented with a screen like Figure 13-4 after the settings have been accepted.

NOTE If each character you have entered appears twice, disable the local echo feature of your telnet program. Note that local echo is a feature that echoes entered characters on screen.

Figure 13-4 **Sample screen of telnet-based control (immediately after command execution)**



4287apj021

Step 5. The Connection menu (labeled 1 in Figure 13-4) of the telnet terminal window allows you to break the connection with the 4287A and quit the telnet session. (In a UNIX environment, typing the] key while holding down the Control key causes the telnet prompt to appear, where you can type quit to break the connection with the 4287A and quit the telnet session as well.)

14 Using Printer

This chapter explains how to use a printer to produce hard copies of your measurement results and images displayed on the LCD screen.

Preparation for Printing

Checking supported printers

To check printers supported by the 4287A, use the following command:

- **:HCOP:PRIN?** on page 286

Selecting a printer

To select the printer you want to connect to the 4287A, use the following command:

- **:HCOP:DPR** on page 285

Executing this command configures the 4287A to use your selected printer. Once you have selected the printer, the printer settings are stored in the non-volatile memory, and you do not have to issue the command again unless you use another printer.

NOTE After you have reconfigured the instrument to use another printer, it may take several seconds for the instrument to update its internal settings. This means that you should not immediately follow this command with another; allow at least 10 seconds before issuing another command.

Outputting the Data to the Printer

Selecting what to output

You can output the following types of data to the printer:

Type of data	Description
Images on the LCD screen	You can print bitmap images*1 from the non-volatile memory (clipboard). If no image resides on the clipboard, the image currently displayed on the screen is transferred to the clipboard before it is output to the printer. When you are working with the measurement results for single-point measurement, you can choose this item to output the data as an image. You can select one of the available color schemes.
Setup Table	Instructs the instrument to output the active table contents, which can contain a measurement point setup table, calibration kit setup table, compensation kit setup table, and BIN sorting setup table. (Monochrome only)
Results of list measurement	Instructs the instrument to output the measurement results of list measurement across all of the measurement points. You cannot output this data when you are working with the results of single-point measurement. (Monochrome only)

*1. This is the image displayed before you pressed the **[Capture]** key (**[Display]** key).

To make this selection, use the following command:

- **:HCOP:CONT** on page 284

Selecting the color scheme

When you print out the image on the LCD screen, you can choose one of the following three color schemes:

Color scheme	Description
Color	Produces a hard copy with colors that approximate those on the screen.
Color (inverse)	Produces a hard copy with colors inverse to those on screen: black for white, white for black, blue for yellow, yellow for blue, red for light blue, and light blue for red.
Monochrome (inverse)	Produces a monochrome hard copy with gray scales inverse to those on screen.

To make this selection, use the following command:

- **:HCOP:IMAG** on page 286

Starting a print operation

To actually send the data to the printer, use the following command:

- **:HCOP** on page 284

Canceling the print operating

To cancel the print operation, use the following command:

- **:HCOP:ABOR** on page 284

Sample Program

Example 14-1 shows a sample program that demonstrates how to print out data. You can find the source file of this program, named printer.bas, on the sample program disk.

This sample program lets the user select a printer and outputs the specified type of data to the printer.

The program is described in detail below:

Line 40	Sets the GPIB address.
Lines 60 to 80	Retrieves and displays the currently selected printer.
Lines 90 to 100	Prompts the user to confirm whether to use another printer and waits until the user presses the y or n key.
Lines 110 to 140	If the user presses the y key in response to line 100, the program passes control to a subprogram named Printer_select to change the printer setting.
Lines 160 to 170	Retrieves the list (1)/single-point (0) measurement setting and stores the setting into the List_stat variables.
Line 190	Allows the user to return to the entry start line and re-enter the data if an error (such as an invalid entry) occurs while entering the number that identifies the type of data to print out.
Lines 210 to 330	Displays the list of items that can be printed and prompts the user to choose one of the items by typing in the appropriate number.
Line 340	Converts the entered value into an integer and stores it into the Content variable.
Line 350	If Content is not within the range between 1 and 3 (for list measurement) or the range between 1 and 2 (for single-point measurement), the program returns the user to the entry start line.
Lines 370 to 450	Determines what to print out based on Content. If Content is 1 (i.e., the user chooses to print the image on the LCD screen), the program sets the color scheme to monochrome.
Line 470	Begins sending the data to the printer.

The Printer_select subprogram in lines 540 to 1030, which allows the user to select another printer, is described below.

Lines 580 to 590	Retrieves the information on supported printers and stores the information into the Info$ variable.
Lines 610 to 690	Extracts the printer information from the Info$ variable and stores the information into the Prin_info$(*) array. Note that the printer information includes the number of supported printers and the specifics to the respective printers and is delimited with <newline> characters (ASCII code 10).
Line 710	Stores the number of supported printers into the Printers variable.
Lines 720 to 840	Extracts the printer number and name from the information specific to each supported printer and stores the printer number into the

Print_no(*) array and the printer name into the Printer$(*) array.

Lines 860 to 970 — Displays the list of supported printers and prompts the user to choose one of the items by typing in the appropriate number. Then the program converts the entered value into an integer and stores it into the Select_pr variable.

Lines 990 to 1020 — Issues the printer selection command and then retrieves and displays the selected printer.

Example 14-1 **Printer (printer.bas)**

```
10      DIM Set_pr$[50],Inp_char$[9]
20      INTEGER List_stat,Max_no,Content
30      CLEAR SCREEN
40      ASSIGN @Agt4287a TO 717
50      !
60      OUTPUT @Agt4287a;":HCOP:DPR?"
70      ENTER @Agt4287a;Set_pr$
80      PRINT "Current Printer Selection: "&Set_pr$
90      PRINT "Do you want to change the printer selection?"
100     INPUT "[Y]es/[N]o",Inp_char$
110     IF UPC$(Inp_char$)="Y" OR UPC$(Inp_char$)="YES" THEN
120       PRINT "## Printer Selection ##"
130       Printer_select(@Agt4287a)
140     END IF
150     !
160     OUTPUT @Agt4287a;":SOUR:LIST:STAT?"
170     ENTER @Agt4287a;List_stat
180     !
190     ON ERROR GOTO Content_select
200 Content_select: !
210     PRINT "## Print Content Selection ##"
220     PRINT "Select Content"
230     PRINT " 1: Screen"
240     PRINT " 2: Setup Tables (Stimulas,Cal Kit,Compen Kit,Bin Sort)"
250     IF List_stat=1 THEN
260       PRINT " 3: List Measurement Result"
270       Max_no=3
280     ELSE
290       Max_no=2
300     END IF
310     PRINT ""
320     PRINT "Input 1 to "&VAL$(Max_no)
330     INPUT "Number?",Inp_char$
340     Content=IVAL(Inp_char$,10)
350     IF Content<1 OR Content>Max_no THEN Content_select
360     OFF ERROR
370     SELECT Content
380       CASE 1
390         OUTPUT @Agt4287a;":HCOP:CONT SCR"
400         OUTPUT @Agt4287a;":HCOP:IMAG MON"
410       CASE 2
420         OUTPUT @Agt4287a;":HCOP:CONT SET"
430       CASE 3
440         OUTPUT @Agt4287a;":HCOP:CONT LIST"
450     END SELECT
460     !
470     OUTPUT @Agt4287a;":HCOP"
480     !
490     PRINT "Program finished."
500     END
510     !=============================================
```

```
520    ! Printer Selection Function
530    !============================================
540  SUB Printer_select(@Agt4287a)
550    DIM Info$[500],Prin_info$(0:20)[50],Printer$(1:20)[50],
Set_pr$[50]
560    INTEGER Info_len,Loc,N,Prin_no(1:20)
570    !
580    OUTPUT @Agt4287a;":HCOP:PRIN?"
590    ENTER @Agt4287a USING "-K";Info$
600    Info_len=LEN(Info$)
610    Loc=2
620    N=0
630    FOR I=2 TO Info_len-1
640      IF Info$[I;1]=CHR$(10) THEN
650        Prin_info$(N)=Info$[Loc,I-1]
660        Loc=I+1
670        N=N+1
680      END IF
690    NEXT I
700    !
710    Printers=IVAL(Prin_info$(0),10)
720    FOR I=1 TO Printers
730      IF Prin_info$(I)[1;1]="," THEN
740        Prin_info$(I)=Prin_info$(I)[2,Info_len]
750      END IF
760      Info_len=LEN(Prin_info$(I))
770      FOR J=1 TO Info_len
780        IF Prin_info$(I)[J;1]="," THEN
790          Printer$(I)=Prin_info$(I)[J+1,Info_len]
800          Prin_no(I)=IVAL(Prin_info$(I)[1,J-1],10)
810          J=Info_len
820        END IF
830      NEXT J
840    NEXT I
850    !
860    ON ERROR GOTO Printer_select
870 Printer_select:   !
880    PRINT "Select Printer"
890    FOR I=1 TO Printers
900      PRINT USING "2D,2A,40A";Prin_no(I),": ",Printer$(I)
910    NEXT I
920    PRINT ""
930    PRINT "Input 1 to "&VAL$(Prin_no(Printers))
940    INPUT "Printer No?",Inp_char$
950    Select_pr=IVAL(Inp_char$,10)
960    IF Select_pr<1 OR Select_pr>MAX(Prin_no(*)) THEN Printer_select
970    OFF ERROR
980    !
990    OUTPUT @Agt4287a;":HCOP:DPR ";Select_pr
1000   OUTPUT @Agt4287a;":HCOP:DPR?"
1010   ENTER @Agt4287a;Set_pr$
1020   PRINT "Current Printer Selection: "&Set_pr$
1030 SUBEND
```

15 Sample Application Programs

This chapter provides sample measurements (sample programs).

Measuring the DUT with a Test Fixture

Example 15-1 is a sample program that demonstrates how to measure a chip component with a test fixture. You can find the source file of this program, named meas_fxt.bas, on the sample program disk.

Start the program after mounting the test head on the fixture stand and connecting it to the Agilent 4287A. When you are prompted with the message “Set Open-Connection,” connect the OPEN standard to the test head's 7 mm terminal and press the **[y]** key followed by the **[Enter]** key to obtain the OPEN measurement data for calculating the calibration coefficients. Repeat the same steps to obtain the SHORT, LOAD, and LOW LOSS CAPACITOR data for calculating calibration coefficients.

When the instrument has finished measuring the data for calculating the calibration coefficients, the program prompts you to select the test fixture. Enter the number that corresponds to the test fixture you want to use and then press the **[Enter]** key. When you are presented with the message “Set Open-Connection,” connect the test fixture to the test head and set up the test fixture for OPEN measurement. Then, press the **[y]** key followed by the **[Enter]** key to obtain the OPEN measurement data for calculating the compensation coefficients. When the “Set Short-Connection” message appears, repeat the same steps to obtain the SHORT measurement data for calculating the compensation coefficients.

NOTE For more information on using the test fixture, including how to set it up for OPEN and SHORT measurements, refer to the test fixture's manual.

When the instrument has finished measuring the data for calculating the compensation coefficients, the program displays the message “Set DUT, then Push [Enter] key.” Mount the DUT on the test fixture and press the **[Enter]** key. Then the instrument measures the DUT and displays the results. After displaying the measurement results, the program displays the message “Once more? [Y]es/[N]o.” If you want to measure the DUT again or measure another DUT, press the **[y]** key followed by the **[Enter]** key to continue the measurement session. If you want to quit the measurement session, press any key except **[y]** and **[Enter]**.

The program is described in detail below:

Lines 70 to 80	Sets the GPIB address and select code.
Lines 120 to 140	Stores the active table number (No.1), the unit of the signal source level (mA), and the number of measurement points (4 points) into the Act_tab, Unit$, and Nop variables, respectively.
Lines 150 to 260	Stores the frequency, averaging factor, and signal source level at each point into the Freq(*), Ave(*), and Pow(*) arrays, respectively. The Freq(*) array contains four values of 100 MHz, 800 MHz, 1 GHz, and 3 GHz; the Ave(*) array contains “1” for all points; the Pow(*) array contains “0.2 mA” for all points.
Lines 270 to 300	Stores the parameter settings for measurement parameters 1 through 4 into the Para$(*) array so that it contains Ls, Q, |Z|, and Rs.
Lines 290 to 320	Stores the R_{dc} measurement lower limit for the OPEN standard (100 Ω) into the Open_l_lim variable; the R_{dc} measurement upper limit for the SHORT standard (25 Ω) into the Short_u_lim variable; the R_{dc} measurement lower and upper limits for the LOAD standard (25 Ω and

	100 Ω) into the Load_l_lim and Load_u_lim variables, respectively.
Line 410	Resizes the Res array based on the value of the Nop variable.
Lines 450 to 460	Resets the instrument and sets the data transfer format to ASCII.
Lines 470 to 480	Sets the active table number to Act_tab and the unit of the signal source level to Unit$.
Lines 490 to 530	Configures the measurement point setup table.
Line 540	Turns on list measurement.
Lines 560 to 580	Sets measurement parameters 1 through 4 to Para$(1) through Para$(4).
Line 620	Configures the instrument to use the 4287A Option 007 (16195B 7-mm calibration kit).
Lines 640 to 750	Passes control to a subprogram named FNCal, which measures the data for the OPEN, SHORT, LOAD, and LOW LOSS CAPACITOR standards. For more information on the FNCal subprogram, refer to the description in Example 4-1 on page 46.
Lines 770 to 790	Calculates the calibration coefficients and turns on the calibration function.
Line 840	Passes control to a subprogram named Set_fixture, which configures the test fixture. For more information on the Set_fixture subprogram, refer to the description in Example 4-2 on page 60.
Line 860	Configures the 4287A to use its built-in definition for the compensation kit value.
Lines 890 to 940	Passes control to a subprogram named FNCompen, which measures the OPEN and SHORT data. For more information on the FNCompen subprogram, refer to the description in Example 4-2 on page 60.
Lines 960 to 980	Calculates the compensation coefficients and turns on the compensation function.
Lines 1020 to 1030	Sets the trigger source to GPIB/LAN trigger and turns on the continuous activation of the trigger system.
Lines 1080 to 1090	Prompts the user to connect a DUT and waits for a press of the **[Enter]** key after the connection.
Lines 1130 to 1180	Triggers the instrument after the trigger system is put into Waiting for Trigger state, and then retrieves the measurement results.
Lines 1220 to 1290	Displays the measurement results.
Lines 1310 to 1320	Prompts the user to choose whether to perform a measurement again. If the user presses the **[y]** key and **[Enter]** key, the program returns to the DUT connection part to repeat measurement.

Example 15-1 **Measuring the DUT with a Test Fixture (meas_fxt.bas)**

```
10    DIM Unit$[9],Para$(1:4)[9],Buff$[9],Inp_char$[9],Img$[200]
20    REAL Freq(1:32),Pow(1:32),Res(1:32,1:7),Open_l_lim,Open_u_lim
30    REAL Short_l_lim,Short_u_lim,Load_l_lim,Load_u_lim
40    INTEGER Scode,Act_tab,Nop,Ave(1:32),Result,I
50    CLEAR SCREEN
60    !
70    ASSIGN @Agt4287a TO 717
80    Scode=7
90    !
100   ! Measurement Condition
110   !
120   Act_tab=1              ! Active Table Number: 1
130   Unit$="A"              ! Power Level unit: mA
140   Nop=4                  ! Number of Points: 4
150   Freq(1)=1.0E+8         ! Point No.1  Frequency: 100 MHz
160   Ave(1)=1               !             Averaging Factor: 1
170   Pow(1)=.2              !             OSC Level: 0.2 mA
180   Freq(2)=8.0E+8         ! Point No.2  Frequency: 800 MHz
190   Ave(2)=1               !             Averaging Factor: 1
200   Pow(2)=.2              !             OSC Level: 0.2 mA
210   Freq(3)=1.0E+9         ! Point No.3  Frequency: 1 GHz
220   Ave(3)=1               !             Averaging Factor: 1
230   Pow(3)=.2              !             OSC Level: 0.2 mA
240   Freq(4)=3.0E+9         ! Point No.4  Frequency: 3 GHz
250   Ave(4)=1               !             Averaging Factor: 1
260   Pow(4)=.2              !             OSC Level: 0.2 mA
270   Para$(1)="LS"          ! Measurement    Para.1: Ls
280   Para$(2)="Q"           !     Parameter  Para.2: Q
290   Para$(3)="Z"           !                Para.3: Z
300   Para$(4)="RS"          !                Para.4: Rs
310   !
320   ! Rdc Limit for Calibration/Compensation
330   !
340   Open_l_lim=100         ! Open Rdc Lower Limit : 100 ohm
350   Open_u_lim=1.E+9       ! Open Rdc Lower Limit : Dummy
360   Short_l_lim=-1.E+9     ! Short Rdc Lower Limit: Dummy
370   Short_u_lim=25         ! Short Rdc Lower Limit: 25 ohm
380   Load_l_lim=25          ! Load Rdc Lower Limit : 25 ohm
390   Load_u_lim=100         ! Load Rdc Lower Limit : 100 ohm
400   !
410   REDIM Res(1:Nop,1:7)
420   !----------------------------------------
430   ! Measurement Condition Setting
440   !----------------------------------------
450   OUTPUT @Agt4287a;":SYST:PRES"
460   OUTPUT @Agt4287a;":FORM ASC"
470   OUTPUT @Agt4287a;":SOUR:LIST:TABL ";Act_tab
480   OUTPUT @Agt4287a;":SOUR:UNIT "&Unit$
490   OUTPUT @Agt4287a;":SOUR:LIST ";Nop;",";
500   FOR I=1 TO Nop-1
510     OUTPUT @Agt4287a;Freq(I);",";Ave(I);",";Pow(I);",";
520   NEXT I
530   OUTPUT @Agt4287a;Freq(Nop);",";Ave(Nop);",";Pow(Nop)
540   OUTPUT @Agt4287a;":SOUR:LIST:STAT ON"
550   !
560   FOR I=1 TO 4
570     OUTPUT @Agt4287a;":CALC:PAR"&VAL$(I)&":FORM "&Para$(I)
580   NEXT I
590   !----------------------------------------
600   ! Calibration
610   !----------------------------------------
```

```
620    OUTPUT @Agt4287a;":CORR1:CKIT DEF"
630    !
640    PRINT "## Measurement for Calibration##"
650    Result=FNCal(@Agt4287a,Scode,"Open",Open_l_lim,Open_u_lim)
660    IF Result<>0 THEN Prog_end
670    !
680    Result=FNCal(@Agt4287a,Scode,"Short",Short_l_lim,Short_u_lim)
690    IF Result<>0 THEN Prog_end
700    !
710    Result=FNCal(@Agt4287a,Scode,"Load",Load_l_lim,Load_u_lim)
720    IF Result<>0 THEN Prog_end
730    !
740    Result=FNCal(@Agt4287a,Scode,"Low Loss C",-1.E+9,1.E+9)
750    IF Result<>0 THEN Prog_end
760    !
770    OUTPUT @Agt4287a;":CORR1:COLL:SAVE"
780    OUTPUT @Agt4287a;"*OPC?"
790    ENTER @Agt4287a;Buff$
800    !----------------------------------------
810    ! Compensation
820    !----------------------------------------
830    PRINT "## Test Fixture Setting ##"
840    CALL Set_fixture(@Agt4287a)
850    !
860    OUTPUT @Agt4287a;":CORR2:CKIT DEF"
870    !
880    PRINT "## Measurement for Compensation ##"
890    PRINT "Set the test fixture on the coaxial port, then"
900    Result=FNCompen(@Agt4287a,Scode,"Open",Open_l_lim)
910    IF Result<>0 THEN Prog_end
920    !
930    Result=FNCompen(@Agt4287a,Scode,"Short",Short_u_lim)
940    IF Result<>0 THEN Prog_end
950    !
960    OUTPUT @Agt4287a;":CORR2:COLL:SAVE"
970    OUTPUT @Agt4287a;"*OPC?"
980    ENTER @Agt4287a;Buff$
990    !----------------------------------------
1000   ! Trigger source setting
1010   !----------------------------------------
1020   OUTPUT @Agt4287a;":TRIG:SOUR BUS"
1030   OUTPUT @Agt4287a;":INIT:CONT ON"
1040 Meas_start:!
1050   !----------------------------------------
1060   ! Measurement
1070   !----------------------------------------
1080   PRINT "Set DUT, then Push [Enter] key"
1090   INPUT "",Inp_char$
1100   !
1110   ! Triggering and data read
1120   !
1130   REPEAT
1140     OUTPUT @Agt4287a;":STAT:OPER:COND?"
1150     ENTER @Agt4287a;Cond_reg
1160   UNTIL BIT(Cond_reg,5)
1170   OUTPUT @Agt4287a;"*TRG"
1180   ENTER @Agt4287a;Res(*)
1190   !----------------------------------------
1200   ! Display Result
1210   !----------------------------------------
1220   Img$="2D,4X,2D,3X,MD.3DE,X,MD.3DE,X,MD.3DE,X,MD.3DE,X,MD.3DE,X,
MD.3DE"
1230   PRINT "### Result ###"
1240   PRINT "No. Status     ";
```

```
1250   PRINT USING "3A,8X,3A,8X,3A,8X,3A,#";Para$(1),Para$(2),Para$(3),
Para$(4)
1260   PRINT "       Imon       Vmon"
1270   FOR I=1 TO Nop
1280     PRINT USING Img$;I,Res(I,1),Res(I,2),Res(I,3),Res(I,4),Res(I,5)
,Res(I,6),Res(I,7)
1290   NEXT I
1300   !
1310   INPUT "Once more? [Y]es/[N]o",Inp_char$
1320   IF UPC$(Inp_char$)="Y" OR UPC$(Inp_char$)="YES" THEN Meas_start
1330   !
1340 Prog_end:END
1350   !=============================================
1360   ! Calibration Data Measurement Function
1370   !=============================================
1380 DEF FNCal(@Agt4287a,INTEGER Scode,Standard$,REAL L_lim,REAL U_lim)
1390   DIM Inp_char$[9],Trig_sour$[9],Buff$[9]
1400   REAL Meas_data
1410   INTEGER Err_flag
1420   OUTPUT @Agt4287a;":TRIG:SOUR?"
1430   ENTER @Agt4287a;Trig_sour$
1440   OUTPUT @Agt4287a;":ABOR"
1450   OUTPUT @Agt4287a;":TRIG:SOUR BUS"
1460   OUTPUT @Agt4287a;":INIT:CONT ON"
1470   OUTPUT @Agt4287a;":STAT:OPER:PTR 0"
1480   OUTPUT @Agt4287a;":STAT:OPER:NTR 16"
1490   OUTPUT @Agt4287a;":STAT:OPER:ENAB 16"
1500   OUTPUT @Agt4287a;"*SRE 128"
1510 Cal_meas:!
1520   PRINT "Set "&Standard$&"-Connection."
1530   INPUT "OK? [Y/N]",Inp_char$
1540   IF UPC$(Inp_char$)="Y" THEN
1550     OUTPUT @Agt4287a;"*CLS"
1560     OUTPUT @Agt4287a;"*OPC?"
1570     ENTER @Agt4287a;Buff$
1580     ON INTR Scode GOTO Meas_end
1590     ENABLE INTR Scode;2
1600     SELECT Standard$
1610       CASE "Open"
1620         OUTPUT @Agt4287a;":CORR1:COLL STAN1"
1630       CASE "Short"
1640         OUTPUT @Agt4287a;":CORR1:COLL STAN2"
1650       CASE "Load"
1660         OUTPUT @Agt4287a;":CORR1:COLL STAN3"
1670       CASE "Low Loss C"
1680         OUTPUT @Agt4287a;":CORR1:COLL STAN4"
1690     END SELECT
1700     OUTPUT @Agt4287a;":TRIG"
1710     PRINT "Now measuring..."
1720 Meas_wait:  GOTO Meas_wait
1730 Meas_end:  OFF INTR Scode
1740     Err_flag=0
1750     SELECT Standard$
1760       CASE "Open"
1770         OUTPUT @Agt4287a;":DATA:RCAD1?"
1780         ENTER @Agt4287a;Rdc
1790         PRINT "Rdc =";ABS(Rdc)
1800         IF ABS(Rdc)<L_lim THEN Err_flag=1
1810       CASE "Short"
1820         OUTPUT @Agt4287a;":DATA:RCAD2?"
1830         ENTER @Agt4287a;Rdc
1840         PRINT "Rdc =";ABS(Rdc)
1850         IF ABS(Rdc)>U_lim THEN Err_flag=1
1860       CASE "Load"
```

```
1870          OUTPUT @Agt4287a;":DATA:RCAD3?"
1880          ENTER @Agt4287a;Rdc
1890          PRINT "Rdc =";ABS(Rdc)
1900          IF ABS(Rdc)<L_lim OR ABS(Rdc)>U_lim THEN Err_flag=1
1910      END SELECT
1920      IF Err_flag=0 THEN
1930        PRINT Standard$&" Data Measurement Complete"
1940      ELSE
1950        PRINT "ERROR!!"
1960        GOTO Cal_meas
1970      END IF
1980      OUTPUT @Agt4287a;":TRIG:SOUR "&Trig_sour$
1990      RETURN 0
2000    ELSE
2010      OUTPUT @Agt4287a;":TRIG:SOUR "&Trig_sour$
2020      PRINT "Program Interruption"
2030      RETURN -1
2040    END IF
2050  FNEND
2060    !============================================
2070    ! Compensation Data Measurement Function
2080    !============================================
2090  DEF FNCompen(@Agt4287a,INTEGER Scode,Standard$,REAL Limit)
2100    DIM Inp_char$[9],Trig_sour$[9],Buff$[9]
2110    REAL Rdc
2120    INTEGER Err_flag
2130    OUTPUT @Agt4287a;":TRIG:SOUR?"
2140    ENTER @Agt4287a;Trig_sour$
2150    OUTPUT @Agt4287a;":ABOR"
2160    OUTPUT @Agt4287a;":TRIG:SOUR BUS"
2170    OUTPUT @Agt4287a;":INIT:CONT ON"
2180    OUTPUT @Agt4287a;":STAT:OPER:PTR 0"
2190    OUTPUT @Agt4287a;":STAT:OPER:NTR 16"
2200    OUTPUT @Agt4287a;":STAT:OPER:ENAB 16"
2210    OUTPUT @Agt4287a;"*SRE 128"
2220  Compen_meas: !
2230    PRINT "Set "&Standard$&"-Connection."
2240    INPUT "OK? [Y/N]",Inp_char$
2250    IF UPC$(Inp_char$)="Y" THEN
2260      OUTPUT @Agt4287a;"*CLS"
2270      OUTPUT @Agt4287a;"*OPC?"
2280      ENTER @Agt4287a;Buff$
2290      ON INTR Scode GOTO Meas_end
2300      ENABLE INTR Scode;2
2310      SELECT Standard$
2320        CASE "Open"
2330          OUTPUT @Agt4287a;":CORR2:COLL STAN1"
2340        CASE "Short"
2350          OUTPUT @Agt4287a;":CORR2:COLL STAN2"
2360      END SELECT
2370      OUTPUT @Agt4287a;":TRIG"
2380      PRINT "Now measuring..."
2390  Meas_wait:  GOTO Meas_wait
2400  Meas_end:  OFF INTR Scode
2410      Err_flag=0
2420      SELECT Standard$
2430        CASE "Open"
2440          OUTPUT @Agt4287a;":DATA:RCMD1?"
2450          ENTER @Agt4287a;Rdc
2460          PRINT "Rdc =";ABS(Rdc)
2470          IF ABS(Rdc)<Limit THEN Err_flag=1
2480        CASE "Short"
2490          OUTPUT @Agt4287a;":DATA:RCMD2?"
2500          ENTER @Agt4287a;Rdc
```

```
2510         PRINT "Rdc =";ABS(Rdc)
2520         IF ABS(Rdc)>Limit THEN Err_flag=1
2530     END SELECT
2540     IF Err_flag=0 THEN
2550       PRINT Standard$&" Data Measurement Complete"
2560     ELSE
2570       PRINT "ERROR!!"
2580       GOTO Compen_meas
2590     END IF
2600     OUTPUT @Agt4287a;":TRIG:SOUR "&Trig_sour$
2610     RETURN 0
2620   ELSE
2630     OUTPUT @Agt4287a;":TRIG:SOUR "&Trig_sour$
2640     PRINT "Program Interruption"
2650     RETURN -1
2660   END IF
2670 FNEND
2680   !=============================================
2690   ! Test Fixture Setting Function
2700   !=============================================
2710 SUB Set_fixture(@Agt4287a)
2720   DIM Inp_char$[30]
2730   INTEGER Fixture
2740   REAL E_len
2750   !
2760   ON ERROR GOTO Fixture_select
2770 Fixture_select:  !
2780   PRINT "Select Test Fixture"
2790   PRINT " 1: None"
2800   PRINT " 2: 16191A"
2810   PRINT " 3: 16192A"
2820   PRINT " 4: 16193A"
2830   PRINT " 5: 16194A"
2840   PRINT " 6: 16196A"
2850   PRINT " 7: 16196B"
2860   PRINT " 8: 16196C"
2870   PRINT " 9: USER"
2880   INPUT "Input 1 to 9",Inp_char$
2890   Fixture=IVAL(Inp_char$,10)
2900   IF Fixture<1 OR Fixture>8 THEN Fixture_select
2910   OFF ERROR
2920   SELECT Fixture
2930     CASE 1
2940       OUTPUT @Agt4287a;":CORR2:FIXT NONE"
2950     CASE 2
2960       OUTPUT @Agt4287a;":CORR2:FIXT FXT16191A"
2970     CASE 3
2980       OUTPUT @Agt4287a;":CORR2:FIXT FXT16192A"
2990     CASE 4
3000       OUTPUT @Agt4287a;":CORR2:FIXT FXT16193A"
3010     CASE 5
3020       OUTPUT @Agt4287a;":CORR2:FIXT FXT16194A"
3030     CASE 6
3040       OUTPUT @Agt4287a;":CORR2:FIXT FXT16196A"
3050     CASE 7
3060       OUTPUT @Agt4287a;":CORR2:FIXT FXT16196B"
3070     CASE 8
3080       OUTPUT @Agt4287a;":CORR2:FIXT FXT16196C"
3090     CASE 9
3100       OUTPUT @Agt4287a;":CORR2:FIXT USER"
3110       CALL Inp_data("Electrical Length of the User Fixture",E_len)
3120       OUTPUT @Agt4287a;":CORR2:FIXT:EDEL:DIST ";E_len
3130   END SELECT
3140 SUBEND
```

```
3150   !============================================
3160   ! Data Input Function
3170   !============================================
3180 SUB Inp_data(Mes$,Inp_val)
3190   DIM Inp_char$[30]
3200   ON ERROR GOTO Inp_start
3210 Inp_start:!
3220   PRINT "Input "&Mes$
3230   INPUT "Value?",Inp_char$
3240   Inp_val=VAL(UPC$(Inp_char$))
3250   PRINT "Input Value: ";Inp_val
3260   INPUT "OK? [Y/N]",Inp_char$
3270   IF UPC$(Inp_char$)<>"Y" THEN Inp_start
3280   OFF ERROR
3290 SUBEND
```

Using an Auto-sorting System

Example 15-2 shows a sample program designed for use with a handler-based auto-sorting system to automate the measurement task on a 10 nH inductor. You can find the source file of this program, named meas_sys.bas, on the sample program disk.

Start the program after setting up the auto-sorting system. The program prompts you to enter the definition values for the LOAD standard. Following the on-screen instructions, you must enter the Rs, Ls, and R_{dc} values for the LOAD standards (predefined working standards) at 100 MHz and 800 MHz.

When you have finished defining the LOAD standard values, the program displays the message “Set Open-Connection.” Disconnect the system's test connectors (such as the contact probe) so that the test circuit is open and press the **[y]** key followed by the **[Enter]** key to measure the OPEN data for calculating the calibration coefficients. When you are presented with the message “Set Short-Connection,” short-circuit the test connectors, and press the **[y]** key followed by the **[Enter]** key to obtain the SHORT measurement data for calculating the calibration coefficients. Finally, the program displays the message “Set Load-Connection.” Connect the working standard to the test connectors and press the **[y]** key followed by the **[Enter]** key to measure the LOAD data for calculating the calibration coefficients.

When the instrument has finished the above measurement, the program turns on the calibration function and displays the message “Set Dut. Then input external trigger.” In the auto-sorting system, connect the test connectors with a DUT and input an external trigger signal from the handler interface. When the instrument has finished measuring the DUT, the program displays the result of bin sorting. The program repeats this process 10 times.

When the instrument has finished the 10th cycle of measurement, the program displays the statistics including the number of DUTs sorted into each bin, saves the measurement results under the file name log_data.csv, and then terminates.

The program is described in detail below:

Lines 110 to 120	Sets the GPIB address and select code.
Lines 160 to 180	Stores the active table number (No.1), the unit of the signal source level (mV), and the number of measurement points (2 points) into the Act_tab, Unit$, and Nop variables, respectively.
Lines 190 to 240	Stores the frequency, averaging factor, and signal source level at each point into the Freq(*), Ave(*), and Pow(*) arrays, respectively. The Freq(*) array contains two values of 100 MHz and 800 MHz; the Ave(*) array contains “1” for all points; the Pow(*) array contains “500 mV” for all points.
Lines 250 to 270	Stores the on/off settings for the screen display (on), beep (off), and key lock (on) into the Disp$, Beep$, and Lock$ variables, respectively.
Line 280	Stores the name of the measurement result file (log_data.csv) into the File$ variable.
Line 290	Stores the number of measurement cycles (10) into the Meas_max variable.
Lines 330 to 380	Stores the R_{dc} measurement lower limit for the OPEN standard (100 Ω) into the Open_l_lim variable and the R_{dc} measurement upper limit

for the SHORT standard (25 Ω) into the Short_u_lim variable.

NOTE The sample program sets the R_{dc} limits for each standard by assuming only typical uses: a lower limit of 100 Ω for the OPEN standard, an upper limit of 25 Ω for the SHORT standard, and no limits for the LOAD standard. To gain more effective protection against operational errors, however, it is recommended that you modify these values based on your actual working standards; for more information, refer to “Preventing operational errors when measuring data for calculating calibration coefficients” on page 40.

Lines 420 to 430 Stores the lower and upper limits (-10 Ω and 10 Ω) for the R_{dc} measurement for conduct check into the Rdc_l_lim and Rdc_u_lim variables, respectively.

Lines 470 to 480 Stores the maximum sorting condition number (4) into the Max_cond variable and the maximum bin number (6) into the Max_bin variable.

Line 490 Stores the maximum good bin number (2) into the Ogbin variable.

Lines 500 to 1420 Stores sorting condition settings into the corresponding variables to configure the sorting conditions for each bin as follows:

	100 MHz		**800 MHz**	
	Ls (reference value: 10 nH)	**Q**	**Ls (reference value: 10 nH)**	**Q**
BIN1 (good bin)	Within the range of ± 3%	≥ 10	Within the range of ± 5%	≥ 10
BIN2 (good bin)	Within the range of ± 5%	≥ 10	Within the range of ± 5%	≥ 10
BIN3 (bad bin)	Within the range of ± 5%	≥ 10	Within the range of ± 5%	< 10
BIN4 (bad bin)	Within the range of ± 5%	≥ 10	Not within the range of ± 5% (exclusive of ±5%)	≥ 10
BIN5 (bad bin)	Within the range of ± 5%	≥ 10	Not within the range of ± 5% (exclusive of ±5%)	< 10
BIN6 (bad bin)	Within the range of ± 5%	< 10	No condition	No condition

Lines 1460 to 1470 Resets the instrument and sets the data transfer format to ASCII.

Lines 1480 to 1490 Sets the active table number to Act_tab and the unit of the signal source level to Unit$.

Lines 1500 to 1540 Configures the measurement point setup table.

Line 1550 Turns on list measurement.

Lines 1560 to 1570 Turns on R_{dc} measurement and sets the limit range for R_{dc} measurement to the range between Rdc_l_lim and Rdc_u_lim.

Lines 1580 to 1610 Assigns the bin sorting parameters (Para$(1) and Para$(2)) to measurement parameters 1 and 2 and hides the results for measurement parameters 3 and 4.

Line 1620 to 1640 Turns off the screen display and beep.

Line 1650 to 1670 Locks the front panel, keyboard, and mouse.

Line 1710 to 1730 Configures the instrument to use the user-defined calibration kit with its values (Rs-Ls) defined for each measurement point.

Lines 1740 to 1820 Passes control to a subprogram named Inp_data, which obtains the definition values for the load (working standard) from user input. For more information on the Inp_data subprogram, refer to the description in Example 4-1 on page 46.

Lines 1840 to 1920 Passes control to a subprogram named FNCal, which measures the data for OPEN, SHORT, and LOAD standards. For more information on the FNCal subprogram, refer to the description in Example 4-1 on page 46.

Lines 1940 to 1960 Calculates the calibration coefficients and turns on the calibration function.

Lines 2000 to 2020 After measurement is stopped (the trigger system is stopped), the program sets the trigger source to External trigger and turns on the continuous activation of the trigger system.

Lines 2060 to 2200 Configures the bin sorting setup table.

Lines 2210 to 2220 Assigns all bins with numbers greater than Ogbin as good bins and turn on the bin sorting function.

Lines 2230 to 2260 Turns on the bin count function and clears the current bin count.

Lines 2300 to 2320 Calculates and sets the maximum number of data segments captured for statistical analysis and then begins retrieving the data.

Lines 2370 to 2400 Configures the instrument to generate an SRQ upon completion of measurement.

Lines 2420 to 2580 Iterates the following steps Meas_max times.

1. Lines 2340 to 2460: Waits until the trigger system is put into Waiting for Trigger state.
2. Lines 2470 to 2490: Clears the status byte register and operation status event register.
3. Lines 2500 to 2510: Sets the branch target for an SRQ interrupt to enable SRQ interrupts.
4. Lines 2520 to 2530: Prompts the user to connect a DUT and input an external trigger. The program waits until the instrument receives an external trigger and completes the measurement cycle.

NOTE As shown in this example, the measurement cycle must be synchronized with the operation status of the 4287A (trigger input timing, detection of the end of measurement, and so on). The sample program uses the status report system to provide synchronization with the trigger input and end of measurement. In a handler-based auto-sorting system, you can also use handler interface output signals such as /READY_FOR_TRIG, /INDEX, or /EOM to achieve synchronization.

5. Lines 2550 to 2570: Retrieves and displays the results of bin sorting.

NOTE In a handler-based auto-sorting system, you can also use handler interface signals such as /BIN1 through /BIN13 or /OUT_OF_GOOD_BINS to obtain the results of bin sorting.

Lines 2620 to 2720 Retrieves and displays the bin count.

Lines 2730 to 2990 Performs statistical analysis and then retrieves and displays the results.

Lines 3030 to 3040 Saves the measurement results (data stored in the volatile memory for statistical analysis) under the file name identified by the File$ variable.

Example 15-2 **Using an Auto-Sorting System (meas_sys.bas)**

```
10     DIM Unit$[9],Para$(1:4)[9],Lim_mode$(1:4)[9],L_type$(1:13,1:4)[9]
20     DIM File$[20],Disp$[9],Beep$[9],Lock$[9],Img1$[200],Img2$[200],
Buff$[9]
30     REAL Freq(1:32),Pow(1:32),Point_no(1:4),L_lim(1:13,1:4),U_lim
(1:13,1:4)
40     REAL Nominal(1:13),R1(1:32,1:10),R2(1:32,1:10)
50     REAL Load_rs,Load_ls,Load_rdc,Rdc_l_lim,Rdc_u_lim
60     REAL Open_l_lim,Open_u_lim,Short_l_lim,Short_u_lim,Load_l_lim,
Load_u_lim
70     INTEGER Scode,Act_tab,Nop,Ave(1:32),Meas_max,Result,Cond_reg,I,J
80     INTEGER Max_cond,Max_bin,Ogbin,Bin_sort_result,Bin(1:14)
90     CLEAR SCREEN
100    !
110    ASSIGN @Agt4287a TO 717
120    Scode=7
130    !
140    ! Measurement Condition
150    !
160    Act_tab=1               ! Active Table Number: 1
170    Unit$="V"               ! Power Level unit: mV
180    Nop=2                   ! Number of Points: 2
190    Freq(1)=1.0E+8          ! Point No.1  Frequency: 100 MHz
200    Ave(1)=1                !             Averaging Factor: 1
210    Pow(1)=500              !             OSC Level: 500 mV
220    Freq(2)=8.0E+8          ! Point No.2  Frequency: 800 MHz
230    Ave(2)=1                !             Averaging Factor: 1
240    Pow(2)=500              !             OSC Level: 500 mV
250    Disp$="OFF"             ! Display Off
260    Beep$="OFF"             ! Done/Warn Beeper Off
270    Lock$="ON"              ! Front panel/KBD/Mouse Lock On
280    File$="log_data.csv"    ! Log Data Save File Name
290    Meas_max=10             ! Maximum Measurement Number
300    !
310    ! Rdc Limit for Calibration/Compensation
320    !
330    Open_l_lim=100          ! Open Rdc Lower Limit : 100 ohm
340    Open_u_lim=1.E+9        ! Open Rdc Upper Limit : Dummy
350    Short_l_lim=-1.E+9      ! Short Rdc Lower Limit: Dummy
360    Short_u_lim=25          ! Short Rdc Upper Limit: 25 ohm
370    Load_l_lim=-1.E+9       ! Load Rdc Lower Limit : Dummy
380    Load_u_lim=1.E+9        ! Load Rdc Upper Limit : Dummy
390    !
400    ! Rdc Limit for Contact Check
410    !
420    Rdc_l_lim=-10           ! Lower Limit : -10 ohm
430    Rdc_u_lim=10            ! Upper Limit :  10 ohm
440    !
450    ! Bin Sort
460    !
470    Max_cond=4
480    Max_bin=6
490    Ogbin=2
500    !                              ====[ALL BIN]====
```

```
510    Point_no(1)=1          ! Condition 1 Point No. : 1 (100 MHz)
520    Para$(1)="LS"          !             Parameter : Ls
530    Lim_mode$(1)="PCNT"    !             Limit mode: Percent
540    Nominal(1)=1.0E-8      !             Nominal   : 10 nF
550    Point_no(2)=1          ! Condition 2 Point No. : 1 (100 MHz)
560    Para$(2)="Q"           !             Parameter : Q
570    Lim_mode$(2)="ABS"     !             Limit mode: Absolute
580    Point_no(3)=2          ! Condition 3 Point No. : 2 (800 MHz)
590    Para$(3)="LS"          !             Parameter : Ls
600    Lim_mode$(3)="PCNT"    !             Limit mode: Percent
610    Nominal(3)=1.0E-8      !             Nominal   : 10 nF
620    Point_no(4)=2          ! Condition 4 Point No. : 1 (100 MHz)
630    Para$(4)="Q"           !             Parameter : Q
640    Lim_mode$(4)="ABS"     !             Limit mode: Absolute
650    !                             =====[BIN1]======
660    L_lim(1,1)=-3.0        ! Condition 1 Lower Limit : -3 %
670    U_lim(1,1)=3.0         !             Upper Limit : +3 %
680    L_type$(1,1)="IN"      !             Limit Type  : IN
690    L_lim(1,2)=10.0        ! Condition 2 Lower Limit : 10
700    U_lim(1,2)=1.0E+9      !             Upper Limit : 1E9
710    L_type$(1,2)="IN"      !             Limit Type  : IN
720    L_lim(1,3)=-5.0        ! Condition 3 Lower Limit : -5 %
730    U_lim(1,3)=5.0         !             Upper Limit : +5 %
740    L_type$(1,3)="IN"      !             Limit Type  : IN
750    L_lim(1,4)=10.0        ! Condition 4 Lower Limit : 10
760    U_lim(1,4)=1.0E+9      !             Upper Limit : 1E9
770    L_type$(1,4)="IN"      !             Limit Type  : IN
780    !                            =====[BIN2]======
790    L_lim(2,1)=-5.0        ! Condition 1 Lower Limit : -5 %
800    U_lim(2,1)=5.0         !             Upper Limit : +5 %
810    L_type$(2,1)="IN"      !             Limit Type  : IN
820    L_lim(2,2)=10.0        ! Condition 2 Lower Limit : 10
830    U_lim(2,2)=1.0E+9      !             Upper Limit : 1E9
840    L_type$(2,2)="IN"      !             Limit Type  : IN
850    L_lim(2,3)=-5.0        ! Condition 3 Lower Limit : -5 %
860    U_lim(2,3)=5.0         !             Upper Limit : +5 %
870    L_type$(2,3)="IN"      !             Limit Type  : IN
880    L_lim(2,4)=10.0        ! Condition 4 Lower Limit : 10
890    U_lim(2,4)=1.0E+9      !             Upper Limit : 1E9
900    L_type$(2,4)="IN"      !             Limit Type  : IN
910    !                            =====[BIN3]======
920    L_lim(3,1)=-5.0        ! Condition 1 Lower Limit : -5 %
930    U_lim(3,1)=5.0         !             Upper Limit : +5 %
940    L_type$(3,1)="IN"      !             Limit Type  : IN
950    L_lim(3,2)=10.0        ! Condition 2 Lower Limit : 10
960    U_lim(3,2)=1.0E+9      !             Upper Limit : 1E9
970    L_type$(3,2)="IN"      !             Limit Type  : IN
980    L_lim(3,3)=-5.0        ! Condition 3 Lower Limit : -5 %
990    U_lim(3,3)=5.0         !             Upper Limit : +5 %
1000   L_type$(3,3)="IN"      !             Limit Type  : IN
1010   L_lim(3,4)=10.0        ! Condition 4 Lower Limit : 10
1020   U_lim(3,4)=1.0E+9      !             Upper Limit : 1E9
1030   L_type$(3,4)="OUT"     !             Limit Type  : OUT
1040   !                            =====[BIN4]======
1050   L_lim(4,1)=-5.0        ! Condition 1 Lower Limit : -5 %
1060   U_lim(4,1)=5.0         !             Upper Limit : +5 %
1070   L_type$(4,1)="IN"      !             Limit Type  : IN
1080   L_lim(4,2)=10.0        ! Condition 2 Lower Limit : 10
1090   U_lim(4,2)=1.0E+9      !             Upper Limit : 1E9
1100   L_type$(4,2)="IN"      !             Limit Type  : IN
1110   L_lim(4,3)=-5.0        ! Condition 3 Lower Limit : -5 %
1120   U_lim(4,3)=5.0         !             Upper Limit : +5 %
1130   L_type$(4,3)="OUT"     !             Limit Type  : OUT
1140   L_lim(4,4)=10.0        ! Condition 4 Lower Limit : 10
```

```
1150   U_lim(4,4)=1.0E+9       !             Upper Limit : 1E9
1160   L_type$(4,4)="IN"       !             Limit Type  : IN
1170   !                               =====[BIN5]======
1180   L_lim(5,1)=-5.0         ! Condition 1 Lower Limit : -5 %
1190   U_lim(5,1)=5.0          !             Upper Limit : +5 %
1200   L_type$(5,1)="IN"       !             Limit Type  : IN
1210   L_lim(5,2)=10.0         ! Condition 2 Lower Limit : 10
1220   U_lim(5,2)=1.0E+9       !             Upper Limit : 1E9
1230   L_type$(5,2)="IN"       !             Limit Type  : IN
1240   L_lim(5,3)=-5.0         ! Condition 3 Lower Limit : -5 %
1250   U_lim(5,3)=5.0          !             Upper Limit : +5 %
1260   L_type$(5,3)="OUT"      !             Limit Type  : OUT
1270   L_lim(5,4)=10.0         ! Condition 4 Lower Limit : 10
1280   U_lim(5,4)=1.0E+9       !             Upper Limit : 1E9
1290   L_type$(5,4)="OUT"      !             Limit Type  : OUT
1300   !                               =====[BIN6]======
1310   L_lim(6,1)=-5.0         ! Condition 1 Lower Limit : -5 %
1320   U_lim(6,1)=5.0          !             Upper Limit : +5 %
1330   L_type$(6,1)="IN"       !             Limit Type  : IN
1340   L_lim(6,2)=10.0         ! Condition 2 Lower Limit : 10
1350   U_lim(6,2)=1.0E+9       !             Upper Limit : 1E9
1360   L_type$(6,2)="OUT"      !             Limit Type  : OUT
1370   L_lim(6,3)=-5.0         ! Condition 3 Lower Limit : -5 % (Dummy)
1380   U_lim(6,3)=5.0          !             Upper Limit : +5 % (Dummy)
1390   L_type$(6,3)="ALL"      !             Limit Type  : ALL
1400   L_lim(6,4)=10.0         ! Condition 4 Lower Limit : 10  (Dummy)
1410   U_lim(6,4)=1.0E+9       !             Upper Limit : 1E9 (Dummy)
1420   L_type$(6,4)="ALL"      !             Limit Type  : ALL
1430   !----------------------------------------
1440   ! Measurement Condition Setting
1450   !----------------------------------------
1460   OUTPUT @Agt4287a;":SYST:PRES"
1470   OUTPUT @Agt4287a;":FORM ASC"
1480   OUTPUT @Agt4287a;":SOUR:LIST:TABL ";Act_tab
1490   OUTPUT @Agt4287a;":SOUR:UNIT "&Unit$
1500   OUTPUT @Agt4287a;":SOUR:LIST ";Nop;",";
1510   FOR I=1 TO Nop-1
1520     OUTPUT @Agt4287a;Freq(I);",";Ave(I);",";Pow(I);",";
1530   NEXT I
1540   OUTPUT @Agt4287a;Freq(Nop);",";Ave(Nop);",";Pow(Nop)
1550   OUTPUT @Agt4287a;":SOUR:LIST:STAT ON"
1560   OUTPUT @Agt4287a;":SOUR:LIST:RDC ON"
1570   OUTPUT @Agt4287a;":CALC:COMP:RDC:LIM ";Rdc_l_lim;",";Rdc_u_lim
1580   OUTPUT @Agt4287a;":CALC:PAR1:FORM "&Para$(1)
1590   OUTPUT @Agt4287a;":CALC:PAR2:FORM "&Para$(2)
1600   OUTPUT @Agt4287a;":DISP:TEXT1:CALC3 OFF"
1610   OUTPUT @Agt4287a;":DISP:TEXT1:CALC4 OFF"
1620   OUTPUT @Agt4287a;":DISP "&Disp$
1630   OUTPUT @Agt4287a;":SYST:BEEP1:STAT "&Beep$
1640   OUTPUT @Agt4287a;":SYST:BEEP2:STAT "&Beep$
1650   OUTPUT @Agt4287a;":SYST:KLOC "&Lock$
1660   OUTPUT @Agt4287a;":SYST:KLOC:KBD "&Lock$
1670   OUTPUT @Agt4287a;":SYST:KLOC:MOUS "&Lock$
1680   !----------------------------------------
1690   ! Calibration
1700   !----------------------------------------
1710   OUTPUT @Agt4287a;":CORR1:CKIT USER"
1720   OUTPUT @Agt4287a;":CORR1:CKIT:LIST ON"
1730   OUTPUT @Agt4287a;":CORR1:CKIT:STAN3:FORM RL"
1740   FOR I=1 TO Nop
1750     PRINT "## For Point No.:";I;"   Frequency:";Freq(I);" ##"
1760     CALL Inp_data("Load Rs Value",Load_rs)
1770     CALL Inp_data("Load Ls Value",Load_ls)
1780     OUTPUT @Agt4287a;":CORR1:CKIT:STAN3:LIST ";I;",";Load_rs;",";
```

```
Load_ls
1790   NEXT I
1800   PRINT "## For Rdc ##"
1810   CALL Inp_data("Load Rdc Value",Load_rdc)
1820   OUTPUT @Agt4287a;":CORR1:CKIT:STAN3:DC ";Load_rdc
1830   !
1840   PRINT "## Measurement for Calibration##"
1850   Result=FNCal(@Agt4287a,Scode,"Open",Open_l_lim,Open_u_lim)
1860   IF Result<>0 THEN Prog_end
1870   !
1880   Result=FNCal(@Agt4287a,Scode,"Short",Short_l_lim,Short_u_lim)
1890   IF Result<>0 THEN Prog_end
1900   !
1910   Result=FNCal(@Agt4287a,Scode,"Load",Load_l_lim,Load_u_lim)
1920   IF Result<>0 THEN Prog_end
1930   !
1940   OUTPUT @Agt4287a;":CORR1:COLL:SAVE"
1950   OUTPUT @Agt4287a;"*OPC?"
1960   ENTER @Agt4287a;Buff$
1970   !----------------------------------------
1980   ! Trigger source setting
1990   !----------------------------------------
2000   OUTPUT @Agt4287a;":ABOR"
2010   OUTPUT @Agt4287a;":TRIG:SOUR EXT"
2020   OUTPUT @Agt4287a;":INIT:CONT ON"
2030   !----------------------------------------
2040   ! BIN sort setting
2050   !----------------------------------------
2060   FOR I=1 TO Max_cond
2070     OUTPUT @Agt4287a;":CALC:COMP:COND"&VAL$(I)&":SNUM ";Point_no(I)
2080     OUTPUT @Agt4287a;":CALC:COMP:COND"&VAL$(I)&":PAR "&Para$(I)
2090     OUTPUT @Agt4287a;":CALC:COMP:COND"&VAL$(I)&":MODE "&Lim_mode$(
I)
2100     IF Lim_mode$(I)<>"ABS" THEN
2110       OUTPUT @Agt4287a;":CALC:COMP:COND"&VAL$(I)&":NOM ";Nominal(I)
2120     END IF
2130     FOR J=1 TO Max_bin
2140       OUTPUT @Agt4287a;":CALC:COMP:BIN"&VAL$(J)&" ON"
2150       OUTPUT @Agt4287a;":CALC:COMP:BIN"&VAL$(J)&":COND"&VAL$(I)&":L
TYP "&L_type$(J,I)
2160       IF L_type$(J,I)<>"ALL" THEN
2170        OUTPUT @Agt4287a;":CALC:COMP:BIN"&VAL$(J)&":COND"&VAL$(I)&":
LIM ";L_lim(J,I);",";U_lim(J,I)
2180       END IF
2190     NEXT J
2200   NEXT I
2210   OUTPUT @Agt4287a;":CALC:COMP:OGB ";Ogbin
2220   OUTPUT @Agt4287a;":CALC:COMP ON"
2230   OUTPUT @Agt4287a;":CALC:COMP:COUN ON"
2240   OUTPUT @Agt4287a;":CALC:COMP:COUN:CLE"
2250   OUTPUT @Agt4287a;"*OPC?"
2260   ENTER @Agt4287a;Buff$
2270   !----------------------------------------
2280   ! Statistical analysis setting
2290   !----------------------------------------
2300   Data_size=5*Nop*Meas_max
2310   OUTPUT @Agt4287a;":CALC:EXAM:SIZE ";Data_size
2320   OUTPUT @Agt4287a;":CALC:EXAM:STAR"
2330   !----------------------------------------
2340   ! Measurement
2350   !----------------------------------------
2360   ! For SRQ
2370   OUTPUT @Agt4287a;":STAT:OPER:PTR 0"
2380   OUTPUT @Agt4287a;":STAT:OPER:NTR 16"
```

```
2390   OUTPUT @Agt4287a;":STAT:OPER:ENAB 16"
2400   OUTPUT @Agt4287a;"*SRE 128"
2410   ! Triggering and data read
2420   FOR I=1 TO Meas_max
2430     REPEAT
2440       OUTPUT @Agt4287a;":STAT:OPER:COND?"
2450       ENTER @Agt4287a;Cond_reg
2460     UNTIL BIT(Cond_reg,5)
2470     OUTPUT @Agt4287a;"*CLS"
2480     OUTPUT @Agt4287a;"*OPC?"
2490     ENTER @Agt4287a;Buff$
2500     ON INTR Scode GOTO Meas_end
2510     ENABLE INTR Scode;2
2520     PRINT "Set Dut. Then input external trigger."
2530 Meas_wait:  GOTO Meas_wait
2540 Meas_end:  OFF INTR Scode
2550     OUTPUT @Agt4287a;":CALC:COMP:DATA:BIN?"
2560     ENTER @Agt4287a;Bin_sort_result
2570     PRINT "Meas. No.:"&VAL$(I),"BIN =";Bin_sort_result
2580   NEXT I
2590   !---------------------------------------
2600   ! Display
2610   !---------------------------------------
2620   ! [BIN Count Result]
2630   OUTPUT @Agt4287a;":CALC:COMP:DATA:BCOU?"
2640   ENTER @Agt4287a;Bin(*)
2650   Img1$="2X,15A,5D"
2660   PRINT "[BIN Count Result]"
2670   PRINT "   BIN            Count"
2680   PRINT " -----------------------"
2690   FOR I=1 TO 13
2700     PRINT USING Img1$;"BIN"&VAL$(I)&":",Bin(I)
2710   NEXT I
2720   PRINT USING Img1$;"OUT OF BIN1-13:",Bin(14)
2730   ! [Statistical Analysis Result]
2740   FOR I=1 TO Nop
2750     OUTPUT @Agt4287a;":CALC:EXAM:GET? 1,";I
2760     ENTER @Agt4287a;P1(I,1),P1(I,2),P1(I,3),P1(I,4),P1(I,5),
P1(I,6),P1(I,7),P1(I,8),P1(I,9),P1(I,10)
2770     OUTPUT @Agt4287a;":CALC:EXAM:GET? 2,";I
2780     ENTER @Agt4287a;P2(I,1),P2(I,2),P2(I,3),P2(I,4),P2(I,5),
P2(I,6),P2(I,7),P2(I,8),P2(I,9),P2(I,10)
2790   NEXT I
2800   Img1$="X,3A,X,3D,2X,MD.4DE,X,MD.4DE,X,MD.4DE,X,MD.4DE,X,MD.4DE"
2810   Img2$="X,3A,X,3D,2X,10D,2X,10D,2X,10D,2X,10D,2X,10D"
2820   PRINT "[Statistical Analysis Result]"
2830   PRINT "     ----------- Statistical Value for Normal Data -------
-----"
2840   PRINT "Para Point    Mean       Sigma   3*Sigma/Mean Min.        M
ax."
2850   FOR I=1 TO Nop
2860     PRINT USING Img1$;Para$(1),I,P1(I,1),P1(I,2),P1(I,3),P1(I,4),
P1(I,5)
2870   NEXT I
2880   FOR I=1 TO Nop
2890     PRINT USING Img1$;Para$(2),I,P2(I,1),P2(I,2),P2(I,3),P2(I,4),
P2(I,5)
2900   NEXT I
2910   PRINT ""
2920   PRINT "     ------------------- Occurrence Count ----------------
-----"
2930   PRINT "Para Point    Normal    Rdc Fail    Overload    Abnormal A
ll"
2940   FOR I=1 TO Nop
```

```
2950     PRINT USING Img2$;Para$(1),I,P1(I,6),P1(I,7),P1(I,8),P1(I,9),
P1(I,10)
2960   NEXT I
2970   FOR I=1 TO Nop
2980     PRINT USING Img2$;Para$(2),I,P2(I,6),P2(I,7),P2(I,8),P2(I,9),
P2(I,10)
2990   NEXT I
3000   !---------------------------------------
3010   ! Save Log Data
3020   !---------------------------------------
3030   OUTPUT @Agt4287a;":MMEM:STOR """&File$&""",LOG"
3040   PRINT "Log Data File: "&File$
3050   !
3060 Prog_end:END
3070   !============================================
3080   ! Calibration Data Measurement Function
3090   !============================================
3100 DEF FNCal(@Agt4287a,INTEGER Scode,Standard$,REAL L_lim,REAL U_lim)
3110   DIM Inp_char$[9],Trig_sour$[9],Buff$[9]
3120   REAL Meas_data
3130   INTEGER Err_flag
3140   OUTPUT @Agt4287a;":TRIG:SOUR?"
3150   ENTER @Agt4287a;Trig_sour$
3160   OUTPUT @Agt4287a;":ABOR"
3170   OUTPUT @Agt4287a;":TRIG:SOUR BUS"
3180   OUTPUT @Agt4287a;":INIT:CONT ON"
3190   OUTPUT @Agt4287a;":STAT:OPER:PTR 0"
3200   OUTPUT @Agt4287a;":STAT:OPER:NTR 16"
3210   OUTPUT @Agt4287a;":STAT:OPER:ENAB 16"
3220   OUTPUT @Agt4287a;"*SRE 128"
3230 Cal_meas:!
3240   PRINT "Set "&Standard$&"-Connection."
3250   INPUT "OK? [Y/N]",Inp_char$
3260   IF UPC$(Inp_char$)="Y" THEN
3270     OUTPUT @Agt4287a;"*CLS"
3280     OUTPUT @Agt4287a;"*OPC?"
3290     ENTER @Agt4287a;Buff$
3300     ON INTR Scode GOTO Meas_end
3310     ENABLE INTR Scode;2
3320     SELECT Standard$
3330       CASE "Open"
3340         OUTPUT @Agt4287a;":CORR1:COLL STAN1"
3350       CASE "Short"
3360         OUTPUT @Agt4287a;":CORR1:COLL STAN2"
3370       CASE "Load"
3380         OUTPUT @Agt4287a;":CORR1:COLL STAN3"
3390       CASE "Low Loss C"
3400         OUTPUT @Agt4287a;":CORR1:COLL STAN4"
3410     END SELECT
3420     OUTPUT @Agt4287a;":TRIG"
3430     PRINT "Now measuring..."
3440 Meas_wait:  GOTO Meas_wait
3450 Meas_end:  OFF INTR Scode
3460     Err_flag=0
3470     SELECT Standard$
3480       CASE "Open"
3490         OUTPUT @Agt4287a;":DATA:RCAD1?"
3500         ENTER @Agt4287a;Rdc
3510         PRINT "Rdc =";ABS(Rdc)
3520         IF ABS(Rdc)<L_lim THEN Err_flag=1
3530       CASE "Short"
3540         OUTPUT @Agt4287a;":DATA:RCAD2?"
3550         ENTER @Agt4287a;Rdc
3560         PRINT "Rdc =";ABS(Rdc)
```

```
3570         IF ABS(Rdc)>U_lim THEN Err_flag=1
3580       CASE "Load"
3590         OUTPUT @Agt4287a;":DATA:RCAD3?"
3600         ENTER @Agt4287a;Rdc
3610         PRINT "Rdc =";ABS(Rdc)
3620         IF ABS(Rdc)<L_lim OR ABS(Rdc)>U_lim THEN Err_flag=1
3630     END SELECT
3640     IF Err_flag=0 THEN
3650       PRINT Standard$&" Data Measurement Complete"
3660     ELSE
3670       PRINT "ERROR!!"
3680       GOTO Cal_meas
3690     END IF
3700     OUTPUT @Agt4287a;":TRIG:SOUR "&Trig_sour$
3710     RETURN 0
3720   ELSE
3730     OUTPUT @Agt4287a;":TRIG:SOUR "&Trig_sour$
3740     PRINT "Program Interruption"
3750     RETURN -1
3760   END IF
3770 FNEND
3780   !=============================================
3790   ! Data Input Function
3800   !=============================================
3810 SUB Inp_data(Mes$,Inp_val)
3820   DIM Inp_char$[30]
3830   ON ERROR GOTO Inp_start
3840 Inp_start:!
3850   PRINT "Input "&Mes$
3860   INPUT "Value?",Inp_char$
3870   Inp_val=VAL(UPC$(Inp_char$))
3880   PRINT "Input Value: ";Inp_val
3890   INPUT "OK? [Y/N]",Inp_char$
3900   IF UPC$(Inp_char$)<>"Y" THEN Inp_start
3910   OFF ERROR
3920 SUBEND
```

Measuring Array (Multi-Element) Components

When measuring an array component with the scanner, you must select appropriate calibration coefficients for each channel, switched by the scanner, to make a correct measurement (by eliminating errors that depend on measurement paths).

The 4287A can handle up to 8 tables for different measurement conditions (including calibration coefficients). This capability is used to set calibration coefficients for each channel. Specifically, calibration coefficients for all of the channels are first obtained in advance based on tables configured for the same measurement condition. Then, while performing measurement for each channel, the corresponding table is used. In this way, you can perform measurements under the same measurement condition but with different calibration coefficients.

The following describes how to use the 4287A to measure array components.

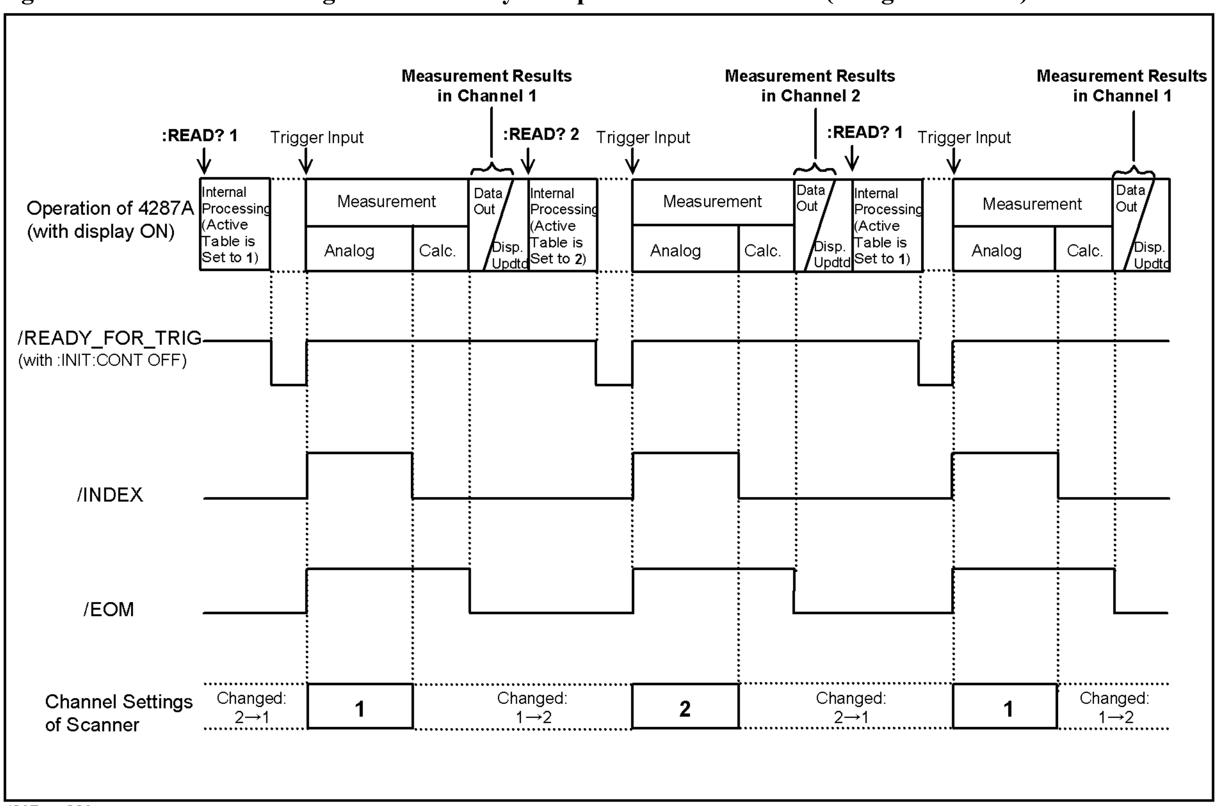
Step 1. Configuring the setup tables

Configure the measurement point setup tables and the calibration kit setup tables for all required channels. If you use the bin sorting function (comparator), also configure the bin sorting setup tables.

Step 2. Obtaining calibration coefficients

Change the channel and active table together and measure the OPEN/SHORT/LOAD data to calculate the calibration coefficients for each channel.

Figure 15-1 **Timing Chart of Array Component Measurement (using 2 channels)**



Step 3. Performing measurement

After setting the channels, perform measurement for each channel while changing the active table to the corresponding table with the **:READ?** command on page 293. During measurement, use the /READY_FOR_TRIG signal for appropriate trigger timing. For details on the timing of trigger input, refer to "Trigger Input Timing When Using the :READ? Command" on page 98. Figure 15-1 shows the timing chart of command execution, trigger input, and channel setup.

Step 4. Sorting and judgment

After completing measurement for all channels, based on the measurement result (or the bin sorting result) for each channel retrieved with the **:READ?** command, perform PASS/FAIL judgment of the DUT as a single array component or bin sorting judgment using an external controller.

Sample Program

Example 15-3 shows a sample program for measuring 4-inductor arrays. You can find the source file of this program, named meas_ary.bas, on the sample program disk.

Start the program. The program prompts you to enter the definition values for the LOAD standard. Following the on-screen instructions, you must enter the Rs, Ls, and R_{dc} values for the LOAD standards for each channel (predefined working standards).

When you have finished defining the LOAD standard values, the program displays the message "Set the Scanner's Channel to No.1, and Set Open-Connection." Set the scanner's channel to 1, disconnect the system's test connectors for channel 1 (such as the contact probe) so that the test circuit is open, and press the **[y]** key followed by the **[Enter]** key to measure the OPEN data for calculating the calibration coefficients for table 1. In the same way, measure the OPEN data for calculating the calibration coefficients for tables 2–4.

When you are presented with the message "Set the Scanner's Channel to No.1, and Set Short-Connection.", set the scanner's channel to 1, short-circuit the test connectors for channel 1, and press the **[y]** key followed by the **[Enter]** key to obtain the SHORT measurement data for calculating the calibration coefficients for table 1. In the same way, measure the SHORT data for calculating the calibration coefficients for tables 2–4.

Finally, the program displays the message "Set the Scanner's Channel to No.1, and Set Load-Connection." Set the scanner's channel to 1, connect the working standard to the test connectors for channel 1, and press the **[y]** key followed by the **[Enter]** key to measure the LOAD data for calculating the calibration coefficients for table 1. In the same way, measure the LOAD data for calculating the calibration coefficients for table tables 2–4.

When the instrument has finished the above measurement, the calibration function is turned on, and the program displays the message "Set the Dut. Set the Scanner's Channel to No.1. Input external trigger after the /READY_FOR_TRIG signal changed to Low level." Connect the test connectors with a DUT and set the scanner's channel to 1. When the /READY_FOR_TRIG signal of the handler interface has changed to Low level, input an external trigger signal from the handler interface. Perform measurement for channels 2–4 in the same way. When the instrument has finished measurement of all channels, it determines bin sorting depending on the results from all of the channels and displays the result of the bin sorting.

When the instrument has finished the 10th cycle of measurement, the program displays the measurement results and then terminates.

The program is described in detail below:

Lines 90 to 100	Sets the GPIB address and select code.
Lines 140 to 150	Stores the number of times the measurement is performed (10) and the number of required tables (4) into the Meas_max and Max_tab_no variables, respectively.
Lines 160 to 200	Stores the unit of the signal source level (mV), the measurement frequency (100 MHz), averaging count (1), the signal source level (500 mV), and measurement parameter 1 (Ls) into the Unit$, Freq, Ave, Pow, and Para1$ variables, respectively.
Lines 210 to 240	Stores the on/off settings for the screen display (on), screen display update (off), beep (off), and key lock (on) into the Disp$, Update$, Beep$, and Lock$ variables, respectively.
Lines 280 to 300	Based on the center value (10 nH) of the limit range of the measurement value (Ls) and the relative boundary values (± 10%), calculates the lower and upper limits and then stores them into the L_lim and U_lim variables, respectively.
Lines 350 to 400	Stores the R_{dc} measurement lower limit for the OPEN standard (100 Ω) into the Open_l_lim variable and the R_{dc} measurement upper limit for the SHORT standard (25 Ω) into the Short_u_lim variable.

NOTE The sample program sets the R_{dc} limits for each standard by assuming only typical uses: a lower limit of 100 Ω for the OPEN standard, an upper limit of 25 Ω for the SHORT standard, and no limits for the LOAD standard. To gain more effective protection against operational errors, however, it is recommended that you modify these values based on your actual working standards; for more information, refer to “Preventing operational errors when measuring data for calculating calibration coefficients” on page 40.

Lines 440 to 450	Resets the instrument and then sets the data transfer format to the ASCII format.
Lines 460 to 500	For all the required tables (1 to Max_tab_no), stores the unit of the signal source level into Unit$, the frequency at measurement point 1 into Freq, averaging count at measurement point 1 into Ave, and the signal source level at measurement point 1 into Pow.
Lines 520 to 530	Turns on list measurement and turns off R_{dc} measurement.
Line 540	Sets measurement parameter 1 to Ls.
Lines 550 to 590	Turns off the result display for measurement parameters 2–4 and measurement signal level monitoring.
Lines 600 to 630	Turns off the screen display, screen display update, and beep.
Lines 640 to 660	Locks the front panel, keyboard, and mouse.
Lines 710 to 820	For all of the required tables (1 to Max_tab_no), configures the calibration kit setup tables in the order of table number.

Lines 740 to 760: Configures the instrument to use the user-defined calibration kit with values defined for each measurement point and selects Rs-Ls as the defined parameter.

Lines 770 to 810: Passes control to a subprogram named Inp_data, which obtains the definition values for the load (working standard) from user input. For more information on the Inp_data subprogram, refer to the description in Example 4-1 on page 46.

Lines 850 to 910 — Passes control to a subprogram named FNCal to measure the OPEN data for calculating the calibration coefficients for all of the required tables (1 to Max_tab_no) in the order of table number. For more information on the FNCal subprogram, refer to the description in Example 4-1 on page 46.

Lines 930 to 990 — Passes control to a subprogram named FNCal to measure the SHORT data for calculating the calibration coefficients for all of the required tables (1 to Max_tab_no) in the order of table number.

Lines 1010 to 1070 — Passes control to a subprogram named FNCal to measure the LOAD data for calculating the calibration coefficients for all of the required tables (1 to Max_tab_no) in the order of table number.

Lines 1090 to 1140 — For all of the required tables (1 to Max_tab_no), calculates the calibration coefficients and turns on the calibration function in the order of table number.

Lines 1180 to 1190 — After the trigger system is stopped (turning off the continuous activation of the trigger system), the program sets the trigger source to External trigger.

Lines 1240 to 1390 — Iterates the following steps Meas_max times.

1. Line 1250: Displays the message that prompts you to connect a DUT.
2. Lines 1260 to 1310: For all of the required tables (1 to Max_tab_no), iterates the following steps in the order of table number.
   a. Displays the message that prompts you to set an appropriate channel of the scanner, specifies the active table, and executes the **:READ?** command.
   b. Prompts the user to input an external trigger after the /READY_FOR_TRIG signal of the handler interface changes to Low level. The program waits until the instrument receives an external trigger and completes the measurement cycle.
   c. Retrieves the measurement result.
3. Lines 1320 to 1380: Determines bins based on whether the measurement results (Ls) for all channels fall between L_lim and U_lim and displays the classified bins.

Lines 1430 to 1490 — Displays the results of the measurements repeated Meas_max times and bin sorting.

Example 15-3 **Measuring Array Components (meas_ary.bas)**

```
10      DIM Unit$[9],Para1$[9],Bin$(1:10)[20],Buff$[9]
20      DIM Disp$[9],Beep$[9],Lock$[9],Img1$[200],Img2$[200]
30      REAL Freq,Pow,Nom,Lim,L_lim,U_lim,Status,D(1:100,1:4)
40      REAL Load_rs,Load_ls,Load_rdc,Rdc_l_lim,Rdc_u_lim
50      REAL Open_l_lim,Open_u_lim,Short_l_lim,Short_u_lim,Load_l_lim,
Load_u_lim
60      INTEGER Scode,Meas_max,Max_tab_no,Nop,Ave,Result,Tab,I
70      CLEAR SCREEN
80      !
90      ASSIGN @Agt4287a TO 717
100     Scode=7
110     !
120     ! Measurement Condition
130     !
140     Meas_max=10             ! Maximum Measurement Number: 10
150     Max_tab_no=4            ! Maximum Table Number: 4
160     Unit$="V"               ! OSC Level unit: mV
170     Freq=1.0E+8             ! Frequency: 100 MHz
180     Ave=1                   ! Averaging Factor: 1
190     Pow=500                 ! OSC Level: 500 mV
200     Para1$="LS"             ! Parameter 1: Ls
210     Disp$="ON"              ! Display On
220     Update$="OFF"           ! Update Display Off
230     Beep$="OFF"             ! Done/Warn Beeper Off
240     Lock$="ON"              ! Front panel/KBD/Mouse Lock On
250     !
260     ! Limit
270     !
280     Nom=1.0E-8              ! Nominal Value : 10 nH
290     Lim=10                  ! Limit : 10 %
300     L_lim=Nom*(1-Lim/100)
310     U_lim=Nom*(1+Lim/100)
320     !
330     ! Rdc Limit for Calibration/Compensation
340     !
350     Open_l_lim=100          ! Open Rdc Lower Limit : 100 ohm
360     Open_u_lim=1.E+9        ! Open Rdc Upper Limit : Dummy
370     Short_l_lim=-1.E+9      ! Short Rdc Lower Limit: Dummy
380     Short_u_lim=25          ! Short Rdc Upper Limit: 25 ohm
390     Load_l_lim=-1.E+9       ! Load Rdc Lower Limit : Dummy
400     Load_u_lim=1.E+9        ! Load Rdc Upper Limit : Dummy
410     !----------------------------------------
420     ! Measurement Condition Setting
430     !----------------------------------------
440     OUTPUT @Agt4287a;":SYST:PRES"
450     OUTPUT @Agt4287a;":FORM ASC"
460     FOR Tab=1 TO Max_tab_no
470       OUTPUT @Agt4287a;":SOUR:LIST:TABL ";Tab
480       OUTPUT @Agt4287a;":SOUR:UNIT "&Unit$
490       OUTPUT @Agt4287a;":SOUR:LIST 1,";Freq;",";Ave;",";Pow
500     NEXT Tab
510     !
520     OUTPUT @Agt4287a;":SOUR:LIST:STAT ON"
530     OUTPUT @Agt4287a;":SOUR:LIST:RDC OFF"
540     OUTPUT @Agt4287a;":CALC:PAR1:FORM "&Para1$
550     OUTPUT @Agt4287a;":DISP:TEXT1:CALC2 OFF"
560     OUTPUT @Agt4287a;":DISP:TEXT1:CALC3 OFF"
570     OUTPUT @Agt4287a;":DISP:TEXT1:CALC4 OFF"
580     OUTPUT @Agt4287a;":DISP:TEXT1:CALC11 OFF"
590     OUTPUT @Agt4287a;":DISP:TEXT1:CALC12 OFF"
600     OUTPUT @Agt4287a;":DISP "&Disp$
```

```
610    OUTPUT @Agt4287a;":DISP:UPD "&Update$
620    OUTPUT @Agt4287a;":SYST:BEEP1:STAT "&Beep$
630    OUTPUT @Agt4287a;":SYST:BEEP2:STAT "&Beep$
640    OUTPUT @Agt4287a;":SYST:KLOC "&Lock$
650    OUTPUT @Agt4287a;":SYST:KLOC:KBD "&Lock$
660    OUTPUT @Agt4287a;":SYST:KLOC:MOUS "&Lock$
670    !---------------------------------------
680    ! Calibration
690    !---------------------------------------
700    PRINT "##### Load Definition #####"
710    FOR Tab=1 TO Max_tab_no
720      PRINT "----- Table No.";Tab;"-----"
730      OUTPUT @Agt4287a;":SOUR:LIST:TABL ";Tab
740      OUTPUT @Agt4287a;":CORR1:CKIT USER"
750      OUTPUT @Agt4287a;":CORR1:CKIT:LIST ON"
760      OUTPUT @Agt4287a;":CORR1:CKIT:STAN3:FORM RL"
770      CALL Inp_data("Load Rs Value",Load_rs)
780      CALL Inp_data("Load Ls Value",Load_ls)
790      CALL Inp_data("Load Rdc Value",Load_rdc)
800     OUTPUT @Agt4287a;":CORR1:CKIT:STAN3:LIST 1,";Load_rs;",";Load_ls
810      OUTPUT @Agt4287a;":CORR1:CKIT:STAN3:DC ";Load_rdc
820    NEXT Tab
830    !
840    PRINT "##### Measurement for Calibration #####"
850    PRINT "##### Open Data Measurement #####"
860    FOR Tab=1 TO Max_tab_no
870      OUTPUT @Agt4287a;":SOUR:LIST:TABL ";Tab
880      PRINT "Set the Scanner's Channel to No."&VAL$(Tab)&", and"
890      Result=FNCal(@Agt4287a,Scode,"Open",Open_l_lim,Open_u_lim)
900      IF Result<>0 THEN Prog_end
910    NEXT Tab
920    !
930    PRINT "##### Short Data Measurement #####"
940    FOR Tab=1 TO Max_tab_no
950      OUTPUT @Agt4287a;":SOUR:LIST:TABL ";Tab
960      PRINT "Set the Scanner's Channel to No."&VAL$(Tab)&", and"
970      Result=FNCal(@Agt4287a,Scode,"Short",Short_l_lim,Short_u_lim)
980      IF Result<>0 THEN Prog_end
990    NEXT Tab
1000   !
1010   PRINT "##### Load Data Measurement #####"
1020   FOR Tab=1 TO Max_tab_no
1030     OUTPUT @Agt4287a;":SOUR:LIST:TABL ";Tab
1040     PRINT "Set the Scanner's Channel to No."&VAL$(Tab)&", and"
1050     Result=FNCal(@Agt4287a,Scode,"Load",Load_l_lim,Load_u_lim)
1060     IF Result<>0 THEN Prog_end
1070   NEXT Tab
1080   !
1090   FOR Tab=1 TO Max_tab_no
1100     OUTPUT @Agt4287a;":SOUR:LIST:TABL ";Tab
1110     OUTPUT @Agt4287a;":CORR1:COLL:SAVE"
1120     OUTPUT @Agt4287a;"*OPC?"
1130     ENTER @Agt4287a;Buff$
1140   NEXT Tab
1150   !---------------------------------------
1160   ! Trigger source setting
1170   !---------------------------------------
1180   OUTPUT @Agt4287a;":ABOR"
1190   OUTPUT @Agt4287a;":TRIG:SOUR EXT"
1200   !---------------------------------------
1210   ! Measurement
1220   !---------------------------------------
1230   PRINT "##### Measurement #####"
1240   FOR I=1 TO Meas_max
```

```
1250      PRINT "Set the Dut."
1260      FOR Tab=1 TO Max_tab_no
1270        PRINT "Set the Scanner's Channel to No."&VAL$(Tab)&"."
1280        OUTPUT @Agt4287a;":READ? ";Tab
1290       PRINT "Input External Trigger after the /READY_FOR_TRIG signal
changed to Low level."
1300        ENTER @Agt4287a;Status,D(I,Tab)
1310      NEXT Tab
1320      ! BIN sorting
1330      IF (D(I,1)<L_lim OR D(I,1)>U_lim) OR (D(I,2)<L_lim OR
D(I,2)>U_lim) OR (D(I,3)<L_lim OR D(I,3)>U_lim) OR (D(I,4)<L_lim OR
D(I,4)>U_lim) THEN
1340        Bin$(I)="BIN2(N.G.)"
1350      ELSE
1360        Bin$(I)="BIN1(GOOD)"
1370      END IF
1380      PRINT "BIN: "&Bin$(I)
1390    NEXT I
1400    !-----------------------------------------
1410    ! Display
1420    !-----------------------------------------
1430    Img1$="8A,3X,5A,8X,5A,8X,5A,8X,5A,8X,3A"
1440    Img2$="5D,3X,MD.4DE,2X,MD.4DE,2X,MD.4DE,2X,MD.4DE,2X,10A"
1450    PRINT "### Result (Parameter: "&Para1$&"  Frequency:";Freq;"Hz
Osc Level:";Pow;"m"&Unit$&") ###"
1460    PRINT USING Img1$;"Dut No.","Ch-1","Ch-2","Ch-3","Ch-4","BIN"
1470    FOR I=1 TO Meas_max
1480      PRINT USING Img2$;I,D(I,1),D(I,2),D(I,3),D(I,4),Bin$(I)
1490    NEXT I
1500    !
1510  Prog_end:END
1520    !=============================================
1530    ! Calibration Data Measurement Function
1540    !=============================================
1550  DEF FNCal(@Agt4287a,INTEGER Scode,Standard$,REAL L_lim,REAL U_lim)
1560    DIM Inp_char$[9],Trig_sour$[9],Buff$[9]
1570    REAL Meas_data
1580    INTEGER Err_flag
1590    OUTPUT @Agt4287a;":TRIG:SOUR?"
1600    ENTER @Agt4287a;Trig_sour$
1610    OUTPUT @Agt4287a;":ABOR"
1620    OUTPUT @Agt4287a;":TRIG:SOUR BUS"
1630    OUTPUT @Agt4287a;":INIT:CONT ON"
1640    OUTPUT @Agt4287a;":STAT:OPER:PTR 0"
1650    OUTPUT @Agt4287a;":STAT:OPER:NTR 16"
1660    OUTPUT @Agt4287a;":STAT:OPER:ENAB 16"
1670    OUTPUT @Agt4287a;"*SRE 128"
1680  Cal_meas:!
1690    PRINT "Set "&Standard$&"-Connection."
1700    INPUT "OK? [Y/N]",Inp_char$
1710    IF UPC$(Inp_char$)="Y" THEN
1720      OUTPUT @Agt4287a;"*CLS"
1730      OUTPUT @Agt4287a;"*OPC?"
1740      ENTER @Agt4287a;Buff$
1750      ON INTR Scode GOTO Meas_end
1760      ENABLE INTR Scode;2
1770      SELECT Standard$
1780        CASE "Open"
1790          OUTPUT @Agt4287a;":CORR1:COLL STAN1"
1800        CASE "Short"
1810          OUTPUT @Agt4287a;":CORR1:COLL STAN2"
1820        CASE "Load"
1830          OUTPUT @Agt4287a;":CORR1:COLL STAN3"
1840        CASE "Low Loss C"
```

```
1850        OUTPUT @Agt4287a;":CORR1:COLL STAN4"
1860    END SELECT
1870    OUTPUT @Agt4287a;":TRIG"
1880    PRINT "Now measuring..."
1890 Meas_wait:  GOTO Meas_wait
1900 Meas_end:!
1910    Err_flag=0
1920    SELECT Standard$
1930      CASE "Open"
1940        OUTPUT @Agt4287a;":DATA:RCAD1?"
1950        ENTER @Agt4287a;Rdc
1960        PRINT "Rdc =";ABS(Rdc)
1970        IF ABS(Rdc)<L_lim THEN Err_flag=1
1980      CASE "Short"
1990        OUTPUT @Agt4287a;":DATA:RCAD2?"
2000        ENTER @Agt4287a;Rdc
2010        PRINT "Rdc =";ABS(Rdc)
2020        IF ABS(Rdc)>U_lim THEN Err_flag=1
2030      CASE "Load"
2040        OUTPUT @Agt4287a;":DATA:RCAD3?"
2050        ENTER @Agt4287a;Rdc
2060        PRINT "Rdc =";ABS(Rdc)
2070        IF ABS(Rdc)<L_lim OR ABS(Rdc)>U_lim THEN Err_flag=1
2080    END SELECT
2090    IF Err_flag=0 THEN
2100      PRINT Standard$&" Data Measurement Complete"
2110    ELSE
2120      PRINT "ERROR!!"
2130      GOTO Cal_meas
2140    END IF
2150    OUTPUT @Agt4287a;":TRIG:SOUR "&Trig_sour$
2160    RETURN 0
2170  ELSE
2180    OUTPUT @Agt4287a;":TRIG:SOUR "&Trig_sour$
2190    PRINT "Program Interruption"
2200    RETURN -1
2210  END IF
2220 FNEND
2230  !============================================
2240  ! Data Input Function
2250  !============================================
2260 SUB Inp_data(Mes$,Inp_val)
2270  DIM Inp_char$[30]
2280  ON ERROR GOTO Inp_start
2290 Inp_start:!
2300  PRINT "Input "&Mes$
2310  INPUT "Value?",Inp_char$
2320  Inp_val=VAL(UPC$(Inp_char$))
2330  PRINT "Input Value: ";Inp_val
2340  INPUT "OK? [Y/N]",Inp_char$
2350  IF UPC$(Inp_char$)<>"Y" THEN Inp_start
2360  OFF ERROR
2370 SUBEND
```

16 Command Reference

This chapter provides a GPIB command reference for the Agilent 4287A. The shorthand names of the commands, without the parts that are normally omitted, appear in alphabetical order in this chapter. If you want to search for commands by their full names, see "GPIB commands" in the index. If you want to search for commands by their functionality, see Appendix C, "GPIB Command Table."

Notational Conventions in this Command Reference

This section describes how to read the description of commands in this chapter.

Syntax

The section headed by "Syntax" describes the syntax to send a command from the external controller to the 4287A.The syntax consists of a command part and a parameter part. The separator between the command part and the parameter part is a space.

When there are several parameters, a comma (,) is used as the separator between adjacent parameters. When the syntax contains an ellipsis between commas, it indicates the omission of one or more parameters; for example, "<numeric 1>,..., <numeric 4>" means that you should specify four parameters: <numeric 1>, <numeric 2>, <numeric 3>, and <numeric 4>. A string type parameter, such as <string> or <string 1>, must be enclosed with double quotes.

You can omit the lowercase characters of a keyword. For example, you can specify **:SYST:PRES** instead of **:SYSTem:PRESet**.

The definition of symbols used in the syntax are as follows:

<>	Characters enclosed by angular brackets are necessary parameters when sending the command.
[]	Parts enclosed by square brackets can be omitted.
{}	Braces indicate that you must select one of the items in this part. Each item is separated by a vertical bar (|).

Description

The section headed by "Description" describes how to use the command or the operation when executed.

Parameters

The section headed by "Parameter" describes the necessary parameters when sending the command. When a parameter is a value type enclosed with <>, information including description, allowable setting range, and initial value is given; when a parameter is a selection type enclosed with {}, information on each selection item is given.

Query response

The section headed by “Query response” describes the data format read out when a query (data read-out) is available with this command.

Each read-out parameter is enclosed with {}. If there are several items within {} separated by a vertical bar (|), only one of them is read out.

When several parameters are read out, they are separated with a comma (,). An ellipsis between commas (...) indicates that the data of that part is omitted. For example, {numeric 1},...,{numeric 4} indicates that four data items, {numeric 1}, {numeric 2}, {numeric 3}, and {numeric 4}, are read out.

The <newline ><^END> is a program message terminator attached at the end of the parameter.

See also

The “See also” section lists other commands associated with the current command.

Equivalent key sequence

The section headed by “Equivalent key sequence” shows the front panel key that has the same effect as this command.

IEEE Common Commands

This section describes the IEEE common commands.

*CLS

Syntax

*CLS

Description

Clears the following (No query):

- Error queue
- Status Byte register
- Standard Event Status register
- Operation Status Event register
- Questionable Status Event register

Equivalent key sequence

No equivalent keys are available on the front panel.

*ESE

Syntax

*ESE <numeric>

*ESE?

Description

Specifies the value of the Standard Event Status enable register.

Parameters

	<numeric>
Description	Sets value in the register
Range	0 to 255
Default	0
Resolution	1

If the parameter is out of the allowable setting range, the bit-by-bit logical product (AND) with 255 (0xff) is set.

Query Response

{numeric}<newline><^END>

See also

***SRE** on page 207

Equivalent key sequence

No equivalent keys are available on the front panel.

*ESR?

Syntax
*ESR?

Description
Returns the value of the Standard Event Status register. Executing this command clears the current register value. (Query only)

Query response
{numeric}<newline><^END>

Equivalent key sequence
No equivalent keys are available on the front panel.

*IDN?

Syntax
*IDN?

Description
Returns the product information for the 4287A, including the manufacturer, model number, and firmware version number. (Query only)

Query response
{string 1},{string 2},{string 3},{string 4}<newline><^END>

The returned data consists of the following items:

{string 1}	Manufacturer. “Agilent Technologies” is always read out.
{string 2}	Model number. “4287A” is always read out.
{string 3}	“00000000” is always read out.
{string 4}	Firmware version number (example: 01.00).

Equivalent key sequence
No equivalent keys are available on the front panel.

*OPC

Syntax
*OPC

Description
Sets the OPC bit (bit 0) in the Standard Event Status register when all pending operations are completed. (No query)

Equivalent key sequence
No equivalent keys are available on the front panel.

*OPC?

Syntax
*OPC?

Description
Reads out 1 when all pending operations are completed. (Query only)

Query response
{1}<newline><^END>

Equivalent key sequence
No equivalent keys are available on the front panel.

*RST

Syntax

*RST

Description

Resets the instrument to its preset state. (No query)

This command works similarly to the **:SYST:PRES** command except that it:

- Turns off the continuous activation of the trigger system.
- Sets the data transfer format to ASCII.

See also

:SYST:PRES on page 306

:INIT:CONT on page 287

Equivalent key sequence

No equivalent keys are available on the front panel.

*SRE

Syntax

*SRE <numeric>

*SRE?

Description

Sets the value of the Service Request enable register.

Parameters

	<numeric>
Description	Sets value in the register
Range	0 to 255
Default	0
Resolution	1

If the parameter is out of the allowable setting range, the bit-by-bit logical product (AND) with 255 (0xff) is set. Note that you cannot set bit 6 to 1.

Query response

{numeric}<newline><^END>

See also

***ESE** on page 204

:STAT:OPER:ENAB on page 299

Equivalent key sequence

No equivalent keys are available on the front panel.

*STB?

Syntax

*STB?

Description

Reads out the value of the Status Byte register. (Query only)

NOTE

You cannot use the this command in telnet session. This command always reads out 0 when you execute the command in telnet session.

Query response

{numeric}<newline><^END>

Equivalent key sequence

No equivalent keys are available on the front panel.

*TRG

Syntax

*TRG

Description

If the trigger mode is set to GPIB/LAN (BUS, with the **:TRIG:SOUR** command), this command triggers the 4287A and, after completion of measurement, reads out the measurement data.

NOTE

This command responds to a query even though it is not suffixed with “?”.

Query response

Same as the **:FETC?** command. See the description of **:FETC?**.

See also

:FETC? on page 280

:TRIG:SOUR on page 310

Equivalent key sequence

No equivalent keys are available on the front panel.

*TST?

Syntax

*TST?

Description

Executes the self-test and reads out the result. (Query only)

Query response

{1|0}<newline><^END>

	Description
1	The result of the self-test is FAIL.
0	The result of the self-test is PASS.

Equivalent key sequence

[System] - **SERVICE MENU** - **EXECUTE INTERNAL TEST**

*WAI

Syntax

*WAI

Description

Waits for all commands sent before completing this command. (No query)

Equivalent key sequence

No equivalent keys are available on the front panel.

4287A GPIB Commands

This section covers the GPIB commands available with the 4287A.

:ABOR

Syntax

:ABORt

Description

Resets the trigger system and puts the trigger sequence into idle state; turns off the continuous activation of the trigger system. (No query)

For more information on the trigger system and each state, see “Trigger system” on page 66.

See also

:INIT on page 287

:INIT:CONT on page 287

Equivalent key sequence

No equivalent keys are available on the front panel.

:AVER:COUN

Syntax

[:SENSe]:AVERage:COUNt <numeric>

[:SENSe]:AVERage:COUNt?

Description

This command sets the averaging factor.

The measurement point for single point measurement, specified with the **:SOUR:LIST:POIN** command, in the active table, specified with the **:SOUR:LIST:TABL** command, must be set here.

Execution of this command does not turn off calibration or compensation automatically. If you need to change only the averaging factor after completion of calibration or compensation, use this command.

NOTE

To change only the averaging factor after completion of calibration/compensation, you may execute the **:SOUR:LIST** command by specifying the parameter so that only the averaging factor will change with the frequency and signal source level identical to the current settings. In this case, calibration and compensation will be turned off automatically; you will need to rerun calibration and compensation.

Parameters

	<numeric>
Description	Averaging factor
Range	1 to 100
Initial value	1
Resolution	1

If your specified parameter is beyond the valid range, the instrument ignores the parameter and uses either the maximum or minimum value depending on whether the parameter is greater than the upper limit or smaller than the lower limit.

Query response

{numeric}<newline><^END>

See also

:SOUR:LIST on page 294

:SOUR:LIST:TABL on page 297

:SOUR:LIST:POIN on page 295

Equivalent key sequence

[Setup View] (Measurement Point Setup display)

:CALC:COMP

Syntax

:CALCulate:COMParator[:STATe] {ON|OFF|1|0}

:CALCulate:COMParator[:STATe]?

Description

Turns on or off the comparator. This setting is linked with the on/off status of the handler interface.

Parameters

	Description
ON or 1	Turns on the comparator
OFF or 0 (initial value)	Turns off the comparator

Query response

{1|0}<newline><^END>

Equivalent key sequence

[System] - **COMPARATOR**

:CALC:COMP:BEEP:COND

Syntax

:CALCulate:COMParator:BEEPer:CONDition {FAIL|PASS}

:CALCulate:COMParator:BEEPer:CONDition?

Description

This command is available when the instrument is configured to beep based on the comparator result (i.e., after you have issued the **:SYST:BEEP2:STAT** command by specifying “ON”). The command lets you specify whether the instrument should beep when the DUT fails to meet the comparator sorting criteria (not sorted into any of bins 1 through 13, or sorted into the NO GOOD bin specified with the **:CALC:COMP:OGB** command) or when the DUT satisfies the comparator sorting criteria (sorted into the GOOD bin).

Parameters

	Description
FAIL (initial value)	Instructs the instrument to beep for a DUT that does not meet the sorting criteria.
PASS	Instructs the instrument to beep for a DUT that meets the sorting criteria.

Query response

{FAIL|PASS}<newline><^END>

See also

:SYST:BEEP2:STAT on page 303

:CALC:COMP:OGB on page 223

Equivalent key sequence

[System] - **BEEPER MENU** - **BEEP COMPARATOR**

:CALC:COMP:BIN{1-13}

Syntax

:CALCulate:COMParator:BIN{1|2|3|4|5|6|7|8|9|10|11|12|13}[:STATe] {ON|OFF|1|0}

:CALCulate:COMParator:BIN{1|2|3|4|5|6|7|8|9|10|11|12|13}[:STATe]?

Description

This command is available when the comparator is enabled. It lets you specify whether the instrument should sort DUTs into bin 1 (:BIN1) through bin 13 (:BIN13).

Parameters

	Description
ON or 1	Turns on the sorting feature
OFF or 0 (initial value)	Turns off the sorting feature

Query response

{1|0}<newline><^END>

See also

:CALC:COMP on page 211

Equivalent key sequence

[Setup View] (Bin sort setup display)

:CALC:COMP:BIN{1-13}:COND{1-4}:LIM

Syntax

:CALCulate:COMParator:BIN{1|2|3|4|5|6|7|8|9|10|11|12|13}:CONDition{1|2|3|4}:LIMit <numeric 1>,<numeric 2>

:CALCulate:COMParator:BIN{1|2|3|4|5|6|7|8|9|10|11|12|13}:CONDition{1|2|3|4}:LIMit?

Description

Lets you specify the limit range that applies to each of the four sorting conditions (:COND1 through :COND4) for bin 1 (:BIN1) through bin 13 (:BIN13). The limit range is inclusive of both upper and lower limit values.

The limit range is applied when the parameter specified with the **:CALC:COMP:COND{1-4}:PAR** command is measured at the point specified with the **:CALC:COMP:COND{1-4}:SNUM** command.

If you have issued the **:CALC:COMP:COND{1-4}:MODE** by specifying “DEV” or “PCNT” to configure the instrument to accept a limit range in deviation or percent mode, the instrument assumes that the limit values are relative to the reference value specified with the **:CALC:COMP:COND{1-4}:NOM** command.

Parameters

	<numeric 1>	**<numeric 2>**
Description	Lower limit value*1	Upper limit value*1
Range	-1E20 to 1E20	-1E20 to 1E20
Default	0	0
Unit	Depends on the sort parameter.	Depends on the sort parameter.
Resolution	1E-20	1E-20

*1. If <numeric 1> is greater than <numeric 2>, the instrument uses <numeric 1> as the upper limit and <numeric 2> as the lower limit.

If your specified parameter is beyond the valid range, the parameter is replaced with either the maximum or minimum value of the valid range depending on whether the parameter is greater than the upper limit or smaller than the lower limit.

Query response

{numeric 1}, {numeric2}<newline><^END>

The returned data always lists the lower and upper limits in that order.

See also

:CALC:COMP:COND{1-4}:SNUM on page 218

:CALC:COMP:COND{1-4}:PAR on page 217

:CALC:COMP:COND{1-4}:MODE on page 215

:CALC:COMP:COND{1-4}:NOM on page 216

:CALC:COMP:BIN{1-13}:COND{1-4}:LTYP on page 214

Equivalent key sequence

[Setup View] (Bin sort setup display)

:CALC:COMP:BIN{1-13}:COND{1-4}:LTYP

Syntax

:CALCulate:COMParator:BIN{1|2|3|4|5|6|7|8|9|10|11|12|13}:CONDition{1|2|3|4}:LTYPe {IN|OUT|ALL}

:CALCulate:COMParator:BIN{1|2|3|4|5|6|7|8|9|10|11|12|13}:CONDition{1|2|3|4}:LTYPe?

Description

Lets you set the limit range mode of each of the four sorting conditions (:COND1 through :COND4) for bin 1 (:BIN1) through bin 13 (:BIN13).

Parameters

	Description
IN	Instructs the instrument to determine that a test has passed the sorting condition where DUTs fall within the limit range (inclusive of the upper and lower limits).
OUT	Instructs the instrument to determine that a test has passed the sorting condition where DUTs do not fall within the limit range (exclusive of the upper and lower limits).
ALL (initial value)	Instructs the instrument to determine that a test has passed the sorting condition where the measurement result is disregarded.

Query response

{IN|OUT|ALL}<newline><^END>

See also

:CALC:COMP:BIN{1-13}:COND{1-4}:LIM on page 213

Equivalent key sequence

[Setup View] (Bin sort setup display)

:CALC:COMP:CLE

Syntax

:CALCulate:COMParator:CLEar

Description

Initializes (resets) all the sorting conditions for each comparator bin and a limit range for R_{dc} measurement. (No query)

Equivalent key sequence

[Alt] - **[2]** - **[8]** - **[2]** (when the bin sort setup display is selected by **[Setup View]**)

:CALC:COMP:COND{1-4}:MODE

Syntax

:CALCulate:COMParator:CONDition{1|2|3|4}:MODE {ABS|DEV|PCNT}

:CALCulate:COMParator:CONDition{1|2|3|4}:MODE?

Description

Lets you select how to specify the limit range that applies to each of the four sorting conditions (:COND1 through :COND4). This setting applies to all of the bins.

Parameters

	Description
ABS (initial value)	Uses absolute mode, in which the upper and lower limits are specified as absolute values.
DEV	Uses deviation mode, in which the upper and lower limits are specified as deviations relative to the reference value*1.
PCNT	Uses percent mode, in which the upper and lower limits are specified as percentages relative to the reference value*1.

*1. You can use the **:CALC:COMP:COND{1-4}:NOM** command to set the reference value.

Query response

{ABS|DEV|PCNT}<newline><^END>

See also

:CALC:COMP:COND{1-4}:NOM on page 216

Equivalent key sequence

[Setup View] (Bin sort setup display)

:CALC:COMP:COND{1-4}:NOM

Syntax

:CALCulate:COMParator:CONDition{1|2|3|4}:NOMinal <numeric>

:CALCulate:COMParator:CONDition{1|2|3|4}:NOMinal?

Description

Lets you specify the limit range reference value that applies to each of the four sorting conditions (:COND1 through :COND4). The reference value applies to all of the bins if you have issued the **:CALC:COMP:COND{1-4}:MODE** command by specifying “DEV” or “PCNT” to configure the instrument to accept a limit range in deviation or percent mode.

Parameters

	<numeric>
Description	Limit range reference value
Range	-1E20 to 1E20
Default	0
Unit	Depends on measurement parameter used to sort DUTs.
Resolution	1E-20

If your specified parameter is beyond the valid range, the instrument ignores the parameter and uses either the maximum or minimum value depending on whether the parameter is greater than the upper limit or smaller than the lower limit.

Query response

{numeric}<newline><^END>

See also

:CALC:COMP:COND{1-4}:MODE on page 215

Equivalent key sequence

[Setup View] (Bin sort setup display)

:CALC:COMP:COND{1-4}:PAR

Syntax

:CALCulate:COMParator:CONDition{1|2|3|4}:PARameter {Z|Y|LS|LP|CS|CP|RS|RP|Q|D|X|G|B|TZR|TZD|TYR|TYD}
:CALCulate:COMParator:CONDition{1|2|3|4}:PARameter?

Description

Lets you specify the measurement parameter for evaluating each of the four sorting conditions (:COND1 through :COND4). This setting applies to all of the bins.

Parameters

	Description
Z	Evaluates the impedance amplitude absolute value
Y	Evaluates the admittance amplitude absolute value
LS	Evaluates the equivalent series inductance
LP	Evaluates the equivalent parallel inductance
CS	Evaluates the equivalent series capacitance
CP	Evaluates the equivalent parallel capacitance
RS	Evaluates the equivalent series resistance
RP	Evaluates the equivalent parallel resistance
D	Evaluates the dissipation factor
Q	Evaluates the Q value (inverse dissipation factor)
X	Evaluates the equivalent series reactance
G	Evaluates the equivalent parallel conductance
B	Evaluates the equivalent parallel susceptance
TZR	Evaluates the impedance phase (in radians)
TZD	Evaluates the impedance phase (in degrees)
TYR	Evaluates the admittance phase (in radians)
TYD	Evaluates the admittance phase (in degrees)

Sorting condition 1 defaults to Z; sorting condition 2 defaults to TZD; sorting condition 3 defaults to RS; sorting condition 4 defaults to X.

Query response

{Z|Y|LS|LP|CS|CP|RS|RP|Q|D|X|G|B|TZR|TZD|TYR|TYD}<newline><^END>

See also

:CALC:COMP:COND{1-4}:SNUM on page 218

Equivalent key sequence

[Setup View] (Bin sort setup display)

:CALC:COMP:COND{1-4}:SNUM

Syntax

:CALCulate:COMParator:CONDition{1|2|3|4}:SNUMber <numeric>

:CALCulate:COMParator:CONDition{1|2|3|4}:SNUMber?

Description

Lets you specify the measurement point for each of the four sorting conditions (:COND1 through :COND4). This setting applies to all of the bins.

This setting is reset when settings in the measurement point setup table are changed by execution of **:SOUR:LIST** or **:SOUR:LIST:CLE** commands.

Parameters

	<numeric>
Description	Point number
Range	1 to number of points (up to 32)
Default	1
Resolution	1

If your specified parameter is beyond the valid range, the instrument ignores the parameter and uses either the maximum or minimum value depending on whether the parameter is greater than the upper limit or smaller than the lower limit.

Query response

{numeric}<newline><^END>

See also

:CALC:COMP:COND{1-4}:PAR on page 217

:SOUR:LIST on page 294

:SOUR:LIST:CLE on page 295

Equivalent key sequence

[Setup View] (Bin sort setup display)

:CALC:COMP:COUN

Syntax

:CALCulate:COMParator:COUNt[:STATe] {ON|OFF|1|0}

:CALCulate:COMParator:COUNt[:STATe]?

Description

Lets you specify whether to use the comparator counter. Enabling this feature causes the instrument to count the number of DUTs put into each bin based on the comparator result.

The maximum count value is 2,147,483,647 (2^{31}-1). If this value is exceeded, the count value remains 2,147,483,647 and is not updated.

The count value is not reset by execution of reset commands (***RST** or **:SYST:PRES**).

Parameters

	Description
ON or 1	Enables the bin counter feature
OFF or 0 (initial value)	Disables the bin counter feature

Query response

{1|0}<newline><^END>

See also

:CALC:COMP:COUN:CLE on page 219

:CALC:COMP:DATA:BCOU? on page 220

Equivalent key sequence

No equivalent keys are available on the front panel.

:CALC:COMP:COUN:CLE

Syntax

:CALCulate:COMParator:COUNt:CLEar

Description

Initializes the comparator bin counter feature by resetting all of the bin counts to zero. (No query)

Equivalent key sequence

No equivalent keys are available on the front panel.

:CALC:COMP:DATA:BCOU?

Syntax

:CALCulate:COMParator:DATA:BCOUnt?

Description

Returns the count for each bin from the comparator bin counter. The command returns all of the bin counts, regardless of whether the instrument is configured to sort DUTs for each bin. (Query only)

Query response

{numeric 1},...,{numeric 14}<newline><^END>

	Description
{numeric 1}	Count for bin 1
{numeric 2}	Count for bin 2
{numeric 3}	Count for bin 3
{numeric 4}	Count for bin 4
{numeric 5}	Count for bin 5
{numeric 6}	Count for bin 6
{numeric 7}	Count for bin 7
{numeric 8}	Count for bin 8
{numeric 9}	Count for bin 9
{numeric 10}	Count for bin 10
{numeric 11}	Count for bin 11
{numeric 12}	Count for bin 12
{numeric 13}	Count for bin 13
{numeric 14}	Count of DUTs that were not sorted into any of bins 1 through 13 (comparator result is 0) or were sorted into NO GOOD bins (set by **:CALC:COMP:OGB** command). That is the count for a measurement when the /OUT_OF_GOOD_BINS signal of the handler interface changes to LOW level.

See also

:CALC:COMP:COUN on page 219

:CALC:COMP:COUN:CLE on page 219

:CALC:COMP on page 211

:CALC:COMP:BIN{1-13} on page 212

:CALC:COMP:OGB on page 223

Equivalent key sequence

No equivalent keys are available on the front panel.

:CALC:COMP:DATA:BIN?

Syntax
:CALCulate:COMParator:DATA:BIN?

Description
Returns the most recent comparator result. (Query only)

Query response
{0|1|2|3|4|5|6|7|8|9|10|11|12|13|14}<newline><^END>

	Description
0	Indicates a DUT that was not sorted into any of bins 1 through 13
1	Indicates a DUT that was sorted into bin 1
2	Indicates a DUT that was sorted into bin 2
3	Indicates a DUT that was sorted into bin 3
4	Indicates a DUT that was sorted into bin 4
5	Indicates a DUT that was sorted into bin 5
6	Indicates a DUT that was sorted into bin 6
7	Indicates a DUT that was sorted into bin 7
8	Indicates a DUT that was sorted into bin 8
9	Indicates a DUT that was sorted into bin 9
10	Indicates a DUT that was sorted into bin 10
11	Indicates a DUT that was sorted into bin 11
12	Indicates a DUT that was sorted into bin 12
13	Indicates a DUT that was sorted into bin 13
14	Indicates sort failed (due to a measurement error)

NOTE
If the comparator feature is disabled, the command returns the sorting result from when the comparator feature was last enabled. However, the command returns zero if the 4287A has been reset or the comparator feature has not been enabled since turning on the 4287A.

See also
:CALC:COMP on page 211

Equivalent key sequence
No equivalent keys are available on the front panel.

:CALC:COMP:DATA:RDC?

Syntax

:CALCulate:COMParator:DATA:RDC?

Description

Returns the most recent R_{dc} limit evaluation result when the R_{dc} measurement feature and the comparator feature are enabled. (Query only)

Query response

	Description
0	Indicates that R_{dc} was beyond the limit
1	Indicates that R_{dc} was within the limit

NOTE

If either the R_{dc} measurement feature or the comparator feature is disabled, the command returns the previous sorting result. However, the command returns zero if the 4287A has been reset or the R_{dc} limit evaluation has not been executed since turning on the 4287A.

See also

:SOUR:LIST:RDC on page 296

:CALC:COMP on page 211

:CALC:COMP:RDC:LIM on page 224

:DATA:RDC? on page 267

Equivalent key sequence

No equivalent keys are available on the front panel.

:CALC:COMP:OGB

Syntax

:CALCulate:COMParator:OGBins <numeric>

:CALCulate:COMParator:OGBins?

Description

Specifies the boundary between good and bad bins (the OUT_OF_GOOD_BINS line) by specifying the number of the good bin that is adjacent to the boundary. All bin numbers that are equal to or smaller than the specified bin number indicate good bins while those larger than the specified number represent bad bins.

NOTE

When a DUT is sorted into a bad bin, the handler interface output signal /OUT_OF_GOOD_BINS becomes active (Low). Also, the /OUT_OF_GOOD_BINS signal becomes active when a DUT is not sorted into any of the bins 1 through 13.

Parameters

	<numeric>
Description	Number of good bin to be adjacent to the boundary
Range	1 to 13
Default	10
Resolution	1

If your specified parameter is beyond the valid range, the instrument ignores the parameter and uses either the maximum or minimum value depending on whether the parameter is greater than the upper limit or smaller than the lower limit.

Query response

{numeric}<newline><^END>

Equivalent key sequence

[Alt] - **[2]** - **[7]** - (when the bin sort setup display is selected by **[Setup View]**)

:CALC:COMP:RDC:LIM

Syntax

:CALCulate:COMParator:RDC:LIMit <numeric 1>,<numeric 2>

:CALCulate:COMParator:RDC:LIMit?

Description

Sets the limit range for the R_{dc} limit evaluation. The limit range is inclusive of both upper and lower limit values.

Parameters

	<numeric 1>	**<numeric 2>**
Description	Lower limit value[*1]	Upper limit value[*1]
Range	-1E20 to 1E20	-1E20 to 1E20
Default	0	10000
Unit	Ω (ohm)	Ω (ohm)
Resolution	1E-20	1E-20

*1. If <numeric 1> is greater than <numeric 2>, the instrument uses <numeric 1> as the upper limit and <numeric 2> as the lower limit.

If your specified parameter is beyond the valid range, the instrument ignores the parameter and uses either the maximum or minimum value depending on whether the parameter is greater than the upper limit or smaller than the lower limit.

Query response

{numeric 1}, {numeric2}<newline><^END>

The returned data always lists the lower and upper limits in that order.

See also

:SOUR:LIST:RDC on page 296

Equivalent key sequence

[Setup View] (Bin sort setup display)

:CALC:EXAM:GET?

Syntax

:CALCulate[:MATH]:EXAMine:GET? <numeric 1>,<numeric 2>

Description

Performs statistical processing at the specified measurement point for the specified measurement item and then returns the results. (Query only)

The number assigned to a measurement item is used to specify it. The number is assigned to only displayed items according to the following order.

- Measurement parameter 1
- Measurement parameter 2
- Measurement parameter 3
- Measurement parameter 4
- Test signal current level monitor
- Test signal voltage level monitor
- R_{dc}

For example, when the measurement parameter 1, the test signal current level, and the R_{dc} are displayed and the rest of the items are not displayed, the correspondence between the numbers and the measurement items is as follows.

- 1: Measurement parameter 1
- 2: Test signal current level monitor
- 3: R_{dc}

When the measurement data is logging to the volatile memory (RAM) at each measurement (that is, when the logged data size has not yet reached maximum), the data logging for statistical analysis is interrupted by execution of this command.

This command is valid only when the RAM contains measurement data for statistical analysis (that is, when the **:CALC:EXAM:STAR** command is not executed); otherwise, the command does not return query response and an error is generated.

If the obtained data number during a measurement is changed by a change in list/single-point measurement or by a change in the number of displayed measurement items after data logging is started, this command returns an invalid result and an error may be generated.

Parameters

	<numeric 1>	**<numeric 2>**
Description	Measurement item number	Measurement point number[*1]
Range	1 to number of displayed measurement items (up to 7)	1 to number of points (up to 32)
Resolution	1	1

*1. In one-point measurement, 1 is used as this parameter at all measurement points.

If your specified parameter is beyond the valid range, the instrument ignores the parameter and uses either the maximum or minimum value depending on whether the parameter is greater than the upper limit or smaller than the lower limit.

Query response

{numeric 1},...,{numeric 10}<newline><^END>

The returned data consists of the following 10 statistical analysis items:

{numeric 1}	Average of measurement data set from normal measurements (that is, measurements when overload or R_{dc} out of range is not detected)
{numeric 2}	Standard deviation of measurement data set from normal measurements (σ)
{numeric 3}	$3\times\sigma$/average of measurement data set from normal measurements
{numeric 4}	Minimum value of measurement data set from normal measurements
{numeric 5}	Maximum value of measurement data set from normal measurements
{numeric 6}	Number of normal measurements (number of data items contained in measurement data set from normal measurements)
{numeric 7}	Number of measurements when R_{dc} out of range is detected
{numeric 8}	Number of measurements when overload is detected
{numeric 9}	Number of abnormal measurements (number of measurements when overload or R_{dc} out of range is detected)
{numeric 10}	Total number of measurements

See also

:CALC:EXAM:STAR on page 228

Equivalent key sequence

[Prmtr]-**DATA EXAM** -{**PRMTR-1**|**PRMTR-2**|**PRMTR-3**|**PRMTR-4**|**I-mon**|**V-mon**|**Rdc**}

:CALC:EXAM:POIN?

Syntax

:CALCulate[:MATH]:EXAMine[:MEMory]:POINt?

Description

Returns the number of measurement data logged in the volatile memory (RAM). (Query only)

Query response

{numeric}<newline><^END>

Equivalent key sequence

No equivalent keys are available on the front panel.

:CALC:EXAM:SIZE

Syntax

:CALCulate[:MATH]:EXAMine[:MEMory]:SIZE <numeric>

:CALCulate[:MATH]:EXAMine[:MEMory]:SIZE?

Description

Sets the maximum number of measurement data logged in the volatile memory for statistical analysis. The maximum number must be set as *Param* × *Nop* × *Times* where:

Param	Number of displayed measurement items covering measurement parameters 1 through 4, test signal current/voltage level and R_{dc}
Nop	Number of measurement points in one measurement (that is, 1 during single-point measurement or the number of measurement points in the active table during list measurement)
Times	Number of measurements needed for statistical analysis

Parameters

	<numeric>
Description	Maximum number of measurement data
Range	1 to 2,400,000
Default	3000
Resolution	Obtained data number at one measurement (*Param* × *Nop*)

If your specified parameter is beyond the valid range, the instrument ignores the parameter and uses either the maximum or minimum value depending on whether the parameter is greater than the upper limit or smaller than the lower limit.

If your specified parameter is not a multiple of (*Param* × *Nop*), the instrument ignores the parameter and uses the next highest acceptable value above the specified parameter.

Query response

{numeric}<newline><^END>

Equivalent key sequence

[Trigger Mode] - **DATA LOGGING** - **MAX LOG SIZE**

:CALC:EXAM:STAR

Syntax

:CALCulate[:MATH]:EXAMine[:MEMory]:STARt

Description

Removes all measurement data logged in the volatile memory for statistical analysis and then starts logging measurement data to the volatile memory (RAM).

Logging of measurement data is finished when the number of logged data reaches maximum or the **:CALC:EXAM:GET?** command is executed. (No query)

See also

:CALC:EXAM:SIZE on page 227

:CALC:EXAM:GET? on page 225

Equivalent key sequence

[Trigger Mode] - **DATA LOGGING** - **START LOGGING**

:CALC:PAR{1-4}:EXPR:CENT

Syntax

:CALCulate:PARameter{1|2|3|4}[:MATH]:EXPRession:CENTer <numeric>

:CALCulate:PARameter{1|2|3|4}[:MATH]:EXPRession:CENTer?

Description

Specifies the reference value for deviation-mode display of measurement results for each of the parameters 1 (:PAR1) through 4 (:PAR4).

Parameters

	<numeric>
Description	Reference value
Range	-1E20 to 1E20
Default	0
Unit	Depends on measurement parameter
Resolution	1E-18

If your specified parameter is beyond the valid range, the instrument ignores the parameter and uses either the maximum or minimum value depending on whether the parameter is greater than the upper limit or smaller than the lower limit.

Query response

{numeric}<newline><^END>

See also

:CALC:PAR{1-4}:EXPR:NAME on page 229

:CALC:PAR{1-4}:EXPR:STAT on page 229

Equivalent key sequence

[Prmtr] - **SETUP DATA MATH** - {**PRMTR-1**|**PRMTR-2**|**PRMTR-3**|**PRMTR-4**} - **CENTER**

:CALC:PAR{1-4}:EXPR:NAME

Syntax

:CALCulate:PARameter{1|2|3|4}[:MATH]:EXPRession:NAME {DEV|PCNT}

:CALCulate:PARameter{1|2|3|4}[:MATH]:EXPRession:NAME?

Description

Specifies the format for deviation-mode display of measurement results for each of the parameters 1 (:PAR1) through 4 (:PAR4).

Parameters

	Description
DEV (initial value)	Instructs the instrument to display the difference between the measured value and the reference value*1 (measured value minus reference value).
PCNT	Instructs the instrument to display the differential percentage*2 between the measured value and the reference value*1.

*1. Use the **:CALC:PAR{1-4}:EXPR:CENT** command to set the reference value.
*2. (measured value - reference value) / reference value × 100

Query response

{DEV|PCNT}<newline><^END>

See also

:CALC:PAR{1-4}:EXPR:CENT on page 228

Equivalent key sequence

[Prmtr] - **SETUP DATA MATH** - {**PRMTR-1**|**PRMTR-2**|**PRMTR-3**|**PRMTR-4**} - **STAT**

:CALC:PAR{1-4}:EXPR:STAT

Syntax

:CALCulate:PARameter{1|2|3|4}[:MATH]:EXPRession:STATe {ON|OFF|1|0}

:CALCulate:PARameter{1|2|3|4}[:MATH]:EXPRession:STATe?

Description

Specifies whether to use deviation mode to display measurement results for each of the parameters 1 (:PAR1) through 4 (:PAR4). In deviation mode, measurement results are expressed as deviations relative to the reference value (specified with the **:CALC:PAR{1-4}:EXPR:CENT**command).

Parameters

	Description
ON or 1	Turns on deviation mode
OFF or 0 (initial value)	Turns off deviation mode (i.e., instructs the instrument to display measurement results as absolute values)

Query response

{1|0}<newline><^END>

See also

:CALC:PAR{1-4}:EXPR:CENT on page 228

Equivalent key sequence

[Prmtr] - **SETUP DATA MATH** - {**PRMTR-1**|**PRMTR-2**|**PRMTR-3**|**PRMTR-4**} - **STAT**

:CALC:PAR{1-4}:FORM

Syntax

:CALCulate:PARameter{1|2|3|4}:FORMat {Z|Y|LS|LP|CS|CP|RS|RP|Q|D|X|G|B|TZR|TZD|TYR|TYD}

:CALCulate:PARameter{1|2|3|4}:FORMat?

Description

Specifies the measurement parameter to use as each of the parameters 1 (:PAR1) through 4 (:PAR4). You can assign these parameters independently of other parameter settings.

Parameters

	Description
Z	Uses absolute value of impedance amplitude as measurement parameter
Y	Uses absolute value of admittance amplitude as measurement parameter
LS	Uses equivalent series inductance as measurement parameter
LP	Uses equivalent parallel inductance as measurement parameter
CS	Uses equivalent series capacitance as measurement parameter
CP	Uses equivalent parallel capacitance as measurement parameter
RS	Uses equivalent series resistance as measurement parameter
RP	Uses equivalent parallel resistance as measurement parameter
D	Uses dissipation factor as measurement parameter
Q	Uses Q value (inverse dissipation factor) as measurement parameter
X	Uses equivalent series reactance as measurement parameter
G	Uses the equivalent parallel conductance as the measurement parameter.
B	Uses equivalent parallel susceptance as measurement parameter
TZR	Uses impedance phase (in radians) as measurement parameter
TZD	Uses impedance phase (in degrees) as measurement parameter
TYR	Uses admittance phase (in radians) as measurement parameter
TYD	Uses admittance phase (in degrees) as measurement parameter

Parameter 1 defaults to Z; parameter 2 defaults to TZD; parameter 3 defaults to RS; parameter 4 defaults to X.

Query response

{Z|Y|LS|LP|CS|CP|RS|RP|Q|D|X|G|B|TZR|TZD|TYR|TYD}<newline><^END>

Equivalent key sequence

[Prmtr] - **SETUP MEAS PRMTRS** - {**PRMTR-1**|**PRMTR-2**|**PRMTR-3**|**PRMTR-4**} - {**|Z|**|**|Y|**|**Ls**|**Lp**|**Cs**|**Cp**|**Rs**|**Rp**|**Q**|**D**|**X**|**G**|**B**|**θz(rad)**|**θz(deg)**|**θy(rad)**|**θy(deg)**}

:CORR1?

Syntax

[:SENSe]:CORRection1[:STATe]?

Description

Returns the on/off status of the calibration mechanism.

You cannot directly turn on or off the calibration mechanism. Instead, the calibration mechanism is automatically turned on when you issue the **:CORR1:COLL:SAVE** command after measuring the data required for calculating calibration coefficients. (Query only)

Query response

{1|0}<newline><^END>

	Description
1	Calibration mechanism is on
0	Calibration mechanism is off

See also

:CORR1:COLL:SAVE on page 246

Equivalent key sequence

No equivalent keys are available on the front panel.

:CORR1:CKIT

Syntax

[:SENSe]:CORRection1:CKIT {DEFault|USER}

[:SENSe]:CORRection1:CKIT?

Description

Configures the instrument to use the specified calibration kit to obtain the data necessary for calculating calibration coefficients. You can specify the 4287A Option 007 (16195B 7-mm calibration kit) or your custom calibration kit.

Parameters

	Description
DEFault (initial value)	Configures instrument to use default 7 mm calibration kit
USER	Configures instrument to use user-defined calibration kit

Query response

{DEF|USER}<newline><^END>

Equivalent key sequence

[Setup View] (Calibration kit setup display)

:CORR1:CKIT:LIST

Syntax

[:SENSe]:CORRection1:CKIT:LIST[:STATe] {ON|OFF|1|0}

[:SENSe]:CORRection1:CKIT:LIST[:STATe]?

Description

Specifies whether the instrument should allow each standard of the user-defined calibration kit to be defined on a point-by-point basis or based on a fixed value that does not depend on a particular measurement point. In the latter case, the same value is applied to all measurement points.

If the instrument has already been configured to accept point-by-point definitions, using this command to reconfigure it to use a fixed value changes the standard values of all measurement points to that of measurement point number 1.

Parameters

	Description
ON or 1	Configures instrument to accept point-by-point definitions
OFF or 0 (initial value)	Configures instrument to accept definitions based on a fixed value (the same value is applied to all measurement points)

Query response

{1|0}<newline><^END>

Equivalent key sequence

[Setup View] (Calibration kit setup display)

:CORR1:CKIT:STAN1:DC

Syntax

[:SENSe]:CORRection1:CKIT:STANdard1:DC <numeric>

[:SENSe]:CORRection1:CKIT:STANdard1:DC?

Description

One of the commands for setting up the OPEN standard of the user-defined calibration kit. Use this command to define the conductance value to use during R_{dc} measurement.

Parameters

	<numeric>
Description	Conductance value
Range	-1E6 to 1E6
Default	0
Unit	S (siemens)
Resolution	1E-18

If your specified parameter is beyond the valid range, the instrument ignores the parameter and uses either the maximum or minimum value depending on whether the parameter is greater than the upper limit or smaller than the lower limit.

Query response

{numeric}<newline><^END>

See also

:CORR1:CKIT:STAN2:DC on page 236

:CORR1:CKIT:STAN3:DC on page 239

Equivalent key sequence

[Setup View] (Calibration kit setup display)

:CORR1:CKIT:STAN1:EDEL

Syntax

[:SENSe]:CORRection1:CKIT:STANdard1:EDELay[:TIME] <numeric>

[:SENSe]:CORRection1:CKIT:STANdard1:EDELay[:TIME]?

Description

Defines the offset delay time of the OPEN standard of the user-defined calibration kit. This value applies to all measurement points regardless of the setting specified with the **:CORR1:CKIT:LIST** command on page 232.

Parameters

	<numeric>
Description	Offset delay time
Range	-1E6 to 1E6
Default	0
Unit	s (seconds)
Resolution	1E-18

If your specified parameter is beyond the valid range, the instrument ignores the parameter and uses either the maximum or minimum value depending on whether the parameter is greater than the upper limit or smaller than the lower limit.

Query response

{numeric}<newline><^END>

See also

:CORR1:CKIT:STAN2:EDEL on page 237

:CORR1:CKIT:STAN3:EDEL on page 240

Equivalent key sequence

[Setup View] (Calibration kit setup display)

:CORR1:CKIT:STAN1:LIST

Syntax

[:SENSe]:CORRection1:CKIT:STANdard1:LIST <numeric 1>,<numeric 2>,<numeric 3>

[:SENSe]:CORRection1:CKIT:STANdard1:LIST? <numeric 1>

Description

Defines the equivalent parallel conductance (G) and equivalent parallel capacitance (Cp) values at a specified measurement point for the OPEN standard of the user-defined calibration kit.

If you have issued the **:CORR1:CKIT:LIST** command by specifying "OFF" to configure the instrument to accept fixed-value definitions for each standard of the user-defined calibration kit, specifying a particular measurement point has no effect; regardless of the measurement point number specified, the same value is applied to all measurement points. Similarly, when you issue this command in its query form, the command returns the same value regardless of the specified measurement point number. Nevertheless, you must specify a valid measurement point number (for example, "1") so that the command can successfully execute.

Parameters

	<numeric 1>	<numeric 2>	<numeric 3>
Description	Measurement point number	G	Cp
Range	1 to number of measurement points	-1E6 to 1E6	-1E6 to 1E6
Default	1	0	8.2E-14
Unit	None	S (siemens)	F (farad)
Resolution	1	1E-18	1E-18

If your specified parameter is beyond the valid range, the instrument ignores the parameter and uses either the maximum or minimum value depending on whether the parameter is greater than the upper limit or smaller than the lower limit.

Query response

{numeric 2},{numeric 3}<newline><^END>

See also

:CORR1:CKIT:LIST on page 232

:CORR1:CKIT:STAN2:LIST on page 238

:CORR1:CKIT:STAN3:LIST on page 242

Equivalent key sequence

[Setup View] (Calibration kit setup display)

:CORR1:CKIT:STAN2:DC

Syntax

[:SENSe]:CORRection1:CKIT:STANdard2:DC <numeric>

[:SENSe]:CORRection1:CKIT:STANdard2:DC?

Description

Defines the dc resistance (R_{dc}) value of the SHORT standard of the user-defined calibration kit.

Parameters

	<numeric>
Description	R_{dc}
Range	-1E6 to 1E6
Default	0
Unit	Ω (ohm)
Resolution	1E-18

If your specified parameter is beyond the valid range, the instrument ignores the parameter and uses either the maximum or minimum value depending on whether the parameter is greater than the upper limit or smaller than the lower limit.

Query response

{numeric}<newline><^END>

See also

:CORR1:CKIT:STAN1:DC on page 233

:CORR1:CKIT:STAN3:DC on page 239

Equivalent key sequence

[Setup View] (Calibration kit setup display)

:CORR1:CKIT:STAN2:EDEL

Syntax

[:SENSe]:CORRection1:CKIT:STANdard2:EDELay[:TIME] <numeric>

[:SENSe]:CORRection1:CKIT:STANdard2:EDELay[:TIME]?

Description

Defines the offset delay time of the SHORT standard of the user-defined calibration kit. This value applies to all measurement points regardless of the setting specified with the **:CORR1:CKIT:LIST** command on page 232.

Parameters

	<numeric>
Description	Offset delay time
Range	-1E6 to 1E6
Default	0
Unit	s (seconds)
Resolution	1E-18

If your specified parameter is beyond the valid range, the instrument ignores the parameter and uses either the maximum or minimum value depending on whether the parameter is greater than the upper limit or smaller than the lower limit.

Query response

{numeric}<newline><^END>

See also

:CORR1:CKIT:STAN1:EDEL on page 234

:CORR1:CKIT:STAN3:EDEL on page 240

Equivalent key sequence

[Setup View] (Calibration kit setup display)

:CORR1:CKIT:STAN2:LIST

Syntax

[:SENSe]:CORRection1:CKIT:STANdard2:LIST <numeric 1>,<numeric 2>,<numeric 3>

[:SENSe]:CORRection1:CKIT:STANdard2:LIST? <numeric 1>

Description

Defines the equivalent series resistance (Rs) and equivalent series inductance (Ls) values at a specified measurement point for the SHORT standard of the user-defined calibration kit.

If you have issued the **:CORR1:CKIT:LIST** command by specifying "OFF" to configure the instrument to accept fixed-value definitions for each standard of the user-defined calibration kit, specifying a particular measurement point has no effect; regardless of the measurement point number specified, the same value is applied to all measurement points. Similarly, when you issue this command in its query form, the command returns the same value regardless of the value you assign to a particular measurement number. Nevertheless, you must specify a valid measurement point number (for example, "1") so that the command can successfully execute.

Parameters

	<numeric 1>	**<numeric 2>**	**<numeric 3>**
Description	Measurement point number	Rs	Ls
Range	1 to number of points (up to 32)	0 to 1E6	0 to 1E6
Default	1	0	0
Unit	None	Ω (ohm)	H (henry)
Resolution	1	1E-18	1E-18

If your specified parameter is beyond the valid range, the instrument ignores the parameter and uses either the maximum or minimum value depending on whether the parameter is greater than the upper limit or smaller than the lower limit.

Query response

{numeric 2},{numeric 3}<newline><^END>

See also

:CORR1:CKIT:LIST on page 232

:CORR1:CKIT:STAN1:LIST on page 235

:CORR1:CKIT:STAN3:LIST on page 242

Equivalent key sequence

[Setup View] (Calibration kit setup display)

:CORR1:CKIT:STAN3:DC

Syntax

[:SENSe]:CORRection1:CKIT:STANdard3:DC <numeric>

[:SENSe]:CORRection1:CKIT:STANdard3:DC?

Description

Defines the dc resistance (R_{dc}) value of the LOAD standard of the user-defined calibration kit.

Parameters

	<numeric>
Description	R_{dc}
Range	-1E6 to 1E6
Default	50
Unit	Ω (ohm)
Resolution	1E-18

If your specified parameter is beyond the valid range, the instrument ignores the parameter and uses either the maximum or minimum value depending on whether the parameter is greater than the upper limit or smaller than the lower limit.

Query response

{numeric}<newline><^END>

See also

:CORR1:CKIT:STAN1:DC on page 233

:CORR1:CKIT:STAN2:DC on page 236

Equivalent key sequence

[Setup View] (Calibration kit setup display)

:CORR1:CKIT:STAN3:EDEL

Syntax

[:SENSe]:CORRection1:CKIT:STANdard3:EDELay[:TIME] <numeric>

[:SENSe]:CORRection1:CKIT:STANdard3:EDELay[:TIME]?

Description

Defines the offset delay time of the LOAD standard of the user-defined calibration kit. This value applies to all measurement points regardless of the setting specified with the **:CORR1:CKIT:LIST** command on page 232.

Parameters

	<numeric>
Description	Offset delay time
Range	-1E6 to 1E6
Default	0
Unit	s (seconds)
Resolution	1E-18

If your specified parameter is beyond the valid range, the instrument ignores the parameter and uses either the maximum or minimum value depending on whether the parameter is greater than the upper limit or smaller than the lower limit.

Query response

{numeric}<newline><^END>

See also

:CORR1:CKIT:STAN1:EDEL on page 234

:CORR1:CKIT:STAN2:EDEL on page 237

Equivalent key sequence

[Setup View] (Calibration kit setup display)

:CORR1:CKIT:STAN3:FORM

Syntax

[:SENSe]:CORRection1:CKIT:STANdard3:FORMat {RL|LQF|CDF}

[:SENSe]:CORRection1:CKIT:STANdard3:FORMat?

Description

Defines the parameter type to use when defining the values specific to the LOAD standard of the user-defined calibration kit. When the parameter type is changed, the LOAD standard values are reset to the initial values. Therefore, define the LOAD standard values after the parameter type is defined by this command.

Parameters

	Description
RL (initial value)	Instructs instrument to accept definitions based on equivalent series resistance (Rs) and equivalent series inductance (Ls) values
LQF	Instructs instrument to accept definitions based on equivalent series inductance (Ls) and quality factor (Q) values
CDF	Instructs instrument to accept definitions based on equivalent parallel capacitance (Cp) and dissipation factor (D) values

Query response

{RL|LQF|CDF}<newline><^END>

See also

:CORR1:CKIT:STAN3:LIST on page 242

Equivalent key sequence

[Setup View] (Calibration kit setup display)

:CORR1:CKIT:STAN3:LIST

Syntax

[:SENSe]:CORRection1:CKIT:STANdard3:LIST <numeric 1>,<numeric 2>,<numeric 3>

[:SENSe]:CORRection1:CKIT:STANdard3:LIST? <numeric 1>

Description

Defines the impedance values at a specified measurement point for the LOAD standard values of the user-defined calibration kit. To specify the parameter type to use when defining the LOAD standard values, use the **:CORR1:CKIT:STAN3:FORM** command to instruct the instrument to accept definitions based on equivalent series resistance (Rs) and equivalent series inductance (Ls) values; equivalent series inductance (Ls) and quality factor (Q) values: or equivalent parallel capacitance (Cp) and dissipation factor (D) values.

If you have issued the **:CORR1:CKIT:LIST** command by specifying “OFF” to configure the instrument to accept fixed-value definitions for each standard of the user-defined calibration kit, specifying a particular measurement point has no effect; regardless of the measurement point number specified, the same value is applied to all measurement points. Similarly, when you issue this command in its query form, the command returns the same value regardless of the value you assign to a particular measurement number. Nevertheless, you must specify a valid measurement point number (for example, “1”) so that the command can successfully execute.

Parameters

- Definitions based on Rs and Ls values

	<numeric 1>	**<numeric 2>**	**<numeric 3>**
Description	Measurement point number	Rs	Ls
Range	1 to number of points (up to 32)	-1E6 to 1E6	-1E6 to 1E6
Default	1	50	0
Unit	None	Ω (ohm)	H (henry)
Resolution	1	1E-18	1E-18

- Definitions based on Ls and Q values

	<numeric 1>	**<numeric 2>**	**<numeric 3>**
Description	Measurement point number	Ls	Q
Range	1 to number of points (up to 32)	-1E6 to 1E6	-1E6 to 1E6
Default	1	0	0
Unit	None	H (henry)	None
Resolution	1	1E-18	1E-18

- Definitions based on Cp and D values

	<numeric 1>	<numeric 2>	<numeric 3>
Description	Measurement point number	Cp	D
Range	1 to number of points (up to 32)	-1E6 to 1E6	-1E6 to 1E6
Default	1	0	0
Unit	None	F (farad)	None
Resolution	1	1E-18	1E-18

If your specified parameter is beyond the valid range, the instrument ignores the parameter and uses either the maximum or minimum value depending on whether the parameter is greater than the upper limit or smaller than the lower limit.

Query response

{numeric 2},{numeric 3}<newline><^END>

See also

:CORR1:CKIT:LIST on page 232

:CORR1:CKIT:STAN3:FORM on page 241

:CORR1:CKIT:STAN1:LIST on page 235

:CORR1:CKIT:STAN2:LIST on page 238

Equivalent key sequence

[Setup View] (Calibration kit setup display)

:CORR1:COLL

Syntax

[:SENSe]:CORRection1:COLLect[:ACQuire] {STAN1|STAN2|STAN3|STAN4}

Description

Obtains the data for calculating the calibration coefficients to use during impedance measurement and the calibration coefficients to use during R_{dc} measurement performed with the specified standard. When a low-loss capacitor is specified as the standard, the command obtains the data for calculating the calibration coefficient for impedance measurement only.

The data is obtained for only the active table. (No query)

NOTE

The measurement to obtain the data is not started by execution of this command. You must trigger the instrument after execution of this command when the trigger source is not set to internal trigger (Int).

Parameters

	Description
STAN1	OPEN standard
STAN2	SHORT standard
STAN3	LOAD standard
STAN4	Low-loss capacitor

See also

:CORR1:COLL:DC on page 245

:CORR1:COLL:RF on page 246

Equivalent key sequence

[Cal/Compen] - **CAL DIALOG**

:CORR1:COLL:DC

Syntax

[:SENSe]:CORRection1:COLLect[:ACQuire]:DC {STAN1|STAN2|STAN3}

Description

Obtains the data for calculating the calibration coefficients to use during R_{dc} measurement performed with the specified standard. The data is obtained for only the active table. (No query)

NOTE

The measurement to obtain the data is not started by execution of this command. You must trigger the instrument after execution of this command when the trigger source is not set to internal trigger (Int).

Parameters

	Description
STAN1	OPEN standard
STAN2	SHORT standard
STAN3	LOAD standard

See also

:CORR1:COLL on page 244
:CORR1:COLL:RF on page 246

Equivalent key sequence

[Cal/Compen] - **CAL DIALOG**

:CORR1:COLL:RF

Syntax

[:SENSe]:CORRection1:COLLect[:ACQuire]:RF {STAN|STAN2|STAN3|STAN4}

Description

Obtains the data for calculating the calibration coefficients to use during impedance measurement performed with the specified standard. The data is obtained for only the active table. (No query)

NOTE

The measurement to obtain the data is not started by execution of this command. You must trigger the instrument after execution of this command when the trigger source is not set to internal trigger (Int).

Parameters

	Description
STAN1	OPEN standard
STAN2	SHORT standard
STAN3	LOAD standard
STAN4	Low-loss capacitor

See also

:CORR1:COLL on page 244

:CORR1:COLL:DC on page 245

Equivalent key sequence

No equivalent keys are available on the front panel.

:CORR1:COLL:SAVE

Syntax

[:SENSe]:CORRection1:COLLect:SAVE

Description

Calculates the calibration coefficients based on the data obtained through the **:CORR1:COLL** command, or a similar command, and turns on the calibration mechanism. You can use the **:CORR1?** command to check the on/off status of the calibration mechanism.

This command is valid only after you have obtained all the data (for both impedance and DC) necessary for all standards (OPEN, SHORT, and LOAD); otherwise, the command fails and an error is generated. (No query)

See also

:CORR1? on page 231

:CORR1:COLL on page 244

:CORR1:COLL:DC on page 245

:CORR1:COLL:RF on page 246

Equivalent key sequence

[Cal/Compen] - **CAL DIALOG**

:CORR2:CKIT

Syntax

[:SENSe]:CORRection2:CKIT {DEFault|USER}

[:SENSe]:CORRection2:CKIT?

Description

Configures the 4287A to use its predefined values for the compensation kit or accept user-defined values when obtaining the data for calculating the compensation coefficients.

Parameters

	Description
DEFault (initial value)	Instructs instrument to use its predefined values
USER	Instructs instrument to accept user-defined values

Query response

{DEF|USER}<newline><^END>

Equivalent key sequence

[Setup View] (Compensation kit setup display)

:CORR2:CKIT:LIST

Syntax

[:SENSe]:CORRection2:CKIT:LIST[:STATe] {ON|OFF|1|0}

[:SENSe]:CORRection2:CKIT:LIST[:STATe]?

Description

Specifies whether the instrument should allow each standard of the compensation kit to be defined on a point-by-point basis or based on a fixed value that does not depend on a particular measurement point. In the latter case, the same value is applied to all measurement points.

If the instrument has already been configured to accept point-by-point definitions, using this command to reconfigure it to use a fixed value changes the standard values of all measurement points to that of measurement point number 1.

Parameters

	Description
ON or 1	Configures instrument to accept point-by-point definitions
OFF or 0 (initial value)	Configures instrument to accept definitions based on a fixed value (the same value is applied to all measurement points)

Query response

{1|0}<newline><^END>

Equivalent key sequence

[Setup View] (Compensation kit setup display)

:CORR2:CKIT:STAN1:DC

Syntax

[:SENSe]:CORRection2:CKIT:STANdard1:DC <numeric>

[:SENSe]:CORRection2:CKIT:STANdard1:DC?

Description

Defines the conductance to use during R_{dc} measurement for the OPEN standard of the compensation kit.

Parameters

	<numeric>
Description	Conductance value
Range	-1E6 to 1E6
Default	0
Unit	S (siemens)
Resolution	1E-18

If your specified parameter is beyond the valid range, the instrument ignores the parameter and uses either the maximum or minimum value depending on whether the parameter is greater than the upper limit or smaller than the lower limit.

Query response

{numeric}<newline><^END>

See also

:CORR2:CKIT:STAN2:DC on page 250

Equivalent key sequence

[Setup View] (Compensation kit setup display)

:CORR2:CKIT:STAN1:LIST

Syntax

[:SENSe]:CORRection2:CKIT:STANdard1:LIST <numeric 1>,<numeric 2>,<numeric 3>

[:SENSe]:CORRection2:CKIT:STANdard1:LIST? <numeric 1>

Description

Defines the equivalent parallel conductance (G) and equivalent parallel capacitance (Cp) values at a specified measurement point for the OPEN standard of the compensation kit.

If you have issued the **:CORR2:CKIT:LIST** command by specifying "OFF" to configure the instrument to accept fixed-value definitions for each standard of the user-defined calibration kit, specifying a particular measurement point has no effect; regardless of the measurement point number specified, the same value is applied to all measurement points. Similarly, when you issue this command in its query form, the command returns the same value regardless of the value you assign to a particular measurement number. Nevertheless, you must specify a valid measurement point number (for example, "1") so that the command can successfully execute.

Parameters

	<numeric 1>	**<numeric 2>**	**<numeric 3>**
Description	Measurement point number	G	Cp
Range	1 to number of points (up to 32)	-1E6 to 1E6	-1E6 to 1E6
Default	1	0	0
Unit	None	S (siemens)	F (farad)
Resolution	1	1E-18	1E-18

If your specified parameter is beyond the valid range, the instrument ignores the parameter and uses either the maximum or minimum value depending on whether the parameter is greater than the upper limit or smaller than the lower limit.

Query response

{numeric 2},{numeric 3}<newline><^END>

See also

:CORR2:CKIT:LIST on page 247

:CORR2:CKIT:STAN2:LIST on page 251

Equivalent key sequence

[Setup View] (Compensation kit setup display)

:CORR2:CKIT:STAN2:DC

Syntax

[:SENSe]:CORRection2:CKIT:STANdard2:DC <numeric>

[:SENSe]:CORRection2:CKIT:STANdard2:DC?

Description

Defines the dc resistance (R_{dc}) value of the SHORT standard of the compensation kit.

Parameters

	<numeric>
Description	R_{dc}
Range	-1E6 to 1E6
Default	0
Unit	Ω (ohm)
Resolution	1E-18

If your specified parameter is beyond the valid range, the instrument ignores the parameter and uses either the maximum or minimum value depending on whether the parameter is greater than the upper limit or smaller than the lower limit.

Query response

{numeric}<newline><^END>

See also

:CORR2:CKIT:STAN1:DC on page 248

Equivalent key sequence

[Setup View] (Compensation kit setup display)

:CORR2:CKIT:STAN2:LIST

Syntax

[:SENSe]:CORRection2:CKIT:STANdard2:LIST <numeric 1>,<numeric 2>,<numeric 3>

[:SENSe]:CORRection2:CKIT:STANdard2:LIST? <numeric 1>

Description

Defines the equivalent series resistance (Rs) and equivalent series inductance (Ls) values at a specified measurement point, for the SHORT standard of the compensation kit.

If you have issued the **:CORR2:CKIT:LIST** command by specifying “OFF” to configure the instrument to accept fixed-value definitions for each standard of the user-defined calibration kit, specifying a particular measurement point has no effect; regardless of the measurement point number specified, the same value is applied to all measurement points. Similarly, when you issue this command in its query form, the command returns the same value regardless of the value you assign to a particular measurement number. Nevertheless, you must specify a valid measurement point number (for example, “1”) so that the command can successfully execute.

Parameters

	<numeric 1>	**<numeric 2>**	**<numeric 3>**
Description	Measurement point number	Rs	Ls
Range	1 to number of points (up to 32)	-1E6 to 1E6	-1E6 to 1E6
Default	1	0	0
Unit	None	Ω (ohm)	H (henry)
Resolution	1	1E-18	1E-18

If your specified parameter is beyond the valid range, the instrument ignores the parameter and uses either the maximum or minimum value depending on whether the parameter is greater than the upper limit or smaller than the lower limit.

Query response

{numeric 2},{numeric 3}<newline><^END>

See also

:CORR2:CKIT:LIST on page 247

:CORR2:CKIT:STAN1:LIST on page 249

Equivalent key sequence

[Setup View] (Compensation kit setup display)

:CORR2:COLL

Syntax

[:SENSe]:CORRection2:COLLect[:ACQuire] {STAN1|STAN2}

Description

Obtains the data for calculating the compensation coefficients to use during impedance measurement and the compensation coefficients to use during R_{dc} measurement performed with the specified standard. The data is obtained for only the active table. This command is valid only when the calibration mechanism is on; otherwise, the command fails and an error is generated. (No query)

NOTE

The measurement to obtain the data is not started by execution of this command. You must trigger the instrument after execution of this command when the trigger source is not set to internal trigger (Int).

Parameters

	Description
STAN1	OPEN standard
STAN2	SHORT standard

See also

:CORR2:COLL:DC on page 253

:CORR2:COLL:RF on page 254

Equivalent key sequence

[Cal/Compen] - **COMPEN DIALOG**

:CORR2:COLL:DC

Syntax

[:SENSe]:CORRection2:COLLect[:ACQuire]:DC {STAN1|STAN2}

[:SENSe]:CORRection2:COLLect[:ACQuire]:DC?

Description

Obtains the data for calculating the compensation coefficients to use during R_{dc} measurement performed with the specified standard. The data is obtained for only the active table. This command is valid only when the calibration mechanism is on; otherwise, the command fails and an error is generated. (No query)

NOTE

The measurement to obtain the data is not started by execution of this command. You must trigger the instrument after execution of this command when the trigger source is not set to internal trigger (Int).

Parameters

	Description
STAN1	OPEN standard
STAN2	SHORT standard

See also

:CORR2:COLL on page 252

:CORR2:COLL:RF on page 254

Equivalent key sequence

[Cal/Compen] - **COMPEN DIALOG**

:CORR2:COLL:OPEN

Syntax

[:SENSe]:CORRection2:COLLect:OPEN[:STATe] {ON|OFF|1|0}

[:SENSe]:CORRection2:COLLect:OPEN[:STATe]?

Description

Turns on or off the OPEN compensation feature and calculates the compensation coefficients. This command is valid only after you have obtained the OPEN standard measurement data for calculating the compensation coefficients; otherwise, the command fails and an error is generated.

Parameters

	Description
ON or 1	Turns on the OPEN compensation feature
OFF or 0 (initial value)	Turns off the OPEN compensation feature

Query response

{1|0}<newline><^END>

See also

:CORR2:COLL:SAVE on page 255

:CORR2:COLL:SHOR on page 255

Equivalent key sequence

[Cal/Compen] - COMPEN STATUS - OPEN

:CORR2:COLL:RF

Syntax

[:SENSe]:CORRection2:COLLect[:ACQuire]:RF {STAN1|STAN2}

[:SENSe]:CORRection2:COLLect[:ACQuire]:RF?

Description

Obtains the data for calculating the compensation coefficients to use during impedance measurement performed with the specified standard. The data is obtained for only the active table. This command is valid only when the calibration mechanism is on; otherwise, the command fails and an error is generated. (No query)

NOTE

The measurement to obtain the data is not started by execution of this command. You must trigger the instrument after execution of this command when the trigger source is not set to internal trigger (Int).

Parameters

	Description
STAN1	OPEN standard
STAN2	SHORT standard

See also

:CORR2:COLL on page 252

:CORR2:COLL:DC on page 253

Equivalent key sequence

No equivalent keys are available on the front panel.

:CORR2:COLL:SAVE

Syntax

[:SENSe]:CORRection2:COLLect:SAVE

Description

Calculates the compensation coefficients and turns on the compensation mechanism. (No query)

If you are measuring only the OPEN standard, issuing this command turns on only the OPEN compensation feature. This is equivalent to issuing the **:CORR2:COLL:OPEN** command by specifying “ON.”

If you are measuring only the SHORT standard, issuing this command turns on only the SHORT compensation feature. This is equivalent to issuing the **:CORR2:COLL:SHOR** command by specifying “ON.”

If you are measuring both the OPEN and SHORT standards, issuing this command turns on both the OPEN and SHORT compensation features of the compensation mechanism. This is equivalent to issuing the **:CORR2:COLL:OPEN** and **:CORR2:COLL:SHOR** commands by specifying “ON.”

See also

:CORR2:COLL on page 252

:CORR2:COLL:OPEN on page 254

:CORR2:COLL:SHOR on page 255

Equivalent key sequence

[Cal/Compen] - **COMPEN DIALOG**

:CORR2:COLL:SHOR

Syntax

[:SENSe]:CORRection2:COLLect:SHORt[:STATe] {ON|OFF|1|0}

[:SENSe]:CORRection2:COLLect:SHORt[:STATe]?

Description

Turns on or off the SHORT compensation feature and calculates the compensation coefficients. This command is valid only after you have obtained the SHORT standard measurement data for calculating the compensation coefficients; otherwise, the command fails and an error is generated.

Parameters

	Description
ON or 1	Turns on the SHORT compensation feature
OFF or 0 (initial value)	Turns off the SHORT compensation feature

Query response

{1|0}<newline><^END>

See also

:CORR2:COLL:SAVE on page 255

:CORR2:COLL:OPEN on page 254

Equivalent key sequence

[Cal/Compen] - **COMPEN STATUS** - **SHORT**

:CORR2:FIXT

Syntax

[:SENSe]:CORRection2:FIXTure {NONE|FXT16191A|FXT16192A|FXT16193A|FXT16194A|FXT16196A|FXT16196B|FXT16196C|USER}

[:SENSe]:CORRection2:FIXTure?

Description

Configures the instrument to use the specified test fixture connected to the test head.

To configure the instrument to use your custom test fixture, you must use the **:CORR2:FIXT:EDEL:DIST** command to compensate for the delay caused by the fixture connection.

Parameters

	Description
NONE (initial value)	Configures instrument to operate without a test fixture
FXT16191A	Configures instrument to use 16191A test fixture
FXT16192A	Configures instrument to use 16192A test fixture
FXT16193A	Configures instrument to use 16193A test fixture
FXT16194A	Configures instrument to use 16194A test fixture
FXT16196A	Configures instrument to use 16196A test fixture
FXT16196B	Configures instrument to use 16196B test fixture
FXT16196C	Configures instrument to use 16196C test fixture
USER	Configures instrument to use your custom test fixture

Query response

{NONE|FXT16191A|FXT16192A|FXT16193A|FXT16194A|FXT16196A|FXT16196B|FXT16196C|USER}<newline><^END>

See also

:CORR2:FIXT:EDEL:DIST on page 257

:CORR2:FIXT:LAB on page 258

Equivalent key sequence

[Cal/Compen] - **SELECT FIXTURE** - {**None**|**16191A**|**16192A**|**16193A**|**16194A**|**16196A**|**16196B**|**16196C**|**USER**}

:CORR2:FIXT:EDEL:DIST

Syntax

[:SENSe]:CORRection2:FIXTure:EDELay:DISTance <numeric>

[:SENSe]:CORRection2:FIXTure:EDELay:DISTance?

Description

If you configure the instrument to use your custom test fixture connected to the test head, this command sets the electrical length that compensates for the delay caused by the connection of the custom test fixture.

Parameters

	<numeric>
Description	Electrical length to compensate for delay caused by fixture connection
Range	-1E6 to 1E6
Default	0
Unit	m (meter)
Resolution	1E-18

If your specified parameter is beyond the valid range, the instrument ignores the parameter and uses either the maximum or minimum value depending on whether the parameter is greater than the upper limit or smaller than the lower limit.

Query response

{numeric}<newline><^END>

See also

:CORR2:FIXT on page 256

Equivalent key sequence

[Cal/Compen] - **SETUP USER FIXTURE** - **ELEC. LENGTH**

:CORR2:FIXT:LAB

Syntax

[:SENSe]:CORRection2:FIXTure:LABel <string>

[:SENSe]:CORRection2:FIXTure:LABel?

Description

Lets you specify the name of your custom test fixture.

Parameters

	<string>
Description	Name of custom test fixture
Range	Up to 8 characters
Default	"USER"

If your specified the name exceeds the maximum allowable length, the name is truncated to the maximum length.

Query response

{string}<newline><^END>

See also

:CORR2:FIXT on page 256

Equivalent key sequence

[Cal/Compen] - **SETUP USER FIXTURE** - **LABEL KIT**

:DATA:CAD{1-8}?

Syntax

:DATA[:DATA]:CAD{1|2|3|4|5|6|7|8}?

Description

Returns a calibration data array (an array of measurement data obtained for calculating the calibration coefficients; see “Calibration Data Arrays” on page 80). The instrument holds eight calibration data arrays that correspond to two measurement passes for each of the OPEN, SHORT, LOAD, and LOW LOSS CAPACITOR standards. To obtain a particular array, suffix the command with the number that corresponds to the desired array. The following table lists the command suffix numbers associated with each array: (Query only)

1: Array that corresponds to first measurement pass for the OPEN standard

2: Array that corresponds to first measurement pass for the SHORT standard

3: Array that corresponds to first measurement pass for the LOAD standard

4: Array that corresponds to first measurement pass for the LOW LOSS CAPACITOR standard

5: Array that corresponds to second measurement pass for the OPEN standard

6: Array that corresponds to second measurement pass for the SHORT standard

7: Array that corresponds to second measurement pass for the LOAD standard

8: Array that corresponds to second measurement pass for the LOW LOSS CAPACITOR standard

Query response

{numeric 1},...,{numeric N×2}<newline><^END>

	Description
{numeric n×2-1}	Real part of measurement data (complex number) obtained at nth point
{numeric n×2}	Imaginary part of measurement data (complex number) obtained at nth point

The command returns the real and imaginary parts of the measurement data (complex number) obtained at each measurement point. Therefore, the number of returned values is equal to N×2, where N represents the number of points defined in the active table while n represents an integer between 1 and N.

Equivalent key sequence

No equivalent keys are available on the front panel.

:DATA:CCO{1-6}

Syntax

:DATA[:DATA]:CCO{1|2|3|4|5|6} <numeric 1>,...,<numeric N×2>

:DATA[:DATA]:CCO{1|2|3|4|5|6}?

where N represents the number of points defined in the active table.

Description

Sets or returns a calibration coefficient array (see "Calibration Coefficient Arrays" on page 80). The instrument holds six calibration coefficient arrays that correspond to coefficients: A1, B1, C1, A2, B2, and C2. To obtain a particular array, suffix the command with the number that corresponds to the desired array. The following table lists the command suffix numbers associated with each array:

1: Array that corresponds to calibration coefficient A1

2: Array that corresponds to calibration coefficient B1

3: Array that corresponds to calibration coefficient C1

4: Array that corresponds to calibration coefficient A2

5: Array that corresponds to calibration coefficient B2

6: Array that corresponds to calibration coefficient C2

Parameters

	Description
<numeric n×2-1>	Real part of calibration coefficient (complex number) at nth point
<numeric n×2>	Imaginary part of calibration coefficient (complex number) at nth point

You must break down the calibration coefficient (complex number) at each measurement point into the real and imaginary parts so that the command receives N×2 parameters in all, where n represents an integer between 1 and N.

Query response

{numeric 1},...,{numeric N×2}<newline><^END>

Equivalent key sequence

No equivalent keys are available on the front panel.

:DATA:CMD{1-2}?

Syntax

:DATA[:DATA]:CMD{1|2}?

Description

Returns a compensation data array (an array of measurement data obtained for calculating the compensation coefficients; see “Compensation Data Arrays” on page 81). The instrument holds two compensation data arrays that correspond to the OPEN and SHORT standards. To obtain a particular array, suffix the command with the number that corresponds to the desired array. The following table lists the command suffix numbers associated with each array: (Query only)

1: Array that corresponds to measurement data for the OPEN standard

2: Array that corresponds to measurement data for the SHORT standard

Query response

{numeric 1},...,{numeric N×2}<newline><^END>

	Description
{numeric n×2-1}	Real part of measurement data (complex number) obtained at nth point
{numeric n×2}	Imaginary part of measurement data (complex number) obtained at nth point

The command returns the real and imaginary parts of the measurement data (complex number) obtained at each measurement point. Therefore, the number of returned values is equal to N×2, where N represents the number of points defined in the active table while n represents an integer between 1 and N.

Equivalent key sequence

No equivalent keys are available on the front panel.

:DATA:CMP{1-3}

Syntax

:DATA[:DATA]:CMP{1|2|3} <numeric 1>,...,<numeric N×2>

:DATA[:DATA]:CMP{1|2|3}?

where N represents the number of points defined in the active table.

Description

Sets or returns a compensation coefficient array (see “Compensation Coefficient Arrays” on page 81). The instrument holds three compensation coefficient arrays that correspond to coefficients: A, B, and C. To obtain a particular array, suffix the command with the number that corresponds to the desired array. The following table lists the command suffix numbers associated each respective array:

1: Array that corresponds to compensation coefficient A

2: Array that corresponds to compensation coefficient B

3: Array that corresponds to compensation coefficient C

Parameters

	Description
<numeric n×2-1>	Real part of compensation coefficient (complex number) at nth point
<numeric n×2>	Imaginary part of compensation coefficient (complex number) at nth point

You must break down the compensation coefficient (complex number) at each measurement point into the real and imaginary parts so that the command receives N×2 parameters in all, where n represents an integer between 1 and N.

Query response

{numeric 1},...,{numeric N×2}<newline><^END>

Equivalent key sequence

No equivalent keys are available on the front panel.

:DATA:FDAT{1-4}?

Syntax

:DATA[:DATA]:FDATa{1|2|3|4}?

Description

Returns the display data array for one of parameters 1 (:FDAT1) through 4 (:FDAT4). This array contains the display data obtained by performing measurement parameter conversion and data operations on the corresponding data array (see "Display Data Arrays" on page 79).

If the measurement fails because of overload, the command returns 9.9E37. (Query only)

Query response

For single-point measurement

{numeric}<newline><^END>

The command returns the value (real number) of the measured point.

For list measurement

{numeric 1},...,{numeric N}<newline><^END>

The command returns as many values (real numbers) as the measurement points defined in the active table, in the order of measurement point numbers.

Equivalent key sequence

No equivalent keys are available on the front panel.

:DATA:IMON?

Syntax

:DATA[:DATA]:IMON?

Description

Returns the result of monitoring the current level of the test signal. If the measurement failed because of overload, the command returns 9.9E37. (Query only)

Query response

For single-point measurement

{numeric}<newline><^END>

The command returns the monitored value (real number) of the measured point.

For list measurement

{numeric 1},...,{numeric N}<newline><^END>

The command returns the monitored value (real number) at each point defined in the active table. Therefore, the returned data contains as many monitored values as the number of measurement points (N) and is sent in the order of measurement point numbers.

See also

:DATA:VMON? on page 267

Equivalent key sequence

No equivalent keys are available on the front panel.

:DATA:RAW?

Syntax

:DATA[:DATA]:RAW?

Description

Returns the measurement data array, which contains complex-number data obtained by calibrating raw measurement data (see “Data Array” on page 79). (Query only)

Query response

For single-point measurement

{numeric 1},{numeric 2}<newline><^END>

The command returns the real and imaginary parts of the data of the measured point.

For list measurement

{numeric 1},...,{numeric N×2}<newline><^END>

	Description
{numeric n×2-1}	Real part of data at nth point
{numeric n×2}	Imaginary part of data at nth point

The command returns the real and imaginary parts of the data at each measurement point. Thus the number of returned values is equal to N×2, where N represents the number of points defined in the active table while n represents an integer between 1 and N.

Equivalent key sequence

No equivalent keys are available on the front panel.

:DATA:RCAD{1-3}?

Syntax

:DATA[:DATA]:RCAD{1|2|3}?

Description

Returns a set of measurement data (real number) for calculating the calibration coefficients to use during R_{dc} measurement. The instrument holds three sets of calculation data, which are obtained by measuring the OPEN, SHORT, and LOAD standards. To obtain a particular data set, suffix the command with the number that corresponds to the desired data set. The following table lists the command suffix numbers associated with each data set: (Query only)

1: OPEN measurement data

2: SHORT measurement data

3: LOAD measurement data

Query response

{numeric}<newline><^END>

Equivalent key sequence

No equivalent keys are available on the front panel.

:DATA:RCCO{1-3}

Syntax

:DATA[:DATA]:RCCO{1|2|3} <numeric>

:DATA[:DATA]:RCCO{1|2|3}?

Description

Sets or returns a calibration coefficient for R_{dc} measurement (see “Calibration coefficients and calibration data for Rdc measurement” on page 83). To set or obtain a particular coefficient, suffix the command with the number that corresponds to the desired coefficient. The following table lists the command suffix numbers associated with each coefficient:

1: Calibration coefficient A for R_{dc} measurement

2: Calibration coefficient B for R_{dc} measurement

3: Calibration coefficient C for R_{dc} measurement

Parameters

	Description
<numeric>	Calibration coefficient (real number) for R_{dc} measurement

Query response

{numeric}<newline><^END>

Equivalent key sequence

No equivalent keys are available on the front panel.

:DATA:RCMD{1-2}?

Syntax

:DATA[:DATA]:RCMD{1|2}?

Description

Returns a set of measurement data (real number) for calculating the compensation coefficients to use during R_{dc} measurement. The instrument holds two sets of calculation data, which are obtained by measuring the OPEN and SHORT standards. To obtain a particular data set, suffix the command with the number that corresponds to the desired data set. The following table lists the command suffix numbers associated with the respective data set: (Query only)

1: OPEN measurement data

2: SHORT measurement data

Query response

{numeric}<newline><^END>

Equivalent key sequence

No equivalent keys are available on the front panel.

:DATA:RCMP{1-3}

Syntax

:DATA[:DATA]:RCMP{1|2|3} <numeric>

:DATA[:DATA]:RCMP{1|2|3}?

Description

Sets or returns a compensation coefficient for R_{dc} measurement (see “Rdc compensation coefficients and compensation data” on page 84). To set or obtain a particular coefficient, suffix the command with the number that corresponds to the desired coefficient. The following table lists the command suffix numbers associated with each coefficient:

1: Compensation coefficient A for R_{dc} measurement

2: Compensation coefficient B for R_{dc} measurement

3: Compensation coefficient C for R_{dc} measurement

Parameters

	Description
<numeric>	Compensation coefficient (real number) for R_{dc} measurement

Query response

{numeric}<newline><^END>

Equivalent key sequence

No equivalent keys are available on the front panel.

:DATA:RDC?

Syntax
:DATA[:DATA]:RDC?

Description
Returns the result of R_{dc} measurement. (Query only)

Query response
{numeric}<newline><^END>

If the R_{dc} measurement feature is disabled, the command fails and an error is generated.

Equivalent key sequence
No equivalent keys are available on the front panel.

:DATA:VMON?

Syntax
:DATA[:DATA]:VMON?

Description
Returns the result of monitoring the voltage level of the test signal. If the measurement fails because of overload, the command returns 9.9E37. (Query only)

Query response

For single-point measurement

{numeric}<newline><^END>

The command returns the monitored value (real number) of the measured point.

For list measurement

{numeric 1},...,{numeric N}<newline><^END>

The command returns the monitored value (real number) at each point defined in the active table. Therefore, the returned data contains as many monitored values as the number of measurement points (N) and is sent in the order of measurement point numbers.

See also
:DATA:IMON? on page 263

Equivalent key sequence
No equivalent keys are available on the front panel.

:DISP

Syntax

:DISPlay[:WINDow][:STATe] {ON|OFF|1|0}

:DISPlay[:WINDow][:STATe]?

Description

Turns on or off the screen display of all of the measurement results, softkey labels, and instrument status information.

Parameters

	Description
ON or 1 (initial value)	Turns on screen display.
OFF or 0	Turns off screen display.

Query response

{1|0}<newline><^END>

Equivalent key sequence

[Display] - **DISPLAY**

:DISP:BACK

Syntax

:DISPlay:BACKlight {ON|OFF|1|0}

:DISPlay:BACKlight?

Description

Turns on or off the backlight of the LCD screen. If the backlight is off, you cannot read information displayed on the screen.

Parameters

	Description
ON or 1 (initial value)	Turns on backlight.
OFF or 0	Turns off backlight.

Query response

{1|0}<newline><^END>

Equivalent key sequence

[System] - **SERVICE MENU** - **BACK LIGHT**

:DISP:CCL

Syntax
:DISPlay:CCLear

Description
Clears the error message displayed in the title display area (at the topmost of the screen). (No query)

Corresponding key
No front panel key is available to execute this function.

:DISP:TEXT1

Syntax
:DISPlay[:WINDow]:TEXT1[:STATe] {ON|OFF|1|0}

:DISPlay[:WINDow]:TEXT1[:STATe]?

Description
Turns on or off the screen display of the measurement results (results of measurement parameters 1 to 4, results of test signal current/voltage level, and R_{dc} measurement results).

Parameters

	Description
ON or 1 (initial value)	Turns on screen display
OFF or 0	Turns off screen display

Query response
{1|0}<newline><^END>

Equivalent key sequence
[Display] - SETUP MEAS DISP - DISPLAY

:DISP:TEXT1:CALC{1-4}

Syntax

:DISPlay[:WINDow]:TEXT1:CALCulate{1|2|3|4}[:STATe] {ON|OFF|1|0}

:DISPlay[:WINDow]:TEXT1:CALCulate{1|2|3|4}[:STATe]?

Description

Turns on or off the screen display of the measurement results for each of the parameters 1 (:CALC1) through 4 (:CALC4).

Parameters

	Description
ON or 1 (initial value)	Turns on screen display
OFF or 0	Turns off screen display

Query response

{1|0}<newline><^END>

Equivalent key sequence

[Display] - **SETUP MEAS DISP** - {**PRMTR-1**|**PRMTR-2**|**PRMTR-3**|**PRMTR-4**} - **DISPLAY**

:DISP:TEXT1:CALC{1-4}:DIG

Syntax

:DISPlay[:WINDow]:TEXT1:CALCulate{1|2|3|4}:DIGit <numeric>

:DISPlay[:WINDow]:TEXT1:CALCulate{1|2|3|4}:DIGit?

Description

Specifies the number of digits to use in the screen display of the measurement result for each of the parameters 1 (:CALC1) through 4 (:CALC4).

Parameters

	<numeric>
Description	Number of digits
Range	4 to 6
Default	4
Resolution	1

If your specified parameter is beyond the valid range, the instrument ignores the parameter and uses either the maximum or minimum value depending on whether the parameter is greater than the upper limit or smaller than the lower limit.

Query response

{numeric}<newline><^END>

Equivalent key sequence

[Display] - **SETUP MEAS DISP** - {**PRMTR-1**|**PRMTR-2**|**PRMTR-3**|**PRMTR-4**} - **DIGIT**

:DISP:TEXT1:CALC{1-4}:FIX

Syntax

:DISPlay[:WINDow]:TEXT1:CALCulate{1|2|3|4}:FIX {ON|OFF|1|0}

:DISPlay[:WINDow]:TEXT1:CALCulate{1|2|3|4}:FIX?

Description

Specifies whether to fix the decimal point in the screen display of the measurement result for each of parameters 1 (:CALC1) through 4 (:CALC4).

Parameters

	Description
ON or 1	Instructs instrument to fix the decimal point
OFF or 0 (initial value)	Instructs instrument NOT to fix the decimal point

Query response

{1|0}<newline><^END>

Equivalent key sequence

[Display] - **SETUP MEAS DISP** - {**PRMTR-1**|**PRMTR-2**|**PRMTR-3**|**PRMTR-4**} - **MSD FIXED**

:DISP:TEXT1:CALC{1-4}:MSD

Syntax

:DISPlay[:WINDow]:TEXT1:CALCulate{1|2|3|4}:MSD <numeric>

:DISPlay[:WINDow]:TEXT1:CALCulate{1|2|3|4}:MSD?

Description

When the instrument is configured to fix the decimal point in the screen display of the measurement result for each of the parameters 1 (:CALC1) through 4 (:CALC4), use this command to set the most significant digit. You can specify the most significant digit by its exponent. For example, to set the most significant digit to 100n (1E-7), specify -7 as the parameter value.

Parameters

	<numeric>
Description	Exponent that indicates the most significant digit
Range	-15 to 15
Default	0
Resolution	1

If your specified parameter is beyond the valid range, the instrument ignores the parameter and uses either the maximum or minimum value depending on whether the parameter is greater than the upper limit or smaller than the lower limit.

Query response

{numeric}<newline><^END>

Equivalent key sequence

[Display] - **SETUP MEAS DISP** - {**PRMTR-1**|**PRMTR-2**|**PRMTR-3**|**PRMTR-4**} - **MODIFY MSD**

:DISP:TEXT1:CALC{11-12}

Syntax

:DISPlay[:WINDow]:TEXT1:CALCulate{11|12}[:STATe] {ON|OFF|1|0}

:DISPlay[:WINDow]:TEXT1:CALCulate{11|12}[:STATe]?

Description

Turns on or off the screen display of the results of monitoring the test signal current level (:CALC11) or voltage level (:CALC12).

Parameters

	Description
ON or 1 (initial value)	Turns on screen display
OFF or 0	Turns off screen display

Query response

{1|0}<newline><^END>

Equivalent key sequence

[Display] - **SETUP MEAS DISP** - {**I-mon**|**V-mon**} - **DISPLAY**

:DISP:TEXT1:CALC{11-12}:DIG

Syntax

:DISPlay[:WINDow]:TEXT1:CALCulate{11|12}:DIGit <numeric>

:DISPlay[:WINDow]:TEXT1:CALCulate{11|12}:DIGit?

Description

Specifies the number of digits to use in the screen display of the results of monitoring the test signal current level (:CALC11) or voltage level (:CALC12).

Parameters

	<numeric>
Description	Number of digits
Range	4 to 6
Default	4
Resolution	1

If your specified parameter is beyond the valid range, the instrument ignores the parameter and uses either the maximum or minimum value depending on whether the parameter is greater than the upper limit or smaller than the lower limit.

Query response

{numeric}<newline><^END>

Equivalent key sequence

[Display] - **SETUP MEAS DISP** - {**I-mon**|**V-mon**} - **DIGIT**

:DISP:TEXT1:CALC{11-12}:FIX

Syntax

:DISPlay[:WINDow]:TEXT1:CALCulate{11|12}:FIX {ON|OFF|1|0}

:DISPlay[:WINDow]:TEXT1:CALCulate{11|12}:FIX?

Description

Specifies whether to fix the decimal point in the screen display of the results of monitoring the test signal current level (:CALC11) or voltage level (:CALC12).

Parameters

	Description
ON or 1	Instructs instrument to fix the decimal point
OFF or 0 (initial value)	Instructs instrument NOT to fix the decimal point

Query response

{1|0}<newline><^END>

Equivalent key sequence

[Display] - **SETUP MEAS DISP** - {**I-mon**|**V-mon**} - **MSD FIXED**

:DISP:TEXT1:CALC{11-12}:MSD

Syntax

:DISPlay[:WINDow]:TEXT1:CALCulate{11|12}:MSD <numeric>

:DISPlay[:WINDow]:TEXT1:CALCulate{11|12}:MSD?

Description

When the instrument is configured to fix the decimal point in the screen display of the results of monitoring the test signal current level (:CALC11) or voltage level (:CALC12), use this command to set the most significant digit. You can specify the most significant digit by its exponent. For example, to set the most significant digit to 0.01 (1E-2), specify -2 as the parameter value.

Parameters

	<numeric>
Description	Exponent that indicates the most significant digit
Range	-15 to 15
Default	0
Resolution	1

If your specified parameter is beyond the valid range, the instrument ignores the parameter and uses either the maximum or minimum value depending on whether the parameter is greater than the upper limit or smaller than the lower limit.

Query response

{numeric}<newline><^END>

Equivalent key sequence

[Display] - **SETUP MEAS DISP** - {**I-mon**|**V-mon**} - **MODIFY MSD**

:DISP:TEXT1:CALC13:DIG

Syntax

:DISPlay[:WINDow]:TEXT1:CALCulate13:DIGit <numeric>

:DISPlay[:WINDow]:TEXT1:CALCulate13:DIGit?

Description

Specifies the number of digits to use in the screen display of the results of R_{dc} measurement.

Parameters

	<numeric>
Description	Number of digits
Range	4 to 6
Default	4
Resolution	1

If your specified parameter is beyond the valid range, the instrument ignores the parameter and uses either the maximum or minimum value depending on whether the parameter is greater than the upper limit or smaller than the lower limit.

Query response

{numeric}<newline><^END>

Equivalent key sequence

[Display] - **SETUP MEAS DISP** - **R_dc** - **DIGIT**

:DISP:TEXT1:CALC13:FIX

Syntax

:DISPlay[:WINDow][:TEXT1]:CALCulate13:FIX {ON|OFF|1|0}

:DISPlay[:WINDow][:TEXT1]:CALCulate13:FIX?

Description

Specifies whether to fix the decimal point in the screen display of the results of R_{dc} measurement.

Parameters

	Description
ON or 1	Instructs instrument to fix the decimal point
OFF or 0 (initial value)	Instructs instrument NOT to fix the decimal point

Query response

{1|0}<newline><^END>

Equivalent key sequence

[Display] - **SETUP MEAS DISP** - **R_dc** - **MSD FIXED**

:DISP:TEXT1:CALC13:MSD

Syntax

:DISPlay[:WINDow]:TEXT1:CALCulate13:MSD <numeric>

:DISPlay[:WINDow]:TEXT1:CALCulate13:MSD?

Description

When the instrument is configured to fix the decimal point in the screen display of the results of R_{dc} measurement, use this command to set the most significant digit. You can specify the most significant digit by its exponent. For example, to set the most significant digit to 100 (1E2), specify 2 as the parameter value.

Parameters

	<numeric>
Description	Exponent that indicates the most significant digit
Range	-15 to 15
Default	0
Resolution	1

If your specified parameter is beyond the valid range, the instrument ignores the parameter and uses either the maximum or minimum value depending on whether the parameter is greater than the upper limit or smaller than the lower limit.

Query response

{numeric}<newline><^END>

Equivalent key sequence

[Display] - **SETUP MEAS DISP** - **R_dc** - **MODIFY MSD**

:DISP:TEXT10

Syntax

:DISPlay[:WINDow]:TEXT10[:STATe] {ON|OFF|1|0}

:DISPlay[:WINDow]:TEXT10[:STATe]?

Description

Specifies whether to display the title (defined with the **:DISP:TEXT10:DATA** command) in the title display area (uppermost part of the screen).

Parameters

	Description
ON or 1 (initial value)	Shows title
OFF or 0	Hides title

Query response

{1|0}<newline><^END>

See also

:DISP:TEXT10:DATA on page 276

Equivalent key sequence

[Display] - **TITLE MENU** - **DISPLAY**

:DISP:TEXT10:DATA

Syntax

:DISPlay[:WINDow]:TEXT10:DATA <string>

:DISPlay[:WINDow]:TEXT10:DATA?

Description

Defines the string to display in the title display area.

Parameters

	<string>
Description	String displayed in the title display area
Range (maximum length)	Up to 90 characters
Default	Blank (“”)

If your specified title exceeds the maximum allowable length, the title is truncated to the maximum length.

Query response

{string}<newline><^END>

See also

:DISP:TEXT10 on page 276

Equivalent key sequence

[Display] - **TITLE MENU** - **MODIFY TITLE**

:DISP:TEXT11

Syntax

:DISPlay[:WINDow]:TEXT11[:STATe] {ON|OFF|1|0}

:DISPlay[:WINDow]:TEXT11[:STATe]?

Description

Specifies whether to display the date and time at the right-hand side of the status display area (lower-right part of the LCD screen).

Parameters

	Description
ON or 1	Shows date and time
OFF or 0 (initial value)	Hides date and time

Query response

{1|0}<newline><^END>

See also

:DISP:TEXT11:MODE on page 277

Equivalent key sequence

[Display] - **DATE & TIME**

:DISP:TEXT11:MODE

Syntax

:DISPlay[:WINDow]:TEXT11:MODE {STAMp|LIVE}

:DISPlay[:WINDow]:TEXT11:MODE?

Description

Specifies whether to update the date and time displayed at the right-hand side of the status display area.

Parameters

	Description
STAMp (initial value)	Does NOT update date and time
LIVE	Updates date and time

Query response

{STAM|LIVE}<newline><^END>

See also

:DISP:TEXT11 on page 277

Equivalent key sequence

[Display] - **DATE & TIME**

:DISP:TEXT2:LAB{1-4}

Syntax

:DISPlay[:WINDow]:TEXT2:LABel{1|2|3|4} {PARam1|PARam2|PARam3|PARam4|VMONitor|IMONitor|FREQuency|AVERage|POWer|RDC}

Description

Defines each of the four display items (:LAB1 through :LAB4) that appear on the list measurement screen.

Parameters

	Description
PARam1	Displays parameter 1 measurement result
PARam2	Displays parameter 2 measurement result
PARam3	Displays parameter 3 measurement result
PARam4	Displays parameter 4 measurement result
VMONitor	Displays result of monitoring the test signal voltage level
IMONitor	Displays result of monitoring the test signal current level
FREQuency	Displays frequency setting of the test signal
AVERage	Displays averaging factor setting
POWer	Displays test signal level setting
RDC	Displays result of R_{dc} measurement

Display item 1 defaults to PARam1; display item 2 defaults to PARam2; display item 3 defaults to PARam3; display item 4 defaults to PARam4.

Query response

{PAR1|PAR2|PAR3|PAR4|VMON|IMON|FREQ|AVER|POW|RDC}<newline><^END>

See also

:SOUR:LIST:STAT on page 297

Equivalent key sequence

[Prmtr] - **SETUP LIST PRMTRS** - {**LABEL-1**|**LABEL-2**|**LABEL-3**|**LABEL-4**} - {**PRMTR-1**|**PRMTR-2**|**PRMTR-3**|**PRMTR-4**|**V-mon**|**I-mon**|**FREQ**|**AVG**|**POWER**|**R_dc**}

:DISP:UPD

Format

:DISPlay:UPDate {ON|OFF|1|0}

:DISPlay:UPDate?

Description

Sets update of the LCD to On or OFF.

When update is set to ON, all displayed items are updated according to changes in measurement values, instrument settings, instrument status, and so on.

When update is set to OFF, only the measurement results (measurement results from measurement parameters 1-4, monitoring results of current and voltage of the measurement signals, R_{dc} measurement results, results of comparator) that are displayed at the execution of the command are updated (the latest results are displayed after each measurement). On the other hand, the measurement results not displayed at the execution of the command, the contents of the instrument status display area, and instrument setting display are not necessarily updated. For example, if update of the LCD is set to OFF when R_{dc} measurement is set to off, R_{dc} measurement results will not be displayed even if you subsequently turn on R_{dc} measurement.

Parameter

	Description
ON or 1 (initial value)	Sets update to ON
OFF or 0	Sets update to OFF

Query response

{1|0}<newline><^END>

Equivalent key sequence

[System] - SERVICE MENU - UPDATE DISPLAY

:FETC?

Syntax

:FETCh?

Description

Returns the measurement data from the most recently performed measurement. (Query only)

Query response

For single-point measurement

{stat},{par1},{par2},{par3},{par4},{Imon},{Vmon},{Rdc},{comp}<newline><^END>

The command returns the following data at the measured point.

{stat}: Measurement status, which is represented as an integer between 0 and 3 as follows:

0: No error
1: Detection of measurement failure (overload)
2: Detection of R_{dc} out of range
3: Simultaneous detection of overload and R_{dc} out of range

{par1}: Parameter 1 measurement result

{par2}: Parameter 2 measurement result

{par3}: Parameter 3 measurement result

{par4}: Parameter 4 measurement result

{Imon}: Result of monitoring test signal current level

{Vmon}: Result of monitoring test signal voltage level

{Rdc}: Result of R_{dc} measurement.

{comp}: Bin sort result, which can be an integer between 0 and 14 as follows:

0: Indicates a DUT that was not sorted into any of bins 1 through 13
1: Sorted into bin 1
2: Sorted into bin 2
3: Sorted into bin 3
4: Sorted into bin 4
5: Sorted into bin 5
6: Sorted into bin 6
7: Sorted into bin 7
8: Sorted into bin 8
9: Sorted into bin 9
10: Sorted into bin 10
11: Sorted into bin 11
12: Sorted into bin 12
13: Sorted into bin 13
14: Sort failed

NOTE

The result of parameter 1 is not returned if the display of parameter 1 is off. The results of parameters 2 through 4 as well as the test signal current/voltage levels are treated in a similar way.

The result of R_{dc} measurement is not returned if the R_{dc} measurement feature is off.

The bin sort result is not returned if the comparator is off.

NOTE If the measurement failed because of overload (that is, the measurement status is 1 or 3), the command returns 9.9E37 for the measurement results of parameters 1 through 4, the test signal monitor results, and the R_{dc} measurement result; the command returns 14 for the comparator result.

For list measurement

{stat 1},{par1 1},{par2 1},{par3 1},{par4 1},{Imon 1},{Vmon 1},{Rdc 1},...,
{stat N},{par1 N},{par2 N},{par3 N},{par4 N},{Imon N},{Vmon N},{Rdc N},
{comp}<newline><^END>

where N represents the number of points defined in the active table while n represents an integer between 1 and N.

The command returns data at all measurement points in the active table. The returned data consists of the following items:

{stat n}:	Measurement status at measurement point number n
{par1 n}:	Parameter 1 measurement result at measurement point number n
{par2 n}:	Parameter 2 measurement result at measurement point number n
{par3 n}:	Parameter 3 measurement result at measurement point number n
{par4 n}:	Parameter 4 measurement result at measurement point number n
{Imon n}:	Result of monitoring test signal current level at measurement point number n
{Vmon n}:	Result of monitoring test signal voltage level at measurement point number n
{Rdc n}:	Result of R_{dc} measurement
{comp}:	Bin sort result

NOTE The result of R_{dc} measurement is returned N times. However, all of the results of R_{dc} measurement have the same value because R_{dc} is measured only once.

The bin sort result is finally returned only once.

See also

:SOUR:LIST:STAT on page 297

:DISP:TEXT1:CALC{1-4} on page 270

:DISP:TEXT1:CALC{11-12} on page 272

:SOUR:LIST:RDC on page 296

:CALC:COMP on page 211

:READ? on page 293

***TRG** on page 208

Equivalent key sequence

No equivalent keys are available on the front panel.

:FORM

Format

:FORMat[:DATA] {ASCii|REAL}

:FORMat[:DATA]?

Description

Specifies the format used for data transfer with the following commands.

- **:FETC?** on page 280
- **:READ?** on page 293
- ***TRG** on page 208
- Commands that begin with **:DATA**

For details on the data transfer format, see “Data Transfer Format” on page 74.

Parameter

	Description
ASCii (initial value)	Specifies ASCII format
REAL	Specifies binary format

Query response

{ASC|REAL}<newline><^END>

See also

:FORM:BORD on page 283

***RST** on page 206

Equivalent key sequence

No equivalent keys are available on the front panel.

:FORM:BORD

Format

:FORMat:BORDer {NORMal|SWAPped}

:FORMat:BORDer?

Description

Specifies the order for transferring each byte comprising 8-byte data if the binary format is selected as the data transfer format. For details on the data transfer format, see “Data Transfer Format” on page 74.

Parameter

	Description
NORMal (initial value)	Specifies byte order so that data transfer begins at the byte containing MSB (Most Significant Bit).
SWAPped	Specifies byte order so that data transfer begins at the byte containing LSB (Least Significant Bit).

Query response

{NORM|SWAP}<newline><^END>

Related command

:FORM on page 282

Equivalent key sequence

No equivalent keys are available on the front panel.

:HCOP

Syntax
:HCOPy[:IMMediate]

Description
Outputs the data selected with the **:HCOP:CONT** command to the printer connected to the 4287A. (No query)

See also
:HCOP:CONT on page 284

Equivalent key sequence
[Display] - **PRINT MENU** - **PRINT**

:HCOP:ABOR

Syntax
:HCOPy:ABORt

Description
Aborts print operation. (No query)

Equivalent key sequence
[Display] - **PRINT MENU** - **ABORT PRINTING**

:HCOP:CONT

Syntax
:HCOPy:CONTent {SCReen|SETup|LIST}

:HCOPy:CONTent?

Description
Lets you select what to print.

Parameters

	Description
SCReen (initial value)	Instructs the bitmap images[*1] from the non-volatile memory (clipboard). If no image resides on the clipboard, the image currently displayed on screen is transferred to the clipboard before it is output to the printer. When you are working with the measurement results for single-point measurement, you can choose this item to output the data as an image.
SETup	Instructs the instrument to output the active table contents, which can contain a measurement point setup table, calibration kit setup table, compensation kit setup table, and BIN sorting setup table.
LIST	Instructs the instrument to output the measurement results of list measurement across all of the measurement points. You cannot output this data when you are working with the results of single-point measurement.

*1. This is the image that is displayed before you press the **[Capture]** key (**[Display]** key).

Query response
{SCR|SET|LIST}<newline><^END>

See also
:HCOP on page 284

Equivalent key sequence
[Display] - **PRINT MENU** - **CONTENT**

:HCOP:DPR

Syntax

:HCOPy:DPRinter <numeric>

:HCOPy:DPRinter?

Description

Configures the 4287A to use the specified printer for print operations. You can use the **:HCOP:PRIN?** command to obtain a list of available (connected) printers and their numbers.

Parameters

	<number>
Description	Printer number
Range	1 to the maximum number returned by the **:HCOP:PRIN?** command
Default	1
Resolution	1

If your specified parameter is beyond the valid range, the instrument ignores the parameter and uses either the maximum or minimum value depending on whether the parameter is greater than the upper limit or smaller than the lower limit.

Query response

{string}<newline><^END>

	Description
{string}	Printer name

NOTE The query response is different from the parameter used for setting.

See also

:HCOP:PRIN? on page 286

Equivalent key sequence

[Display] - **PRINT MENU** - **SELECT DEFAULT PRINTER**

:HCOP:IMAG

Syntax

:HCOPy:IMAGe {NORMal|INVert|MONochrome}

:HCOPy:IMAGe?

Description

If you have issued the **:HCOP:CONT** command by specifying “SCR” to configure the instrument to print out the LCD screen contents, use this command to select the print color scheme.

Parameters

	Description
NORMal (initial value)	Instructs instrument to output a color image using a color scheme that approximates that of the screen display.
INVert	Instructs instrument to output a color image using a color scheme that is inverse to that of the screen display.
MONochrome	Instructs instrument to output a monochrome image using a color scheme inverse that is to that of the screen display.

Query response

{NORM|INV|MON}<newline><^END>

See also

:HCOP:CONT on page 284

Equivalent key sequence

[Display] - **PRINT MENU** - **IMAGE**

:HCOP:PRIN?

Syntax

:HCOPy:PRINters?

Description

Returns the total number of printers available with the 4287A as well as each printer's number and name. Note that when you use the **:HCOP:DPR** command to configure the instrument to use a specific printer, you will need to specify the appropriate printer number. (Query only)

Query response

{string}<newline><^END>

The command returns a string in the following format.

“N<newline>,1,first printer name<newline>,...,N,Nth printer name<newline>”

where N represents the total number of printers.

See also

:HCOP:DPR on page 285

Equivalent key sequence

No equivalent keys are available on the front panel.

:INIT

Syntax

:INITiate[:IMMediate]

Description

When the trigger system is in the idle state, issuing this command activates the trigger system. The trigger system returns to the idle state after completing one trigger cycle. When the trigger system is not in the idle state or configured to be continuously activated (i.e., after you have issued the **:INIT:CONT** command by specifying "ON"), issuing this command generates an error. For more information on the trigger system, see "Trigger system" on page 66. (No query)

See also

:INIT:CONT on page 287

Equivalent key sequence

No equivalent keys are available on the front panel.

:INIT:CONT

Syntax

:INITiate:CONTinuous {ON|OFF|1|0}

:INITiate:CONTinuous?

Description

Specifies whether to continuously activate the trigger system. This setting is initialized to OFF when the ***RST** is issued. For more information on the trigger system, see "Trigger system" on page 66.

Parameters

	Description
ON or 1 (initial value)	Instructs instrument to continuously activate trigger system
OFF or 0	Instructs instrument to NOT continuously activate trigger system

Query response

{1|0}<newline><^END>

See also

***RST** on page 206

Equivalent key sequence

No equivalent keys are available on the front panel.

:MMEM:CAT?

Syntax

:MMEM:CATalog?

Description

This command reads the following information about the storage device (except the floppy disk drive) built in the 4287A. (Query only)

- Capacity used
- Free (available) capacity
- Names and sizes of files

Query response

{used_size},{free_size},{name 1},{type 1},{size 1},...,
{name N},{type N},{size N}<newline><^END>

N is the number of all files contained in the built-in storage.

{used_size}:	Already used capacity (bytes) of built-in storage
{free_size}:	Free capacity (bytes) of built-in storage
{name n}:	Name of the nth file (Character string enclosed within double quotation marks ("))
{type n}:	A pair of double quotation marks ("") are always read.
{size n}:	Size (bytes) of the nth file

With n defined as integer 1 to N, N sets of {name n}, {type n}, and {size n} are read.

Equivalent key sequence

No equivalent keys are available on the front panel.

:MMEM:COPY

Syntax

:MMEM:COPY <string 1>,<string 2>

Description

This command copies a file.

To specify the file, use a file name accompanying an extension. If you want to specify a file residing on the floppy disk, you must attach "A:" to the head of the file name. To use the directory and file names for specification, separate them using a slash (/).

If the specified source file is not found, an error will occur and the command will be ignored. Note that, if the file that has the same name as the specified source file already exists, it will be overwritten. (No query)

Parameters

	<string 1>	**<string 2>**
Description	Source file name	Destination file name
Range	Up to 248 characters (including extension)	Up to 248 characters (including extension)

Equivalent key sequence

[Save/Recall] - **FILE UTILITY**

:MMEM:CRE:DIR

Syntax

:MMEM:CREate:DIRectory <string>

Description

This command creates a new directory (folder).

If you want a directory created on the floppy disk, you must attach "A:" to the head of the file name. If you want a file created under an existing directory, use a slash (/) to separate directory names.

If the file that has the same name as the specified source file already exists, an error will occur and the command will be ignored. (No query)

Parameters

	<string>
Description	Name of the directory to be created
Range	Up to 248 characters

Equivalent key sequence

[Save/Recall] - **FILE UTILITY**

:MMEM:DEL

Syntax

:MMEM:DELete <string>

Description

This command deletes an existing file or directory (folder).

If a directory is specified, all files and directories in it will be deleted.

To specify a file, use a file name accompanying an extension. If you want to specify a file or directory on the floppy disk, you must add "A:" to the head of the file name. To specify a file (directory) under an existing directory, use a slash (/) to separate directory names or a directory and a file (or directory) name.

If you specify "D:/USER" for the directory name, all user-created files and directories in the 4287A built-in storage will be deleted.

If the specified file or directory is not found, an error will occur and the command will be ignored. (No query)

Parameters

	<string>
Description	Name of the directory to be deleted
Range	Up to 248 characters (including extension)

Equivalent key sequence

[Save/Recall] - **FILE UTILITY**

:MMEM:LOAD

Syntax

:MMEM:LOAD <string>

Description

Recalls the instrument settings from an .sta file previously saved with the **:MMEM:STOR** command.

You must specify the file name with the extension. When you specify a file on the floppy disk drive, precede the file name with “A:”. When you specify a file under a directory, delimit the directory and file names with a slash (/).

If your specified file is not found, the command fails and an error is generated. (No query)

Parameters

	<string>
Description	Name of file to recall
Range	Up to 248 characters (including extension)

Equivalent key sequence

[Save/Recall] - **RECALL STATE**

:MMEM:STOR

Format :MMEM:STORe <String>[,{LOG|LIST|SETup|COMParator}]

Description Saves the instrument settings (including calibration/compensation), images on the LCD stored in the volatile memory (clipboard) (images of the LCD when the **[Capture]** key is pressed), measurement data for statistical analysis, list measurement results, or the contents of the setup table as a file. Contents to be saved depend on the extension of the file specified (first parameter). However, you should specify the second parameter only if the extension is ".csv". The list below shows each extension and the corresponding contents to be saved. (No Query)

.sta Instrument settings (binary format)

.bmp Images on the LCD[*1] (bitmap format)

.csv Comma-separated data for the following items (ASCII format)

- Measurement data for statistical analysis[*2]
- List measurement results
- Contents of setup table

.dta Measurement data for statistical analysis[*2] (binary format)

When specifying a file on the floppy disk drive, you must specify "A:" at the beginning of the filename. When specifying a directory name and filename, you must separate them with a slash (/).

If a filename you specify already exists, note that the existing file may be overwritten by the new file.

NOTE A file for instrument settings saved as autorec.sta is automatically recalled during power-on of the 4287A.

Parameter First parameter: <String>

	<String >
Description	Name of file to be saved
Range	Less than 248 characters (including extension)

*1. If no image exists on the clipboard, the images on the LCD are stored on the clipboard when the command is executed and then they are saved.

*2. In the ASCII format (extension ".csv"), up to 65,536 measurement data for statistical analysis can be saved. If the frequency of data measurement stored on the volatile memory exceeds 65,536, only the data of the first 65,536 measurements are saved and the remaining data are ignored. In the binary format (extension ".dta"), there is no limit to measurement frequency, and thus all of the stored measurement data for statistical analysis are saved.

Second parameter: {LOG|LIST|SETup|COMParator}

You should specify the second parameter only if the file extension is ".csv". When this parameter is not specified for any file with the extension ".csv", measurement data for statistical analysis (LOG) are saved.

	Description
LOG	Specifies that measurement data for statistical analysis are saved.
LIST	Specifies that measurement results of list measurement at all measurement points are saved. This parameter is not available for single-point measurement.
SETup	Specifies that contents of all measurement point setup tables, contents of all calibration kit setup tables, and contents of all compensation kit setup tables are saved.
COMParator	Specifies that contents of all BIN sorting setup tables are saved.

Equivalent key sequence

[Save/Recall] - {**SAVE STATE**|**EXPORT LIST VIEW**|**EXPORT LOG DATA(ASC)**|**EXPORT LOG DATA(BIN)**|**SAVE GRAPHIC**}

On the setup screen (**[Setup View]**) **[Alt]** - **[1]** - **[1]**

:READ?

Syntax

:READ? [<numeric>]

Description

When the instrument is configured to use an internal, manual or external trigger source (that is, after you have issued the **:TRIG:SOUR** command by specifying “INT”, “MAN” or “EXT”), issuing this command without the parameter sets the trigger system into trigger wait state. Then this command returns the measurement data when the instrument is triggered and has completed the measurement cycle.

When the instrument is configured to use an internal, manual or external trigger source, issuing this command with the parameter sets the active table to the number specified by the parameter. Then the 4287A is operated as described above. In other words, issuing this command with the parameter causes the same operation as when the **:SOUR:LIST:TABL** command is issued, and then the **:READ?** command is issued without the parameter.

When the instrument is configured to use the GPIB/LAN trigger source (that is, after you have issued the **:TRIG:SOUR** command by specifying “BUS”), this command fails and an error is generated. This is because issuing the command would prevent the instrument from being triggered. (Query only)

NOTE

When the instrument is configured to use a manual or external trigger source, it does not accept any additional command until it is triggered from the external source. To exit from this state without triggering the instrument from the external source, you must send the Device Clear command (“CLEAR” statement in HP BASIC) to abort query processing.

Parameters

This is an optional parameter. You don’t have to specify the parameter if you don’t intend to change the active table every measurement.

	<numeric>
Description	Table number
Range	1 to 8
Default	1
Resolution	1

If your specified parameter is beyond the valid range, the command fails and an error is generated.

Query response

Same as the **:FETC?** command. See the description of **:FETC?**.

See also

:FETC? on page 280

:TRIG:SOUR on page 310

:SOUR:LIST:TABL on page 297

Equivalent key sequence

No equivalent keys are available on the front panel.

:SOUR:LIST

Syntax

:SOURce:LIST <nop>,<freq 1>,<ave 1>,<pow 1>,...,<freq N>,<ave N>,<pow N>

:SOURce:LIST?

where N represents the number of points contained in the active table (this number is specified with the <nop> parameter).

Description

Sets up the active table by specifying the measurement frequency values, averaging factors, and oscillator levels for all measurement points.

Parameters

	<nop>	**<freq n>**	**<ave n>**
Description	Number of measurement points (N)	Measurement frequency at nth point	Averaging factor at nth point
Range	1 to 32	1E6 to 3000E6	1 to 100
Default	1	1E6	1
Unit	————	Hz	————
Resolution	1	100E3	1

	<pow n>		
Description	Oscillator level at nth point		
Unit to apply to setting[*1]	dBm	mA	mV
Range	-40 to 1	0.1 to 10	5 to 502
Default	-13	2	100
Unit	dBm	mA	mV
Resolution	0.1 dB[*2]		

*1. Use the **:SOUR:UNIT** command to select the unit for the setting.
*2. The value is converted to dBm and then rounded off in resolutions of 0.1dB when mA or mV is selected as the unit of oscillator level.

where N represents an integer between 1 and N.

If your specified parameter is beyond the valid range, the instrument ignores the parameter and uses either the maximum or minimum value depending on whether the parameter is greater than the upper limit or smaller than the lower limit.

Query response

{nop},{freq 1},{ave 1},{pow 1},...,{freq N},{ave N},{pow N}<newline><^END>

See also

:SOUR:LIST:SIZE? on page 296
:SOUR:UNIT on page 298

Equivalent key sequence

[Setup View] (Measurement point setup display)

:SOUR:LIST:CLE

Syntax

:SOURce:LIST:CLEar

Description

Resets all of the measurement point setup tables to the factory default settings, regardless of the active table settings. (No query)

Equivalent key sequence

[Alt] - **[2]** - **[8]** - **[2]** (when the measurement point setup display is selected by **[Setup View]**)

:SOUR:LIST:POIN

Syntax

:SOURce:LIST:POINt <numeric>

:SOURce:LIST:POINt?

Description

Specifies the measurement point for single-point measurement. This setting is retained even if the active table is changed. If the specified point number exceeds the maximum point number allowed in the new active table, however, the instrument will perform single-point measurement using that maximum number instead of the previously specified number.

This setting is reset when settings in the measurement point setup table are changed by execution of the **:SOUR:LIST** or **:SOUR:LIST:CLE** command.

Parameters

	<numeric>
Description	Point number for single-point measurement
Range	1 to number of points (up to 32)
Default	1
Resolution	1

If your specified parameter is beyond the valid range, the instrument ignores the parameter and uses either the maximum or minimum value depending on whether the parameter is greater than the upper limit or smaller than the lower limit.

Query response

{numeric}<newline><^END>

See also

:SOUR:LIST on page 294

:SOUR:LIST:CLE on page 295

:SOUR:LIST:STAT on page 297

Equivalent key sequence

[Stml Select] - **POINT No.**

:SOUR:LIST:RDC

Syntax

:SOURce:LIST:RDC {ON|OFF|1|0}

:SOURce:LIST:RDC?

Description

Specifies whether to perform R_{dc} measurement. This setting is retained even if the active table is changed.

Parameters

	Description
ON or 1	Instructs instrument to perform R_{dc} measurement (turns on R_{dc} measurement function)
OFF or 0 (initial value)	Instructs instrument to NOT perform R_{dc} measurement (turns off R_{dc} measurement function)

Query response

{1|0}<newline><^END>

Equivalent key sequence

[Prmtr] - **RDC MEAS**

:SOUR:LIST:RDC:OFSC

Syntax

:SOURce:LIST:RDC:OFSCancel {ON|OFF|1|0}

:SOURce:LIST:RDC:OFSCancel?

Description

Turns ON/OFF the offset cancel function for the R_{dc} measurement.

NOTE Turn ON this setup before measuring calibration/compensation data.

Parameters

	Description
ON or 1	Turns ON the offset cancel function.
OFF or 0 (initial value)	Turns OFF the offset cancel function.

Query response

{1|0}<newline><^END>

Corresponding key

[System] - **SERVICE MENU** - **RDC OFS CANCEL**

:SOUR:LIST:SIZE?

Syntax

:SOURce:LIST:SIZE?

Description

Returns the number of measurement points defined in the active table. (Query only)

Query response

{numeric}<newline><^END>

Equivalent key sequence

No equivalent keys are available on the front panel.

:SOUR:LIST:STAT

Syntax

:SOURce:LIST:STATe {ON|OFF|1|0}

:SOURce:LIST:STATe?

Description

Sets the measurement points to be used during measurement.

List measurement — The instrument measures the DUT's characteristics at all points defined in the active table.

Single-point measurement — The instrument measures the DUT's characteristics only at the point specified by issuing the **:SOUR:LIST:POIN** command.

Parameters

	Description
ON or 1	Instructs instrument to perform list measurement
OFF or 0 (initial value)	Instruct instrument to perform single-point measurement

Query response

{1|0}<newline><^END>

See also

:SOUR:LIST:POIN on page 295

Equivalent key sequence

[Meas View]

:SOUR:LIST:TABL

Syntax

:SOURce:LIST:TABLe <numeric>

:SOURce:LIST:TABLe?

Description

Specifies which table to use as the active table.

Parameters

	<numeric>
Description	Number of the table that should be the active table
Range	1 to 8
Default	1
Resolution	1

If your specified parameter is beyond the valid range, the instrument ignores the parameter and uses either the maximum or minimum value depending on whether the parameter is greater than the upper limit or smaller than the lower limit.

Query response

{numeric}<newline><^END>

Equivalent key sequence

[Stml Select] - **TABLE No.**

:SOUR:UNIT

Syntax

:SOURce:UNIT {DBM|V|A}

:SOURce:UNIT?

Description

Lets you select the unit to be used while displaying and setting the oscillator levels.

Parameters

	Description
DBM (initial value)	Uses dBm as display/setting unit
V	Uses mV as display/setting unit
A	Uses mA as display/setting unit

Query response

{DBM|V|A}<newline><^END>

Equivalent key sequence

[Setup View] (Measurement point setup display)

:STAT:OPER?

Syntax

:STATus:OPERation[:EVENt]?

Description

Returns the value of the Operation Status Event register. (Query only)

Query response

{numeric}<newline><^END>

See also

***CLS** on page 204

Equivalent key sequence

No equivalent keys are available on the front panel.

:STAT:OPER:COND?

Syntax

:STATus:OPERation:CONDition?

Description

Returns the value of the Operation Status Condition register. (Query only)

Query response

{numeric}<newline><^END>

Equivalent key sequence

No equivalent keys are available on the front panel.

:STAT:OPER:ENAB

Syntax

:STATus:OPERation:ENABle <numeric>

:STATus:OPERation:ENABle?

Description

Sets the value of the Operation Status enable register.

Parameters

	<numeric>
Description	Value of enable register
Range	0 to 32767
Default	0
Resolution	1

If you specify a parameter value beyond the valid range, the command assumes a bit-by-bit logical product (AND) with 32767 (0x7fff).

Query response

{numeric}<newline><^END>

See also

***SRE** on page 207

:STAT:PRES on page 301

Equivalent key sequence

No equivalent keys are available on the front panel.

:STAT:OPER:NTR

Syntax

:STATus:OPERation:NTRansition <numeric>

:STATus:OPERation:NTRansition?

Description

Sets the value of the negative transition filter of the operation status register.

Parameters

	<numeric>
Description	Value of negative transition filter
Range	0 to 32767
Default	0
Resolution	1

If you specify a parameter value beyond the valid range, the command assumes a bit-by-bit logical product (AND) with 32767 (0x7fff).

Query response

{numeric}<newline><^END>

See also

:STAT:PRES on page 301

Equivalent key sequence

No equivalent keys are available on the front panel.

:STAT:OPER:PTR

Syntax

:STATus:OPERation:PTRansition <numeric>

:STATus:OPERation:PTRansition?

Description

Sets the value of the positive transition filter of operation status register.

Parameters

	<numeric>
Description	Value of positive transition filter
Range	0 to 32767
Default	0
Resolution	1

If you specify a parameter value beyond the valid range, the command assumes a bit-by-bit logical product (AND) with 32767 (0x7fff).

Query response

{numeric}<newline><^END>

See also

:STAT:PRES on page 301

Equivalent key sequence

No equivalent keys are available on the front panel.

:STAT:PRES

Syntax :STATus:PRESet

Description Initializes the values of the Operation Status register and Questionable Status register. (No query)

Equivalent key sequence No equivalent keys are available on the front panel.

:STAT:QUES?

Syntax :STATus:QUEStionable[:EVENt]?

Description Returns the value of the Questionable Status Event register. (Query only)

Query response {numeric}<newline><^END>

Equivalent key sequence No equivalent keys are available on the front panel.

:STAT:QUES:ENAB

Syntax :STATus:QUEStionable:ENABle <numeric>

:STATus:QUEStionable:ENABle?

Description Sets the value of the Questionable Status enable register.

Parameters

	<numeric>
Description	Value of enable register
Range	0 to 32767
Default	0
Resolution	1

If you specify a parameter value beyond the valid range, the command assumes a bit-by-bit logical product (AND) with 32767 (0x7fff).

Query response {numeric}<newline><^END>

See also ***SRE** on page 207

:STAT:PRES on page 301

Equivalent key sequence No equivalent keys are available on the front panel.

:SYST:BEEP1

Syntax
:SYSTem:BEEPer1[:IMMediate]

Description
Generates a beep to notify the user that a particular operation is complete. (No query)

See also
:SYST:BEEP1:STAT on page 302

Equivalent key sequence
[System] - **BEEPER MENU** - **PLAY BEEP DONE**

:SYST:BEEP1:STAT

Syntax
:SYSTem:BEEPer1:STATe {ON|OFF|1|0}

Description
Specifies whether to enable the beep mechanism used to notify the user that a particular operation (such as measuring the calibration data) is complete.

Parameters

	Description
ON or 1 (initial value)	Enables beep mechanism
OFF or 0	Disables beep mechanism

Query response
{1|0}<newline><^END>

Equivalent key sequence
[System] - **BEEPER MENU** - **BEEP DONE**

:SYST:BEEP2

Syntax
:SYSTem:BEEPer2[:IMMediate]

Description
Generates a beep to notify the user that a warning condition has occurred or that the comparator has returned a result. (No query)

See also
:SYST:BEEP2:STAT on page 303

Equivalent key sequence
[System] - **BEEPER MENU** - **PLAY BEEP WARN**

:SYST:BEEP2:STAT

Syntax

:SYSTem:BEEPer2:STATe {ON|OFF|1|0}

Description

Specifies whether to enable the beep mechanism used to notify the user of a warning condition or a comparator result.

Parameters

	Description
ON or 1 (initial value)	Enables beep mechanism
OFF or 0	Disables beep mechanism

Query response

{1|0}<newline><^END>

See also

:CALC:COMP:BEEP:COND on page 211

Equivalent key sequence

[System] - **BEEPER MENU** - **BEEP WARN**

:SYST:DATE

Syntax

:SYSTem:DATE <year>,<month>,<day>

:SYSTem:DATE?

Description

Sets the date of the 4287A's internal clock.

Parameters

	<year>	<month>	<day>
Description	Year part of the date	Month part of the date	Day part of the date
Range	1980 to 2099	1 to 12	1 to 31
Resolution	1	1	1

If your specified parameter is beyond the valid range, the command fails and an error is generated.

Query response

{year},{month},{day}<newline><^END>

See also

:SYST:TIME on page 307

Equivalent key sequence

[System] - **SET DATE & TIME**

:SYST:ERR?

Syntax

:SYSTem:ERRor?

Description

Returns the oldest error from the 4287A's error queue. The size of the error queue is 100. You can use the ***CLS** command to clear all errors contained in the error queue. (Query only)

NOTE

This commands cannot return an error that occurs by manual operation using the front panel, the mouse or keyboard.

Query response

{numeric},{string}<newline><^END>

{numeric}: Error number

{string}: Error message (a double-quoted string)

If the error queue contains no error, the command returns zero for the error number and "No error" for the error message.

See also

***CLS** on page 204

Equivalent key sequence

No equivalent keys are available on the front panel.

:SYST:ERR:COUN?

Syntax

:SYSTem:ERRor:COUNt?

Description

Returns the number of errors contained in the error queue. (Query only)

Query response

{numeric}<newline><^END>

Equivalent key sequence

No equivalent keys are available on the front panel.

:SYST:EXTR?

Syntax

:SYSTem:EXTRef?

Description

Returns whether the external reference signal is inputted through the Ext Ref In connector on the rear panel. (Query only)

Query response

{1|0}<newline><^END>

	Description
1	External reference signal is inputted
0	External reference signal is not inputted

Equivalent key sequence

No equivalent keys are available on the front panel.

:SYST:KLOC

Syntax

:SYSTem:KLOCk[:FPANel] {ON|OFF|1|0}

:SYSTem:KLOCk[:FPANel]?

Description

Specifies whether to lock the front panel key and rotary knob.

Parameters

	Description
ON or 1	Locked
OFF or 0 (initial value)	Unlocked

Query response

{1|0}<newline><^END>

See also

:SYST:KLOC:KBD on page 305

:SYST:KLOC:MOUS on page 306

Equivalent key sequence

[System] - **KEY LOCK MENU** - **FPANEL LOCK**

:SYST:KLOC:KBD

Syntax

:SYSTem:KLOCk:KBD {ON|OFF|1|0}

:SYSTem:KLOCk:KBD?

Description

Specifies whether to lock the keyboard.

Parameters

	Description
ON or 1	Locked
OFF or 0 (initial value)	No effect (if you want to unlock the keyboard, you need to reboot the 4287A)

Query Response

{1|0}<newline><^END>

See also

:SYST:KLOC on page 305

:SYST:KLOC:MOUS on page 306

Equivalent key sequence

[System] - **KEY LOCK MENU** - **KBD LOCK**

:SYST:KLOC:MOUS

Syntax

:SYSTem:KLOCk:MOUSe {ON|OFF|1|0}

:SYSTem:KLOCk:MOUSe?

Description

Specifies whether to lock the mouse.

Parameters

	Description
ON or 1	Locked
OFF or 0 (initial value)	Unlocked

Query Response

{1|0}<newline><^END>

See also

:SYST:KLOC on page 305

:SYST:KLOC:KBD on page 305

Equivalent key sequence

[System] - **KEY LOCK MENU** - **MOUSE LOCK**

:SYST:POFF

Syntax

:SYSTem:PRESet

Description

Turns off the power to the 4287A. (No query)

Equivalent key sequence

standby switch

:SYST:PRES

Syntax

:SYSTem:PRESet

Description

Resets the instrument to its preset state. This command works similarly to the ***RST** command, except that it: (No query)

- Turns on the continuous activation of the trigger system.
- Has no effect on the data transfer format setting.

See also

***RST** on page 206

Equivalent key sequence

[Preset]

:SYST:TIME

Syntax

:SYSTem:TIME <hour>,<min>,<sec>

:SYSTem:TIME?

Description

Sets the time of the 4287A's internal clock.

Parameters

	<hour>	**<min>**	**<sec>**
Description	Hour part of the time (in the 24-hour format)	Minute part of the time	Second part of the time
Range	0 to 23	0 to 59	0 to 59
Resolution	1	1	1

If your specified parameter is beyond the valid range, the command fails and an error is generated.

Query Response

{hour},{min},{sec}<newline><^END>

See also

:SYST:DATE on page 303

Equivalent key sequence

[System] - SET DATE & TIME

:SYST:VERS?

Syntax

:SYSTem:VERSion?

Description

Returns the SCPI version number the instrument complies with. (Query only)

Query Response

{string}<newline><^END>

The command returns a string in a YYYY.V format. The YYYY part of this string indicates the year version while the V part indicates the version number within that year.

Equivalent key sequence

No equivalent keys are available on the front panel.

:TRIG

Syntax

:TRIGger[:SEQuence1][:IMMediate]

Description

When the trigger system is in trigger event detect state, you can use this command to immediately trigger the instrument to start measurement, regardless of the trigger setting. If the trigger system is not in trigger event detect state, however, issuing the command generates an error. For more information on the trigger system, see “Trigger system” on page 66. (No query)

Equivalent key sequence

No equivalent keys are available on the front panel.

:TRIG:DEL

Syntax

:TRIGger[:SEQuence1]:DELay <numeric>

:TRIGger[:SEQuence1]:DELay?

Description

Specifies the wait time (trigger delay time) between triggering and the start of single-point or list measurement.

Parameters

	<numeric>
Description	Trigger delay time
Range	0 to 1
Default	0
Unit	s (seconds)
Resolution	100E-6

If your specified parameter is beyond the valid range, the instrument ignores the parameter and uses either the maximum or minimum value depending on whether the parameter is greater than the upper limit or smaller than the lower limit.

Query Response

{numeric}<newline><^END>

See also

:TRIG:SEQ2:DEL on page 309

Equivalent key sequence

[Trigger Mode] - **SETUP DELAY** - **TRIGGER DELAY**

:TRIG:SEQ2:DEL

Syntax

:TRIGger:SEQuence2:DELay <numeric>

:TRIGger:SEQuence2:DELay?

Description

Specifies the pre-measurement wait time (measurement point delay time) for each measurement point.

Parameters

	<numeric>
Description	Measurement point delay time
Range	0 to 1
Default	0
Unit	s (seconds)
Resolution	100E-6

If your specified parameter is beyond the valid range, the instrument ignores the parameter and uses either the maximum or minimum value depending on whether the parameter is greater than the upper limit or smaller than the lower limit.

Query Response

{numeric}<newline><^END>

See also

:TRIG:DEL on page 308

Equivalent key sequence

[Trigger Mode] - **SETUP DELAY** - **POINT DELAY**

:TRIG:SLOP

Syntax

:TRIGger:SLOPe {POSitive|NEGative}

:TRIGger:SLOPe?

Description

Sets the polarity of the external trigger signal input through the rear panel EXT TRIGGER terminal and the handler interface.

Parameters

	Description
POSitive (initial value)	Positive (triggering at the rising edge from the LOW level to the HIGH level)
NEGative	Negative (triggering at the falling edge from the HIGH level to the LOW level)

Query Response

{POS|NEG}<newline><^END>

Equivalent key sequence

[Trigger Mode] - **TRIG PRLTY**

:TRIG:SOUR

Syntax

:TRIGger[:SEQuence1]:SOURce {INTernal|MANual|EXTernal|BUS}

:TRIGger[:SEQuence1]:SOURce?

Description

Lets you select one of the following four trigger sources:

Internal — Configures the instrument to use its internal trigger source so that is it automatically and continuously triggered.

Manual — Configures the instrument to be triggered when you press the **[Trigger]** key on the front panel.

External — Configures the instrument to be triggered when a trigger signal is input through the Ext TRIGGER terminal or handler interface.

GPIB/LAN — Configures the instrument to be triggered when the ***TRG** command on page 208 is issued.

Parameters

	Description
INTernal (initial value)	Internal trigger source
MANual	Manual trigger
EXTernal	External trigger source
BUS	GPIB/LAN trigger

Query Response

{INT|MAN|EXT|BUS}<newline><^END>

Equivalent key sequence

[Trigger Mode] - **TRIG SOURCE** - {**INTERNAL** | **MANUAL** | **EXTERNAL** | **BUS**}

Service command

This section describes the command for service engineers. If you use the command shown in this section, accuracy of measurement is not guaranteed.

:SOUR:LIST:RDC:AVER

Syntax

:SOURce:LIST:RDC:AVERage <numeric>

:SOURce:LIST:RDC:AVERage?

Description

Sets the averaging factor of the R_{dc} measurement.

For maximum reduction of measurement variations by ac line noise at measurements for service, set the averaging factor to following number.

When ac line frequency is 50 Hz: 2000

When ac line frequency is 60 Hz: 1667

Parameters

	<numeric>
Description	Averaging factor
Range	1 to 6000
Default	128
Resolution	1

If your specified parameter is beyond the valid range, the instrument ignores the parameter and uses either the maximum or minimum value depending on whether the parameter is greater than the upper limit or smaller than the lower limit.

Query response

{numeric}<newline><^END>

Equivalent key sequence

No equivalent keys are available on the front panel.

A Manual Changes

This appendix contains the information required to adapt this manual to earlier versions or configurations of the Agilent 4287A than that indicated by the current printing date of this manual. The information in this manual applies directly to the 4287A model that has the serial number prefix listed on the title page of this manual.

Manual Changes

To adapt this manual to your Agilent 4287A, refer to Table A-1 and Table A-2.

Table A-1 Manual Changes by Serial Number

Serial Prefix or Number	Make Manual Changes

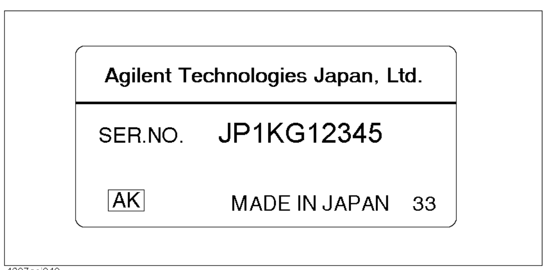
Table A-2 Manual Changes by Firmware Version

Version	Make Manual Changes
1.1x	"Change 1" on page 315, "Change 2" on page 315
1.20	"Change 2" on page 315

Agilent Technologies uses a two-part, ten-character serial number that is stamped on the serial number plate (Figure A-1). The first five characters are the serial prefix and the last five digits are the suffix.

Execute the ***IDN?** command on page 205 to check the firmware version.

Figure A-1 Example of Serial Number Plate



4287aoj048

Change 1

The firmware revision 1.1x dose not support the following commands. Please delete the descriptions about these commands in this manual.

- **:AVER:COUN** command on page 210
- **:MMEM:CAT?** command on page 288
- **:MMEM:COPY** command on page 289
- **:MMEM:CRE:DIR** command on page 289
- **:MMEM:DEL** command on page 290

Change 2

The firmware revision 1.1x, and 1.20 dose not support the following commands. Please delete the descriptions about these commands in this manual.

- **:DISP:CCL** command on page 269
- **:SOUR:LIST:RDC:OFSC** command on page 296

Manual Changes

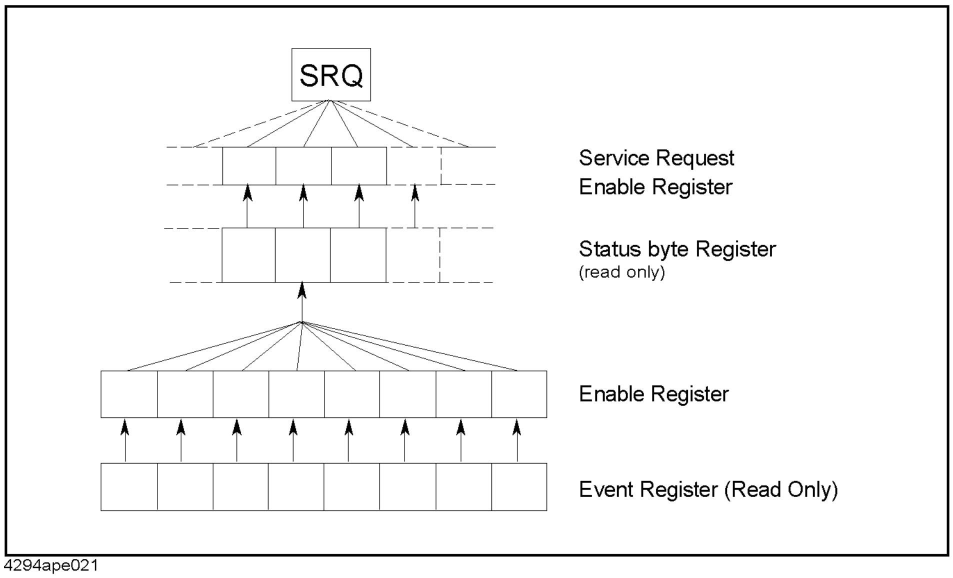
B Status Reporting System

This appendix describes the status reporting system of the Agilent 4287A.

General Status Register Model

The Agilent 4287A has a status reporting system to report the condition of the instrument.

Figure B-1 **General Status Register Model**



The status reporting system has a hierarchical structure as shown in Figure B-1.When the instrument satisfies a particular condition, the corresponding bit of the event register is set to 1.Therefore, you can check the instrument status by reading the event register.

When the event register bit is set to “1” and a corresponding enable register bit (a bit marked with an arrow in Figure B-1) is also “1,” the summary bit of the status byte register is set to “1.” You can read the status byte register by using the serial poll.

If the bit of the service request enable register is “1,” a service request (SRQ) is generated by the positive transition of the corresponding status byte register bit. By generating SRQ, you can notify the controller that the 4287A is requesting service. In other words, interruption by SRQ can be programmed. For more information on using SRQ, see “Waiting for (Detecting) End of Measurement” on page 70 in Chapter 5, “Starting Measurement Cycle (Triggering) and Detecting End of Measurement,” or “Using the Status Reporting System” on page 135 in Chapter 10, “Error Handling,”.

Event register

The event register reflects the corresponding condition of the 4287A (e.g., occurrence of an event) as a bit status. These bits continuously monitor changes in the 4287A's state and change the bit status when the condition (e.g., change bit status to "1" if a specific event occurs) for each bit is met. You cannot change the bit status by issuing a GPIB command.

The Agilent 4287A has the following event registers:

- Standard Event Status Register (see Table B-2 for details.)
- Operation Status Event Register (see Table B-3 for details.)
- Questionable Status Event Register (see Table B-4 for details.)

Enable register

Setting the enable register allows you to specify event register bits that can set "1" to the summary bit of the status byte register when an event occurs. The register bits work as mask bits; setting "1" to an enable register will enable a corresponding bit in the event register.

For example, when you want to set "1" as the summary bit in the status byte register by a specific register condition, set the corresponding enable register to "1."

Status byte register

If the enabled event register is set to "1," a corresponding bit of the status byte register is also set to "1." This register also indicates the output queue and SRQ status.

The value of the status byte register can be read by using the ***STB?** command on page 207 or the serial poll (SPOLL statement in HP BASIC) from the controller.

Reading the status byte register by using the ***STB?** command does not affect the contents of the status byte register. However, reading it with the SPOLL statement of HP BASIC will clear the RQS bit in the status byte register.

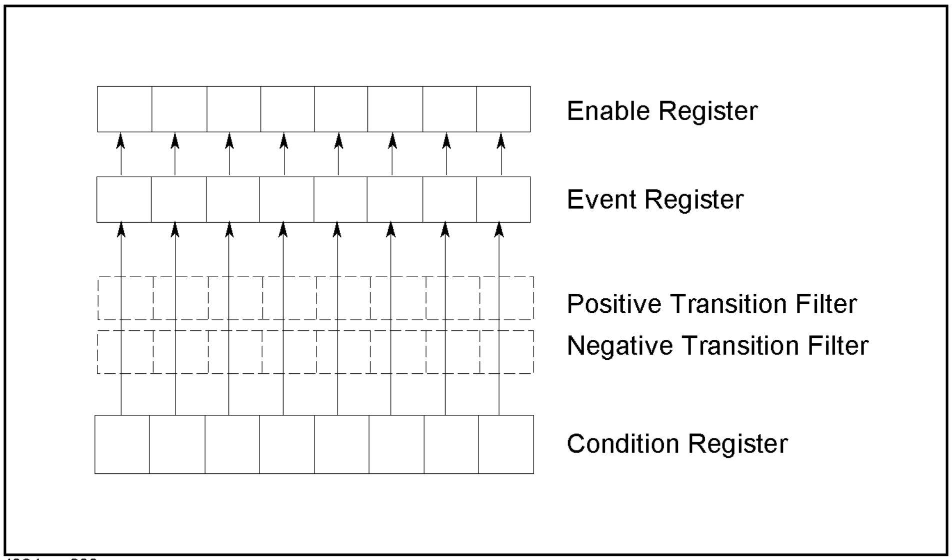
Setting the service request enable register using the ***SRE** command on page 207 can generate a service request synchronously with the status byte register.

Condition register and transition filter

When the status register has a transition filter, there is a lower register called a condition register under the event register. The transition filter is between the event register and the condition register.

The transition filter enables you to select a positive and/or negative transition of the condition register bit in order to set a bit in the corresponding event register. For example, using the negative transition filter to set bit 3 to “1” causes bit 3 of the event register to be set to “1” when bit 3 of the condition register makes a negative transition, that is, changes from 1 to 0,

Figure B-2 **Transition filter and condition register**



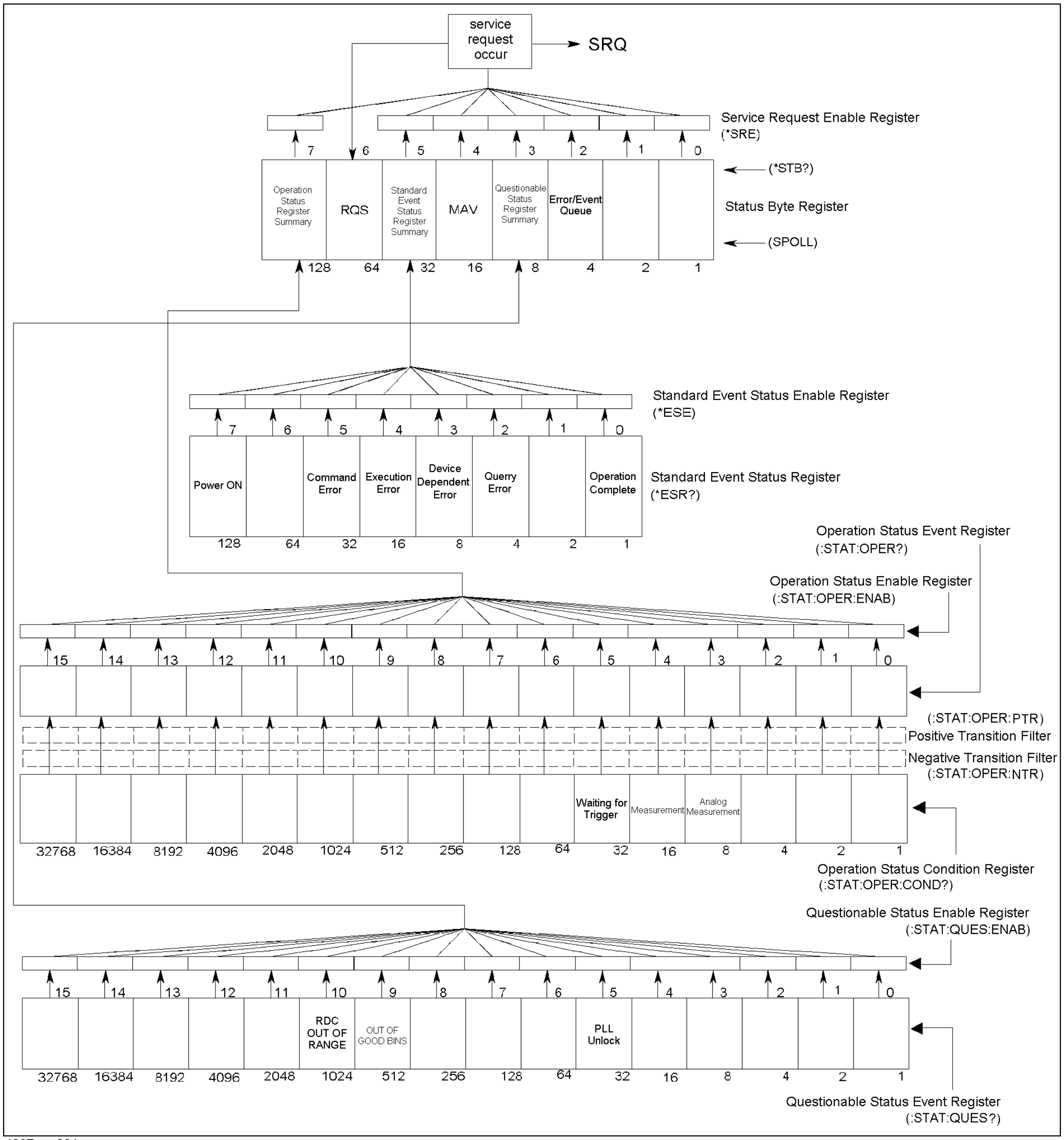
4294ape022

The 4287A's condition register and transition filter work only with the operation status register.

Status Register Structure

The status reporting system has a hierarchical structure as shown in Figure B-3. The status byte register is a summary of registers in the lower level. This section describes status registers in each hierarchy. Each bit of the status register is described in Table B-1 through Table B-4.

Figure B-3 Status Register Structure



4287ape001

Table B-1 Status Bit Definitions of Status Byte (STB)

Bit Position	Name	Description
0, 1	Not used	Always 0
2	Error/Event Queue	Set to “1” if the error/event queue contains data; reset to “0” when all of the data has been retrieved.
3	Questionable Status Register Summary	Set to “1” when one of the enabled bits in the status event status register is set to “1.”
4	MAV (Message Available)	Set to “1” when the output queue contains data; reset to “0” when all of the data has been retrieved.
5	Standard Event Status Register Summary	Set to “1” when one of the enabled bits in the status event status register is set to “1.”
6	RQS	Set to “1” when any of the status byte register bits enabled by the service request enable register is set to “1”; reset to “0” when all of the data has been retrieved through serial polling.
7	Operation Status Register Summary	Set to “1” when one of the enabled bits in the operational status register is set to “1.”

Issuing the ***CLS** command will clear all bits from the status byte register.

Table B-2 Status Bit Definitions of Event Status Register (ESR)

Bit Position	Name	Description
0	Operation Complete	Set to “1” upon completion of all operations done by commands that precede the ***OPC** command on page 205.
1	Not used	Always 0
2	Query Error	1. Set to “1” when the 4287A receives a data output request but there is no data to output. 2. Set to “1” when the data of the 4287A's output queue has been cleared because of a new message received before the completion of data output.
3	Device Dependent Error	Set to “1” when an error has occurred and the error is not a command, query, or execution error.
4	Execution Error	1. Set to “1” when any parameter in a GPIB command exceeds its input range or is inconsistent with the 4287A’s capabilities. 2. Set to “1” when a GPIB command cannot be properly executed due to some condition of the 4287A.
5	Command Error	1. Set to “1” when an IEEE 488.2 syntax error occurs (a command sent to the 4287A does not follow the IEEE 488.2 syntax). Possible violations include the command parameter violating the 4287A listening formats or being unacceptable. 2. Set to “1” when a semantic error occurs. Possible causes include a command containing misspellings being sent to the 4287A or an IEEE 488.2 command that is not supported by the 4287A being sent. 3. Set to “1” when GET (Group Execution Trigger) is input while a program message is being received.
6	Not used	Always 0
7	Power ON	Set to “1” when the 4287A is powered ON.

Issuing the ***CLS** command will clear all bits from the standard event status register.

Table B-3 Status Bit Definitions of the Operation Status Condition Register

Bit Position	Name	Description
0 to 2	Not used	Always 0
3	Analog Measurement	Set to “1” during analog measurement*1.
4	Measurement	Set to “1” during measurement*2.
5	Waiting for Trigger	Set to “1” when the instrument is waiting for a trigger*3.
6 to 15	Not used	Always 0

*1. This is when the handler interface’s /INDEX signal is active.
*2. This is when the handler interface’s /EOM signal is active.
*3. This is when the trigger system is in trigger wait state. For more information on the trigger system, refer to “Trigger system” on page 66.

Issuing the ***CLS** command will clear all bits from the operation status event register.

Table B-4 Status Bit Definitions of Questionable Status Event Register

Bit Position	Name	Description
0 to 4	Not used	Always 0
5	PLL Unlock	Set to “1” when a PLL unlock occurs.
6 to 8	Not used	Always 0
9	OUT OF GOOD BINS	Set to “1” when the bin sorting result is OUT OF GOOD BINS*1.
10	RDC OUT OF RANGE	Set to “1” when the result of R_{dc} measurement fails to fall within the specified limit range.
11 to 15	Not used	Always 0

*1. This is when the handler interface's /OUT_OF_GOOD_BINS is active (the DUT is sorted into the bad bin or not sorted into any bin).

Issuing the ***CLS** command will clear all bits from the questionable status event register.

Using the Status Reporting System

You can manage the status report system using the following commands in any combination:

- ***CLS** on page 204
- ***SRE** on page 207
- ***STB?** on page 207
- ***ESE** on page 204
- ***ESR?** on page 205
- **:STAT:PRES** on page 301
- **:STAT:OPER:ENAB** on page 299
- **:STAT:OPER:COND?** on page 299
- **:STAT:OPER?** on page 299
- **:STAT:OPER:PTR** on page 300
- **:STAT:OPER:NTR** on page 300
- **:STAT:QUES?** on page 301
- **:STAT:QUES:ENAB** on page 301

For sample programs that demonstrate the use of the commands listed above, refer to "Waiting for (Detecting) End of Measurement" on page 70 in Chapter 5 or "Using the Status Reporting System" on page 135 in Chapter 10.

NOTE You cannot use the ***STB?** command in telnet session. Refer Figure B-3, "Status Register Structure," and use the command to read lower level registers of the status byte register.

C GPIB Command Table

This appendix provides the Agilent 4287A GPIB command list sorted according to function.

GPIB Command Table

The following table lists the 4287A GPIB commands sorted according to function. See Chapter 16, “Command Reference,” on page 201 for detailed information on the 4287A GPIB commands.

Function	Setting/Operation		GPIB Command
Measurement Condition	Reset	Turns off the continuous activation of the trigger system.	***RST** (page 206)
		Turns on the continuous activation of the trigger system.	**:SYST:PRES** (page 306)
	Measurement parameter		**:CALC:PAR{1-4}:FORM** (page 230)
	List measurement On/Off		**:SOUR:LIST:STAT** (page 297)
	Measurement point for single-point measurement		**:SOUR:LIST:POIN** (page 295)
	Active table		**:SOUR:LIST:TABL** (page 297)
	Measurement point setup table (stimulus setup table)	Clear	**:SOUR:LIST:CLE** (page 295)
		Unit of oscillator level	**:SOUR:UNIT** (page 298)
		Oscillator (frequency, level) and averaging factor	**:SOUR:LIST** (page 294)
		Averaging factor	**:AVER:COUN** (page 210)
		Reads the number of measurement points	**:SOUR:LIST:SIZE?** (page 296)
	R_{dc} measurement	On/Off	**:SOUR:LIST:RDC** (page 296)
		Offset cancel function On/Off	**:SOUR:LIST:RDC:OFSC** (page 296)
		Limit range	**:CALC:COMP:RDC:LIM** (page 224)
	Deviation measurement	On/Off	**:CALC:PAR{1-4}:EXPR:STAT** (page 229)
		Mode	**:CALC:PAR{1-4}:EXPR:NAME** (page 229)
		Reference value	**:CALC:PAR{1-4}:EXPR:CENT** (page 228)
	Delay time	Trigger delay	**:TRIG:DEL** (page 308)
		Measurement point delay	**:TRIG:SEQ2:DEL** (page 309)

GPIB Command Table

Function	Setting/Operation			GPIB Command
Calibration	Calibration kit selection			**:CORR1:CKIT** (page 231)
	Standard definition for user calibration kit	Impedance definition method (fixed/point-by-point)		**:CORR1:CKIT:LIST** (page 232)
		Open	Impedance value (G and Cp)	**:CORR1:CKIT:STAN1:LIST** (page 235)
			Dc conductance value	**:CORR1:CKIT:STAN1:DC** (page 233)
			Offset delay	**:CORR1:CKIT:STAN1:EDEL** (page 234)
		Short	Impedance value (Rs and Ls)	**:CORR1:CKIT:STAN2:LIST** (page 238)
			Dc resistance value (R_{dc})	**:CORR1:CKIT:STAN2:DC** (page 236)
			Offset delay	**:CORR1:CKIT:STAN2:EDEL** (page 237)
		Load	Definition impedance parameter type	**:CORR1:CKIT:STAN3:FORM** (page 241)
			Impedance value	**:CORR1:CKIT:STAN3:LIST** (page 242)
			Dc resistance value (R_{dc})	**:CORR1:CKIT:STAN3:DC** (page 239)
			Offset delay	**:CORR1:CKIT:STAN3:EDEL** (page 240)
	Measurement of data for calibration coefficient calculation	Data for Impedance and R_{dc} measurement		**:CORR1:COLL** (page 244)
		Data for Impedance measurement		**:CORR1:COLL:RF** (page 246)
		Data for R_{dc} measurement		**:CORR1:COLL:DC** (page 245)
	Checks calibration status (On/Off)			**:CORR1?** (page 231)
	Calculates the calibration coefficient and turns on the calibration function			**:CORR1:COLL:SAVE** (page 246)

GPIB Command Table

Function	Setting/Operation			GPIB Command
Compensation	Selection of standard values (default values/user defined values)			**:CORR2:CKIT** (page 247)
	Standard definition	Impedance definition method (fixed/point-by-point)		**:CORR2:CKIT:LIST** (page 247)
		Open	Impedance value (G and Cp)	**:CORR2:CKIT:STAN1:LIST** (page 249)
			Dc conductance value	**:CORR2:CKIT:STAN1:DC** (page 248)
		Short	Impedance value (Rs and Ls)	**:CORR2:CKIT:STAN2:LIST** (page 251)
			Dc resistance value (R_{dc})	**:CORR2:CKIT:STAN2:DC** (page 250)
	Measurement of data for compensation coefficient calculation	Data for Impedance and R_{dc} measurement		**:CORR2:COLL** (page 252)
		Data for Impedance measurement		**:CORR2:COLL:RF** (page 254)
		Data for R_{dc} measurement		**:CORR2:COLL:DC** (page 253)
	Calculates the compensation coefficient and turns on the compensation function			**:CORR2:COLL:SAVE** (page 255)
	Open compensation function On/Off			**:CORR2:COLL:OPEN** (page 254)
	Short compensation function On/Off			**:CORR2:COLL:SHOR** (page 255)
Test fixture selection (port extension compensation function)	Fixture selection			**:CORR2:FIXT** (page 256)
	User fixture setting	Electrical length		**:CORR2:FIXT:EDEL:DIST** (page 257)
		Fixture name		**:CORR2:FIXT:LAB** (page 258)

Function	Setting/Operation				GPIB Command
Comparator (BIN sort)	On/Off				**:CALC:COMP** (page 211)
	Reads comparator result				**:CALC:COMP:DATA:BIN?** (page 221)
	Beep mode				**:CALC:COMP:BEEP:COND** (page 211)
	Fixes the boundary line between good BIN and no good BIN				**:CALC:COMP:OGB** (page 223)
	BIN setting	Clears all settings			**:CALC:COMP:CLE** (page 214)
		On/Off of each BIN			**:CALC:COMP:BIN{1-13}** (page 212)
		Sorting condition setting	For all BINs	Measurement point number	**:CALC:COMP:COND{1-4}:SNUM** (page 218)
				Parameter	**:CALC:COMP:COND{1-4}:PAR** (page 217)
				limit mode	**:CALC:COMP:COND{1-4}:MODE** (page 215)
				Nominal value	**:CALC:COMP:COND{1-4}:NOM** (page 216)
			For each BIN	Limit range	**:CALC:COMP:BIN{1-13}:COND{1-4}:LIM** (page 213)
				BIN range mode	**:CALC:COMP:BIN{1-13}:COND{1-4}:LTYP** (page 214)
	BIN counter	On/Off			**:CALC:COMP:COUN** (page 219)
		Count number	Clear		**:CALC:COMP:COUN:CLE** (page 219)
			Read		**:CALC:COMP:DATA:BCOU?** (page 220)
	R_{dc} measurement comparator (for contact check)	Limit range			**:CALC:COMP:RDC:LIM** (page 224)
		Evaluation result			**:CALC:COMP:DATA:RDC?** (page 222)
Trigger	Triggering				**:TRIG** (page 308)
	Triggering and measurement data reading				***TRG** (page 208)
	Trigger source				**:TRIG:SOUR** (page 310)
	Polarity of external trigger				**:TRIG:SLOP** (page 309)
	Delay time	Trigger delay			**:TRIG:DEL** (page 308)
		Measurement point delay			**:TRIG:SEQ2:DEL** (page 309)
	Trigger system	Reset			**:ABOR** (page 209)
		Initiates once			**:INIT** (page 287)
		Continuous activation On/Off			**:INIT:CONT** (page 287)

GPIB Command Table

Function	Setting/Operation		GPIB Command
Data read/write	Data transfer format	Sets the format	**:FORM** (page 282)
		Sets the byte order of binary transfer format	**:FORM:BORD** (page 283)
	Triggers and reads measurement data		***TRG** (page 208)
	Reads measurement data		**:FETC?** (page 280)
	Reads measurement data when measurement completed after triggering		**:READ?** (page 293)
	Reads measurement data array		**:DATA:RAW?** (page 264)
	Reads display data array		**:DATA:FDAT{1-4}?** (page 263)
	R_{dc} measurement	Reads R_{dc} measurement result	**:DATA:RDC?** (page 267)
		Reads comparator evaluation result	**:CALC:COMP:DATA:RDC?** (page 222)
	Test signal level monitor	Reads current level	**:DATA:IMON?** (page 263)
		Reads voltage level	**:DATA:VMON?** (page 267)
	Reads/writes calibration coefficients		**:DATA:CCO{1-6}** (page 260)
	Reads data to calculate calibration coefficients		**:DATA:CAD{1-8}?** (page 259)
	Reads/writes calibration coefficients for R_{dc} measurement		**:DATA:RCCO{1-3}** (page 265)
	Reads data to calculate calibration coefficients for R_{dc} measurement		**:DATA:RCAD{1-3}?** (page 265)
	Reads/writes compensation coefficients		**:DATA:CMP{1-3}** (page 262)
	Reads data to calculate compensation coefficients		**:DATA:CMD{1-2}?** (page 261)
	Reads/writes compensation coefficients for R_{dc} measurement		**:DATA:RCMP{1-3}** (page 266)
	Reads data to calculate compensation coefficients for R_{dc} measurement		**:DATA:RCMD{1-2}?** (page 266)
	Reads BIN sort result		**:CALC:COMP:DATA:BIN?** (page 221)
	Reads BIN count result		**:CALC:COMP:DATA:BCOU?** (page 220)
Statistical analysis	Executes statistical analysis and reads its results		**:CALC:EXAM:GET?** (page 225)
	Starts logging data for statistical analysis		**:CALC:EXAM:STAR** (page 228)
	Sets maximum data size		**:CALC:EXAM:SIZE** (page 227)
	Reads logged data size		**:CALC:EXAM:POIN?** (page 226)

GPIB Command Table

Function	Setting/Operation		GPIB Command
Status report structure	Clears registers		***CLS** (page 204)
	Reads status byte register		***STB?** (page 207)
	Reads service request enable register		***SRE** (page 207)
	Standard event status register	Reads register	***ESR?** (page 205)
		Sets enable register	***ESE** (page 204)
		Setting of OPC bit when operation finishes	***OPC** (page 205)
	Operation status register	Resets	**:STAT:PRES** (page 301)
		Reads condition register	**:STAT:OPER:COND?** (page 299)
		Sets enable register	**:STAT:OPER:ENAB** (page 299)
		Reads event register	**:STAT:OPER?** (page 299)
		Sets positive transition filter	**:STAT:OPER:PTR** (page 300)
		Sets negative transition filter	**:STAT:OPER:NTR** (page 300)
	Questionable status register	Resets	**:STAT:PRES** (page 301)
		Sets enable register	**:STAT:QUES:ENAB** (page 301)
		Reads event register	**:STAT:QUES?** (page 301)
Save/Recall and file management	Save		**:MMEM:STOR** (page 291)
	Recall		**:MMEM:LOAD** (page 290)
	Copy		**:MMEM:COPY** (page 289)
	Creates a new directory (folder)		**:MMEM:CRE:DIR** (page 289)
	Deletes an existing file or directory		**:MMEM:DEL** (page 290)
	Reads the information about a storage device		**:MMEM:CAT?** (page 288)
Printer	Selection of printer		**:HCOP:DPR** (page 285)
	Reads information of available printers		**:HCOP:PRIN?** (page 286)
	Print out	Executes	**:HCOP** (page 284)
		Aborts	**:HCOP:ABOR** (page 284)
	Print setting	Contents	**:HCOP:CONT** (page 284)
		Color	**:HCOP:IMAG** (page 286)

GPIB Command Table

Function	Setting/Operation			GPIB Command
Display	LCD's backlight On/Off			**:DISP:BACK** (page 268)
	Display On/Off			**:DISP** (page 268)
	Update On/Off			**:DISP:UPD** (page 279)
	Results	Display On/Off		**:DISP:TEXT1** (page 269)
		Result of measurement parameter 1 to 4	Display On/Off	**:DISP:TEXT1:CALC{1-4}** (page 270)
			Number of digits	**:DISP:TEXT1:CALC{1-4}:DIG** (page 270)
			Fixed decimal point mode On/Off	**:DISP:TEXT1:CALC{1-4}:FIX** (page 271)
			Most significant digit	**:DISP:TEXT1:CALC{1-4}:MSD** (page 271)
		Result of test signal level monitor	Display On/Off	**:DISP:TEXT1:CALC{11-12}** (page 272)
			Number of digits	**:DISP:TEXT1:CALC{11-12}:DIG** (page 272)
			Fixed decimal point mode On/Off	**:DISP:TEXT1:CALC{11-12}:FIX** (page 273)
			Most significant digit	**:DISP:TEXT1:CALC{11-12}:MSD** (page 273)
		Result of R_{dc} measurement	Number of digits	**:DISP:TEXT1:CALC13:DIG** (page 274)
			Fixed decimal point mode On/Off	**:DISP:TEXT1:CALC13:FIX** (page 274)
			Most significant digit	**:DISP:TEXT1:CALC13:MSD** (page 275)
	Title	Display On/Off		**:DISP:TEXT10** (page 276)
		Title characters		**:DISP:TEXT10:DATA** (page 276)
	Time and date	Display On/Off		**:DISP:TEXT11** (page 277)
		Update On/Off		**:DISP:TEXT11:MODE** (page 277)
	Displayed item in list measurement display			**:DISP:TEXT2:LAB{1-4}** (page 278)
	Clears the displayed error message			**:DISP:CCL** (page 269)
Key lock	Front panel key			**:SYST:KLOC** (page 305)
	Keyboard			**:SYST:KLOC:KBD** (page 305)
	Mouse			**:SYST:KLOC:MOUS** (page 306)
Beeper	Beep to notify the completion of operation		On/Off	**:SYST:BEEP1:STAT** (page 302)
			Generation of a beep	**:SYST:BEEP1** (page 302)
	Beep to notify an error/warning or sorting results		On/Off	**:SYST:BEEP2:STAT** (page 303)
			Generation of a beep	**:SYST:BEEP2** (page 302)
Internal clock	Sets the date			**:SYST:DATE** (page 303)
	Sets the time			**:SYST:TIME** (page 307)

GPIB Command Table

Function	Setting/Operation		GPIB Command
Other functions	Shutdown		**:SYST:POFF** (page 306)
	Executes the self-test		***TST?** (page 208)
	Reads product information		***IDN?** (page 205)
	Reads error queue	Error number and error message	**:SYST:ERR?** (page 304)
		Number of errors	**:SYST:ERR:COUN?** (page 304)
	Checks whether the external reference signal is inputted at Ext Ref In terminal		**:SYST:EXTR?** (page 304)
	Reads the SCPI version		**:SYST:VERS?** (page 307)
	Waits for the completion of operation		***WAI** (page 208)
	Reads 1 when operation is complete		***OPC?** (page 205)
	Sets 1 to OPC bit when operation is complete		***OPC** (page 205)

GPIB Command Table

D GPIB Command Tree

This appendix provides the Agilent 4287A GPIB command tree.

Command Tree

The Agilent 4287A command tree is shown in the following table.

Command	Parameter	Note
ABORt		[No query]
CALCulate		
:COMParator		
:BEEPer		
:CONDition	{PASS|FAIL}	
[:STATe]	{ON|OFF|1|0}	
:BIN{1|2|3|4|5|6|7|8|9|10|11|12|13}		
:CONDition{1|2|3|4}		
:LIMit	<numeric>,<numeric>	
:LTYPe	{IN|OUT|ALL}	
[:STATe]	{ON|OFF|1|0}	
:CLEar		[No query]
:CONDition{1|2|3|4}		
:MODE	{ABS|DEV|PCNT}	
:NOMinal	<numeric>	
:PARameter	{Z|Y|LS|LP|CS|CP|RS|RP|D|Q|X|G|B|TZR|TZD|TYR|TYD}	
:SNUMber	<numeric>	
:COUNt		
:CLEar		[No query]
[:STATe]	{ON|OFF|1|0}	
:DATA		
:BCOU?		[Query only]
:BIN?		[Query only]
:RDC?		[Query only]
:OGBINs	<numeric>	
:RDC		
:LIMit	<numeric>,<numeric>	
[:STATe]	{ON|OFF|1|0}	
PARameter		
[:MATH]		
:EXAMine		
[:MEMory]		
:STARt		[No query]
:POINt?	<numeric>	[Query only]
:SAVE		[No query]
PARameter{1|2|3|4}		
:FORMat	{Z|Y|LS|LP|CS|CP|RS|RP|D|Q|X|G|B|TZR|TZD|TYR|TYD}	
[:MATH]		
:EXAMine		[No query]
:GET?	<numeric>	[Query only]
:LIMit	<numeric>,<numeric>	
:EXPRession		
:CENTer	<numeric>	
:NAME	{DEV|PCNT}	
:STATe	{ON|OFF|1|0}	

Command	Parameter	Note
DATA		
[:DATA]		
:CAD{1|2|3|4|5|6|7|8}?		[Query only]
:CCO{1|2|3|4|5|6}	<numeric>,..,<numeric>	
:CMD{1|2}?		[Query only]
:CMP{1|2|3}	<numeric>,..,<numeric>	
:FDATa{1|2|3|4}?		[Query only]
:IMON?		[Query only]
:RAW?		[Query only]
:RCAD{1|2|3}?		[Query only]
:RCCO{1|2|3}	<numeric>	
:RCMD{1|2}?		[Query only]
:RCMP{1|2|3}	<numeric>	
:RDC?		[Query only]
:VMON?		[Query only]
DISPlay		
:BACKlight	{ON|OFF|1|0}	
:CCLear		[No query]
:UPDate	{ON|OFF|1|0}	
[:WINDow]		
[:STATe]	{ON|OFF|1|0}	
:TEXT1		
:CALCulate{1|2|3|4}		
[:STATe]	{ON|OFF|1|0}	
:DIGit	<numeric>	
:FIX	{ON|OFF|1|0}	
:MSD	<numeric>	
:CALCulate{11|12}		
[:STATe]	{ON|OFF|1|0}	
:DIGit	<numeric>	
:FIX	{ON|OFF|1|0}	
:MSD	<numeric>	
:CALCulate13		
:DIGit	<numeric>	
:FIX	{ON|OFF|1|0}	
:MSD	<numeric>	
[:STATe]	{ON|OFF|1|0}	
:TEXT10		
:DATA	<string>	
[:STATe]	{ON|OFF|1|0}	
:TEXT11		
[:STATe]	{ON|OFF|1|0}	
:MODE	{STAMp|LIVE}	
:TEXT2		
:LABel{1|2|3|4}	{PAR1|PAR2|PAR3|PAR4|VMON|IMON|FREQ|AVER|POW|RDC}	

Command	Parameter	Note
FETCh?		[Query only]
FORMat		
:BORDer	{NORMal|SWAPped}	
[:DATA]	{ASCii|REAL}	
HCOPy		
:ABORt		[No query]
:CONtent	{SCReen|SETup|LIST}	
:DPRINter	<numeric>	
:IMAGe	{NORMal|INVert|MONochrome}	
:PRINters?		[Query only]
[:IMMediate]		[No query]
INITiate		
:CONTinuous	{ON|OFF|1|0}	
[:IMMediate]		[No query]
MMEMory		
:CATalog?		[Query only]
:COPY	<string>,<string>	[No query]
:CREate		
:DIRectory	<string>	[No query]
:DELete	<string>	[No query]
:LOAD	<string>	[No query]
:STORe	<string>	[No query]
READ?		[Query only]

<table>
<tr><th>Command</th><th>Parameter</th><th>Note</th></tr>
<tr><td>[SENSe]</td><td></td><td></td></tr>
<tr><td>:AVERage</td><td></td><td></td></tr>
<tr><td>:COUNt</td><td><numeric></td><td></td></tr>
<tr><td>:CORRection1</td><td></td><td></td></tr>
<tr><td>:CKIT</td><td>{DEFault|USER}</td><td></td></tr>
<tr><td>:LIST</td><td></td><td></td></tr>
<tr><td>[:STATe]</td><td>{ON|OFF|1|0}</td><td></td></tr>
<tr><td>:STANdard1</td><td></td><td></td></tr>
<tr><td>:DC</td><td><numeric></td><td></td></tr>
<tr><td>:EDELay</td><td></td><td></td></tr>
<tr><td>[:TIME]</td><td><numeric></td><td></td></tr>
<tr><td>:LIST</td><td><numeric>,<numeric>,<numeric></td><td></td></tr>
<tr><td>:STANdard2</td><td></td><td></td></tr>
<tr><td>:DC</td><td><numeric></td><td></td></tr>
<tr><td>:EDELay</td><td></td><td></td></tr>
<tr><td>[:TIME]</td><td><numeric></td><td></td></tr>
<tr><td>:LIST</td><td><numeric>,<numeric>,<numeric></td><td></td></tr>
<tr><td>:STANdard3</td><td></td><td></td></tr>
<tr><td>:DC</td><td><numeric></td><td></td></tr>
<tr><td>:EDELay</td><td></td><td></td></tr>
<tr><td>[:TIME]</td><td><numeric></td><td></td></tr>
<tr><td>:FORMat</td><td>{RL|LQF|CDF}</td><td></td></tr>
<tr><td>:LIST</td><td><numeric>,<numeric>,<numeric></td><td></td></tr>
<tr><td>:COLLect</td><td></td><td></td></tr>
<tr><td>[:ACQuire]</td><td>{STANdard1|STANdard2|STANdard3|STANdard4}</td><td>[No query]</td></tr>
<tr><td>:RF</td><td>{STANdard1|STANdard2|STANdard3|STANdard4}</td><td>[No query]</td></tr>
<tr><td>:DC</td><td>{STANdard1|STANdard2|STANdard3}</td><td>[No query]</td></tr>
<tr><td>:SAVE</td><td></td><td>[No query]</td></tr>
<tr><td>[:STATe]?</td><td>{1|0}</td><td>[Query only]</td></tr>
<tr><td>:CORRection2</td><td></td><td></td></tr>
<tr><td>:CKIT</td><td>{DEFault|USER}</td><td></td></tr>
<tr><td>:LIST</td><td></td><td></td></tr>
<tr><td>[:STATe]</td><td>{ON|OFF|1|0}</td><td></td></tr>
<tr><td>:STANdard1</td><td></td><td></td></tr>
<tr><td>:DC</td><td><numeric></td><td></td></tr>
<tr><td>:LIST</td><td><numeric>,<numeric>,<numeric></td><td></td></tr>
<tr><td>:STANdard2</td><td></td><td></td></tr>
<tr><td>:DC</td><td><numeric></td><td></td></tr>
<tr><td>:LIST</td><td><numeric>,<numeric>,<numeric></td><td></td></tr>
<tr><td>:COLLect</td><td></td><td></td></tr>
<tr><td>[:ACQuire]</td><td>{STANdard1|STANdard2}</td><td>[No query]</td></tr>
<tr><td>:RF</td><td>{STANdard1|STANdard2}</td><td>[No query]</td></tr>
<tr><td>:DC</td><td>{STANdard1|STANdard2}</td><td>[No query]</td></tr>
<tr><td>:OPEN</td><td></td><td></td></tr>
<tr><td>[:STATe]</td><td>{ON|OFF|1|0}</td><td></td></tr>
<tr><td>:SAVE</td><td></td><td>[No query]</td></tr>
<tr><td>:SHORT</td><td></td><td></td></tr>
<tr><td>[:STATe]</td><td>{ON|OFF|1|0}</td><td></td></tr>
<tr><td>:FIXTure</td><td>{NONE|16191A|16192A|16193A|16196A|16196B|16196C|USER}</td><td></td></tr>
<tr><td>:LABel</td><td><string></td><td></td></tr>
<tr><td>:EDELay</td><td></td><td></td></tr>
<tr><td>:DISTance</td><td><numeric></td><td></td></tr>
</table>

Command			Parameter	Note
SOURce				
	:LIST		<numeric>,..,<numeric> (Nop*1×3+1 parameters)	
		:CLEar		[No query]
		:POINt	<numeric>	
		:RDC	{ON|OFF|1|0}	
		:OFSCancel	{ON|OFF|1|0}	
		:SIZE?		[Query only]
		:STATe	{ON|OFF|1|0}	
		:TABLe	<numeric>	
	:UNIT		{DBM|V|A}	
STATus				
	:OPERation			
		:CONDition?		[Query only]
		:ENABle	<numeric>	
		:NTRansition	<numeric>	
		:PTRansition	<numeric>	
		[:EVENt]?		[Query only]
	:PRESet			[No query]
	:QUEStionable			
		:ENABle	<numeric>	
		[:EVENt]?		[Query only]
SYSTem				
	:BEEPer1			
		[:IMMediate]		[No query]
		:STATe	{ON|OFF|1|0}	
	:BEEPer2			
		[:IMMediate]		[No query]
		:STATe	{ON|OFF|1|0}	
	:DATE		<numeric>,<numeric>,<numeric>	
	:ERRor?			[Query only]
	:ERRor			
		:COUNt?		[Query only]
	:EXTRef?			[Query only]
	:KLOCk			
		[:FRONt]	{ON|OFF|1|0}	
		:KBD	{ON|OFF|1|0}	
		:MOUSe	{ON|OFF|1|0}	
	:POFF			[No query]
	:PRESet			[No query]
		:CONFirm	{ON|OFF|1|0}	
	:TIME		<numeric>,<numeric>,<numeric>	
	:VERSion?			[Query only]
TRIGger				
	[:SEQuence1]			
		:DELay	<numeric>[MS|M|S]	
		[:IMMediate]		[No query]
		:SOURce	{INTernal|MANual|EXTernal|BUS}	
	:SEQuence2			
		:DELay	<numeric>[MS|M|S]	
	:SLOPe		{POSitive|NEGative}	

*1. Nop: The number of measurement points defined in the active table.

E 4286A vs. 4287A GPIB Commands Correspondence Table

This appendix gives the correspondence between the Agilent 4287A GPIB commands and those of the Agilent 4286A.

4286A vs. 4287A GPIB Commands Correspondence Table

The table below shows the correspondence between the 4286A and 4287A GPIB commands. For details of each command, refer to the 4286A *Programming Description Manual* and Chapter 16, "Command Reference," in the 4287A *Programming Description Manual*.

NOTE

There are some cases where the corresponding commands differ in how they are used (e.g., how to supply the parameter(s)). Therefore, it is important to fully understand the details of each command's function for the particular machine you are using. For example, the measurement parameters setting commands listed in the table are **:CALC:FORM** for the 4286A and**:CALC:PAR{1-4}:FORM** on page 230 for the 4287A, which differ in their use as shown in the example below. **Accordingly, simple command replacement cannot modify a 4286A program into one suitable for the 4287A.**

Example: Setting Ls-Q as the measurement parameter (HP BASIC):

4286A:
```
10  OUTPUT 717; ":CALC:FORM LSQ"
```

4287A:
```
10  OUTPUT 717; ":CALC:PAR1:FORM LS"
20  OUTPUT 717; ":CALC:PAR2:FORM Q"
```

4286A vs. 4287A GPIB Commands Correspondence Table

Function	Item to set/run		GPIB command	
			4286A	4287A
Measurement settings	Reset	Trigger System Consecutive Start Off	***RST**	←on page 206
		Trigger System Consecutive Initiation On	**:SYST:PRES**	←on page 306
	Measurement Parameter Setting		**:CALC:FORM**	**:CALC:PAR{1-4}:FORM** on page 230
	Set Measurement Points and Test Signal	Set Test Signal Level	**:SOUR:POW** **:SOUR:CURR** **:SOUR:VOLT**	(Because these differ in how they are used, there is no one-to-one correspondence between the two machines' commands.) **:SOUR:LIST** on page 294 **:SOUR:UNIT** on page 298 **:SOUR:LIST:CLE** on page 295 **:SOUR:LIST:STAT** on page 297 **:SOUR:LIST:POIN** on page 295 **:SOUR:LIST:TABL** on page 297 **:AVER:COUN** on page 210
		Set List Table	**:SENS:LIST:CLE** **:SENS:LIST:MODIF:SEGM{1-10}:FREQ** **:SENS:LIST:MODIF:SEGM{1-10}:AVER:COUN** **:SENS:LIST:SAVE** **:SENS:LIST:SEGM** **:SENS:LIST:SEGM:ADD** **:SENS:LIST:SEGM:AVER:COUN** **:SENS:LIST:SEGM:DEL** **:SENS:LIST:SEGM:EDIT** **:SENS:LIST:SEGM:FREQ** **:SENS:LIST:SEGM:QUIT** **:SENS:LIST:SEGM:SAVE**	
	Set R_{dc} Measurement	Measurement ON/OFF	**:SENS:RDC**	**:SOUR:LIST:RDC** on page 296
		Comparator ON/OFF	**:CALC:RDC:LIM:STAT**	None. (This is done by turning ON/OFF the entire function of the comparator.)
		Limit Value	**:CALC:RDC:LIM:UPP** **:CALC:RDC:LIM:LOW**	**:CALC:COMP:RDC:LIM** on page 224
	Set Delay Time	Trigger Delay (for each trigger)	**:SENS:SWE:DWEL2**	**:TRIG:DEL** on page 308
		Point Delay	**:SENS:SWE:DWEL1**	**:TRIG:SEQ2:DEL** on page 309

4286A vs. 4287A GPIB Commands Correspondence Table

Function	Item to set/run		GPIB command	
			4286A	4287A
Calibration	Select Calibration Kit		**:SENS:CORR1:CKIT**	**:CORR1:CKIT** on page 231
	Set User Definition Calibration Kit		**:SENS:CORR1:CKIT:LAB**	None.
	Save User Definition Calibration Kit		**:SENS:CORR1:CKIT:SAVE**	None. (Saved with the hardware settings.)
	Define Each Standard of User Definition Calibration Kit	Select How to Define Impedance Value (for each fixed point and measurement point)	None.	**:CORR1:CKIT:LIST** on page 232
		Define Open	**:SENS:CORR1:CKIT:STAN1:G** **:SENS:CORR1:CKIT:STAN1:C**	**:CORR1:CKIT:STAN1:LIST** on page 235 **:CORR1:CKIT:STAN1:DC** on page 233 **:CORR1:CKIT:STAN2:LIST** on page 238
		Define Short	**:SENS:CORR1:CKIT:STAN2:R** **:SENS:CORR1:CKIT:STAN2:L**	**:CORR1:CKIT:STAN2:LIST** on page 238 **:CORR1:CKIT:STAN2:DC** on page 236 **:CORR1:CKIT:STAN2:EDEL** on page 237
		Define Load	**:SENS:CORR1:LOAD:TYPE** **:SENS:CORR1:CKIT:STAN3:R** **:SENS:CORR1:CKIT:STAN3:L** **:SENS:CORR1:CKIT:STAN3:Q** **:SENS:CORR1:CKIT:STAN3:F**	**:CORR1:CKIT:STAN3:FORM** on page 241 **:CORR1:CKIT:STAN3:LIST** on page 242 **:CORR1:CKIT:STAN3:DC** on page 239 **:CORR1:CKIT:STAN3:EDEL** on page 240
	Measure Calibration Coefficient Calculation Data		**:SENS:CORR1:COLL**	**:CORR1:COLL** on page 244 **:CORR1:COLL:RF** on page 246 **:CORR1:COLL:DC** on page 245
	Select Measurement Points for Calibration Coefficient Calculation Data		**:SENS:CORR1:COLL:FPO**	None. (There is no mode for measuring data with fixed measurement points.)
	Check Calibration Function ON/OFF		**:SENS:CORR1?**	**:CORR1?** on page 231
	Calibrate Calibration Coefficient and Turn On Calibration Function		**:SENS:CORR1:COLL:SAVE**	**:CORR1:COLL:SAVE** on page 246
	Set Extension of Port		**:SENS:CORR1:EDEL:STAT** **:SENS:CORR1:EDEL**	None. (The same function can be implemented with the electrical length setting of fixture selection.)

4286A vs. 4287A GPIB Commands Correspondence Table

Function	Item to set/run		GPIB command 4286A	GPIB command 4287A
Compensation	Select Compensation Kit		None.	**:CORR2:CKIT** on page 247
	Set User Definition Compensation Kit Label		**:SENS:CORR2:CKIT:LAB**	None.
	Save User Definition Compensation Kit		**:SENS:CORR2:CKIT:SAVE**	None. (Saved with the hardware settings.)
	Define Each Standard of User Definition Compensation Kit	Select How to Define Impedance Value (for each fixed point and measurement point)	None.	**:CORR2:CKIT:LIST** on page 247
		Define Open	**:SENS:CORR2:CKIT:STAN1:G** **:SENS:CORR2:CKIT:STAN1:C**	**:CORR2:CKIT:STAN1:LIST** on page 249 **:CORR2:CKIT:STAN1:DC** on page 248
		Define Short	**:SENS:CORR2:CKIT:STAN2:R** **:SENS:CORR2:CKIT:STAN2:L**	**:CORR2:CKIT:STAN2:LIST** on page 251 **:CORR2:CKIT:STAN2:DC** on page 250
		Define Load	**:SENS:CORR2:CKIT:STAN3:R** **:SENS:CORR2:CKIT:STAN3:L**	None. (Cannot perform load compensation.)
	Select Definition Value of User Definition Compensation Kit		**:SENS:CORR2:CKIT:STAN1** **:SENS:CORR2:CKIT:STAN2** **:SENS:CORR2:CKIT:STAN3**	None.
	Measure Compensation Coefficient Calculation Data		**:SENS:CORR2:COLL**	**:CORR2:COLL** on page 252 **:CORR2:COLL:RF** on page 254 **:CORR2:COLL:DC** on page 253
	Select Measurement Points for Calibration Coefficient Calculation Data		**:SENS:CORR2:COLL:FPO**	None. (There is no mode for measuring data with fixed measurement points.)
	Calculate Compensation Coefficient		**:SENS:CORR2:COLL:SAVE**	**:CORR2:COLL:SAVE** on page 255
	Set Open Compensation Function ON/OFF		**:SENS:CORR2:OPEN**	**:CORR2:COLL:OPEN** on page 254
	Set Short Compensation Function ON/OFF		**:SENS:CORR2:SHOR**	**:CORR2:COLL:SHOR** on page 255
	Set Load Compensation Function ON/OFF		**:SENS:CORR2:LOAD**	None. (Cannot perform load compensation.)
Fixture Selection	Fixture Selection		**:SYST:FIXT**	**:CORR2:FIXT** on page 256
	Set User-created Fixture	Amount Compensated (Electrical Length)	**:SYST:FIXT:DIST**	**:CORR2:FIXT:EDEL:DIST** on page 257
		Name	**:SYST:FIXT:LAB**	**:CORR2:FIXT:LAB** on page 258
		Save	**:SYST:FIXT:SAVE**	None. (Saved with the hardware settings.)

4286A vs. 4287A GPIB Commands Correspondence Table

Function	Item to set/run			GPIB command 4286A	GPIB command 4287A
Comparator (BIN Sort)	ON/OFF Setting			**:CALC:COMP:STAT**	**:CALC:COMP** on page 211
	Read Results of Decision			**:DATA? BIN**	**:CALC:COMP:DATA:BIN?** on page 221
	Set Beep Output Mode			**:CALC:BEEP:COND**	**:CALC:COMP:BEEP:COND** on page 211
	BIN Setting			**:CALC:COMP:CLE** **:CALC:COMP:OFFS** **:CALC:COMP:SAVE** **:CALC:COMP:SEGM** **:CALC:COMP:SEGM:ADD** **:CALC:COMP:SEGM:DEL** **:CALC:COMP:SEGM:EDIT** **:CALC:COMP:SEGM:SAVE** **:CALC:COMP:SEGM:UPP** **:CALC:COMP:SEGM:LOW** **:CALC:COMP:CONT:SEGM** **:CALC:COMP:SREJ:STAT** **:CALC:COMP:SREJ:UPP** **:CALC:COMP:SREJ:LOW**	(Because these differ in how they are used, there is no one-to-one correspondence between the two machines' commands.) **:CALC:COMP:CLE** on page 214 **:CALC:COMP:COND{1-4}:SNUM** on page 218 **:CALC:COMP:COND{1-4}:PAR** on page 217 **:CALC:COMP:COND{1-4}:MODE** on page 215 **:CALC:COMP:COND{1-4}:NOM** on page 216 **:CALC:COMP:BIN{1-13}** on page 212 **:CALC:COMP:BIN{1-13}:COND{1-4}:LIM** on page 213 **:CALC:COMP:BIN{1-13}:COND{1-4}:LTYP** on page 214 **:CALC:COMP:OGB** on page 223
	BIN Counter	ON/OFF Setting		**:CALC:COMP:COUN**	←on page 219
		Count Value	Clear	**:CALC:COMP:COUN:CLE**	←on page 219
			Read	**:DATA? BCOU**	**:CALC:COMP:DATA:BCOU?** on page 220
	R_{dc} Measurement Result Comparator	ON/OFF Setting		**:CALC:RDC:LIM:STAT**	None. (This is done by turning ON/OFF the entire function of the comparator.)
		Set Limit Value		**:CALC:RDC:LIM:UPP** **:CALC:RDC:LIM:LOW**	**:CALC:COMP:RDC:LIM** on page 224
		Read Results of Decision		**:DATA? RDCL**	**:CALC:COMP:DATA:RDC?** on page 222
	Limit Test			**:CALC:LIM:STAT** **:CALC:LIM:CLE** **:CALC:LIM:SAVE** **:CALC:LIM:SEGM** **:CALC:LIM:SEGM:ADD** **:CALC:LIM:SEGM:DEL** **:CALC:LIM:SEGM:EDIT** **:CALC:LIM:SEGM:SAVE** **:CALC:LIM:SEGM:UPP** **:CALC:LIM:SEGM:LOW** **:CALC:LIM:SEGM:CONT**	None. (The comparator function is used instead.)

4286A vs. 4287A GPIB Commands Correspondence Table

Function	Item to set/run		GPIB command 4286A	GPIB command 4287A
Trigger	Release Trigger		***TRG**	**:TRIG** on page 308 ***TRG** on page 208 (with Query response)
	Set Trigger Event Mode		**:TRIG:EVEN:TYPE**	None.
	Set Trigger Source		**:TRIG:SOUR**	←on page 310
	Set Polarity of External Trigger		**:TRIG:SLOP**	←on page 309
	Set Delay Time	Trigger Delay (for each trigger)	**:SENS:SWE:DWEL2**	**:TRIG:DEL** on page 308
		Point Delay (for each point)	**:SENS:SWE:DWEL1**	**:TRIG:SEQ2:DEL** on page 309
	Trigger System	Reset	**:ABOR**	←on page 209
		Initiate Once	**:INIT**	←on page 287
		Reset and then Reinitiate	**:INIT:AGA:ALL**	None.
		Set Continuous Start ON/OFF	**:INIT:CONT**	←on page 287
Data Read/Write	Set Data Transfer Format		**:FORM**	←on page 282
	Set Byte Order for Binary Transfer		None.	**:FORM:BORD** on page 283
	Read Results of Impedance Measurement (complex number data before calibration/compensation)		**:DATA? RAW**	**:DATA:RAW?** on page 264
	Read Results of Impedance Measurement (complex number data after calibration/compensation and before parameter conversion)		**:DATA? DATA**	None.
	Read Measurement Results of Measurement Parameters		**:DATA? DTR**	**:DATA:FDAT{1-4}?** on page 263
	Read Results of R_{dc} Measurement		**:DATA? RDC**	**:DATA:RDC?** on page 267
	Read Results of R_{dc} Comparator Decision		**:DATA? RDCL**	**:CALC:COMP:DATA:RDC?** on page 222
	Read Results of R_{dc} Comparator Decision, R_{dc} Measurement, and Measurement Parameter		**:DATA? RDCDT**	None. (The equivalent information can be obtained with **:FETC?** on page 280 or **:READ?** on page 293.)
	Read Results of Monitoring Test Signal Level		**:DATA? MON**	**:DATA:IMON?** on page 263 **:DATA:VMON?** on page 267

4286A vs. 4287A GPIB Commands Correspondence Table

Function	Item to set/run		GPIB command	
			4286A	4287A
Data Read/Write (continued)	Read/Write Calibration Coefficient		**:DATA CCO1{1-3}**	**:DATA:CCO{1-6}** on page 260
	Read Data for Calibration Coefficient Calculation		None.	**:DATA:CAD{1-8}?** on page 259
	Read/Write R_{dc} Measurement Calibration Coefficient		None.	**:DATA:RCCO{1-3}** on page 265
	Read Data for R_{dc} Measurement Calibration Coefficient Calibration		None.	**:DATA:RCAD{1-3}?** on page 265
	Read/Write Compensation Coefficient		**:DATA CMP{1-3}**	**:DATA:CMP{1-3}** on page 262
	Read Data for Compensation Coefficient Calculation		None.	**:DATA:CMD{1-2}?** on page 261
	Read/Write R_{dc} Measurement Compensation Coefficient		None.	**:DATA:RCMP{1-3}** on page 266
	Read Data for R_{dc} Measurement Compensation Coefficient Calculation		None.	**:DATA:RCMD{1-2}?** on page 266
	Fixture Compensation Standard Array (Standard Value of Compensation Kit)	Read/Write	**:DATA:DEF**	None.
		Clear	**:DATA:DEL**	None.
	Read Results of BIN Sort		**:DATA? BIN**	**:CALC:COMP:DATA:BIN?** on page 221
	Read Results of BIN Count		**:DATA? BCOU**	**:CALC:COMP:DATA:BCOU?** on page 220
	Read Sweep Parameter Values of All Measurement Points (Stimulus Array)		**:DATA? SPAR**	None.
	Read Results of Limit Test		**:DATA? LFA{1-2}** **:DATA? LLIS{1-2}** **:DATA? LRES{1-2}** **:DATA:VAL? LRES{1-2}** **:DATA:POIN? LFA**	None.

4286A vs. 4287A GPIB Commands Correspondence Table

Function	Item to set/run		GPIB command 4286A	GPIB command 4287A
Status Report Mechanism	Clear Register		***CLS**	←on page 204
	Read Status Byte Register Value		***STB?**	←on page 207
	Set Service Request Significant Register		***SRE**	←on page 207
	Standard Event Status Register	Read Register Value	***ESR?**	←on page 205
		Set Significant Register Value	***ESE**	←on page 204
		Set OPC Bit Indicated at End of Operation	***OPC**	←on page 205
	Hardware Event Status Register	Read Register Value	**:STAT:INST?**	None. (Of the commands previously assigned to this register, those also required for the 4287A are assigned to other registers that can be used for verification.)
		Set Significant Register Value	**:STAT:INST:ENAB**	
	Operation Status Register	Reset	**:STAT:PRES**	←on page 301
		Read Condition Register Value	**:STAT:OPER:COND?**	←on page 299
		Set Significant Register Value	**:STAT:OPER:ENAB**	←on page 299
		Read Event Register Value	**:STAT:OPER?**	←on page 299
		Set Positive Transition Filter Value	**:STAT:OPER:PTR**	←on page 300
		Set Negative Transition Filter Value	**:STAT:OPER:NTR**	←on page 300
	Questionable Status Register	Reset	**:STAT:PRES**	←on page 301
		Set Significant Register Value	**:STAT:QUES:ENAB**	←on page 301
		Read Event Register Value	**:STAT:QUES?**	←on page 301

Note: The 4286A and 4287A basically use the same commands for the status report mechanism. However, the structures of the mechanisms are considerably different. For details on this mechanism, refer to the *Programming Description Manual* of the machine you are using.

4286A vs. 4287A GPIB Commands Correspondence Table

Function	Item to set/run		GPIB command 4286A	GPIB command 4287A
Save/Recall	Save/Recall		**:MMEM:STOR:CAL:AUTO** **:MMEM:STOR:DINT:GRAP** **:MMEM:STOR:DINT:TRAC** **:MMEM:STOR:ITEM:TRAC:CAT?** **:MMEM:STOR:ITEM:TRAC:DEL** **:MMEM:STOR:ITEM:TRAC:SEL** **:MMEM:STOR:STAT** **:MMEM:STOR:TRAC** **:MMEM:LOAD:STAT** **:MMEM:LOAD:CAL** **:MMEM:LOAD:TRAC**	(Because these differ in how they are used, there is no one-to-one correspondence between the two machines' commands.) **:MMEM:STOR** on page 291 **:MMEM:LOAD** on page 290
	File Management	Copy	**:MMEM:COPY**	←on page 289
		Delete	**:MMEM:DEL**	←on page 290
		Delete CALREC_C	**:MMEM:DEL:CAL**	None.
		Creat a new directory	**:MMEM:CRE:DIR**	←on page 289
		Change current directory	**:MMEM:CDIR**	None.
		Change file extension	**:MMEM:FNAM:EXT{1-2}**	None.
		Initialize a strage device	**:MMEM:INIT**	None.
		Read the information about a storage device	None.	**:MMEM:CAT?** on page 288
	File Management		**:MMEM:CDIR** **:MMEM:COPY** **:MMEM:CRE:DIR** **:MMEM:DEL** **:MMEM:DEL:CAL** **:MMEM:FNAM:EXT{1-2}** **:MMEM:INIT**	None. (Cannot be performed with a GPIB command; do this by manually operating the front panel.)
Printer	Items Related to Printer or Plotter Settings		**:HCOP:DEF** **:HCOP:DEV:LANG** **:HCOP:DEV:SPE** **:HCOP:ITEM:ANN:STAT** **:HCOP:ITEM:MENU:STAT** **:HCOP:ITEM:TDST:STAT** **:HCOP:PAGE:DIM:FULL** **:HCOP:PAGE:DIM:QUAD{1-4}** **:HCOP:PAGE:SCAL**	(Because these differ in how they are used, there is no one-to-one correspondence between the two machines' commands.) **:HCOP:DPR** on page 285 **:HCOP:PRIN?** on page 286 **:HCOP:CONT** on page 284 **:HCOP:IMAG** on page 286
	Output	Run	**:HCOP**	←on page 284
		Stop	**:HCOP:ABOR**	←on page 284

4286A vs. 4287A GPIB Commands Correspondence Table

Function	Item to set/run		GPIB command 4286A	GPIB command 4287A
Display	Display Settings		**:DISP:DATA:PARA{1-2}** **:DISP:DATA:PARA{1-2}:MSD{1-10}** **:DISP:DATA:PARA{1-2}:MSD:ALL** **:DISP:DATA:PARA{1-2}:MSD:AUTO** **:DISP:DATA:PARA{1-2}:MSD:FIX** **:DISP:ALL** **:DISP:BCOU:STAT** **:DISP:TEXT10** **:DISP:TEXT{1-10}:PAGE** **:DISP:TEXT{1-10}:STAT** **:DISP:TRAC:STAT** **:CALC:FORM2**	(Because these differ in how they are used, there is no one-to-one correspondence between the two machines' commands.) **:DISP:BACK** on page 268 **:DISP** on page 268 **:DISP:UPD** on page 279 **:DISP:TEXT1** on page 269 **:DISP:TEXT1:CALC{1-4}** on page 270 **:DISP:TEXT1:CALC{1-4}:DIG** on page 270 **:DISP:TEXT1:CALC{1-4}:FIX** on page 271 **:DISP:TEXT1:CALC{1-4}:MSD** on page 271 **:DISP:TEXT1:CALC{11-12}** on page 272 **:DISP:TEXT1:CALC{11-12}:DIG** on page 272 **:DISP:TEXT1:CALC{11-12}:FIX** on page 273 **:DISP:TEXT1:CALC{11-12}:MSD** on page 273 **:DISP:TEXT1:CALC13:DIG** on page 274 **:DISP:TEXT1:CALC13:FIX** on page 274 **:DISP:TEXT1:CALC13:MSD** on page 275 **:DISP:TEXT10** on page 276 **:DISP:TEXT10:DATA** on page 276 **:DISP:TEXT11** on page 277 **:DISP:TEXT11:MODE** on page 277 **:DISP:TEXT2:LAB{1-4}** on page 278
Lock I/O Device	Front Panel Key		**:SYST:KLOC**	←on page 305
	Keyboard		None.	**:SYST:KLOC:KBD** on page 305
	Mouse		None.	**:SYST:KLOC:MOUS** on page 306
Beep	Turn ON/OFF Beep Indicating Completion of Operation		**:SYST:BEEP1:STAT**	←on page 302
	Beep Indicating Warning or Results of BIN Sort	ON/OFF Setting	**:SYST:BEEP2:STAT**	←on page 303
		Set Beep Output Mode (OK/NG)	**:CALC:BEEP:COND**	**:CALC:COMP:BEEP:COND** on page 211
Built-in Clock	Set Date		**:SYST:DATE**	←on page 303
	Set Date Format		**:SYST:DATE:MODE**	None.
	Set Time of Day		**:SYST:TIME**	←on page 307

4286A vs. 4287A GPIB Commands Correspondence Table

Function	Item to set/run		GPIB command 4286A	GPIB command 4287A
Others	Shutdown		***TST?**	←on page 208
	Read Product Information		***IDN?**	←on page 205
	Read Error Queue		**:SYST:ERR?**	←on page 304
	Check Whether External Reference Signal Is Being Input		**:DIAG:EREF:STAT?**	**:SYST:EXTR?** on page 304
	Read SCPI Vehicle		**:SYST:VERS?**	←on page 307
	Read Optional Information		***OPT?**	None.
	Waiting for End of Command Run		***WAI**	←on page 208
	Read 1 at End of Command Run		***OPC?**	←on page 205
	Set OPC Bit at End of Command Run		***OPC**	←on page 205
	Set GPIB Address	External Controller	**:SYST:COMM:GPIB:CONT:ADDR**	None.
		Printer/Plotter	**:SYST:COMM:GPIB:RDEV{1-2}:ADDR**	None.
	Parallel I/O Port Control		**:SYST:COMM:PAR:DATA?** **:SYST:COMM:PAR:TRAN:DATA**	None.
	Set Handler Interface Output Mode		**:SYST:COMM:PAR2:MODE**	None.
	Send Front Panel Key and Soft Key Codes		**:SYST:KEY**	None.
	Items Related to IBASIC Control		**All commands beginning with :PROG** ***PCB**	None. (IBASIC is not supported.)

F List of Responses to Measurement Failure

This appendix summarizes how the Agilent 4287A responds when a measurement fails (an overloading or exceeding the R_{dc} limit range is detected).

Responses to Measurement Failure

When any of the events listed below is detected, the instrument responds by displaying the corresponding notification on the LCD screen, outputting the corresponding data through GPIB, and activating the corresponding handler interface signal, as shown in Table F-1.

- Overload
  (This failure condition is detected when the instrument fails in its ranging performance; for example, when the DUT is detached during measurement.)
- R_{dc} out of range
  (This failure condition is detected when the R_{dc} measurement result falls outside of the limit range.)
- Overload and R_{dc} out of range

Table F-1 List of instrument responses to overload and R_{dc} out of range conditions

<table>
<tr><th rowspan="3"></th><th colspan="4">Notification on LCD screen</th><th colspan="3">GPIB output</th><th rowspan="3">Activated handler interface signal(s)</th></tr>
<tr><th colspan="3">Measurement results</th><th rowspan="2">Comparator sorting results</th><th rowspan="2">Measurement status</th><th rowspan="2">Measured values*1</th><th rowspan="2">Comparator sorting results</th></tr>
<tr><th>Parameters 1 through 4</th><th>Test signal level monitoring</th><th>R_{dc}</th></tr>
<tr><td>Overload*2</td><td>9.9E37</td><td>9.9E37</td><td>Measured values*3</td><td rowspan="3">14</td><td>1</td><td>9.9E37</td><td rowspan="3">14</td><td>/OVLD</td></tr>
<tr><td>R_{dc} out of range</td><td>Measured values*4</td><td>Measured values*4</td><td>Measured values*5 (highlighted in red)</td><td>2</td><td>Measured values*6</td><td>/RDC_OUT_OF_RANGE</td></tr>
<tr><td>Overload *2 and R_{dc} out of range</td><td>9.9E37</td><td>9.9E37</td><td>Measured values*5 (highlighted in red)</td><td>3</td><td>9.9E37</td><td>/OVLD
/RDC_OUT_OF_RANGE</td></tr>
</table>

*1. All of the measured values including the measurement results for parameters 1 through 4, test signal level monitoring, and R_{dc} measurement.
*2. In the instrument status area (near the bottom of the screen), an “Ovld” indicator appears in red.
*3. The instrument never detects an overload condition during R_{dc} measurement.
*4. Measured values are displayed as usual, but they can be incorrect due to imperfect contact.
*5. Measured values are displayed as usual, but they are highlighted in red.
*6. Measured values are retrieved as usual, but they can be incorrect due to imperfect contact.

G Initial Settings

This appendix provides initial settings, settings that can be saved/recalled, and settings that can be backed up.

Initial Settings, Settings that can be Saved/Recalled, Settings that can be Backed Up

The following table shows the following items.

- Initial settings (factory settings)
- Settings reset from the GPIB by the **:SYST:PRES** command on page 306 or the keys on the front panel
- Settings reset from the GPIB by the ***RST** command on page 206
- Settings that can be saved/recalled

  The table uses the following symbols.

  ❍ : Settings that can be saved/recalled

  × : Settings that cannot be saved/recalled
- Settings that can be backed up

  The table uses the following symbols.

  ❍ : Settings that can be backed up

  × : Settings that cannot be backed up
- Available method to set a setting

  The table uses the following symbols.

  GPIB : Settings that can be set by remote controller using a GPIB command.

  Front : Settings that can be set by the front panel keys, the keyboard or the mouse.

  Both : Settings that can be set by either of the above methods.

NOTE The symbol "←" in the table indicates that the value is the same as that indicated to the left.

Setting items			Initial settings (factory settings)	Reset		Save/ Recall	Backup	Available method to set
				:SYST:PRES	*RST			
Measurement parameter	Parameter 1		|Z|	←	←	❍	×	Both
	Parameter 2		θz (degree)	←	←	❍	×	Both
	Parameter 3		Rs	←	←	❍	×	Both
	Parameter 4		X	←	←	❍	×	Both
List measurement/single-point measurement			Single-point measurement	←	←	❍	×	Both
Measured point number on single-point measurement			1	←	←	❍	×	Both
Active table number			1	←	←	❍	×	Both
Measurement point setup table	Number of measurement points		1	←	←	❍	×	Both
	Oscillator	Frequency	1 [MHz]	←	←	❍	×	Both
		Level	-13 [dBm]	←	←	❍	×	Both
	Averaging factor		1	←	←	❍	×	Both
	Unit of oscillator level		dBm	←	←	❍	×	Both
R_{dc} measurement	On/Off		Off	←	←	❍	×	Both
	Offset cancel function		Off	←	←	×	×	Both
	Limit range	Lower limit value	0 [Ω]	←	←	❍	×	Both
		Upper limit value	10 [kΩ]	←	←	❍	×	Both
Deviation measurement	On/Off		Off	←	←	❍	×	Both
	Mode		DEV	←	←	❍	×	Both
	Reference value (center value)		0	←	←	❍	×	Both
Delay time	Trigger delay time		0 [s]	←	←	❍	×	Both
	Measurement point delay time		0 [s]	←	←	❍	×	Both
LCD's backlight On/Off			On	←	←	×	×	Both
Display On/Off			On	←	←	❍	×	Both
Display's update On/Off			On	←	←	×	×	Both
Results display (measurement parameters 1 to 4, test signal level monitor, R_{dc} measurement)	All results display On/Off		On	←	←	❍	×	Both
	Each result displays On/Off (except R_{dc} measurement result)		On	←	←	❍	×	Both
	Number of digits		4	←	←	❍	×	Both
	Fixed decimal point mode On/Off		Off	←	←	❍	×	Both
	Most significant digit		0	←	←	❍	×	Both

Initial Settings, Settings that can be Saved/Recalled, Settings that can be Backed Up

Setting items				Initial settings (factory settings)	Reset :SYST:PRES	Reset *RST	Save/ Recall	Backup	Available method to set
Title display	On/Off			Off	←	←	❍	×	Both
	Title characters			“ ” (blank)	←	←	❍	×	Both
Time and date display	On/Off			Off	←	←	❍	×	Both
	Live/Stamp			Stamp	←	←	❍	×	Both
Displayed items on the list measurement display	Item 1 (LABEL-1)			Measurement parameter 1	←	←	❍	×	Both
	Item 2 (LABEL-2)			Measurement parameter 2	←	←	❍	×	Both
	Item 3 (LABEL-3)			Measurement parameter 3	←	←	❍	×	Both
	Item 4 (LABEL-4)			Measurement parameter 4	←	←	❍	×	Both
Trigger source				Internal	←	←	❍	×	Both
Polarity of external trigger				Positive	←	←	❍	×	Both
Trigger system continuous activation On/Off				On	←	Off	×	×	GPIB
Maximum data size for statistical analysis				3000	←	←	❍	×	Both
Comparator (BIN sort) function On/Off				Off	←	←	❍	×	Both
Boundary between good BIN and no good BIN				10	←	←	❍	×	Both
BIN1 to BIN13 setting	On/Off			Off	←	←	❍	×	Both
	Sorting conditions 1 to 4	Measurement point number		1	←	←	❍	×	Both
		Parameter	Condition 1	|Z|	←	←	❍	×	Both
			Condition 2	θz (degree)	←	←	❍	×	Both
			Condition 3	Rs	←	←	❍	×	Both
			Condition 4	X	←	←	❍	×	Both
		Limit mode (ABS/%/DEV)		ABS	←	←	❍	×	Both
		Limit	Nominal value	0	←	←	❍	×	Both
			Lower limit value	0	←	←	❍	×	Both
			Upper limit value	0	←	←	❍	×	Both
		BIN range mode (IN/OUT/ALL)		ALL	←	←	❍	×	Both
BIN count function On/Off				Off	←	←	❍	×	GPIB

<table>
<tr><th colspan="5" rowspan="2">Setting items</th><th rowspan="2">Initial settings (factory settings)</th><th colspan="2">Reset</th><th rowspan="2">Save/ Recall</th><th rowspan="2">Backup</th><th rowspan="2">Available method to set</th></tr>
<tr><th>:SYST:PRES</th><th>*RST</th></tr>
<tr><td colspan="5">Calibration option of ‘Calibration Wizard’ (calibration only /calibration and compensation)</td><td>Calibration and Compensation</td><td>No effect</td><td>←</td><td>×</td><td>❍</td><td>Front</td></tr>
<tr><td rowspan="14">Setting of ‘Calibration Wizard’</td><td rowspan="4">Calibration</td><td colspan="3">Low-Loss C</td><td>Check</td><td>No effect</td><td>←</td><td>×</td><td>❍</td><td>Front</td></tr>
<tr><td colspan="3">DC Open</td><td>No check</td><td>No effect</td><td>←</td><td>×</td><td>❍</td><td>Front</td></tr>
<tr><td colspan="3">DC Short</td><td>No check</td><td>No effect</td><td>←</td><td>×</td><td>❍</td><td>Front</td></tr>
<tr><td colspan="3">DC Load</td><td>No check</td><td>No effect</td><td>←</td><td>×</td><td>❍</td><td>Front</td></tr>
<tr><td rowspan="4">Compensation</td><td colspan="3">Open</td><td>Check</td><td>No effect</td><td>←</td><td>×</td><td>❍</td><td>Front</td></tr>
<tr><td colspan="3">Short</td><td>Check</td><td>No effect</td><td>←</td><td>×</td><td>❍</td><td>Front</td></tr>
<tr><td colspan="3">DC Open</td><td>No check</td><td>No effect</td><td>←</td><td>×</td><td>❍</td><td>Front</td></tr>
<tr><td colspan="3">DC Short</td><td>No check</td><td>No effect</td><td>←</td><td>×</td><td>❍</td><td>Front</td></tr>
<tr><td colspan="4">Target table on measurement of data (All tables/Active table only)</td><td>Active table only</td><td>No effect</td><td>←</td><td>×</td><td>❍</td><td>Front</td></tr>
<tr><td colspan="4">Automatically saves the state into auto-recall file (autorec.sta) when the ‘Calibration Wizard’ is completed</td><td>No check</td><td>No effect</td><td>←</td><td>×</td><td>❍</td><td>Front</td></tr>
<tr><td rowspan="4">R_{dc} check at measurement of each standard</td><td colspan="3">On/Off</td><td>Off (No check)</td><td>No effect</td><td>←</td><td>×</td><td>❍</td><td>Front</td></tr>
<tr><td rowspan="3">Limit</td><td rowspan="2">Calibration</td><td>Short-Load</td><td>25 [Ω]</td><td>No effect</td><td>←</td><td>×</td><td>❍</td><td>Front</td></tr>
<tr><td>Load-Open</td><td>100 [Ω]</td><td>No effect</td><td>←</td><td>×</td><td>❍</td><td>Front</td></tr>
<tr><td>Compensation</td><td>Short-Open</td><td>50 [Ω]</td><td>No effect</td><td>←</td><td>×</td><td>❍</td><td>Front</td></tr>
</table>

Initial Settings, Settings that can be Saved/Recalled, Settings that can be Backed Up

Setting items			Initial settings (factory settings)	Reset		Save/ Recall	Backup	Available method to set
				:SYST:PRES	*RST			
Target table in measurement of data for calibration coefficient calculation (all tables/active table only) *1			Active table only	No effect	←	×	❍	Front
Automatically saves the state into auto-recall file (autorec.sta) when the calibration coefficients are calculated *2			No check	No effect	←	×	❍	Both
Calibration kit selection (7 mm standard/user defined)			7 mm standard	←	←	❍	×	Both
User defined calibration kit	Impedance definition method (fixed/point-by-point)		Fixed	←	←	❍	×	Both
	Open	Equivalent parallel conductance (G)	0 [S]	←	←	❍	×	Both
		Equivalent parallel capacitance (Cp)	0 [F]	←	←	❍	×	Both
		Dc conductance	0 [S]	←	←	❍	×	Both
		Offset delay time	0 [s]	←	←	❍	×	Both
	Short	Equivalent series resistance (Rs)	0 [Ω]	←	←	❍	×	Both
		Equivalent series inductance (Ls)	0 [H]	←	←	❍	×	Both
		Dc resistance	0 [Ω]	←	←	❍	×	Both
		Offset delay time	0 [s]	←	←	❍	×	Both
	Load	Definition impedance parameter type	Rs and Ls	←	←	❍	×	Both
		Equivalent series resistance (Rs)	50 [Ω]	←	←	❍	×	Both
		Equivalent series inductance (Ls)	0 [H]	←	←	❍	×	Both
		Dc resistance	50 [Ω]	←	←	❍	×	Both
		Offset delay time	0 [s]	←	←	❍	×	Both

*1. When data measurement is performed by GPIB command, the target table is always 'active table only' regardless of this setting.

*2. When calculation of the calibration coefficients is performed by GPIB command, the state is not saved into auto-recall file (autorec.sta) regardless of this setting.

Setting items			Initial settings (factory settings)	Reset: :SYST:PRES	Reset: *RST	Save/ Recall	Backup	Available method to set
Open compensation On/Off			Off	←	←	❍	×	Both
Short compensation On/Off			Off	←	←	❍	×	Both
Target table in measurement of data for compensation coefficient calculation (all tables/active table only)[*1]			Active table only	No effect	←	×	❍	Front
Automatically saves the state into auto-recall file (autorec.sta) when the compensation coefficients are calculated[*2]			No check	No effect	←	×	❍	Both
Selection of compensation kit definition values (predefined values/user defined values)			Predefined values (default)	←	←	❍	×	Both
User defined values	Impedance definition method (fixed/point-by-point)		Fixed	←	←	❍	×	Both
	Open	Equivalent parallel conductance (G)	0 [S]	←	←	❍	×	Both
		Equivalent parallel capacitance (Cp)	0 [F]	←	←	❍	×	Both
		Dc conductance	0 [S]	←	←	❍	×	Both
	Short	Equivalent series resistance (Rs)	0 [Ω]	←	←	❍	×	Both
		Equivalent series inductance (Ls)	0 [H]	←	←	❍	×	Both
		Dc resistance	0 [Ω]	←	←	❍	×	Both
Test fixture selection			None	←	←	❍	×	Both
User fixture		Electrical length	0 [m]	←	←	❍	×	Both
		Name	"USER"	←	←	❍	×	Both

Setting items			Initial settings (factory settings)	Reset		Save/ Recall	Backup	Available method to set
				:SYST:PRES	*RST			
Data transfer format	Data transfer format (ASCII/Binary)		ASCII	No effect	ASCII	×	×	GPIB
	Byte order when data transfer format is set to binary (normal/swapped)		Normal	No effect	Normal	×	×	GPIB
Printer	Printer selection		HP DeskJet 970C Series	No effect	←	×	❍	Both
	Content		Screen graphics	←	←	❍	×	Both
	Color		Normal	←	←	❍	×	Both
	Orientation		Portrait	←	←	❍	×	Front
Key lock	Front panel		Off	←	←	×	×	Both
	Keyboard		Off	No effect	←	×	×	Both
	Mouse		Off	←	←	×	×	Both
Beeper	On/Off of beep to notify the completion of operation		On	←	←	❍	×	Both
	Beep to notify an error/warning or sorting results	On/Off	On	←	←	❍	×	Both
		Mode	FAIL	←	←	❍	×	Both
Time and date of the internal clock			———	No effect	←	×	❍	Both
GPIB address			17	No effect	←	×	❍	Front
IP address			192.168.0.1	No effect	←	×	❍	Front
Gateway IP address			127.0.0.1	No effect	←	×	❍	Front
Subnet mask			255.255.255.0	No effect	←	×	❍	Front
Computer name			4287A	No effect	←	×	❍	Front
Enable/Disable setting of network device			Disable	No effect	←	×	❍	Front
Service request enable register value			0	No effect	←	×	×	GPIB
Standard event status enable register value			0	No effect	←	×	×	GPIB
Operation status register	Enable register value		0	No effect	←	×	×	GPIB
	Positive transition filter value		32767	No effect	←	×	×	GPIB
	Negative transition filter value		0	No effect	←	×	×	GPIB
Questionable status enable register value			0	No effect	←	×	×	GPIB

H Error messages

The Agilent 4287A provides error messages to indicate its operating status. This appendix describes the error messages of the 4287A in order of error number. To search error messages alphabetically, refer to the *Operation Manual*.

Error messages are displayed at the top of the 4287A's LCD. Error messages generated during the execution of a GPIB command are preceded by the string "[GPIB]" or "[TELNET]" and can be read out using the GPIB command. This section describes each error message and its remedy.

You can clear error messages displayed on the screen using the following commands.

- **:DISP:CCL** on page 269

NOTE Errors with a negative error number are basically general errors defined by IEEE488.2 for GPIB instruments. On the other hand, errors with a positive error number are defined specifically for the 4287A.

Order of error number

No number

A21 board can't be detected. The instrument will be automatically shutdown in 20 seconds.

The A21 board cannot be detected.

The 4287A will be automatically shut down in approximately 20 seconds after the occurrence of this error. The 4287A is at fault and needs repair.

Contact the Agilent Technologies sales office or the company you purchased this instrument.

NOTE This is a special error that occurs at the startup of the 4287A. The error message, unlike other ones, is displayed in the box that appears at the center of the LCD display, instead of the top of it. No error number is assigned.

No number

A24 GPIB board can't detected. Press OK to continue.

The A24 board cannot be detected.

Although the measurement screen appears normally, the instrument has started up abnormally (GPIB is disabled). To recover the normal status, reboot the 4287A (turn OFF the standby switch and then ON again).

If this error persists after rebooting the 4287A, or occurs frequently, the 4287A is at fault and needs repair. Contact the Agilent Technologies sales office or the company you purchased this instrument.

NOTE This is a special error that occurs at the startup of the 4287A. The error message, unlike other ones, is displayed in the box that appears at the center of the LCD display, instead of the top of it. No error number is assigned.

0 **(No error)**

No error has occurred.

This message is not displayed on the LCD. 0 is returned as the error number if no error has occurred in the instrument when the **:SYST:ERR?** command on page 304 is sent through GPIB.

6 **Additional standards needed**

Before the completion of all data measurements required for calculating the calibration/compensation coefficients, a GPIB command requiring some part of the measurement data is sent. For example, when only the OPEN and SHORT measurements of the calibration kit have been complete, the **:CORR1:COLL:SAVE** command on page 246, which performs calculation of the calibration coefficients, is sent.

Measure all of the required data.

7 **Calibration required**

Although the calibration is not turned on, a GPIB command is sent that is valid only when the calibration is turned on. For example, the **:CORR2:COLL** command on page 252, which obtains the data for calculating the compensation coefficients, is executed.

Turn on the calibration.

11 **Compensation required**

Although compensation is not turned on, a GPIB command is sent that is valid only when compensation is turned on. For example, the **:DATA:CMP{1-3}** command on page 262, which reads out the compensation coefficients, is executed when compensation is turned off.

Turn on the compensation.

22 **Printer error**

The printer does not respond to control from the 4287A.

Check the power to the printer, cable connections, paper, and so on.

61 **No data available on memory**

Although the data for statistical analysis has not been acquired, the **:CALC:EXAM:GET?** command on page 225, which executes statistical analysis and acquires the results, is sent.

Acquire the data for statistical analysis.

62 **Can't execute data examination**

The data for statistical analysis has been acquired, but change is made to the settings during data acquisition, and thus statistical analysis cannot be executed.

Acquire the data for statistical analysis with the current settings.

104 **Save error**

When saving a file, anomalies in the storage media are detected. For example, when you attempt to save a file on a floppy disk, there is not enough space on the disk.

Make sure there is enough space on the floppy disk.

105 **Recall error**

An error occurs while reading out (recalling) a file. For example, you attempt to read out a file with invalid contents (such as an instrument setting file with extension ".sta", which is saved by using an instrument other than the 4287A).

Make sure that the contents of the file are valid.

106 **Invalid File Name**

When executing the save/recall file command, a file name string is invalid. For example, when executing the save command, no extension for the file is specified.

Specify a valid file name.

This error also occurs if the floppy disk has not been correctly set into the drive or if the disk is write-protected when you attempt to save a file onto the disk.

120 **PLL unlock**

Phase lock loop is not locked

When you enter the external reference signal, check to make sure it is correct. If you entered the correct signal or you did not enter any signal, the instrument needs adjustment or repair. Contact your local Agilent Technologies sales office or the company you purchased this instrument from.

198 **Power on test failed**

In the power-on self test, a fault is detected.

Contact your local Agilent Technologies sales office or the company you purchased this instrument from.

-100 **Command error**

A comprehensive syntax error occurs for which the 4287A cannot detect further details of the error. This error code simply indicates the occurrence of a command error that is defined in IEEE488.2,11.5.1.1.4.

-101 **Invalid character**

Invalid characters exist in the program message string. For example, in a correct program message "**:CALC:PAR1:FORM LS**", an ampersand (&) is inserted by mistake to give "**:CALC:PAR1:FORM&LS**".

-102 **Syntax error**

There is a command or data type that cannot be recognized. For example, in a correct program message "**:SYST:PRES**", a colon (:) is inserted by mistake to give "**:SYST::PRES**".

-103 **Invalid separator**

The parser (syntax analysis program) expects a separator, but a character other than a separator is sent. For example, although the correct way is to use ";" to separate two sent program messages such as "**:CALC:PAR1:FORM LS;*OPC?**", the semicolon (;) needed to separate the program messages is missing to give "**:CALC:PAR1:FORM LS *OPC?**".

-104 **Data type error**

The parser recognized impossible data elements. For example, numeric value or string data is expected, but block data is sent.

-105 **GET not allowed**

A group execution trigger (GET) is received in a program message. (Refer to IEEE488.2,7.7.)

-108 **Parameter not allowed**

The number of parameters is larger than required by the command. For example, although the **:SOUR:LIST:TABL** command on page 297 requires one parameter such as "**:SOUR:LIST:TABL 3**", two parameters are added to give "**:SOUR:LIST:TABL 3,5**".

-109 **Missing parameter**

The number of parameters is less than required by the command. For example, although the **:SOUR:LIST:TABL** command on page 297 requires one parameter such as "**:SOUR:LIST:TABL 3**", no parameter is added to give "**:SOUR:LIST:TABL**".

-112 **Program mnemonic too long**

The length of the header exceeds 12 characters. (Refer to IEEE488.2,7.6.1.4.1.)

-113 **Undefined header**

A header not defied for the 4287A is received. For example, "***XYZ**", which is not defined for the 4287A, is received.

-120 **Numeric data error**

Numeric data (including numeric data without a decimal point) causes an error. A numeric value error other than -121 to -129 occurs.

-121 **Invalid character in number**

An invalid character for the data type of the syntax analysis target is received. For example, alphabetical characters exist in a decimal value or “9” exists in octal data.

-123 **Exponent too large**

The absolute value of the exponent exceeds 32,000. (Refer to IEEE488.2,7.7.2.4.1.)

-124 **Too many digits**

The number of digits of the mantissa of the decimal value data element exceeds 255 except for preceding 0s. (Refer to IEEE488.27.7.2.4.1.)

-128 **Numeric data not allowed**

A numeric value data element (that does not violate the standard) is received where the 4287A does not accept any numeric value data element.

-131 **Invalid suffix**

The suffix does not meet the syntax defined in IEEE488.2,7.7.3.2 or is inappropriate for the 4287A.

-134 **Suffix too long**

The suffix contains notation of 12 characters or more. (Refer to IEEE488.2,7.7.3.4.)

-138 **Suffix not allowed**

A suffix is added to a numeric value element that does not permit a suffix.

-148 **Character data not allowed**

A character data element (that does not violate the standard) is received where the 4287A does not accept any character data element.

-150 **String data error**

An error not included in error numbers between -151 and -159 occurs during the syntax analysis of a string data element.

-151 **Invalid string data**

Character string data are expected, but the string data received are invalid for some reason. (Refer to IEEE488.2,7.7.5.2.) For example, the END message is received before the end quotation mark character appears.

-158 **String data not allowed**

A string data element is received where the 4287A does not accept any string data element. For example, a parameter must be enclosed with double quotation marks (“...”) but they are missing.

-161 **Invalid block data**

Block data are expected, but the block data received are invalid for some reason. (Refer to IEEE488.2,7.7.6.2.) For example, the END message is received before the length of the block data is reached.

-168 **Block data not allowed**

A block data element is received where the 4287A does not accept any block data element.

-170 **Expression error**

An error not included in error numbers between -171 and -179 occurs during the syntax analysis of equation data.

-171 **Invalid expression**

The equation data element is invalid. (Refer to IEEE488.2,7.7.7.2.) For example, parentheses are not paired or a character violates the standard.

-178 **Expression data not allowed**

An equation data element is received where the 4287A does not accept any equation data element.

-200 **Execution error**

A comprehensive execution error occurs for which the 4287A cannot detect further details of the error. This error code simply indicates the occurrence of an execution error that is defined in IEEE488.2,11.5.1.1.5.

-211 **Trigger ignored**

A trigger command or trigger signal is received and recognized by the 4287A, but it is ignored due to the timing relationship with the 4287A. For example, this happens when the 4287A's trigger system is not in the Waiting for Trigger state).

-213 **Init ignored**

Another measurement is being executed and the measurement start request (**:INIT** command on page 287) is ignored.

-221 **Setting conflict**

A program data element complying with the syntax standard is analyzed, but the 4287A cannot execute it at present.

-222 **Data out of range**

A data element (that does not violate the standard) is received out of the range defined for the 4287A.

-223 **Too much data**

The received block, equation, or string type program data complies with the standard but the amount of data exceeds the limit that the 4287A can handle due to memory or device-specific conditions related to memory.

-224 **Illegal parameter value**

The value of the parameter is not allowed.

-230 **Data corrupt or stale**

The data is invalid or a newly initiated read operation has not been completed since the latest access.

-256 **File name not found**

The specified filename is not found and, as a result, the command is not executed correctly. For example, this happens when you attempt to read a file that does not exist on the disk.

This message is also displayed when you attempt to read a file on floppy disk drive, but no floppy disk is correctly inserted in the drive.

-310 **System error**

One of the “system errors” defined for the 4287A occurs.

-321 **Out of memory**

An internal operation needed more memory than is available.

-400 **Query error**

A comprehensive Query error occurs for which the 4287A cannot detect further details. This code simply indicates the occurrence of a Query error that is defined in IEEE488.2,11.5.1.1.7 and 6.3.

-410 **Query INTERRPUTED**

This indicates the status that causes an “INTERRUPTED” Query error. (Refer to IEEE488.1,6.3.2.3.) This error occurs, for example, when data byte (DAB) or GET is received after Query but before the response has been completely sent.

-420 **Query UNTERMINATED**

This indicates the status that causes an “UNTERMINATED” Query error. (Refer to IEEE488.2,6.3.2.) This error occurs, for example, when the 4287A is specified as a talker and an incomplete program message is received.

-430 **Query DEADLOCKED**

This indicates the status that causes a “DEADLOCKED” Query error. (Refer to IEEE488.2,6.3.1.7.) This error occurs, for example, when both input and output buffers become full and the 4287A cannot continue processing.

-440 **Query UNTERMINATED after indefinite response**

In a certain program message, after a Query that requests an ambiguous response is executed, another Query is received. (Refer to IEEE488.2,6.5.7.5.7.)

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