Caution

Do not exceed the operating input power, voltage, and current level and signal type appropriate for the instrument being used, refer to your instrument's Function Reference.

Electrostatic discharge(ESD) can damage the highly sensitive microcircuits in your instrument. ESD damage is most likely to occur as the test fixtures are being connected or disconnected. Protect them from ESD damage by wearing a grounding strap that provides a high resistance path to ground. Alternatively, ground yourself to discharge any static charge built-up by touching the outer shell of any grounded instrument chassis before touching the test port connectors.

Safety Summary

When you notice any of the unusual conditions listed below, immediately terminate operation and disconnect the power cable.
Contact your local Agilent Technologies sales representative or authorized service company for repair of the instrument. If you continue to operate without repairing the instrument, there is a potential fire or shock hazard for the operator.

- Instrument operates abnormally.
- Instrument emits abnormal noise, smell, smoke or a spark-like light during the operation.
- Instrument generates high temperature or electrical shock during operation.
- Power cable, plug, or receptacle on instrument is damaged.
- Foreign substance or liquid has fallen into the instrument.

Herstellerbescheinigung

GERÄUSCHEMISSION

LpA < 70 dB
am Arbeitsplatz
normaler Betrieb
nach DIN 45635 T. 19

Manufacturer's Declaration

ACOUSTIC NOISE EMISSION

LpA < 70 dB
operator position
normal operation
per ISO 7779

DECLARATION OF CONFORMITY

According to ISO/IEC Guide 22 and CEN/CENELEC EN 45014

Manufacturer's Name: Agilent Technologies Japan, Ltd.

Manufacturer's Address: 1-3-2, Murotani, Nishi-ku, Kobe-shi, Hyogo, 651-2241 Japan

Declares, that the product:

Product Name: Network Analyzer

Model Number: E5070B / E5071B

Product Options: This declaration covers all options of the above product(s)

Conforms with the following product standards:

EMC: Standard	Limit
IEC 61326-1:1997 +A1:1998 / EN 61326-1:1997 +A1:1998	
CISPR 11:1997 / EN 55011:1998 +A1:1999	Group 1, Class A [1]
IEC 61000-4-2:1995 / EN 61000-4-2:1995 +A1:1998	4 kV CD, 8 kV AD
IEC 61000-4-3:1995 / EN 61000-4-3:1996 +A1:1998	3 V/m 80% AM 80 - 1000 MHz
IEC 61000-4-4:1995 / EN 61000-4-4:1995	0.5 kV signal lines, 1 kV power lines
IEC 61000-4-5:1995 / EN 61000-4-5:1995	0.5 kV line-line, 1 kV line-ground
IEC 61000-4-6:1996 / EN 61000-4-6:1996	3 V 80% AM 0.15 - 80 MHz
IEC 61000-4-11:1994 / EN 61000-4-11:1994	1 cycle, 100%
Australia/New Zealand: AS/NZS 2064.1/2	
Canada: ICES-001:1998	

Safety: IEC 61010-1:1990 +A1:1992 +A2:1995 / EN 61010-1:1993 +A2:1995
CAN / CSA C22.2 No. 1010.1-92

Conformity / Supplementary Information:

The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC (including 93/68/EEC) and carries the CE-marking accordingly (European Union).

LEDs in this product are Class 1 in accordance with EN 60825-1:1994.

[1] The product was tested in a typical configuration with Agilent Technologies test systems.

Kobe, Japan Jun. 28, 2002
Date

Koichi Yanagawa
Name Koichi Yanagawa / Quality Engineering Manager

For further information, please contact your local Agilent Technologies sales office, agent or distributor.

Agilent E5070B/E5071B ENA Series RF Network Analyzers

User's Guide

Third Edition

FIRMWARE REVISIONS

This manual applies directly to instruments that have the firmware revision 3.5x.
For additional information about firmware revisions, see Appendix A.

Agilent Technologies

Agilent Part No. E5070-90050

July 2003

Printed in Japan

Notices

Agilent Technologies Japan, Ltd.

Component Test PGU-Kobe

1-3-2, Murotani, Nishi-ku, Kobe, Hyogo, 651-2241 Japan

Manual Printing History

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

August 2002	First Edition (part number: E5070-90030)
March 2003	Second Edition (part number: E5070-90040, changes for firmware version 3.50)
July 2003	Third Edition (part number: E5070-90050)

Safety Summary

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific WARNINGS elsewhere in this manual may impair the protection provided by the equipment. Such noncompliance would also violate safety standards of design, manufacture, and intended use of the instrument. Agilent Technologies assumes no liability for the customer's failure to comply with these precautions.

NOTE The E5070B/E5071B complies with INSTALLATION CATEGORY II as well as POLLUTION DEGREE 2 in IEC61010-1. The E5070B/E5071B is an INDOOR USE product.

NOTE The LEDs in the E5070B/E5071B are Class 1 in accordance with IEC60825-1, CLASS 1 LED PRODUCT

- Ground the Instrument

  To avoid electric shock, the instrument chassis and cabinet must be grounded with the supplied power cable's grounding prong.

- DO NOT Operate in an Explosive Atmosphere

  Do not operate the instrument in the presence of inflammable gasses or fumes. Operation of any electrical instrument in such an environment clearly constitutes a safety hazard.

- Keep Away from Live Circuits

  Operators must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with the power cable connected. Under certain conditions, dangerous voltage levels may remain even after the power cable has been disconnected. To avoid injuries, always disconnect the power and discharge circuits before touching them.

- DO NOT Service or Adjust the Instrument Alone

  Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

- DO NOT Substitute Parts or Modify the Instrument

  To avoid the danger of introducing additional hazards, do not install substitute parts or perform unauthorized modifications to the instrument. Return the instrument to an Agilent Technologies Sales and Service Office for service and repair to ensure that safety features are maintained in operational condition.

- Dangerous Procedure Warnings

  Warnings, such as the example below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed.

WARNING **Dangerous voltage levels, capable of causing death, are present in this instrument. Use extreme caution when handling, testing, and adjusting this instrument.**

Safety Symbols

General definitions of safety symbols used on the instrument or in manuals are listed below.

Instruction Manual symbol: the product is marked with this symbol when it is necessary for the user to refer to the instrument manual.

Alternating current.

Direct current.

On (Supply).

Off (Supply).

In-position of push-button switch.

Out-position of push-button switch.

A chassis terminal; a connection to the instrument's chassis, which includes all exposed metal structure.

Stand-by.

WARNING **This warning sign denotes a hazard. It calls attention to a procedure, practice, or condition that, if not correctly performed or adhered to, could result in injury or death to personnel.**

CAUTION This Caution sign denotes a hazard. It calls attention to a procedure, practice, or condition that, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the instrument.

NOTE This Note sign denotes important information. It calls attention to a procedure, practice, or condition that is essential for the user to understand.

Certification

Agilent Technologies certifies that this product met its published specifications at the time of shipment from the factory. Agilent Technologies further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology, to the extent allowed by the Institution's calibration facility or by the calibration facilities of other International Standards Organization members.

Documentation Warranty

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Assistance

Product maintenance agreements and other customer assistance agreements are available for Agilent Technologies products.

For any assistance, contact your nearest Agilent Technologies Sales and Service Office. Addresses are provided at the back of this manual.

Typeface Conventions

Sample (bold)	Boldface type is used when a term is defined or emphasis.
Sample (Italic)	Italic type is used for emphasis.
Sample key	Indicates a hardkey (key on the front panel or external keyboard) labeled "Sample." "key" may be omitted.
Sample menu/button/box	Indicates a menu/button/box on the screen labeled "Sample" which can be selected/executed by clicking. "menu," "button," or "box" may be omitted.
Sample block/toolbar	Indicates a block (group of hardkeys) or a toolbar (setup toolbar) labeled "Sample."
Sample 1 - **Sample 2** - **Sample 3**	Indicates a sequential operation of **Sample 1**, **Sample 2**, and **Sample 3** (menu, button, or box). "-" may be omitted.

Documentation Map

The following manuals are available for the Agilent E5070B/E5071B.

- ***User's Guide*** **(Part Number E5070-900x0, attached to Option ABA)**

  This manual describes most of the basic information needed to use the E5070B/E5071B. It provides a function overview, detailed operation procedure for each function (from preparation for measurement to analysis of measurement results), measurement examples, specifications, and supplemental information. For programming guidance on performing automatic measurement with the E5070B/E5071B, please see the *Programming Manual*.

- ***Installation and Quick Start Guide*** **(Part Number E5070-900x1, attached to Option ABA)**

  This manual describes installation of the instrument after it is delivered and the basic procedures for applications and analysis. Refer to this manual when you use the E5070B/E5071B for the first time.

- ***Programmer's Guide*** **(Part Number E5070-900x2, attached to Option ABA)**

  This manual provides programming information for performing automatic measurement with the E5070B/E5071B. It includes an outline of remote control, procedures for detecting measurement start (trigger) and end (sweep end), application programming examples, a command reference, and related information.

- ***VBA Programmer's Guide*** **(Part Number E5070-900x3, attached to Option ABA)**

  This manual describes programming information for performing automatic measurement with internal controller. It includes an outline of VBA programming, some sample programming examples, a COM object reference, and related information.

NOTE The number position shown by "x" in the part numbers above indicates the edition number. This convention is applied to each manual, CD-ROM (for manuals), and sample programs disk issued.

VBA Macro

The Agilent folder (D:\Agilent) on the hard disk of the E5070B/E5071B contains the VBA macros (VBA Projects) used in this manual.

The customer shall have the personal, non-transferable rights to use, copy, or modify the VBA macros for the customer's internal operations.

The customer shall use the VBA macros solely and exclusively for their own purposes and shall not license, lease, market, or distribute the VBA macros or modification of any part thereof.

Agilent Technologies shall not be liable for any infringement of any patent, trademark, copyright, or other proprietary right by the VBA macros or their use. Agilent Technologies does not warrant that the VBA macros are free from infringements of such rights of third parties. However, Agilent Technologies will not knowingly infringe or deliver software that infringes the patent, trademark, copyright, or other proprietary right of a third party.

Contents

1 Precautions

This chapter describes cautions that must be observed in operating the E5070B/E5071B.

Software Installed

The Windows operating system installed in this machine is customized for more effective operation, and has different functions that are not part of the Windows operating system for ordinary PCs (personal computers).
Therefore, do not attempt to use the system in ways other than those described in this manual or to install Windows-based software (including anti-virus software) for ordinary PCs as doing so may cause malfunctions.

Also note the followings.

- Do not update the Windows operating system installed in this machine to the Windows operating system for ordinary PCs. Doing so will cause malfunctions.
- Do not attempt to update VBA (Visual Basic for Applications) software installed in this machine to its equivalent developed for ordinary PCs. Doing so will cause malfunctions.
- Do not allow any computer virus to infect the system. This machine has no virus check function nor anti-virus software installed.

Agilent Technologies will not be held liable for any failure or damage arising from negligence regarding these prohibitions and warnings.

NOTE If the pre-installed software is damaged somehow, resulting in errant behavior by the machine, perform a system recovery. For further details of system recovery, refer to "System Recovery" on page 318.

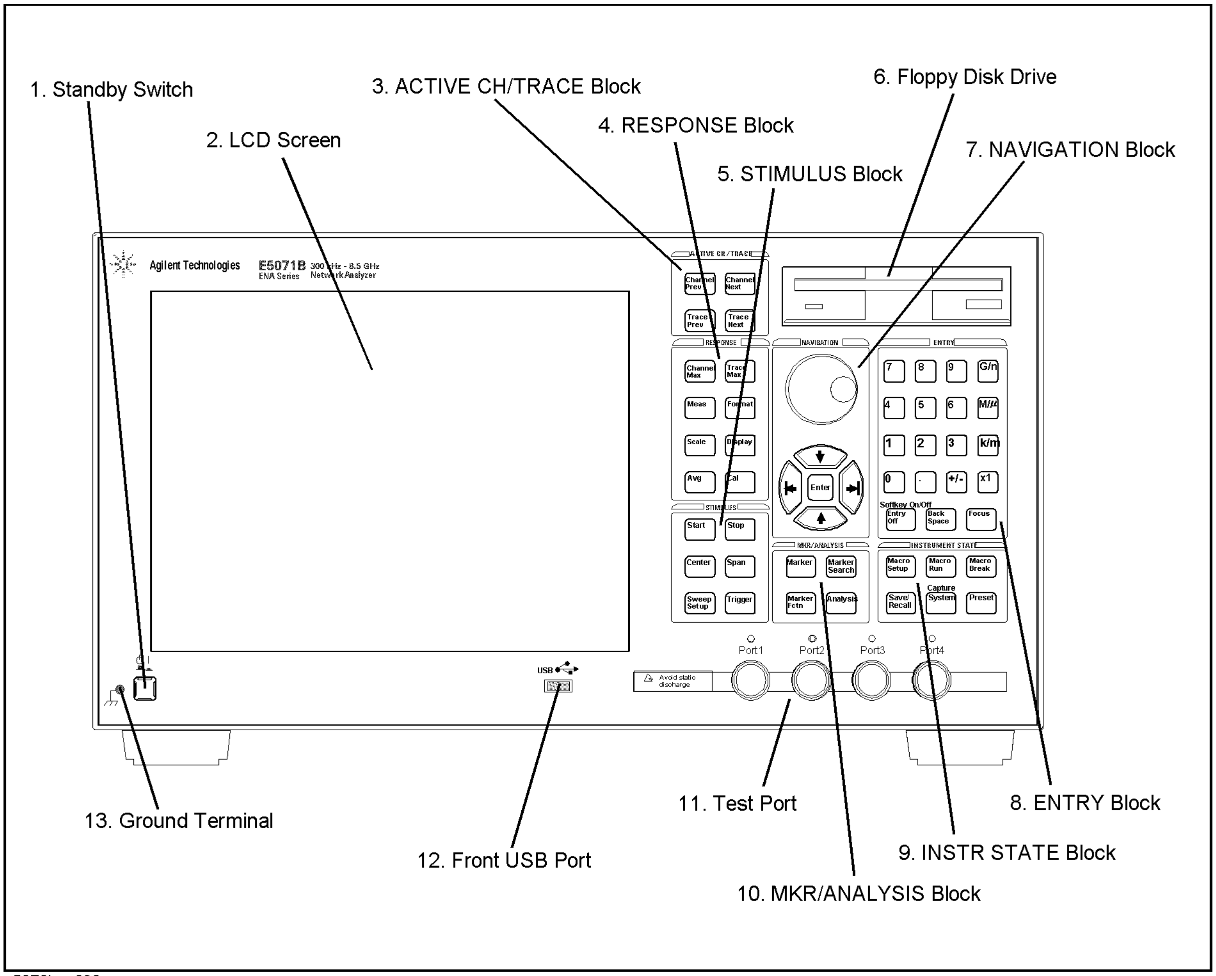
2 Overview of Functions

This chapter describes the functions of the E5070B/E5071B that can be accessed from the front panel, LCD screen, and rear panel.

Front Panel: Names and Functions of Parts

This section describes the names and functions of parts on the front panel of the E5070B/E5071B. For more about the functions displayed on the LCD screen, see "Screen Area: Names and Functions of Parts" on page 34. For more about the functions of softkeys, see Appendix D, "Softkey Functions," on page 453.

Figure 2-1 Front Panel



e5070bue032

1. Standby Switch

Used for choosing between power-on (|) and standby (⏻) states of the E5070B/E5071B.

NOTE

To turn off the power for the E5070B/E5071B, be sure to follow the steps described below.

1. First, press this standby switch, or send a shutdown command from the external controller to activate the shutdown process (the processing of software and hardware necessary to turn off the power supply). This will put the E5070B/E5071B into the standby state.
2. Next, if necessary, turn off the power supply to the “8. Power Cable Receptacle (to LINE)” on page 48 on the rear panel.

Under normal use, never directly interrupt the power supply to the power cable receptacle on the rear panel when the power supply is on. Always keep the “7. Line Switch (Always ON)” on page 47 at (|). Never turn it off (○).
If you directly interrupt the power supply to the power cable receptacle when the power supply is on, or turn off the “7. Line Switch (Always ON)” on page 47, the shutdown process will not work. This could damage the software and hardware of the E5070B/E5071B and lead to device failure.

Turning on the power supply after a faulty shutdown may cause the system to start up in a condition called “safe mode”. If this occurs, first shut down the system to put it into the standby state, and then turn on the power supply again and start up the system in normal mode.

For more about turning the power supply on/off and putting it into the standby state, see Chapter 1 “Installation Guide” in the *Installation and Quick Start Guide*.

2. LCD Screen

A 10.4-inch TFT color LCD used for displaying traces, scales, settings, softkeys, etc. Either a standard color LCD or touch screen color LCD (Option 016) are available. The touch screen LCD allows you to manipulate softkeys by touching the LCD screen directly with the finger. For more about the LCD screen, see “Screen Area: Names and Functions of Parts” on page 34.

NOTE

Do not press the surface of the LCD screen (both standard and touch screen types) with a sharp object (e.g., a nail, pen, or screwdriver). Pressing the surface with a sharp-pointed object will damage the LCD screen surface or cause the screen to fail. Be especially careful when using a touch screen LCD.

3. ACTIVE CH/TRACE Block

A group of keys for selecting active channels and traces. For more about the concepts of channels and traces, see “Setting Channels and Traces” on page 53.

Channel Next Key	Select the next channel as the active channel. (Each time the key is pressed causes the active channel to step up from the channel with the currently designated number to one with a larger channel number.) An active channel is one for which the sweep range, etc. are defined. To change the settings for a channel, use this key to first make the channel active.
Channel Prev Key	Select the previous channel as the active channel. (Each time the key is pressed causes the active channel to step down from the channel with the currently designated number to one with a smaller channel number.)
Trace Next Key	Select the next trace as the active trace. (Each time the key is pressed causes the active trace to step up from the trace with the currently designated number to one with a larger channel number.) An active trace is one for which the measurement parameters, etc. are defined. To change the settings for a trace, use this key to first make the trace active.
Trace Prev Key	Select the previous trace as the active trace. (Each time the key is pressed causes the active trace to step down from the trace with the currently designated number to one with a smaller trace number.)

4. RESPONSE Block

A group of keys used mainly for setting up response measurements on the E5070B/E5071B.

Channel Max Key	Changes between normal and maximum display of the active channel window. In normal display, all the defined channel windows (both active and non-active) are displayed in split views on the screen. In maximum display, only the active channel window is displayed over the entire area, with non-active windows not displayed. To maximize the active channel, double-click the channel window frame. Measurements are also carried out on the non-active channels that are not displayed.
Trace Max Key	Changes between normal and maximum display of the active trace. In normal display, all traces defined on the channel (both active and non-active) are displayed on the screen. In maximum display, only the active trace is displayed over the entire area, with non-active traces not displayed. To maximize the active trace, double-click the area inside the channel window (excluding the frame). Measurements are also carried out on the non-active traces not displayed.
Meas Key	Displays the “Measurement Menu” on page 493 on the right side of the screen. Manipulating the “Measurement Menu” enables you to specify the measurement parameters (types of S-parameters) for each trace.
Format Key	Displays the “Format Menu” on page 484 on the right side of the screen. Manipulating the “Format Menu” enables you to specify the data format (data transformation and graph formats) for each trace.
Scale Key	Displays the “Scale Menu” on page 502 on the right side of the screen. Manipulating the “Scale Menu” enables you to specify the scale for displaying a trace (magnitude per division, value of the reference line, etc.) for each trace. You can also specify the electrical delay and phase offset for each trace.
Display Key	Displays the “Display Menu” on page 480 on the right side of the screen. Manipulating the “Display Menu” enables you to specify the number of channels and channel window array, the number and arrangement of traces, the setup for data math, etc.
Avg Key	Displays the “Average Menu” on page 467 on the right side of the screen. Manipulating the “Average Menu” enables you to define the averaging, smoothing, and IF bandwidth.
Cal Key	Displays the “Calibration Menu” on page 468 on the right side of the screen. Manipulating the “Calibration Menu” enables you to turn the calibration and error correction on/off and change definitions for calibration kits.

5. STIMULUS Block

A group of keys for defining the stimulus values (signal sources and triggers).

Start Key	Displays the data entry bar for specifying the start value of the sweep range in the upper part of the screen. (It also displays the "Stimulus Menu" on page 503 for specifying the sweep range on the right side of the screen.)
Stop Key	Displays the data entry bar for specifying the stop value of the sweep range in the upper part of the screen. (It also displays the "Stimulus Menu" in the same way as Start.)
Center Key	Displays the data entry bar for specifying the center value of the sweep range in the upper part of the screen. (It also displays the "Stimulus Menu" in the same way as Start.)
Span Key	Displays the data entry bar for specifying the span value of the sweep range in the upper part of the screen. (It also displays the "Stimulus Menu" in the same way as Start.)
Sweep Setup Key	Displays the "Sweep Setup Menu" on page 504 on the right side of the screen. Manipulating the "Sweep Setup Menu" enables you to specify the signal source power level, sweep time, number of points, sweep type, etc.
Trigger Key	Displays the "Trigger Menu" on page 510 on the right side of the screen. Manipulating the "Trigger Menu" enables you to specify the trigger mode and trigger source. Specify the trigger mode for each channel.

6. Floppy Disk Drive

A device for storing to and reading from a floppy disk the setup state of the E5070B/E5071B, measurement data, calibration data, data on images displayed on the LCD screen, VBA (Visual Basic for Applications) programs, etc. The floppy disk drive is compatible with a 3.5-inch, 1.44 MB, DOS (Disk Operating System) formatted floppy disk.

A floppy disk access lamp is provided at the lower left of the floppy disk drive opening. When the floppy disk drive is accessing a disk (for reading or writing), this lamp will light up green.

A disk eject button is provided at the lower right of the floppy disk drive opening. Pressing this button causes the inserted floppy disk to be ejected.

NOTE

Insert a floppy disk into the floppy disk drive opening **right side up** in the direction of the arrow marked on the disk.

Do not press the disk eject button while the floppy disk access lamp is on. Trying to forcefully pull the floppy disk out while the lamp is on may damage the floppy disk or disk drive.

7. NAVIGATION Block

The keys and knob in the NAVIGATION block are used to navigate between softkey menus, tables (limit table, segment table, etc.), or a selected (highlighted) area in a dialog box, or to change a numeric value in the data entry area by stepping up or down. When selecting one of two or more objects (softkey menus, data entry areas, etc.) to manipulate with the NAVIGATION block keys displayed on the screen, first press the Focus key in the "8. ENTRY Block" on page 30 to select the object to be manipulated (focus on the object) and then manipulate the NAVIGATION block keys (knob) to move your selection (highlighted object) or change numeric values.

In the following, you will see how the NAVIGATION block keys work both when the focus is on a softkey menu and when the focus is in the data entry area. For more about manipulating tables and dialog boxes, refer to the manipulation procedure for each of those functions.

When the focus is in a softkey menu (the softkey menu is selected)

When the focus is placed on a softkey menu (the menu title area in the uppermost part is displayed in blue), the NAVIGATION block keys work as described below.

Knob (Turn clockwise or counterclockwise.)	Moves the softkey selection (highlighted display) up or down.
↑ ↓ Key	Moves the softkey selection (highlighted display) up or down.
⇤ Key	Displays the softkey menu one layer above.
⇥ Key	Displays the softkey menu one layer below.
Knob or Enter key (to be pressed)	Executes the function of the selected softkey.

After pressing the data entry softkey, the focus automatically moves to the data entry area.

When the focus is in the data entry area (the data entry area is selected)

When the focus is placed on the data entry area (the data entry bar is displayed in blue), the NAVIGATION block keys work as described below.

Knob (Turn clockwise or counterclockwise.)	Increases or decreases the numeric value in the data entry area in small steps.
↑ ↓ Key	Increases or decreases the numeric value in the data entry area in large steps.
⇤ ⇥ Key	Moves the cursor (|) in the data entry area laterally back and forth. Use it together with the "8. ENTRY Block" keys to change data one character at a time.
Knob or Enter key (to be pressed)	Finishes the entry in the data entry area, and moves the focus to the softkey menu.

8. ENTRY Block

A group of keys used for entering numeric data.

[0] [1] [2] ... [9] [.] Key (Numeric key)	Type numeric characters and a decimal point at the position of the cursor in the data entry area.
[+/-] Key	Alternately changes the sign (+, –) of a numeric value in the data entry area.
[G/n] [M/μ] [k/m] [x1] Key	Adds a prefix to the numeric data typed by using the numeric key and [+/-] and then enters that data. One of the two prefixes written on the surface of the key is automatically selected depending on the parameter to be entered. [x1] is entered without a prefix being given.
Softkey On/Off [Entry Off] Key	Turns off the data entry bar if it is displayed. If the dialog box is displayed, cancels the entry and close the dialog box. If the data entry bar and dialog box are not displayed, turns the softkey menu display on/off.
[Back Space] Key	Deletes a character to the left of the cursor (|) in the data entry area. When two or more characters in the data entry area are selected (highlighted), deletes all the characters selected.
[Focus] Key	Changes the selection (focus) between the objects to be manipulated by the NAVIGATION block keys and ENTRY block keys. The objects to be manipulated by the NAVIGATION block keys and ENTRY block keys include softkey menus, data entry areas, tables (e.g., segment tables, limit tables, and marker tables), and dialog boxes. When two or more of these are displayed on the screen and need selecting, use this key to change the selection (focus) between the objects to be manipulated. When a softkey menu is selected, the menu name area at the top of the menu is displayed in blue. When a data entry area is selected, the data entry bar is displayed in blue. When a table is selected, the frame of the table window is displayed in light gray. While a dialog box is displayed, the focus is fixed on the dialog box and cannot be changed.

9. INSTR STATE Block

A group of the keys related to the macro function, store and call function, control/management function, and presetting the E5070B/E5071B (returning it to the preset state).

Macro Setup Key	Displays the "Macro Setup Menu" on page 485 on the right side of the screen. Manipulating the "Macro Setup Menu" enables you to start up the VBA editor, or create, call, or store a VBA project.
Macro Run Key	Executes a VBA procedure called "main" having a VBA module named Module1.
Macro Break Key	Stops the VBA procedure being executed.
Save/Recall Key	Displays the "Save/Recall Menu" on page 500 on the right side of the screen. Manipulating the "Save/Recall Menu" enables you to store to or read from the internal hard disk or floppy disk the setup conditions, calibration data, and trace data of the analyzer.
Capture System Key	First, temporarily saves the data for the image displayed on the LCD screen the moment this key is pressed [*1] to the internal memory (clipboard). Immediately after, displays the "System Menu" on page 506 on the right side of the screen. Manipulating the "System Menu" enables you to define the setup for and execute the limit test or define the setup concerning the control and management of the analyzer. Using the **Dump Screen Image** key enables you to store the image data in the clipboard to a file on the internal hard disk or a floppy disk. Also, using the **Print** key in the System menu enables you to print the image data in the clipboard to a printer.
Preset Key	Displays the "Preset Menu" on page 499 on the right side of the screen. Pressing **OK** in the "Preset Menu" enables you to return the analyzer to the initial setup state, called the preset setup. For the initial setup for each of the functions, see Appendix C, "List of Default Values," on page 443.

*1. Strictly speaking, the temporary save occurs the moment the "System Menu" is manipulated. Therefore, this also occurs when the menu bar is used to execute **5 Instr State** - **5 System**.

10. MKR/ANALYSIS Block

A group of keys used for analyzing the measurement results by using the markers, fixture simulator, etc. For functions of the keys in the MKR/ANALYSIS block, see Chapter 2 “Overview of Functions” in the *User’s Guide*.

Marker Key	Displays the “Marker Menu” on page 487 on the right side of the screen. Manipulating the “Marker Menu” enables you to turn the markers on/off and move them by entering stimulus values. You can place up to 10 markers on each trace.
Marker Search Key	Displays the “Marker Search Menu” on page 490 on the right side of the screen. Manipulating the “Marker Search Menu” enables you to move a marker to a specific point (maximum, minimum, peak, and a point with a target value) on a trace. You can also find the bandwidth parameters (up to six) and display them.
Marker Fctn Key	Displays the “Marker Function Menu” on page 489 on the right side of the screen. Manipulating the “Marker Function Menu” enables you to not only specify the marker sweep range and coupling of markers on a channel but also display statistics data on traces.
Analysis Key	Displays the “Analysis Menu” on page 455 on the right side of the screen. Manipulating the “Analysis Menu” enables you to use the analytical function called the fixture simulator.

11. Test Port

A port to which the DUT is connected. Option 213 and 214 each has two ports, Option 314 and 314 each has three ports, and Options 413 and 414 each has four ports. While signals are being output from a test port, the yellow LED above the test port lights up.

Connector type: 50 Ω, N-type, female

CAUTION ⚠ Do not apply a DC voltage or current to the test port. Applying a DC voltage or current may lead to device failure. In particular, there is a possibility of the capacitor remaining charged. Connect the measurement sample (DUT) to the test port (or the test fixture, cables, etc. connected to the test port) after the analyzer has been completely discharged.

The test ports comply with Installation Category I of IEC 61010-1.

12. Front USB Port

A USB (Universal Serial Bus) port (number of parts: 1) specifically for an ECal (Electronic Calibration) module, a USB/GPIB interface, a multiport test set or a printer. Connecting a designated ECal module to this port enables ECal measurement to be performed. Connecting a designated printer to this port enables screen information on the E5070B/E5071B to be printed to the printer. For more about executing ECal measurements, see Chapter 4, “Calibration,” on page 81, and for printing to a printer, see “Printing Displayed Screen” on page 259. The specifications of this port are identical to the “14. Rear USB port” on page 49.

NOTE We do not support connections to the USB port of devices other than designated printers, ECal modules, a USB/GPIB interface, and multiport test sets.

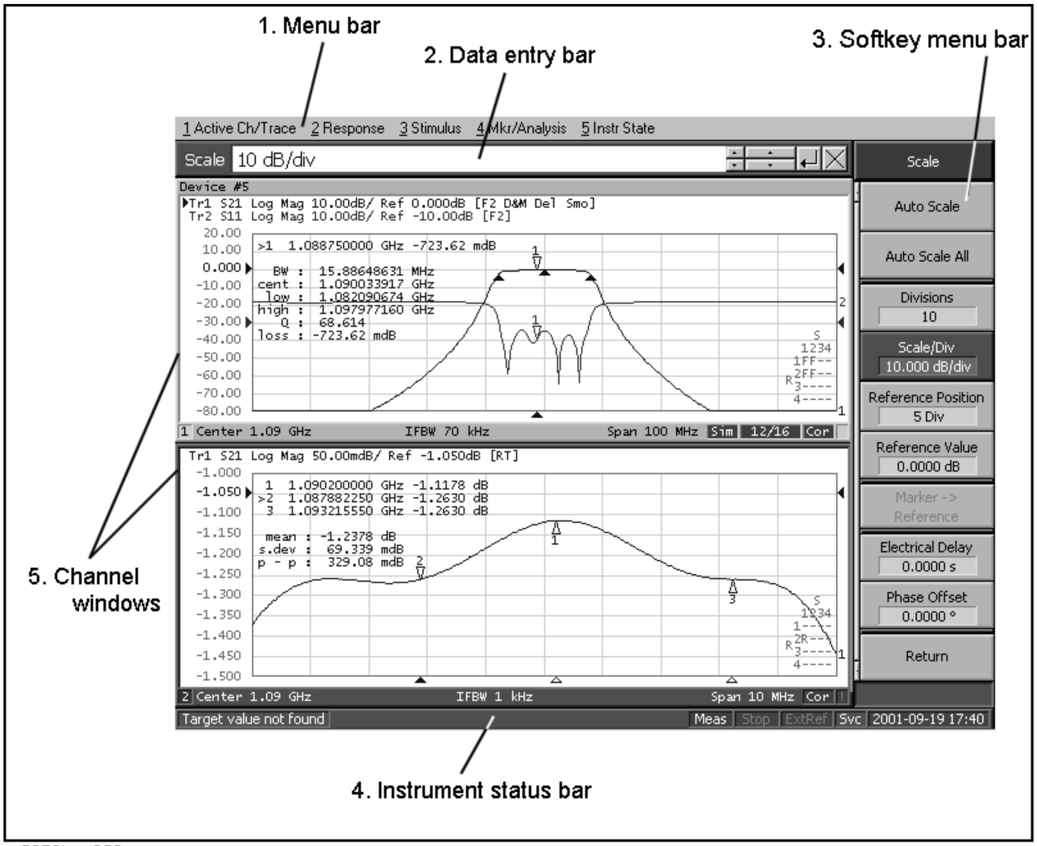
13. Ground Terminal

Connected to the chassis of the E5070B/E5071B. You can connect a banana type plug to this terminal.

Screen Area: Names and Functions of Parts

This section describes the names and functions of parts on the LCD screen of the E5070B/E5071B.

Figure 2-2 **Screen Display**



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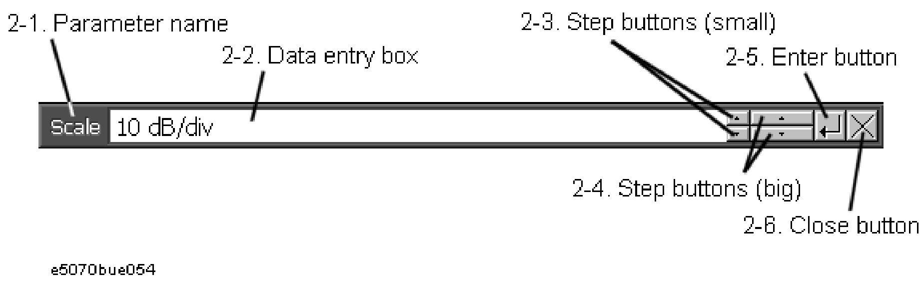
1. Menu Bar

By using the mouse and keyboard to manipulate the menu bar, you can perform interface operations that are equivalent to those of the keys in the ACTIVE CH/TRACE block, RESPONSE block, STIMULUS block, MKR/ANALYSIS block, and INSTR STATE block on the front panel of the E5070B/E5071B. The menus on the menu bar correspond to the key blocks, and their submenus to the hardkeys inside the key blocks.

2. Data Entry Bar

Used to enter numeric data into the E5070B/E5071B. Press a hardkey or softkey to enter data, and the data entry bar will appear at the top of the screen. To assign a title to a channel window, an entry bar that allows you to enter letters and symbols by using the front panel keys or mouse is displayed instead.

Figure 2-3 **Data Entry Bar**



NOTE To manipulate the data entry bar using the front panel keys, the data entry bar must be selected as the object to be manipulated (with the focus placed on it). When the focus is placed on the data entry bar, the entire bar is displayed in blue. Pressing or clicking Focus in the "8. ENTRY Block" on page 30 enables you to move the focus to the desired object.

2-1. Parameter Name

Displays the name of the parameter for which data will be entered.

2-2. Data Entry Area

When the data entry bar is displayed for the first time, the current settings are displayed on it. You can change numeric values by typing from the keyboard or in the ENTRY block on the front panel.

2-3. Step Button (Small)

Increases or decreases the numeric value in the data entry area in small steps. Use the mouse to manipulate this button.

2-4. Step Button (Large)

Increases or decreases the numeric value in the data entry area in large steps. Use the mouse to manipulate this button.

2-5. Enter Button

After typing numeric values in the data entry area by using the keyboard or the numeric keys in the ENTRY block on the front panel, press this button to finish the entry. Use the mouse to manipulate this button.

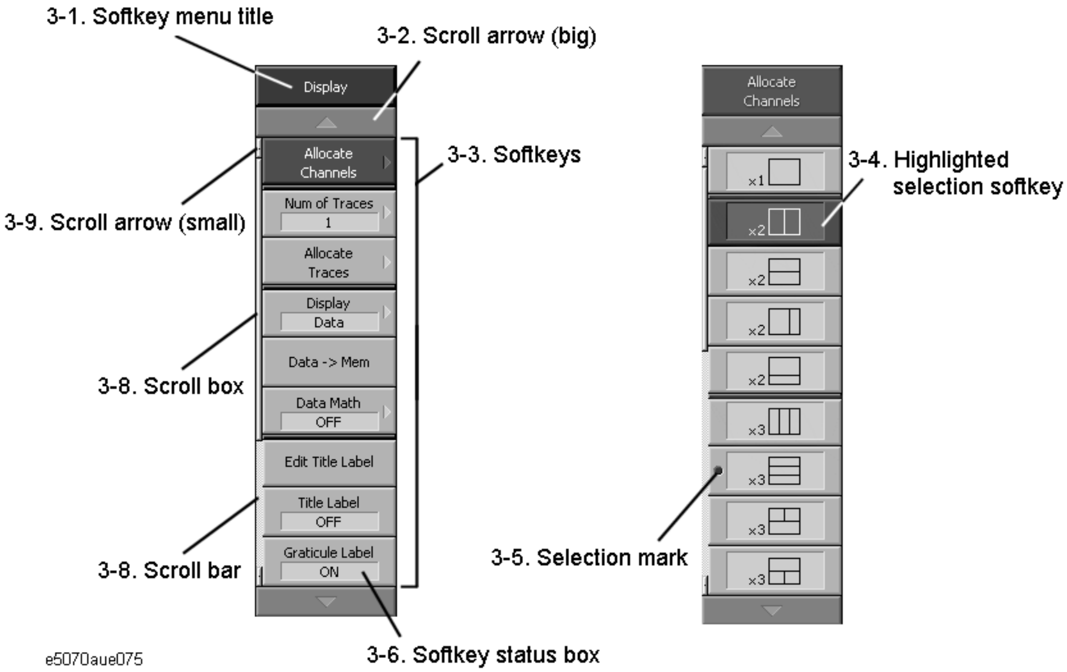
2-6. Close Button

Closes the data entry area (turns off the display). Use the mouse to manipulate this button.

3. Softkey Menu Bar

A group of keys on the screen called by the hardkeys and menu bars. You can manipulate these keys by using the NAVIGATION block keys on the front panel, the mouse, or the keyboard. When a touch screen LCD (Option 016) is used, you can perform manipulations by directly touching the screen with your finger instead of using a mouse.

Figure 2-4 **Softkey Menu Bar**



NOTE To manipulate a menu bar, it has to be selected as the object to be manipulated (with the focus placed on it). When the focus is placed on a menu bar, the menu title area at the top is displayed in blue. Pressing or clicking on Focus of "8. ENTRY Block" on page 30 enables you to move the focus to the desired object.

3-1. Softkey Menu Title

The title of the softkey menu is displayed here. Double-clicking on this part of the menu bar displays the top layer of softkeys.

3-2. Scroll Arrow (Large)

When the softkeys in a menu overflow the screen, using this key enables you to scroll the menu page by page. Both upward and downward scroll arrows are available. Use the mouse to manipulate these buttons.

3-3. Softkeys

These are the actual keys you would use to perform setup. A ▶ displayed to the right of a softkey indicates that pressing that softkey will display the lower layer of softkeys.

3-4. Highlighted Softkey

Pressing and Enter on the front panel or pressing Enter on the keyboard causes the highlighted (selected) softkey to be executed. You can change which softkey in the menu is highlighted by turning or pressing on the front panel, or by pressing ↑ ↓ on the keyboard. Pressing the key on the front panel or the ← key on the keyboard brings up the upper level softkey menu and pressing the key on the front panel or the → key on the keyboard brings up the lower level softkey menu.

3-5. Selection Mark

Shows which softkey function is currently selected.

3-6. Softkey Status Display

Displays the setup status of that softkey.

3-7. Scroll Bar

When the softkeys in a menu overflow the screen, clicking on the blank part of this scroll bar enables you to scroll the softkey menu up or down.

3-8. Scroll Box

You can scroll the softkey menu up or down by using the mouse to select and drag the scroll box (pressing the button on the object to be moved and then releasing the button at the desired location). The length and position of the scroll box represent the ratio and position of the currently displayed part to the length of the entire softkey menu.

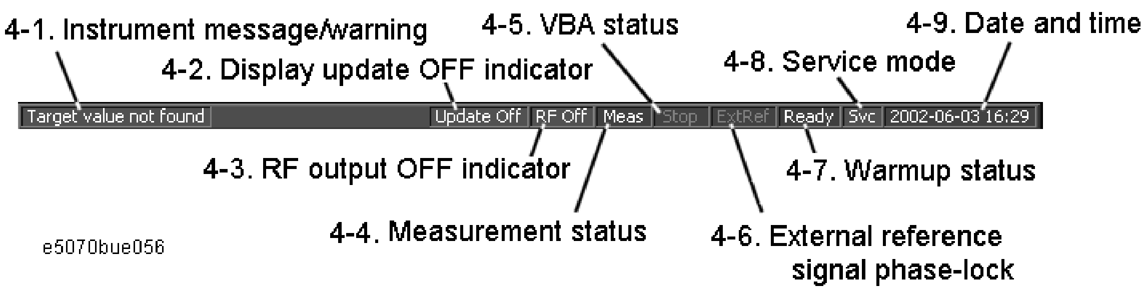
3-9. Scroll Arrow (Small)

Using this button, you can scroll the menu one softkey at a time. Both upward and downward scroll arrows are available. Use the mouse to manipulate these buttons.

4. Instrument Status Bar

The bar that displays the status of the entire instrument.

Figure 2-5 **Instrument Status Bar**



4-1. Instrument Message/Warning

Displays instrument messages and warnings. Instrument messages are displayed in gray and warnings in red. For the meanings of the instrument messages and warnings, see Appendix B, “Troubleshooting,” on page 425

4-2. Display update OFF indicator

When updating of information displayed on the LCD screen is turned off, this indicator is displayed.

4-3. Rf output OFF indicator

When the stimulus signal output is turned off, this indicator is displayed.

4-4. Measurement Status

Displays the measurement status of the E5070B/E5071B.

Setup	Setup for measurement in progress
Hold	Measurement on hold (idling)
Init	Measurement being initialized
Man	The trigger source is set to “Manual” and waiting for trigger.
Ext	The trigger source is set to “External” and waiting for trigger.
Bus	The trigger source is set to “Bus” and waiting for trigger.
Meas	A measurement is in progress.

4-5. VBA Status

Displays the state of the execution of the VBA program in the E5070B/E5071B.

Run	A VBA program is currently running.
Stop	A VBA program has stopped.

4-6. External Reference Signal Phase Lock

When the frequency reference signal is input to the “10. External Reference Signal Input Connector (Ref In)” on page 48 on the rear panel, and the measurement signal of the E5070B/E5071B is phase-locked to the reference signal, **ExtRef** is displayed in blue.

ExtRef (displayed in blue)	Measurement signal is phase-locked to the external reference signal
ExtRef (displayed in gray)	Measurement signal is not phase-locked to the external reference signal.

NOTE Even when the “9. High Stability Frequency Reference Output Connector (Ref Oven, Option 1E5 only)” on page 48 and “10. External Reference Signal Input Connector (Ref In)” on page 48 are connected, phase-locking may not occur immediately after power-on in a low-temperature environment. (The “ExtRef” display remains gray, not turning blue.) In such a case, wait a few minutes until the instrument has warmed up and the “ExtRef” display turns blue.

4-7. Warm-up Status

Ready (displayed in blue)	Shows the warm-up in the instrument is completed.
Ready (displayed in gray)	Shows the warm-up in the instrument is not completed.

4-8. Service Mode

Indicates the service mode status.

SVC (displayed in blue)	The E5070B/E5071B is in service mode, which is used for self-diagnosis and repair of the E5070B/E5071B. Therefore, measurement performance will not be guaranteed according to the specifications. If, under normal use, the system remains in the service mode and does not return to normal operating mode, there is a possibility that the instrument is out of order.
SVC (displayed in red)	An abnormal condition has been detected inside the E5070B/E5071B. The unit may be damaged. Contact the Customer Contact listed at the end of this brochure or the distributor from whom the unit was purchased.
SVC (displayed in gray)	The E5070B/E5071B is in normal mode.

4-9. Date / Time

Displays the date and time generated by the internal clock. The display format is as follows:

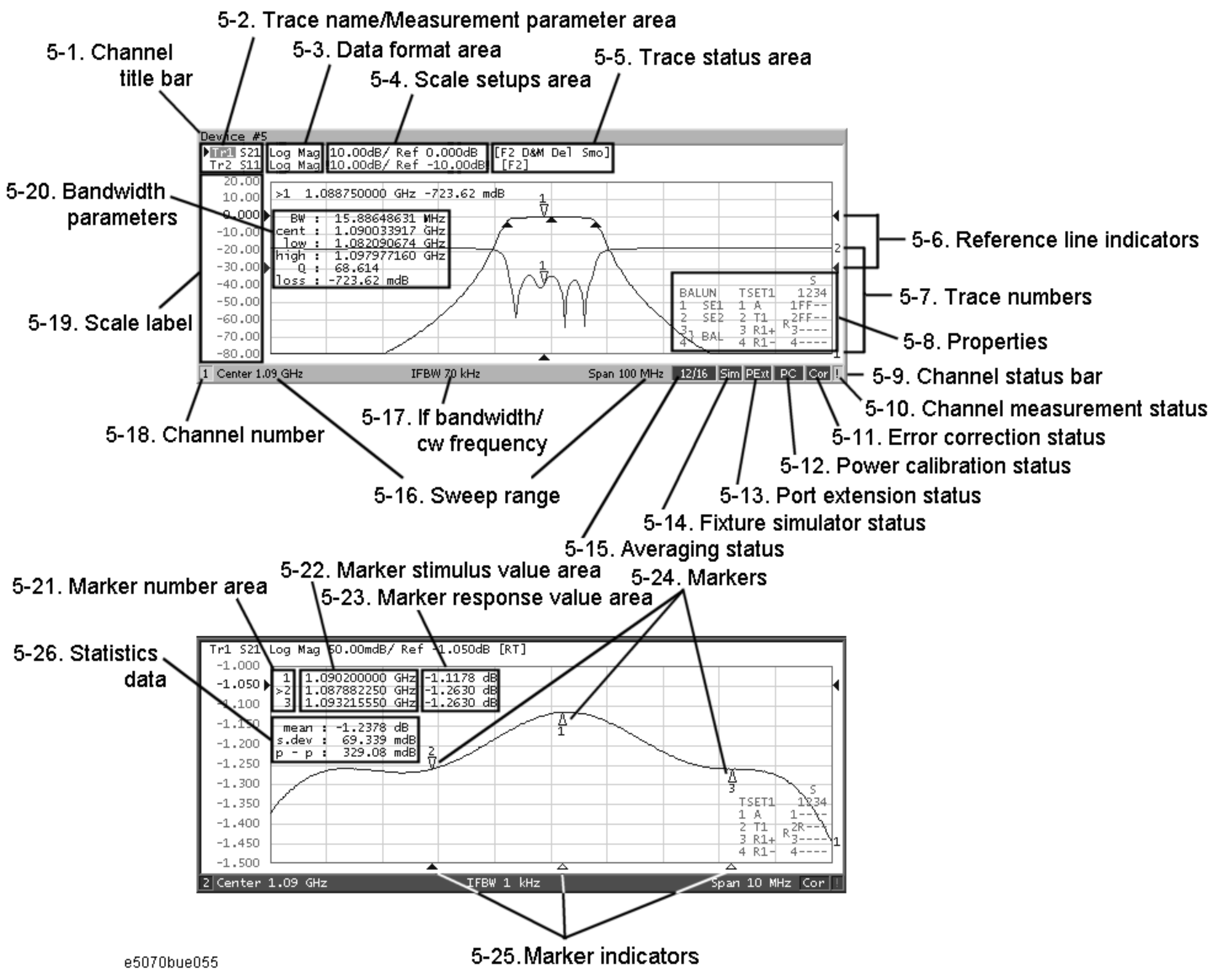
YYYY-MM-DD HH:MM	**YYYY**: Year (AD) **MM**: Month **DD**: Day **HH:MM**: Time (0:00 to 23:59)

You can turn the date and time display on/off by manipulating the keys: System - **Clock Setup** - **Show Clock**.

5. Channel Window

Windows for displaying traces. Because a channel corresponds to a window, it is called a channel window. When the outer frame of a channel window is displayed in light gray, the channel is the active channel (the channel for which setup is being performed). In Figure 2-2 on page 34, channel 1 (the upper window) is the active channel. To make a channel active, use Channel Next or Channel Prev. Clicking inside a channel window will also make a channel active.

Figure 2-6 Channel Window



5-1. Channel Title Bar

You can assign a title to each channel and have the title displayed on the bar. For more about setting up a channel title bar, see “Labeling a Window” on page 78.

5-2. Trace Name/Measurement Parameter

The names of the traces (Tr1 through Tr9)on the channel and their measurement parameters are displayed here. ▶ to the right of the trace name indicates the active trace (the trace for which setup is being performed). To make a trace active, use Trace Next or Trace Prev. Clicking the line where the trace name is placed (the mouse pointer changes from to) also makes a trace active.

5-3. Data Format

The data format of each trace is displayed here. For more on setting up data formats, see “Selecting a Data Format” on page 70.

5-4. Scale Settings

The scale setting for each trace is displayed here. This example shows that “0.00dB/” corresponds to 10 dB per division. “Ref 0.000dB” shows that the value of the reference line is at 0 dB. For more about setting scales, see “Setting the Scales” on page 74.

5-5. Trace Status Area

The setup for each trace is displayed here.

Table 2-1 Trace Status Display

Classification	Contents inside the [ ]	Meaning
Error correction	**RO**	Error correction: ON (OPEN (n) response calibration)
	RS	Error correction: ON (SHORT (n) response calibration)
	RT	Error correction: ON (THRU (n) response calibration)
	F1	Error correction: ON (1-port calibration)
	F2	Error correction: ON (Full 2-port calibration)
	F3	Error correction: ON (Full 3-port calibration)
	F4	Error correction: ON (Full 4-port calibration)
Turning on/off traces	Nothing	Data trace: ON, Memory trace: OFF
	M	Data trace: OFF, Memory trace: ON
	D&M	Data trace: ON, Memory trace: ON
	off	Data trace: OFF, Memory trace: OFF
Performing data math	**D+M** (**D+M&M**)	Execution of Data+Mem math
	D–**M** (**D**–**M&M**)	Execution of Data–Mem math
	D*M (**D*M&M**)	Execution of Data*Mem math
	D/M (**D/M&M**)	Execution of Data/Mem math
Electrical delay	**Del**	A numeric value other than 0 (zero) is specified as the electrical delay or phase offset.
Smoothing	**Smo**	Smoothing: ON
Gating	**Gat**	Gating: ON
Parameter conversion	**Zr**	Conversion: ON (Impedance: Reflection measurement)
	Zt	Conversion: ON (Impedance: Transmission measurement)
	Yr	Conversion: ON (Admittance: Reflection measurement)
	Yt	Conversion: ON (Admittance: Transmission measurement)
	1/S	Conversion: ON (Inverse S-parameter)

5-6. Reference Line Indicators

The indicators that indicate the position of the reference line for the Y-axis scale in the rectangular display format. One indicator to the right and the other to the left of the scale. (▶ and ◀). To enter a numeric value for the position of the reference line, open the data entry bar using keys: Scale - **Reference Position**. You can also move the position of the reference line by placing the mouse pointer on either of the two reference line indicators (the pointer changes from to .), moving the indicator vertically with the left mouse button kept pressed, and then releasing the button at the desired location. (This mouse operation is called a drag-and-drop operation).

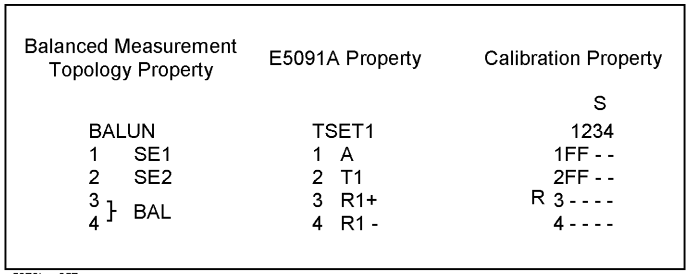
5-7. Trace Number

In the rectangular display format, the trace number is displayed in the same color as the trace at the right end of each trace.

5-8. Properties

Displays the following properties.

Figure 2-7 **Properties**



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Calibration Property	Displays the status of the obtained calibration coefficients on the channel. For details, see “Acquisition status of calibration coefficient for each channel” on page 90.
E5091A Property	Displays the assignment information of the test ports on the channel. For details, see “Displaying the E5091A property” on page 327.
Balanced Measurement Topology Property	Displays the topology for balanced measurement on the channel. For details, see “Checking device type and port assignment” on page 213.

5-9. Channel Status Bar

The status of each channel is displayed here. (See parts 5-10 through 5-16.)

5-10. Channel Measurement Status

Displays the update status of traces on the channel.

!	Measurement in progress. When the sweep time exceeds 1.5 seconds, ↑ is displayed at the point on the trace.
#	Invalid traces. The measurement conditions have changed, but the traces on the channel currently displayed have not been updated to match the new conditions.
(No display)	The measurement has not executed.

5-11. Error Correction Status

Displays the execution status of error correction on the channel. For details, see “Execution status of error correction for each channel” on page 89.

5-12. Power Calibration Status

Displays the execution status of power level error correction on the channel. For details, see “Turning On or Off Power Level Error Correction” on page 155.

5-13. Port Extension Status

Shows whether the port extension is turned ON or OFF.

PExt (displayed in blue)	Port extension: ON
(not displayed)	Port extension: OFF

5-14. Fixture Simulator Status

Shows whether the fixture simulator is turned ON or OFF.

Sim (displayed in blue)	Fixture simulator: ON
(not displayed)	Fixture simulator: OFF

5-15. Averaging Status

Displays the averaging factor and averaging count when averaging is turned on.

n/m (displayed in blue)	Averaging: ON (m: averaging factor; n: averaging count)
(not displayed)	Averaging: OFF

5-16. Sweep Range

Indicates the sweep range by using the start/stop or center/span.

5-17. IF Bandwidth/CW Frequency

Indicates the IF bandwidth when the sweep type is linear/log frequency or the CW frequency when the sweep type is power.

5-18. Channel Number

Indicates the channel number.

5-19. Graticule Labels

Y-axis divisions in the rectangular display format. When traces in the rectangular display format are overlaid, the Y-axis divisions for the active trace are displayed. The value of the reference line (the division line between ▶ and ◀) is entered numerically by opening the data entry bar using the keys: [Scale] + **Reference Value**. You can change values of the reference line at one division intervals by placing the mouse pointer in the area of the graticule label (the pointer changes from ↖ to ↕), moving the pointer vertically with the left mouse button pressed, and then releasing the button at the desired location.

5-20. Bandwidth Parameters

Turning on the bandwidth search function displays the bandwidth parameters here. For more about the bandwidth search function, see “Determining the Bandwidth of the Trace (Bandwidth Search)” on page 187.

5-21. Marker Numbers

The marker values are displayed in a list at positions 5-21, 5-22, and 5-23. Position 5-21 displays the marker numbers. For the active marker (the one for which setup and analysis are being performed), **>** is displayed to the left of the marker number. For the reference marker, △ is displayed instead of the marker number.

5-22. Marker Stimulus Values

The marker stimulus value for each marker (the frequency/power level at the marker point) is displayed here.

5-23. Marker Response Values

The marker response value for each marker (the measurement value at the marker point) is displayed here. Two (or three) response values are displayed for data in Smith chart or polar display format.

5-24. Markers

The markers used for reading values on a trace. Up to 10 markers can be displayed for each trace.

n ▽	Active marker (the one for which setup and analysis are being performed)
△ n	Non-active marker

n denotes a marker number. For the reference marker, however, nothing is displayed at the location of n. Clicking the marker or one of the “5-25. Marker Indicators” makes the marker active.

5-25. Marker Indicators

Indicates the positions of markers on the stimulus axis.

▲	Active marker indicator
△	Non-active marker indicator

You can also move a marker to the desired position by placing the mouse pointer on the marker indicator or position of the marker itself (the pointer changes from to ◂▸), moving the indicator vertically with the left mouse button pressed, and then releasing the button at the desired location.

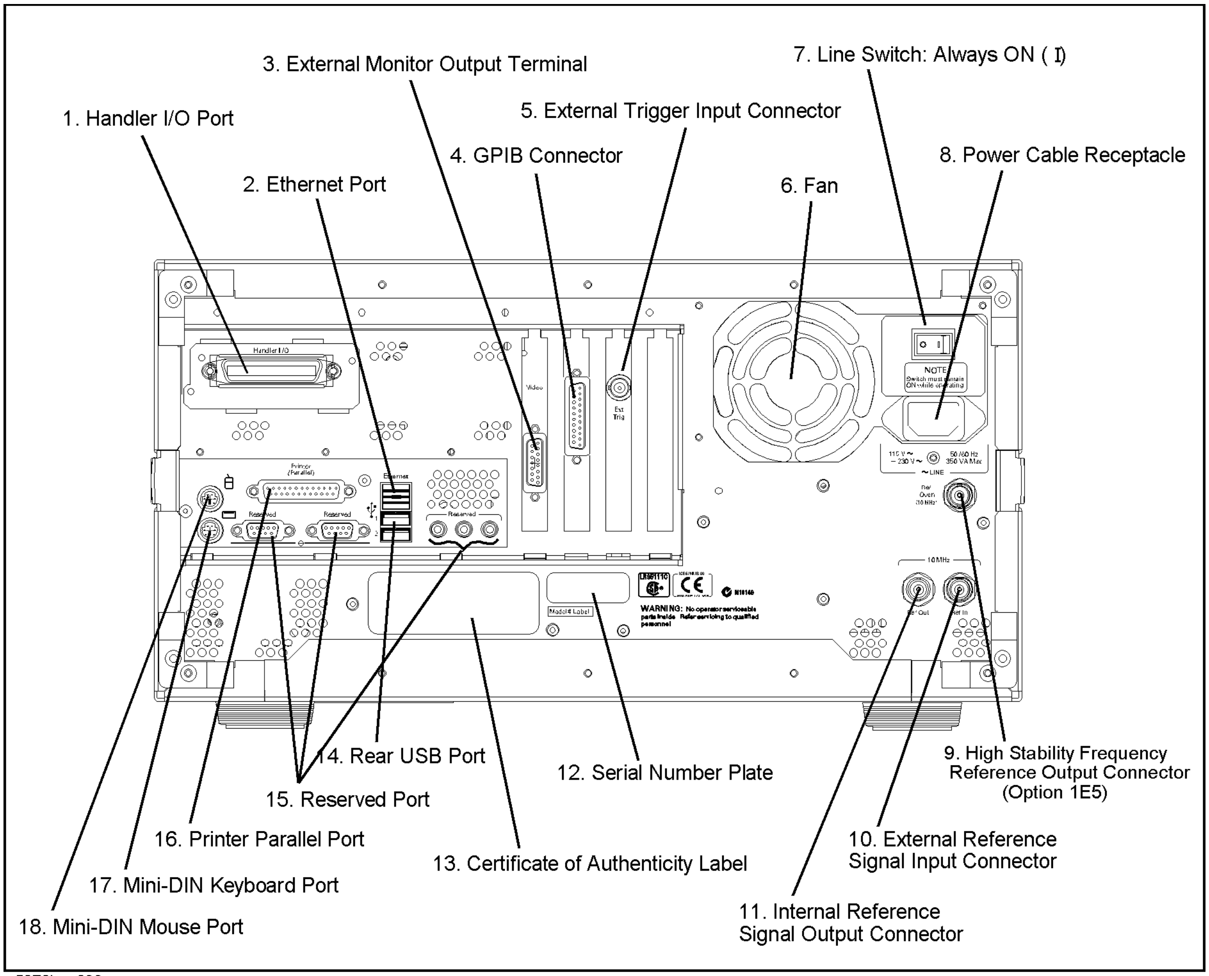
5-26. Statistics Data

Turning on the statistics data function displays statistics data here. For more about the statistics data function, see “Determining the Mean, Standard Deviation, and p-p of the Trace” on page 189.

Rear Panel: Names and Functions of Parts

This section describes the names and functions of the parts on the rear panel of the E5070B/E5071B.

Figure 2-8 **Rear Panel**



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1. Handler I/O Port

The terminal to which an automatic machine (handler) used on a production line is connected. For more about using the handler I/O port, see the Programmer’s Guide.

Connector type: 36-pin Ribbon (Centronics) connector

2. Ethernet Port

A terminal for connecting the E5070B/E5071B to a LAN (Local Area Network). Connecting this instrument to a LAN enables you to access the hard disk drive of this instrument from an external PC or to control this instrument by using SICL-LAN or telnet.

Connector type: 8-pin RJ-45 connector
Base standard: 10Base-T/100Base-TX Ethernet (automatic data rate selection)

3. External Monitor Output Terminal (Video)

A terminal to which the external color monitor (display device) is connected. By connecting the color monitor to this terminal, the same information shown on the LCD screen of the main body can be displayed on an external color monitor.

Connector type: 15-pin VGA connector, female

4. GPIB Connector

General Purpose Interface Bus (GPIB). The connection of an external controller and other devices through this connector allows an automatic measurement system to be structured. For more about the automatic measurement system using the GPIB, see the Programmer’s Guide.

5. External Trigger Input Connector (Ext Trig)

A connector to which external trigger signals are input. This connector detects the downward transition from the HIGH state in TTL signals as the trigger signal. To use this connector to generate a trigger, you must set the trigger source to the “external” side. (Key operation: Trigger -**Trigger Source** - **External**).

Connector type: BNC connector, female

6. Fan

The cooling fan for limiting the temperature rise inside the E5070B/E5071B. This fan exhausts heated air from inside the analyzer to the outside.

7. Line Switch (Always ON)

Always keep this switch on (|).

CAUTION **Do not use this switch to turn off (◯) the mains. Doing so may cause the analyzer to fail.** For more information, see the description of the “1. Standby Switch” on page 25.

8. Power Cable Receptacle (to LINE)

The receptacle (outlet) to which the power cable is connected.

NOTE To feed power, use the included three-prong power cable with a ground conductor.

The plug attached to the power cable (on the power outlet side or device side of the cable) serves as the disconnecting device (device that cuts off power supply) of the E5070B/E5071B. When the power supply must be cut off to avoid danger of electric shock or the like, pull out the power cable plug (on the power outlet side or device side of the cable). For the procedure for turning off the mains in normal use, see the description in "1. Standby Switch" on page 25.

For more about the power supply, see Chapter 2 "Installation" in the Installation and Quick Start Guide.

9. High Stability Frequency Reference Output Connector (Ref Oven, Option 1E5 only)

When Option 1E5 (High stability frequency reference) is installed, the reference signal is output from this connector.

Connector type: BNC connector, female
Output signal (Nominal): 10 MHz, +2 dBm

NOTE When Option 1E5 (High stability frequency reference) is installed, connect this connector to the "10. External Reference Signal Input Connector (Ref In)" on page 48 by using the BNC(m)-BNC(m) cable included with the option.

10. External Reference Signal Input Connector (Ref In)

The reference signal input connector for phase-locking the measurement signal from the E5070B/E5071B to the external frequency reference signal. Inputting the reference signal to this connector improves the accuracy and stability of the frequency of the measurement signal from the E5070B/E5071B.

Connector type: BNC connector, female
Input signal (Nominal): 10 MHz ±10 ppm, 0 to +6 dBm

NOTE When the frequency reference signal is input to this connector, the measurement signal from the E5070B/E5071B is automatically phase-locked to the reference signal. When an input signal is not present, the frequency reference signal inside the E5070B/E5071B is automatically used. The **ExtRef** on the instrument status bar is displayed in blue when the system is phase-locked to the external reference signal and in gray when not phase-locked.

When using Option 1E5 (High stability frequency reference), connect this connector to the "9. High Stability Frequency Reference Output Connector (Ref Oven, Option 1E5 only)" on page 48 by using the BNC(m)-BNC(m) cable included with the option.

11. Internal Reference Signal Output Connector (Ref Out)

A connector for outputting the internal frequency reference signal from the E5070B/E5071B. By connecting this output connector to the external reference signal input connector of another device, the device can be phase-locked to the internal reference signal of the E5070B/E5071B and used under this condition.

Connector type: BNC connector, female
Output signal (Nominal): 10 MHz, +2 dBm
Output impedance (Nominal): 50 Ω

12. Serial Number Plate

The seal showing the serial number of the product.

13. Certificate of Authenticity Label

The label showing information of the “Certificate of Authenticity.”

14. Rear USB port

A USB (Universal Serial Bus) port (number of ports: 2) specifically for an ECal (Electronic Calibration), a USB/GPIB interface, a multiport test set or a printer. The specifications of this port are identical to the “12. Front USB Port” on page 33.

15. Reserved Port (Reserved)

Using these two ports is not allowed. No connections.

16. Printer Parallel Port

The 25-pin parallel port for printer connection. Connecting a designated printer to this port allows screen information on the E5070B/E5071B to be printed to a printer. For more about printing to a printer, see “Printing Displayed Screen” on page 259.

17. Mini-DIN Keyboard Port

The port to which a mini-DIN type keyboard is connected. The keyboard can be used to edit VBA programs inside the E5070B/E5071B or to enter file names. Since the arrow keys and numeric keys on the keyboard work in the same way as the arrow keys and numeric keys on the front panel of the E5070B/E5071B, you can use it instead of the front panel operation.

NOTE Be sure to only use a keyboard designated for use with this instrument. Using a keyboard other than those designated may cause wrong actions to occur.

18. Mini-DIN Mouse Port

The port to which a mini-DIN type mouse is connected. Using a mouse enables you to more efficiently perform the operations of menu bars, softkeys, and dialog boxes as well as selecting an active channel or an active trace. The mouse also enables you to move a marker or the scale reference line using drag-and-drop operations.

NOTE Be sure to only use a mouse designated for use with this instrument. Using a mouse other than those designated may cause wrong actions to occur.

3 Setting Measurement Conditions

This chapter describes how to set up the measurement conditions for the Agilent E5070B/E5071B Network Analyzer.

Initializing Parameters

The E5070B/E5071B has three different initial settings as shown in Table 3-1 below.

Table 3-1 **E5070B/E5071B Initial Settings and Methods for Restoring Them**

Initial setting	**Restore Method**
Preset state	• Press Preset - **OK** on the front panel or, • Execute the :SYST:PRES command.
*RST state	Execute the *RST command.
Factory default setting	(The way the E5070B/E5071B is set up prior to shipment from the factory)

For further details of each setting, refer to Appendix C, “List of Default Values,” on page 443. To restore initial settings using commands, refer to the Programmer’s Guide and VBA Programmer’s Guide.

Setting Channels and Traces

The E5070B/E5071B allows you to use up to 16 channels (when the number of traces is up to 4) to perform measurement under 16 different stimulus conditions.

For each channel, up to 16 traces (measurement parameters) can be displayed (when the number of channels is up to 4). Because multiple traces can be displayed for each channel, the feature to link the stimulus conditions between channels is not provided and each channel is always independent of one another. In other words, for the E5070B/E5071B, you need to set the measurement conditions and execute calibration for all channels you use for measurement.

For the E5070B/E5071B, you can change the number of available channels and the upper limit of the number of traces. If you change the upper limit setting, you need to restart the firmware of the E5070B/E5071B. Therefore, first, set the upper limit appropriately depending on the numbers of channels and traces necessary for your measurement.

When you set items whose setting target is channels/traces (refer to “Setting target for each setting item (range to which setting affects)” on page 58), the target is the selected (active) channel/trace. You can specify only the displayed channels/traces as active channels/traces. Therefore, set the display of channels/traces before setting the measurement conditions.

Setting upper limits of number of channels/traces

For the E5070B/E5071B, you can select the upper limits of the number of channels and the number of traces from the following combinations.

- 4 channels and 16 traces
- 9 channels and 9 traces
- 12 channels and 6 traces
- 16 channels and 4 traces

For the compatibility of saving/recalling the instrument state file when the maximum number of channels/traces is different, see “Saving and Recalling Instrument State” on page 244

The selection procedure is as follows:

Step 1. Press System.

Step 2. Press **Misc Setup**.

Step 3. Press **Channel/Trace Setup**.

Step 4. Press the desired softkey to select the upper limits of the number of channels and the number of traces.

Step 5. Press **Return**. The dialog box that prompts you to restart the firmware appears. Click the **Yes** button to restart the firmware.

Setting channel display (layout of channel windows)

The measurement result for each channel is displayed in its dedicated window (channel window). You cannot have a single window display the measurement results from more than one channel. This means that setting the window layout determines the number of channels displayed on screen.

NOTE The execution of measurement for each channel does not depend on how the channel is displayed (channels that are not displayed can be measured). For information on the measurement execution for each channel (trigger mode and trigger source), refer to Chapter 5, “Making Measurements,” on page 167.

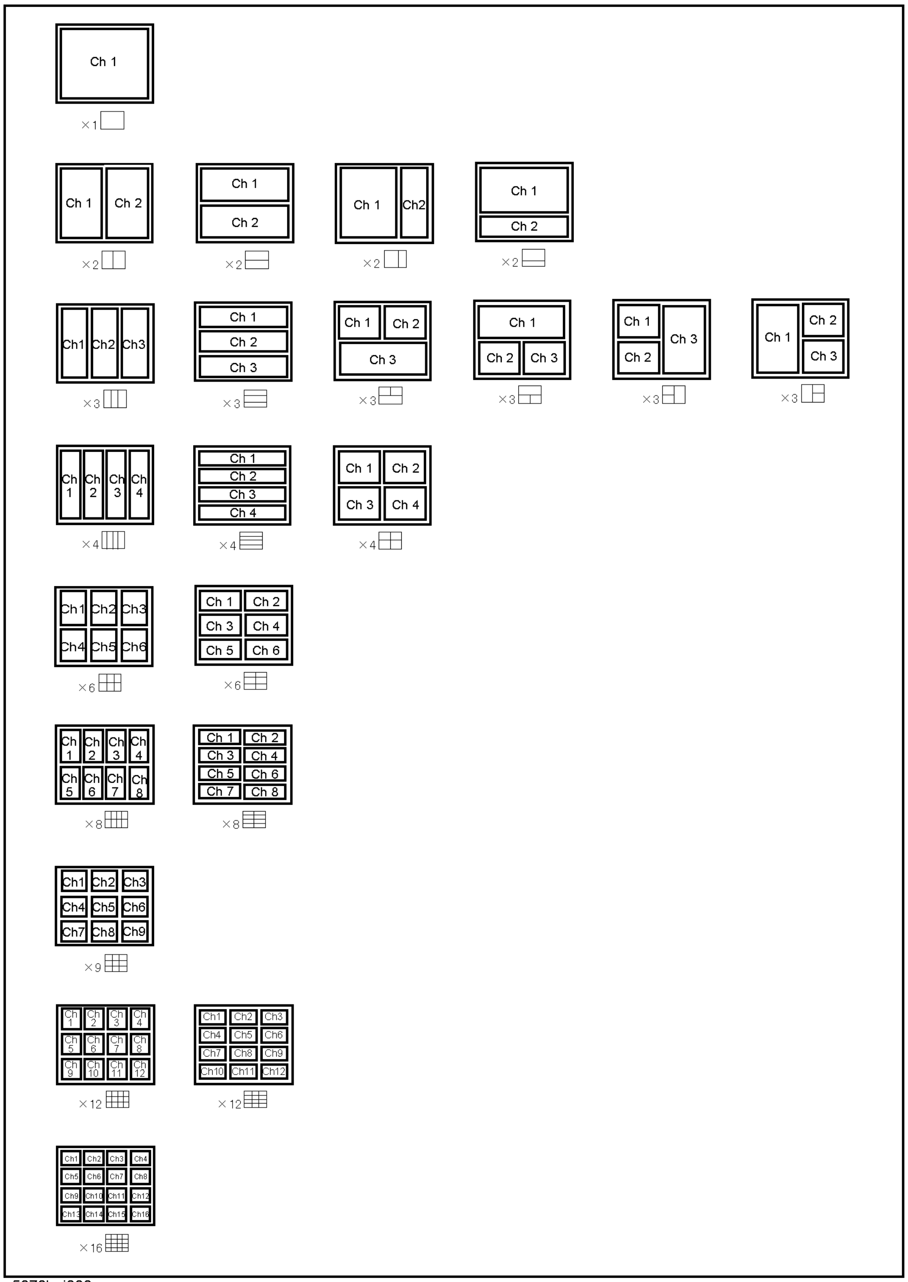
The setting procedure of the window layout is as follows:

Step 1. Press Display.

Step 2. Press **Allocate Channels**.

Step 3. Press the desired softkey to select the window layout (refer to Figure 3-1).

Figure 3-1 **Layout of channel windows**



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Setting trace display

Setting number of traces

Depending on the measurement parameters of the traces displayed for each channel, a sweep necessary for each channel is executed. For more information, refer to “Sweep Order in Each Channel” on page 168.

You specify the trace display with the number of traces (upper limit of displayed trace numbers). For example, if you set the number of traces to 3, trace 1 to trace 3 are displayed.

The setting procedure of the number of traces is as follows:

Step 1. Press Channel Next or Channel Prev to select the channel for which you want to set the number of traces.

Step 2. Press Display.

Step 3. Press **Number of Traces**.

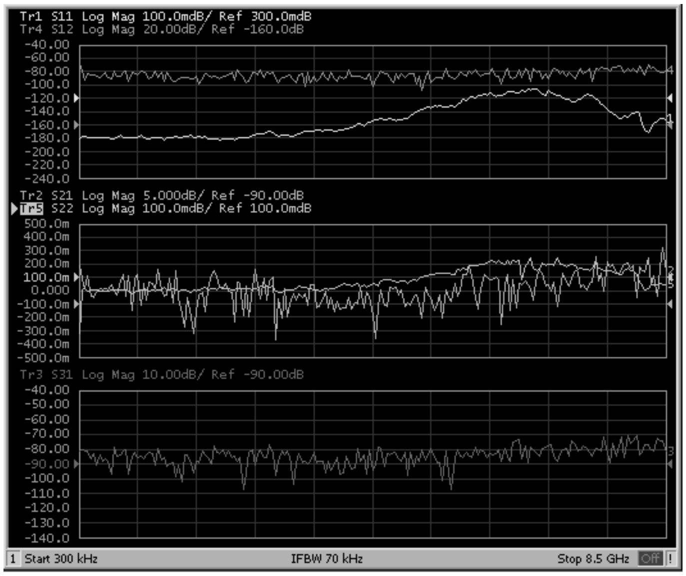
Step 4. Press the desired softkey to set the number of traces.

Setting trace layout (graph layout)

Traces are laid out and displayed in the order of the trace number from graph 1 according to the graph layout in the channel window.

You can select the graph layout from Figure 3-2.

If the number of traces is less than the number of graphs, nothing is displayed in the remaining area. If the number of traces you set exceeds the number of graphs, excess traces are superimposed from the first graph. For example, if you select ×3 as the graph layout and set the number of traces to 5, graph 1 (Gr1 in Figure 3-2) and graph 2 (Gr2 in Figure 3-2) display traces 1 and 4 and traces 2 and 5 by superimposing and graph 3 (Gr3 in Figure 3-2) displays trace 3 singly as shown in the figure below.



The setting procedure of the graph layout is as follows:

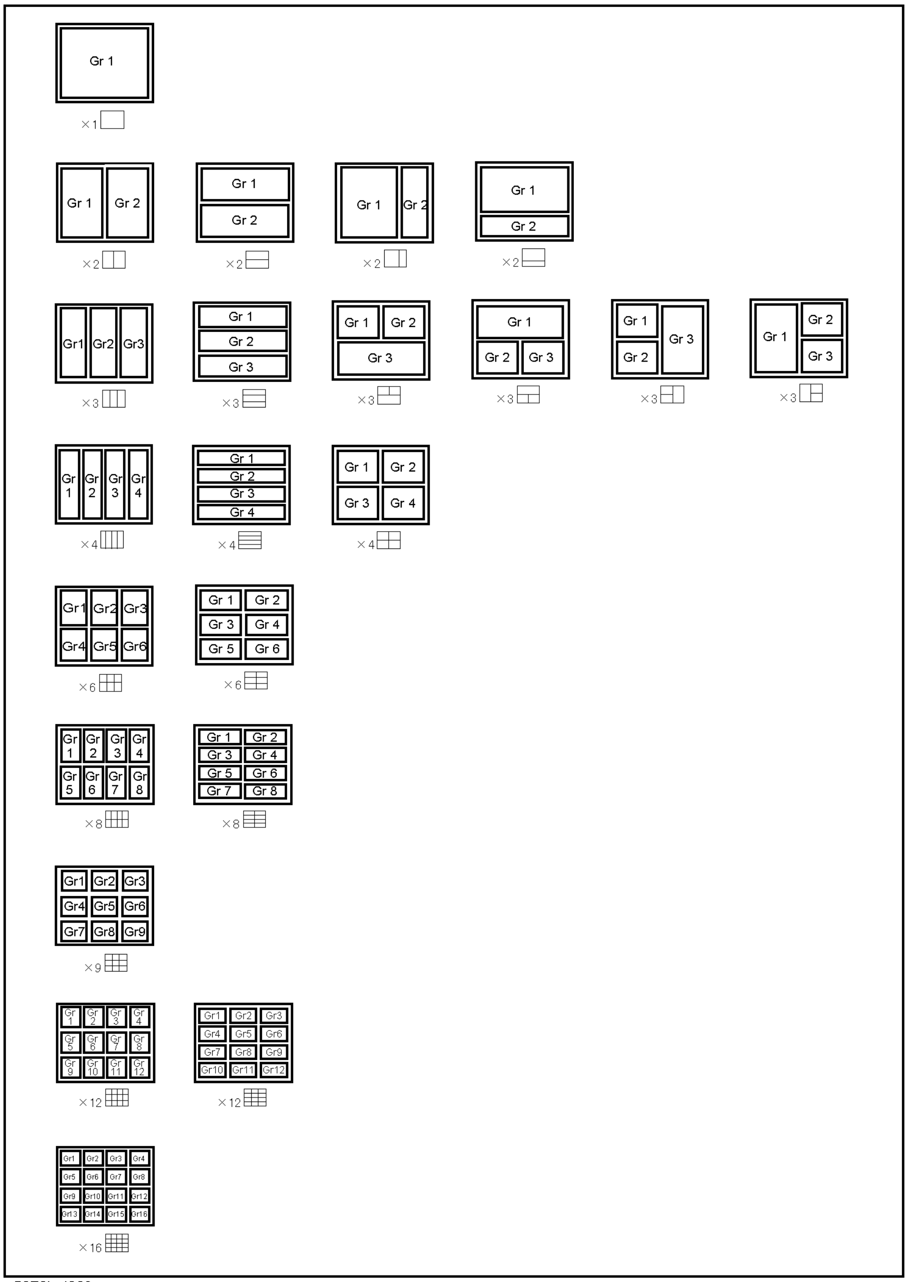
Step 1. Press Channel Next or Channel Prev to select the channel for which you want to set the graph layout.

Step 2. Press Display.

Step 3. Press **Allocate Traces**.

Step 4. Press the desired softkey to select the graph layout (refer to Figure 3-2).

Figure 3-2 **Graph layout**



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Active channel

The channel whose setting is to be changed is called an active channel. The window frame for the active channel is displayed brighter than window frames for other channels. To change the setting specific to a certain channel, first activate the channel.

To change the active channel, use the following hardkeys:

Hardkey	Function
Channel Next	Change the active channel to the next channel with the larger channel number.
Channel Prev	Change the active channel to the next channel with the smaller channel number.

Active trace

The trace whose setting is to be changed is called an active trace. The trace name on the screen (for example, Tr3) of the current active trace is highlighted and indicated with ▶ to the left. To change the setting specific to a certain trace, first activate the trace.

To select the active trace, use the following hardkeys:

Hardkey	Function
Trace Next	Change the active trace to the next trace with the larger trace number.
Trace Prev	Change the active trace to the next trace with the smaller trace number.

Setting target for each setting item (range to which setting affects)

Table 3-2 describes the setup items (analyzer, channel, or trace) and the effect that each parameter has on them.

Table 3-2 Parameters and Setup Items (Controlled Items)

Parameter	Setup Items (Controlled Items)			Setup Key(s)
	Analyzer	Channel	Trace	
Stimulus Settings				
Sweep range		√		Start Stop Center Span
Power, CW frequency		√		Sweep Setup - **Power**
Sweep time/Sweep delay time		√		Sweep Setup - **Sweep Time/Sweep Delay**
Number of points		√		Sweep Setup - **Points**
Segment sweep		√		Sweep Setup - **Sweep Type /Edit Segment Table/Segment Display**
Sweep mode		√		Sweep Setup - **Sweep Mode**
Trigger Settings				
Trigger source	√			Trigger - **Trigger Source/Restart/Trigger**
Trigger mode		√(*1)		Trigger - **Hold/Hold All Channels /Single /Continuous/Continuous Disp Channels**
Response Settings				
Measurement parameter			√	Meas
Data format			√	Format
Scale, Electrical delay, Phase offset			√(*2)	Scale
Memory trace and data math			√	Display - **Display /Data → Mem /Data Math**
Window title		√		Display - **Edit Title Label /Title Label (ON/OFF)**
Graticule label in rectangular form		√		Display - **Graticule Label (ON/OFF)**
Color inversion	√			Display - **Invert Color**
Frequency display ON/OFF	√			Display - **Frequency (ON/OFF)**
Display update ON/OFF	√			Display - **Update (ON/OFF)**
Averaging		√		Avg - **Averaging Restart /Avg Factor/Averaging (ON/OFF)**
Smoothing			√	Avg - **Smo Aperture /Smoothing (ON/OFF)**

Table 3-2 Parameters and Setup Items (Controlled Items)

Parameter	Setup Items (Controlled Items)			Setup Key(s)
	Analyzer	Channel	Trace	
IF bandwidth		√		Avg - **IF Bandwidth**
Calibration		√		Cal
Marker			√(*3)	Marker Marker Search Marker Fctn
Analysis				
Fixture simulator		√(*4)		Analysis - **Fixture Simulator**
Time domain			√	Analysis - **Gating** Analysis - **Transform**
Parameter conversion			√	Analysis - **Conversion**
Limit test			√	Analysis - **Limit Test**
Saving and recalling data	√			Save/Recall
Macro	√			Macro Setup Macro Run Macro Break
System				
Printing/Saving display screen/Beeper/GRIB settings/Network settings/Date & Time/Key lock/Backlight/Firmware revision/Service menu	√			System
Preset	√			Preset

*1. **Hold All Channels** for the analyzer.
*2. **Auto Scale All** and scale **Divisions** must be set up in rectangular form for each channel.
*3. Turning the marker table display on or off applies to the entire analyzer. On the other hand, the sweep range setting of the marker must be performed for each channel. In the preset conditions, marker coupling is enabled and marker settings and movements are effective for all traces on a channel.
*4. The balanced-unbalanced conversion function (**BalUn ON/OFF**) must be turned on or off for each trace.

3. Setting Measurement Conditions

Setting the System Z0

NOTE This function is available with the firmware version 3.01 or greater.

The procedure to set the system characteristic impedance (Z0) is as follows:

Step 1. Press Cal.

Step 2. Press **Set Z0**.

Step 3. Enter the system Z0 using the ENTRY block keys on the front panel.

Setting Stimulus Conditions

You can set the stimulus condition for each channel independently.

Setting sweep type

You can select the sweep type from the following 4 types.

Sweep type	Description
Linear	Sweeps frequencies in linear scale.
Log	Sweeps frequencies in logarithmic scale.
Segment	Performs a sweep with linear sweep conditions (segments) combined. For more information, refer to “Performing a Segment-by-Segment Sweep (Segment Sweep)” on page 287.
Power	Sweeps power levels in linear scale.

The procedure to select the sweep type is as follows:

Step 1. Press [Channel Next] or [Channel Prev] to select the channel for which you want to set the sweep type.

Step 2. Press [Sweep Setup].

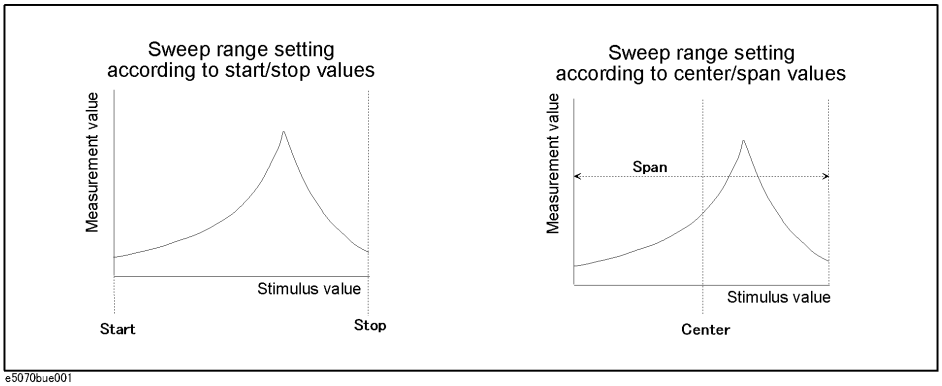
Step 3. Press **Sweep Type**.

Step 4. Press the desired softkey to select the sweep type.

Setting the Sweep Range

There are two ways to set the sweep range: by specifying the lowest and the highest values and by specifying the center value and a span. Once the sweep range is set, it is possible to change the range by substituting the lowest value, the highest value, or the center value with a value (stimulus value) represented by a marker on the trace.

Figure 3-3 **Setting the Sweep Range**



Setting the Sweep Range with the Lowest and Highest Values

Step 1. Press Channel Next or Channel Prev to select the channel for which the sweep range will be set.

Step 2. Press Start.

Step 3. Using the ENTRY block keys on the front panel, input the lowest value.

Step 4. Press Stop.

Step 5. Using the ENTRY block keys on the front panel, input the highest value.

Setting the Sweep Range with the Center Value and a Span

Step 1. Press Channel Next or Channel Prev to select the channel for which the sweep range will be set.

Step 2. Press Center.

Step 3. Using the ENTRY block keys on the front panel, input the center value.

Step 4. Press Span.

Step 5. Using the ENTRY block keys on the front panel, input a span value.

Setting the Sweep Range Using the Marker

Step 1. In the channel window whose range must be set, place the active marker on the active trace to a position that corresponds to the new range (to the lowest, highest, or center value).

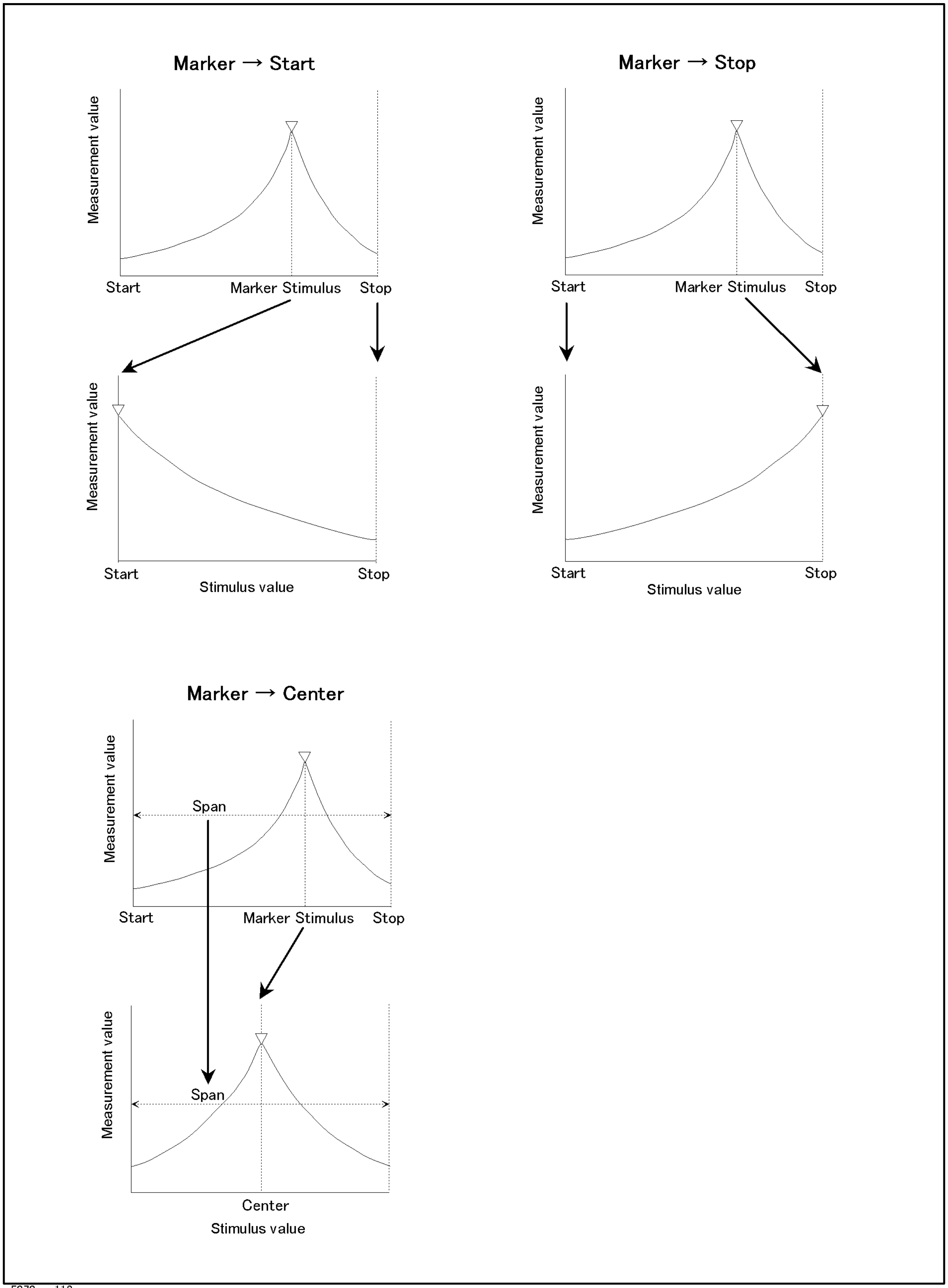
Step 2. Press Marker Fctn.

Step 3. Press the softkey that corresponds to each value.

Softkey	Function
Marker → Start	Sets the lowest value to the stimulus value of the active marker on the currently active trace.
Marker → Stop	Sets the highest value to the stimulus value of the active marker on the currently active trace.
Marker → Center	Sets the center value to the stimulus value of the active marker on the currently active trace.

NOTE If the reference marker is on and the stimulus value of the active marker is expressed by a value relative to the reference marker, the absolute stimulus value will be used to set the new sweep range.

Figure 3-4 **Setting the Sweep Range Using the Marker**



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On/off of stimulus signal output

You can turn on/off the stimulus signal output.

When you turn off the stimulus signal output, you cannot perform measurement and therefore you do not need to turn it off usually. This is mainly used to turn the output back to on when the output has been turned off due to the power trip feature.

Follow these steps to turn it on/off:

Step 1. Press [Sweep Setup].

Step 2. Press **Power**.

Step 3. Press **RF Out**. Each press toggles between on/off.

When set to off, “RF OFF” is displayed in “4. Instrument Status Bar” on page 38.

Power trip

The power trip is a feature that the instrument automatically turns off the output of the stimulus signal to protect the instrument when a signal whose level exceeds the upper limit is inputted to the test port.

If the power output is automatically turned off due to the power trip feature, remove the cause of the overinput and turn on the power output according to the above steps to restart the measurement.

Setting fixed frequency at power sweep

The setting procedure of the fixed frequency (CW frequency) at the power sweep is as follows:

Step 1. Press [Channel Next] or [Channel Prev] to select the channel for which you want to set the fixed frequency.

Step 2. Press [Sweep Setup].

Step 3. Press **Power**.

Step 4. Press **CW Freq**.

Step 5. Enter the fixed frequency using the ENTRY block keys on the front panel.

Setting power level at frequency sweep

You can set the power level at the frequency sweep independently for each test port, within the range of –20 dBm to 10 dBm (for the instrument with option 214, 314, or 414, the range of –55 dBm to 10 dBm) and in resolution of 0.05 dB.

Selecting range

When option 214, 314, or 414 is installed, you can select from the following power ranges.

Selectable power range	
–20 dBm to 10 dBm	–25 dBm to 7 dBm
–30 dBm to 2 dBm	–35 dBm to –3 dBm
–40 dBm to –8 dBm	–45 dBm to –13 dBm
–50 dBm to –18 dBm	–55 dBm to –23 dBm

NOTE The range selection is common to all ports. You cannot select it for each port independently.

The selection procedure of the range is as follows:

Step 1. Press Channel Next or Channel Prev to select the channel for which you want to set the power range.

Step 2. Press Sweep Setup.

Step 3. Press **Power**.

Step 4. Press **Power Ranges**.

Step 5. Press the desired softkey to select the power range.

Setting the level

Step 1. Press Channel Next or Channel Prev to select the channel for which you want to set the power level.

Step 2. Press Sweep Setup.

Step 3. Press **Power**.

Step 4. Press **Port Couple** and select the on/off of the level coupling for all ports.

ON	The same power level is outputted to all ports.
OFF	A specific power level is outputted to each port independently.

NOTE The power level of port 1 is coupled with the power level for all ports.

NOTE If you change the on/off of the level coupling, all ports are automatically changed to the same level value as that of port 1.

Step 5. When setting level for all ports (Port Couple ON)

1. Press **Power**.
2. Enter the power level using the ENTRY block keys on the front panel.

When setting level for each port (Port Couple OFF)

1. Press **Port Power**.
2. Press the softkey corresponding to each port (**Port 1 Power** to **Port 4 Power**).
3. Enter the power level using the ENTRY block keys on the front panel.

Correcting attenuation of power level (using power slope feature)

You can use the power slope feature to correct the attenuation of a power level simply proportional to the frequency (attenuation due to cables and so on), which improves the accuracy of the level applied to the DUT actually.

On/off of power slope feature

Step 1. Press [Channel Next] or [Channel Prev] to select the channel for which power slope feature will be turned on or off.

Step 2. Press [Sweep Setup].

Step 3. Press **Power**.

Step 4. Press **Slope [OFF]** (**Slope [ON]**). Each press toggles between on/off.

Setting correction coefficient (correction amount for 1 GHz)

Step 1. Press [Channel Next] or [Channel Prev] to select the channel for which you want to set the correction coefficient.

Step 2. Press [Sweep Setup].

Step 3. Press **Power**.

Step 4. Press **Slope [xxx dB/GHz]**. "**xxx**" represents the current set value.

Step 5. Enter the correction coefficient using the ENTRY block keys on the front panel.

Setting the Number of Points

The number of points is the number of data items collected in one sweep. It can be set to any number from 2 to 1601 for each channel independently.

- To obtain a higher trace resolution against the stimulus value, choose a larger number of points.
- To obtain higher throughput, keep the number of points to a smaller value within an allowable trace resolution.
- To obtain higher measurement accuracy after calibration, perform calibration using the same number of points as in actual measurements.

Setting the Number of Points

Step 1. Press Channel Next or Channel Prev to select the channel for which the number of points will be set.

Step 2. Press Sweep Setup.

Step 3. Press **Points**.

Step 4. Using the ENTRY block keys on the front panel, input the desired number of points.

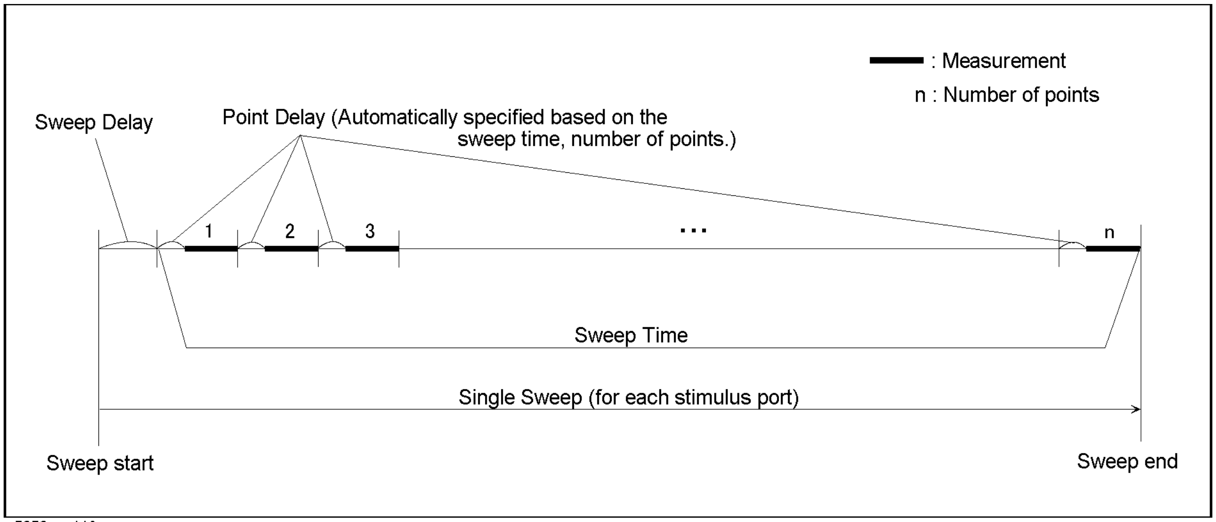
Setting the Sweep Time

Sweep time is the time it takes to complete a sweep for each stimulus (source) port. Two modes are available for setting the sweep time: manual sweep time mode and automatic sweep time mode.

Manual Sweep Time Mode	In this mode, the sweep time is set manually. Once the sweep time is set, changes in measurement conditions will not affect the sweep time as long as it is within the analyzer's capability. If the sweep time becomes lower than the analyzer’s lower sweep time limit, the sweep time will be reset to the shortest time within the conditions. If the sweep time exceeds the analyzer’s upper sweep time limit, the sweep time will be reset to the longest time within the conditions.
Automatic Sweep Time Mode	The sweep time is always kept to the shortest time possible with the current measurement conditions.

Figure 3-5 shows the definitions of the sweep time and the sweep delay time.

Figure 3-5 **Sweep Time and Sweep Delay Time**



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Sweep delay is time before starting a sweep for each stimulus (source) port

Setting Up the Sweep Time (Manual Sweep Time Mode)

Step 1. Press Channel Next or Channel Prev to select the channel for which sweep time will be set.

Step 2. Press Sweep Setup.

Step 3. Press **Sweep Time**.

Step 4. Using the ENTRY block keys on the front panel, input the desired sweep time (in seconds).

If the previous operation mode was automatic sweep time mode, entering a new sweep time forces the machine to switch to manual sweep time mode.

Switching to Automatic Sweep Time Mode

Step 1. Press Channel Next or Channel Prev to select the channel which will be switched to automatic sweep time mode.

Step 2. Press Sweep Setup.

Step 3. Press **Sweep Time**.

Step 4. Press 0 x1. (By entering zero (seconds), automatic sweep time becomes effective.)

Selecting Measurement Parameters

The E5070B/E5071B allows users to evaluate the DUT (device under test) characteristics using the following measurement parameters.

- S-parameters
- Mixed mode S-parameters

This section describes the definition of S-parameters and how to choose their values. For the definition and use of mixed mode S-parameters, refer to “Evaluating Balanced Devices (balance-unbalance conversion function)” on page 207.

Definition of S-Parameters

S-parameters (scattering parameters) are used to evaluate how signals are reflected by and transferred through the DUT. An S-parameter is defined by the ratio of two complex numbers and contains information about magnitude and phase of the signal. S-parameters are typically expressed as follows.

$S_{out\ in}$

out: port number of the DUT from which the signal is output
in: port number of the DUT to which the signal is input

For example, S-parameter S_{21} is the ratio of the output signal of port 2 on the DUT with the input signal of port 1 on the DUT, both expressed in complex numbers.

Setting Up S-Parameters

Step 1. Press [Channel Next] (or [Channel Prev]) and [Trace Next] (or [Trace Prev]) to select the trace for which measurement parameters will be set up.

Step 2. Press [Meas].

Step 3. Press a softkey that corresponds to the desired S-parameter.

S-parameters on the softkeys are expressed as follows.

$S_{out\ in}$

out: test port number of the E5070B/E5071B to which the DUT’s output signal is input
in: test port number of the E5070B/E5071B from which the signal is applied to the DUT

3. Setting Measurement Conditions

Selecting a Data Format

The E5070B/E5071B allows you to display measured S-parameters using the following data formats:

❑ Rectangular display formats

- Log magnitude format
- Phase format
- Expanded phase format
- Positive phase format
- Group delay format
- Linear magnitude format
- SWR format
- Real format
- Imaginary format

❑ Polar format
❑ Smith chart format

Rectangular Display Formats

Rectangular display format draws traces by assigning stimulus values (linear scale) to the X-axis and response values to the Y-axis (see Figure 3-6). Eight different formats are available depending on the selection of data for the Y-axis (see Table 3-3).

Figure 3-6 **Rectangular Display Format**

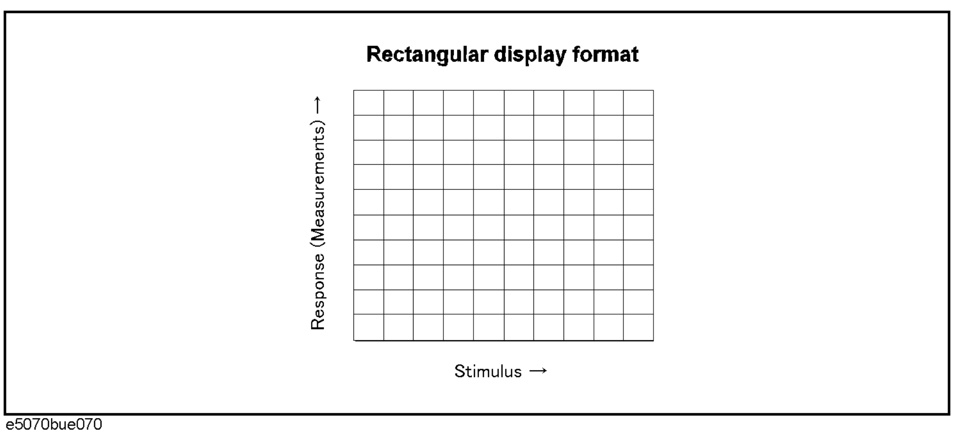


Table 3-3 Eight Types of Rectangular Display Formats

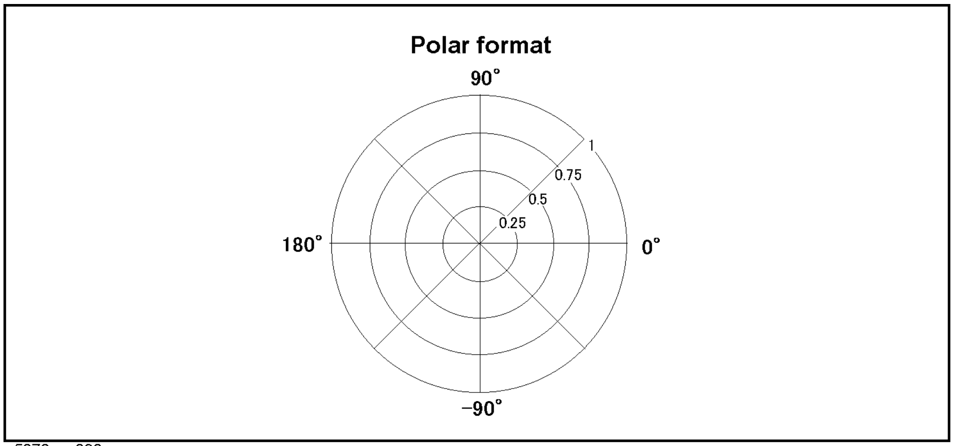
Type	Y-axis Data Type	Y-axis Unit	Application Examples
Log magnitude format	Magnitude	dB	•Return loss measurement •Insertion loss measurement (or gain measurement)
Phase format	Phase (displayed in the range from −180° to +180°)	Degrees (°)	•Measurement of the deviation from the linear phase
Expanded phase format	Phase (it is possible to display above +180° and below −180°)	Degrees (°)	•Measurement of the deviation from the linear phase
Positive phase format	Phase (displayed in the range from 0° to +360°)	Degrees (°)	•Measurement of the deviation from the linear phase
Group delay format	Signal transfer delays within the DUT	Seconds (s)	•Group delay measurement
Linear magnitude format	Magnitude	(Abstract number)	•Reflection coefficient measurement
SWR format	$\frac{1+\rho}{1-\rho}$ (ρ: reflection coefficient)	(Abstract number)	•Measurement of the standing wave ratio
Real format	Real part of the measured complex parameter	(Abstract number)	
Imaginary format	Imaginary part of the measured complex parameter	(Abstract number)	

Polar Format

In the polar format, traces are drawn by expressing the magnitude as a displacement from the origin (linear) and phase in an angle counterclockwise from the positive X-axis. This data format does not have the stimulus axis so, frequencies must be read using the marker. Also, the polar format allows users to select one of the following three data groups for displaying the marker response values.

- Linear magnitude and phase (°)
- Log magnitude and phase (°)
- Real and imaginary parts

Figure 3-7 Polar Format



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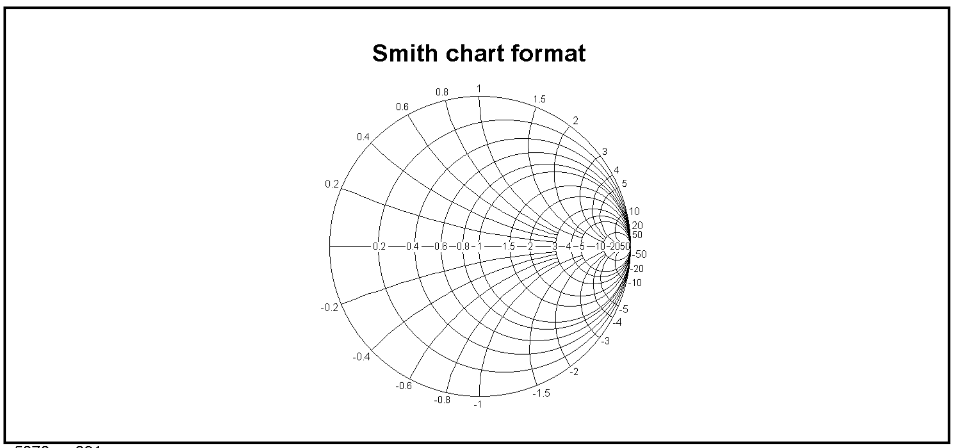
Smith Chart Format

The Smith chart format is used to display impedances based on reflection measurement data on the DUT. In this format, traces are plotted on the same spots as in the polar format. The Smith chart format allows users to select one of the following five data groups for displaying the marker response values.

- Linear magnitude and phase (°)
- Log magnitude and phase (°)
- Real and imaginary parts
- Resistance (Ω), reactance (Ω), and inductance (H) or capacitance (F)
- Conductance (S), susceptance (S), and capacitance (F) or inductance (H)

Figure 3-8 **Smith Chart Format**



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Selecting a Data Format

Use the following procedure to select a data format.

Step 1. Press Channel Next (or Channel Prev) and Trace Next (or Trace Prev) to select the trace for which the data format will be set.

Step 2. Press Format .

Step 3. Press the softkey that corresponds to the desired data format.

Softkey	Function
Log Mag	Selects the log magnitude format.
Phase	Selects the phase format.
Group Delay	Selects the group delay format.
Smith - Lin / Phase	Selects the Smith chart format (with linear magnitude and phase as the marker response values).
Smith - Log / Phase	Selects the Smith chart format (with log magnitude and phase as the marker response values).
Smith - Real / Imag	Selects the Smith chart format (with the real and imaginary parts as the marker response values).
Smith - R + jX	Selects the Smith chart format (with resistance and reactance as the marker response values).
Smith - G + jB	Selects the Smith chart format (with conductance and susceptance as the marker response values).
Polar - Lin / Phase	Selects the polar format (with linear magnitude and phase as the marker response values).
Polar - Log / Phase	Selects the polar format (with log magnitude and phase as the marker response values).
Polar - Real / Imag	Selects the polar format (with the real and imaginary parts as the marker response values).
Lin Mag	Selects the linear magnitude format
SWR	Selects the SWR (standing wave ratio) format.
Real	Selects the real format
Imaginary	Selects the imaginary format
Expand Phase	Selects the expanded phase format
Positive Phase	Selects the positive phase format

Setting the Scales

Auto Scale

The auto scale function is used to tailor each scale (scale/division and the reference line value) automatically in such a way that traces will appear in the proper sizes on the screen for easy observation.

Single Trace Auto Scale

Follow the procedure below to perform the auto scale function only on a specific trace.

Step 1. Press [Channel Next] (or [Channel Prev]) and [Trace Next] (or [Trace Prev]) to select the trace for which the auto scale function will be performed.

Step 2. Press [Scale].

Step 3. Press **Auto Scale**.

Auto Scale on All Traces Within a Channel

Step 1. Press [Channel Next] (or [Channel Prev]) to select the channel for which the auto scale function will be performed.

Step 2. Press [Scale].

Step 3. Press **Auto Scale All**.

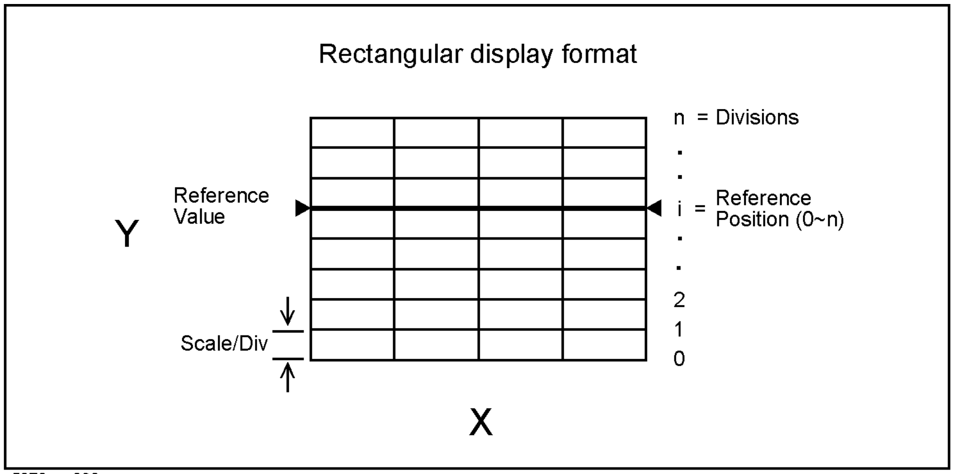
Manual Scale Adjustment on a Rectangular Display Format

For a rectangular display format, four parameters are used to manually adjust the scales. (See Table 3-3 and Figure 3-9.)

Table 3-4 Adjustable Scale Features on a Rectangular Display Format

Adjustable Feature	Description
Divisions (**Divisions**)	Defines the number of divisions on the Y-axis. An even number from 4 to 30 must be used. Once set, it is commonly applied to all traces displayed in any rectangular format within that channel.
Scale/Division (**Scale/Div**)	Defines the number of increments per division on the Y-axis. The value applies only to the active trace.
Reference position (**Reference Position**)	Defines the position of the reference line. The position must be specified using the number assigned to each division on the Y-axis starting at 0 (the least significant) running up to the number of divisions being used (the most significant). The position applies only to the active trace.
Reference line value (**Reference Value**)	Defines the value corresponding to the reference line. It must be set using the unit on the Y-axis. The reference line value applies only to the active trace.

Figure 3-9 **Manual Scale Setup on a Rectangular Display Format**



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Manually Setting Scales on a Rectangular Display Format

Step 1. Press Channel Next (or Channel Prev) and Trace Next (or Trace Prev) to select the trace for which scale features will be adjusted.

Step 2. Press Scale.

Step 3. Press the softkey that corresponds to the particular feature that needs to be adjusted.

Softkey	Function
Divisions	Defines the number of divisions on the Y-axis.
Scale/Div	Defines the number of increments per division on the Y-axis.
Reference Position	Defines the position of the reference line.
Reference Value	Defines the value corresponding to the reference line.

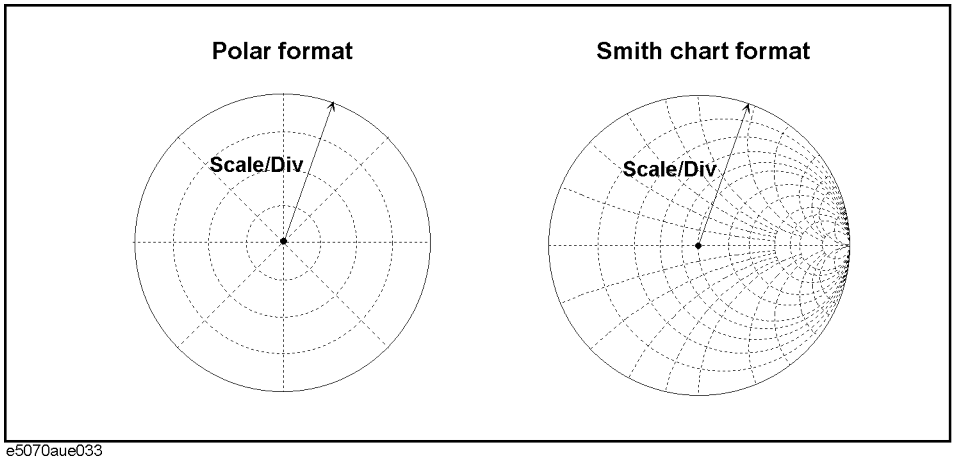
NOTE It is also possible to turn off the display of graticule labels. For details, refer to "Turning Off the Display of Graticule Labels" on page 77.

3. Setting Measurement Conditions

Manual Scale Adjustment on the Smith Chart/Polar Format

Manual scale adjustment on the Smith chart format or the polar format is done using the displacement (Scale/Div of the outermost circle. (See Figure 3-10.)

Figure 3-10 **Manual Scale Setup on the Smith Chart/Polar Format**



Manually Setting Scales on the Smith Chart/Polar Format

Step 1. Press Channel Next (or Channel Prev) and Trace Next (or Trace Prev) to select the trace for which the scale will be adjusted.

Step 2. Press Scale.

Step 3. Press **Scale/Div**.

Step 4. Using the ENTRY block keys on the front panel, input the displacement of the outermost circle.

Setting the Value of a Reference Line Using the Marker

When using a rectangular display format, it is possible to change the reference line value to be equal to the response value of the active marker on the active trace.

Setting the Reference Line Value Using the Marker

Step 1. Place the active marker on the active trace on the position that corresponds to the new reference line value.

Step 2. Press Scale or Marker Fctn.

Step 3. Press **Marker → Reference** to change the reference line value to the marker response value.

NOTE If the reference marker is on and the stimulus value of the active marker is expressed using a value relative to the reference marker, the absolute stimulus value will be used to set the new reference line value.

Setting Window Displays

Maximizing the Specified Window/Trace Display

When using multiple channels, it is possible to maximize a specific channel window on the screen. When multiple traces are displayed in a channel window, it is also possible to maximize a specific trace display within that channel window.

Maximizing a Window

Step 1. Press [Channel Next] (or [Channel Prev]) to select the channel whose window will be maximized.

Step 2. Press [Channel Max] to maximize the channel window.

Press [Channel Max] one more time to reduce the window to its previous size.

Maximizing a Trace Display

Step 1. Press [Channel Next] (or [Channel Prev]) to select the channel to which the trace belongs.

Step 2. Press [Trace Next] (or [Trace Prev]) to select the trace whose display will be maximized.

Step 3. Press [Trace Max] to maximize the trace display.

Press [Trace Max] one more time to reduce the display to its previous size.

Turning Off the Display of Graticule Labels

When using a rectangular display format, the graph area can be expanded to the left by turning off the display of graticule labels.

Turning Off Graticule Label Display

Step 1. Press [Channel Next] (or [Channel Prev]) to select the channel for which graticule label display will be turned on or off.

Step 2. Press [Display].

Step 3. Press **Graticule Label** to turn graticule label display on or off.

Erasing the Frequency Labels

It is possible to set the analyzer so it does not show the frequency labels on the screen. When using this function, the frequency information cannot be read without manipulating the analyzer. Thus, this function provides an effective means of security.

Erasing the Frequency Labels

Step 1. Press [Display].

Step 2. Press **Frequency** to turn off the frequency display.

NOTE Turning off the frequency display using the **Frequency** key does not erase the frequency display within the Stimulus softkey, which is turned on by pressing [Start], [Stop], [Center], and [Span]. The display of the softkey bar itself can be switched on or off by pressing [Softkey On/Off].

Labeling a Window

It is possible to assign a unique name to a channel and display it on the screen. This feature is useful in saving and/or printing measurement result for future reference.

Labeling a Window

Step 1. Press [Channel Next] or [Channel Prev] to select the channel to be labeled.

Step 2. Press [Display].

Step 3. Press **Edit Title Label**.

The title label input dialog box (see Figure 3-11) appears.

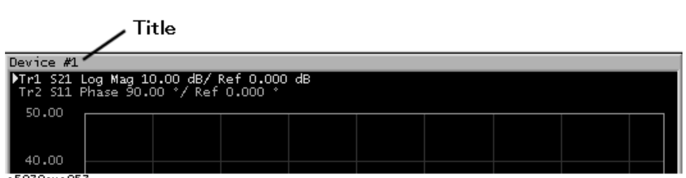
Figure 3-11 **Title Label Input Dialog Box**

Step 4. Using keys that appear in the dialog box, type a label and press **Enter**.

Step 5. Press **Title Label** to turn on the title display.

The title will appear within a frame at the top of the channel window (title bar). (See Figure 3-12.)

Figure 3-12 **Title Display**



Setting display colors

Selecting display mode

You can select the display mode of the LCD display from 2 modes: normal display (background: black) or inverted display (background: white). In normal display, the colors of items are preset so that you can recognize them easily on the display of the instrument. On the other hand, in inverted display, they are preset to colors obtained by almost inverting the default settings of the normal display so that you can use data easily when storing it into a graphic file.

The selection procedure is as follows:

Step 1. Press Display.

Step 2. Press **Invert Color** to select the display color. OFF indicates the normal display; ON the inverted display.

Setting display color for each item

You can set the display color to the normal display or the inverted display separately for each of the following items.

- ❏ Data/memory trace
- ❏ Labels and lines of graphs
- ❏ File display of the limit test and limit lines
- ❏ Background

You set the color of each item by specifying the amounts of red (R), green (G), and blue (B) contained in the color. You can specify each of R, G, and B in 6 steps (0 to 5). Therefore, 216 colors in total are available by combining them. The below table shows the R, G, and B values for main colors for reference purposes.

	R	G	B		R	G	B		R	G	B
White	5	5	5	Gray	2	2	2	Black	0	0	0
Light red	5	3	3	Red	5	0	0	Dark red	2	0	0
Light yellow	5	5	3	Yellow	5	5	0	Dark yellow	2	2	0
Light green	3	5	3	Green	0	5	0	Dark green	0	2	0
Light cyan	3	5	5	Cyan	0	5	5	Dark cyan	0	2	2
Light blue	3	3	5	Blue	0	0	5	Dark blue	0	0	2
Light magenta	5	3	5	Magenta	5	0	5	Dark magenta	2	0	2

The setting procedure is as follows:

Step 1. Press System.

Step 2. Press **Misc Setup**.

Step 3. Press **Color Setup**.

Step 4. Press **Normal** (for normal display) or **Invert** (for inverted display).

Step 5. Press the softkey corresponding to the item for which you want to set the display color.

Softkey	Function
Data Trace 1 to **9**	Specifies the data trace of traces 1 to 9.
Mem Trace 1 to **9**	Specifies the memory trace of traces 1 to 9.
Graticule Main	Specifies the graticule label and the outer lines of graphs.
Graticule Sub	Specifies the grid of graphs.
Limit Fail	Specifies the fail display in the limit test result.
Limit Line	Specifies the limit line.
Background	Specifies the background.

Step 6. Press **Red**.

Step 7. Select the amount of red (R) from **0** to **5**.

Step 8. Press **Green**.

Step 9. Select the amount of green (G) from **0** to **5**.

Step 10. Press **Blue**.

Step 11. Select the amount of blue (B) from **0** to **5**.

Resetting the display colors to the factory state

You can reset the display colors in normal display and inverted display to the preset factory state.

The selection procedure is as follows:

Step 1. Press System.

Step 2. Press **Misc Setup**.

Step 3. Press **Color Setup**.

Step 4. Press **Normal** (for normal display) or **Invert** (for inverted display).

Step 5. Press **Reset Color**.

Step 6. Press **OK**.

4 Calibration

This chapter describes the calibration process to use with the Agilent E5070B/E5071B.

Measurement Errors and their Characteristics

It is important to understand factors contributing to measurement errors in order to determine the appropriate measures that should be taken to improve accuracy. Measurement errors are classified into three categories:

- Drift errors
- Random errors
- Systematic errors

Drift Errors

Drift errors are caused by deviations in performance of the measuring instrument (measurement system) that occur after the calibration. Major causes are the thermal expansion of connecting cables and the thermal drift of the frequency converter within the measuring instrument. These errors may be reduced by carrying out frequent calibrations as the ambient temperature changes or by maintaining a stable ambient temperature during the course of a measurement.

Random Errors

Random errors occur irregularly along the time line. Since random errors are unpredictable, they cannot be eliminated in a calibration. These errors are further classified into the following sub-categories depending on their causes.

- Instrument noise errors
- Switch repeatability errors
- Connector repeatability errors

Instrument Noise Errors

Instrument noise errors are caused by electric fluctuations within components used in the measuring instrument. These errors may be reduced by increasing the power of signal supplied to the DUT, narrowing the IF bandwidth, and enabling sweep averaging.

Switch Repeatability Errors

Switch repeatability errors occur due to the fact that electrical characteristics of the mechanical RF switch used in the measuring instrument change every time it is switched on. These errors may be reduced by carrying out measurements under conditions in which no switching operation takes place.
You can ignore those errors since the E5070B/E5071B does not have mechanical RF switches.

Connector Repeatability Errors

Connector repeatability errors are caused by fluctuations in the electrical characteristics of connectors due to wear. These errors may be reduced by handling connectors with care.

Systematic Errors

Systematic errors are caused by imperfections in the measuring instrument and the test setup (cables, connectors, fixtures, etc.). Assuming that these errors are repeatable (i.e., predictable) and their characteristics do not change relative to time, then it is possible to eliminate these errors mathematically at the time of measurement by determining the characteristics of these errors in a calibration. There are six types of systematic errors, as follows.

Errors caused by signal leaks in the measuring system:

- Directivity
- Isolation (cross-talk)

Errors caused by reflections in the measuring system:

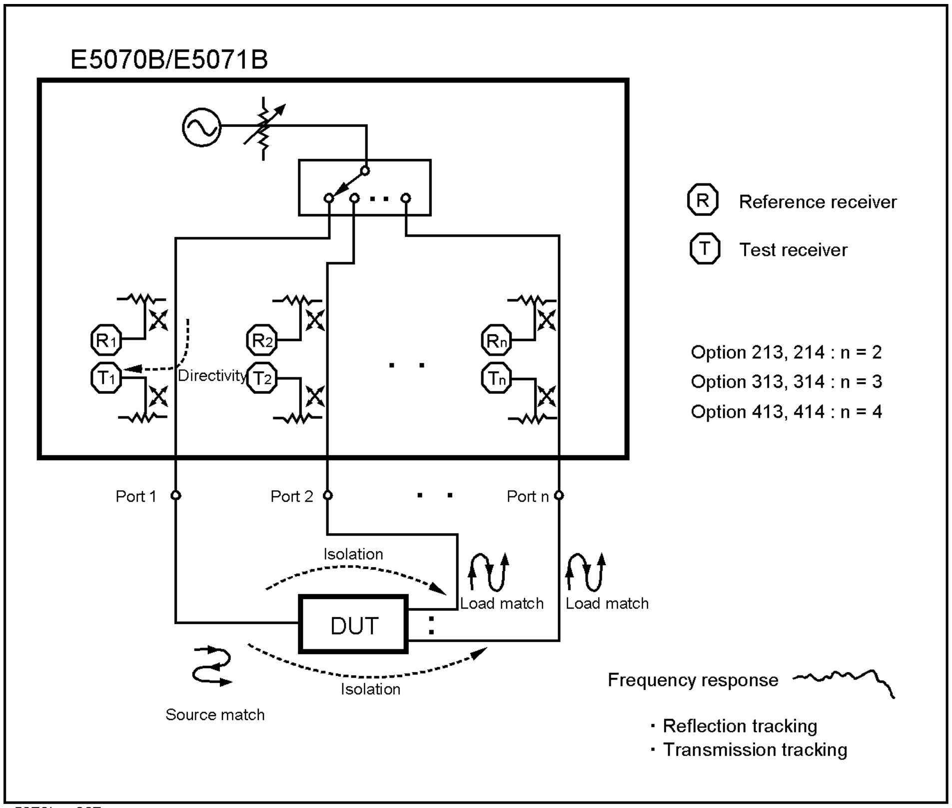
- Source match
- Load match

Errors caused by the frequency response of the receiver within the measuring instrument:

- Reflection tracking
- Transmission tracking

The E5070B/E5071B has 2 receivers for each test port, the reference receiver and the test receiver (transmission measurement or reflection measurement) and allows you to perform measurements using these receivers at the same time. Figure 4-1 shows the architecture of the test ports of the E5070B/E5071B and systematic errors.

Figure 4-1 **E5070B/E5071B Port Architecture and Systematic Errors**



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Directivity error (Ed)

Directivity errors are caused by the fact that, in a reflection measurement, signals other than the reflection signal from the DUT are received by receiver T1 (see Figure 4-1) through the directivity coupler. When a certain port is a stimulus port, this error can be defined as a constant value for each stimulus port because the state of the termination at the other ports does not change. The number of directivity errors of the E5070B/E5071B is the number of stimulus ports you use.

Ed1	Directivity error of port 1
Ed2	Directivity error of port 2
Ed3[*1]	Directivity error of port 3
Ed4[*2]	Directivity error of port 4

*1. Options 313, 314, 413, and 414 only
*2. Options 413 and 414 only

Isolation error (Ex)

An isolation error (crosstalk error) is caused because signals other than the transmission signal of the DUT leak to the test receiver of the transmission measurement port in transmission measurement. When a certain port is a stimulus port, an isolation error is defined for each of the other ports. Therefore, the number of isolation errors of the E5070B/E5071B is the total number of the combinations of stimulus ports and response ports.

Ex21, Ex31[*1], and Ex41[*2]	Isolation error when port 1 is a stimulus port.
Ex12, Ex32[*1], and Ex42[*2]	Isolation error when port 2 is a stimulus port.
Ex13[*1], Ex23[*1], and Ex43[*2]	Isolation error when port 3 is a stimulus port.
Ex14[*2], Ex24[*2], and Ex34[*2]	Isolation error when port 4 is a stimulus port.

*1. Options 313, 314, 413, and 414 only
*2. Options 413 and 414 only

Source match error (Es)

A source match error is caused because the reflection signal of the DUT reflects at the signal source and enters into the DUT again. When a certain port is a stimulus port, this error can be defined as a constant value for each stimulus port because the state of the signal source switch does not change. The number of source match errors of the E5070B/E5071B is the number of stimulus ports you use.

Es1	Source match error of port 1
Es2	Source match error of port 2
Es3*1	Source match error of port 3
Es4*2	Source match error of port 4

*1. Options 313, 314, 413, and 414 only
*2. Options 413 and 414 only

Load match error (El)

A load match error is caused because part of the signal transmitted in the DUT reflects at a response port and all of the signal is not measured by the receiver of the response port. When a certain port is a stimulus port, a load match error is defined for each of the other ports. Therefore, the number of load match errors of the E5070B/E5071B is the total number of the combinations of stimulus ports and response ports.

El21, El31*1, and El41*2	Load match error when port 1 is a stimulus port.
El12, El32*1, and El42*2	Load match error when port 2 is a stimulus port.
El13*1, El23*1, and El43*2	Load match error when port 3 is a stimulus port.
El14*2, El24*2, and El34*2	Load match error when port 4 is a stimulus port.

*1. Options 313, 314, 413, and 414 only
*2. Options 413 and 414 only

Reflection tracking error (Er)

A reflection tracking error is caused because the difference in frequency response between the test receiver and the reference receiver of a stimulus port in reflection measurement. This error can be defined as a constant value for each stimulus port because the combination of the test receiver and the reference receiver of a stimulus port is always the same. The number of reflection tracking errors of the E5070B/E5071B is the number of stimulus ports you use.

Er1	Reflection tracking error of port 1
Er2	Reflection tracking error of port 2
Er3*1	Reflection tracking error of port 3
Er4*2	Reflection tracking error of port 4

*1. Options 313, 314, 413, and 414 only
*2. Options 413 and 414 only

Transmission tracking error (Et)

A transmission tracking error is caused because the difference in frequency response between the test receiver of a response port and the reference receiver of a stimulus port in transmission measurement. When a certain port is a stimulus port, a transmission tracking error is defined for each of the other ports. Therefore, the number of transmission tracking errors of the E5070B/E5071B is the total number of the combinations of stimulus ports and response ports.

Et21, Et31[*1], and Et41[*2]	Transmission tracking error when port 1 is a stimulus port.
Et12, Et32[*1], and Et42[*2]	Transmission tracking error when port 2 is a stimulus port.
Et13[*1], Et23[*1], and Et43[*2]	Transmission tracking error when port 3 is a stimulus port.
Et14[*2], Et24[*2], and Et34[*2]	Transmission tracking error when port 4 is a stimulus port.

*1. Options 313, 314, 413, and 414 only
*2. Options 413 and 414 only

Calibration Types and Characteristics

Table 4-1 shows the different types of calibrations and the features of each method.

Table 4-1 Calibration Types and Characteristics

Calibration Method	Standard(s) Used	Corrected Error Factor	Measurement Parameters	Characteristics
No calibration	None	None	All parameters	• Low accuracy • Calibration not required
Response Calibration[*1]	•OPEN or SHORT[*2] •LOAD[*3]	Following 2 error terms: •Reflection Tracking (Er) •Directivity (Ed)[*3]	S11 (Reflection characteristics at 1 port)	•Medium accuracy •Quick calibration •An isolation calibration improves the accuracy in a reflection measurement of the DUT that has high return loss
	•THRU •LOAD[*3]	Following 2 error terms: •Transmission Tracking (Et) •Isolation (Ex)[*3]	S21 (1 direction transmission characteristics at 2 ports)	•Medium accuracy •Quick calibration •An isolation calibration improves the accuracy in a transmission measurement of a device that has high insertion loss
1-Port Calibration	ECal module (2-port/4-port)	Following 3 error terms: •Directivity (Ed) •Source Match (Es) •Reflection Tracking (Er)	S11 (Reflection characteristics at 1 port)	•Highly accurate 1-port measurement •Quick calibration with low chance of operator errors
	•OPEN •SHORT •LOAD			•Highly accurate 1-port measurement (more accurate than the ECal)
Full 2-Port Calibration[*1]	ECal module (2-port/4-port)	Following 12 error terms: •Directivity (Ed1,Ed2) •Isolation (Ex21,Ex12)[*3] •Source Match (Es1,Es2) •Load Match (El1,El2) •Transmission Tracking (Et21,Et12) •Reflection Tracking (Er1,Er2)	S11,S21,S12,S22 (All S-parameters at 2 ports)	•Highly accurate 2-port measurement •Quick calibration with low chance of operator errors
	•OPEN •SHORT •LOAD •THRU			•A 2-port measurement with the highest degree of accuracy
Full 3-Port Calibration[*4*1]	ECal module (2-port[*5]/ 4-port)	Following 2 error terms: •Directivity (Ed1,Ed2,Ed3) •Isolation (Ex21,Ex31,Ex12,Ex32,Ex13,Ex23)[*3] •Source Match (Es1,Es2,Es3) •Load Match (El21,El31,El12,El32,El13,El23) •Transmission Tracking (Et21,Et31,Et12,Et32,Et13,Et23) •Reflection Tracking (Er1,Er2,Er3)	S11,S21,S31,S12,S22,S32,S13,S23,S33 (All S-parameters at 3 ports)	•Highly accurate 3-port measurement •Quick calibration with low chance of operator errors
	•OPEN •SHORT •LOAD •THRU			•A 3-port measurement with the highest degree of accuracy

Table 4-1 Calibration Types and Characteristics

Calibration Method	Standard(s) Used	Corrected Error Factor	Measurement Parameters	Characteristics
Full 4-Port Calibration[*6*1]	ECal module (2-port[*5]/ 4-port)	Following 2 error terms: •Directivity (Ed1,Ed2,Ed3,Ed4) •Isolation (Ex21,Ex31,Ex41,Ex12,Ex32,Ex42,Ex13,Ex23,Ex43,Ex14,Ex24,Ex34)[*3] •Source Match (Es1,Es2,Es3,Es4) •Load Match (El1,El2,El3,El4) •Transmission Tracking (Et21,Et31,Et41,Et12,Et32,Et42,Et13,Et23,Et43,Et14,Et24,Et34) •Reflection Tracking (Er1,Er2,Er3,Er4)	S11,S21,S31,S41,S12,S22,S32,S42,S13,S23,S33,S43,S14,S24,S34,S44 (All S-parameters at 4 ports)	•Highly accurate 4-port measurement •Quick calibration with low chance of operator errors compared with the full 4-port calibration using OPEN, SHORT LOAD, and THRU standards
	•OPEN •SHORT •LOAD •THRU			•A 4-port measurement with the highest degree of accuracy

*1. The user may select whether or not to carry out an isolation calibration.
*2. A general principle is to use an open standard if the impedance of the device is larger than 50 Ω and a short standard if it is less.
*3. Only when an isolation calibration is carried out. Isolation calibration is not performed when the 2 port ECal module and ECal Assistant VBA macro are used.
*4. Only for options 313, 314, 413, and 414.
*5. Used with the EcalAssistant VBA macro pre-installed in the E5070B/E5071B.
*6. Only for options 413 and 414

Checking Calibration Status

Execution status of error correction for each channel

You can check the error correction execution status for each channel with the error correction status.

The error correction status is indicated in the channel status bar in the lower part of the window by the symbols in the below table.

Symbol	Execution status of error correction
Cor (displayed in blue)	Error correction: On (enabled for all traces)
Cor (displayed in gray)	Error correction: On (enabled for some traces)
Off (displayed in gray)	Error correction: Off
--- (displayed in gray)	Error correction: On (no calibration data)
C? (displayed in blue)	Error correction: On (Interpolation is being executed or the IF bandwidth, power level, power range, sweep time, sweep delay time, sweep mode, or sweep type is different from that when the calibration was executed.)
C! (displayed in blue)	Error correction: On (Extrapolation is being executed.)

Execution status of error correction for each trace

You can check the status of the error correction actually executed for each trace with the trace status area.

For a trace for which error correction is executed, the applied calibration type is indicated in the trace status area by the symbols in the below table.

Symbol	Calibration type
RO	Open response calibration
RS	Short response calibration
RT	Thru response calibration
F1	1-port calibration
F2	Full 2-port calibration
F3	Full 3-port calibration[*1]
F4	Full 4-port calibration[*1]

*1. The simplified full 3/4 port calibration that you can execute with the SCPI command (that acquires the calibration coefficients omitting a part of the thru measurement) is not discriminated from the normal full 3/4 port calibration and **F3/F4** is displayed.

If no symbol described above is displayed, error correction is not executed for the trace.

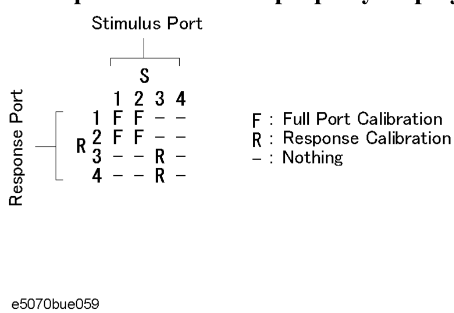
For details about the trace status area, see “5-5. Trace Status Area” on page 42.

Acquisition status of calibration coefficient for each channel

You can check the acquisition status of the calibration coefficient for each channel with the calibration property.

The calibration property displays the acquisition status of the calibration coefficient between test ports for each channel in matrix format. Figure 4-2 shows an example when the calibration coefficients for the full 2-port calibration between test ports 1 and 2, the response calibration for test port 3, and the response calibration (thru) between test ports 4 and 3 have been acquired.

Figure 4-2 **Example of calibration property display**



NOTE The simplified full 3/4 port calibration is not discriminated from the normal full port calibration and **F** is displayed.

Condition to clear already acquired calibration coefficients

In the following cases, already acquired calibration coefficients are cleared.

- ❑ Executing preset clears all calibration coefficients.
- ❑ If S parameters required to calculate the calibration coefficient for the specified calibration type and test ports and those required for the existing calibration coefficient overlap, executing the acquisition of the calibration coefficient (measuring necessary data and then pressing the **Done** softkey) clears the calibration coefficient for which necessary s parameters overlap. Take Figure 4-2 as an example. If you acquire the calibration coefficient of the 1-port calibration for test port 4, both calibration coefficients are not cleared. On the other hand, if you acquire the calibration coefficient for the full 2-port calibration between test ports 2 and 3, the calibration coefficient of the full 2-port calibration between test ports 1 and 2 and that of the response calibration for test port 3 are cleared.

NOTE An asterisk (*) in the upper right of the softkey displayed when selecting a test port indicates that, if you select the test port and execute the acquisition of the calibration coefficient, the existing calibration coefficient will be cleared.

Procedure to turn on/off calibration property display

Follow these steps to turn on/off the calibration property display.

Step 1. Press [Channel Next] or [Channel Prev] to select the channel for which you want to turn on/off the calibration property display.

Step 2. Press [Cal].

Step 3. Press **Property**. Each press toggles between on/off.

Selecting Calibration Kit

Before executing calibration, you need to select a calibration kit you use.

If you use a calibration kit other than predefined, you need to define it. If the connector type of the standard of the calibration kit you use has the polarity (a distinction between male and female), you need to change the standard class definition of the calibration kit depending on the standard you actually use. For more information, see "Changing the Calibration Kit Definition" on page 144.

NOTE If you select a predefined calibration kit, (m) and (f) in the name (label) of the standard displayed in the softkey indicate male (m) and female (f) of the connector of the analyzer, respectively.

Follow these steps to select the calibration kit.

Step 1. Press Channel Next or Channel Prev to select the channel for which you want to select the calibration kit.

Step 2. Press Cal.

Step 3. Press **Cal Kit**.

Step 4. Select the calibration kit.

Softkey	Function
85033E	Selects the calibration kit "85033E."
85033D	Selects the calibration kit "85033D."
85052D	Selects the calibration kit "85052D."
85032F	Selects the calibration kit "85032F."
85032B	Selects the calibration kit "85032B."
85036B/E	Selects the calibration kit "85036B/E."
User	Selects the calibration kit "User."
User	Selects the calibration kit "User."
User	Selects the calibration kit "User."
User	Selects the calibration kit "User."

NOTE If the name (label) of the calibration kit has been changed, the label is displayed as the softkey.

NOTE An asterisk (*) on the upper right of the softkey corresponding to a predefined calibration kit indicates that its definition value has been changed from the factory setting by the user.

OPEN/SHORT Response Calibration (Reflection Test)

In OPEN or SHORT response calibration, calibration data are measured by connecting an OPEN or SHORT standard, respectively, to the desired test port. For frequency response, these calibrations effectively eliminate the reflection tracking error from the test setup in a reflection test using that port (Figure 4-3). It is also possible to carry out isolation calibration with a LOAD standard during OPEN/SHORT response calibration. An isolation calibration will eliminate the directivity error from the test setup in a reflection test using that port (Figure 4-4).

Figure 4-3 **1-Port Error Model (OPEN/SHORT Response)**

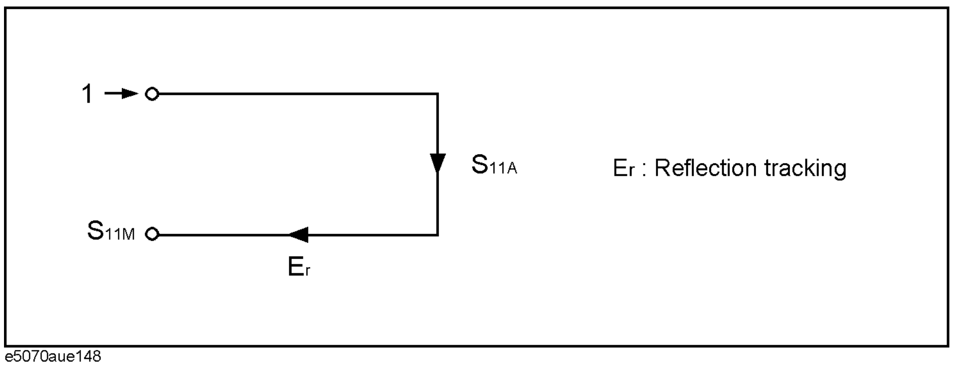
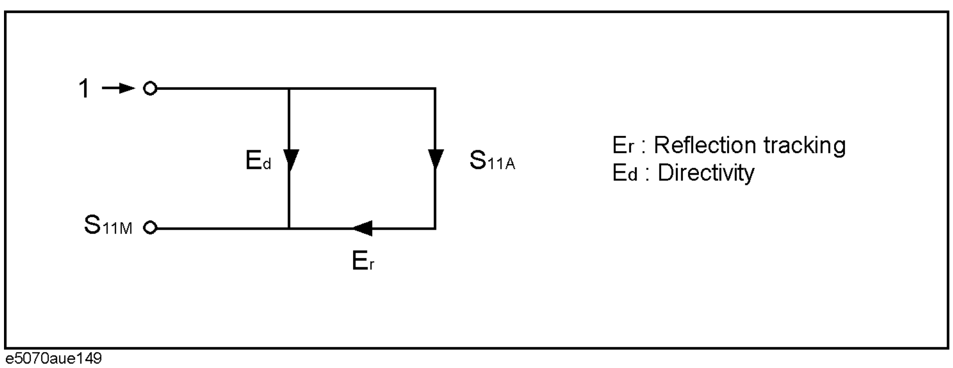


Figure 4-4 **1-Port Error Model (OPEN/SHORT Response + Isolation)**



Procedure

Step 1. Press Channel Next or Channel Prev to select the channel for which you want to perform the calibration.

Step 2. Press Cal.

Step 3. Press **Calibrate**.

Step 4. Select OPEN or SHORT response calibration.

Softkey	Function
Response (Open)	Displays softkeys for performing an open response calibration (response calibration with an OPEN standard).
Response (Short)	Displays softkeys for performing a SHORT response calibration (response calibration with a SHORT standard).

Step 5. Press **Select Port**.

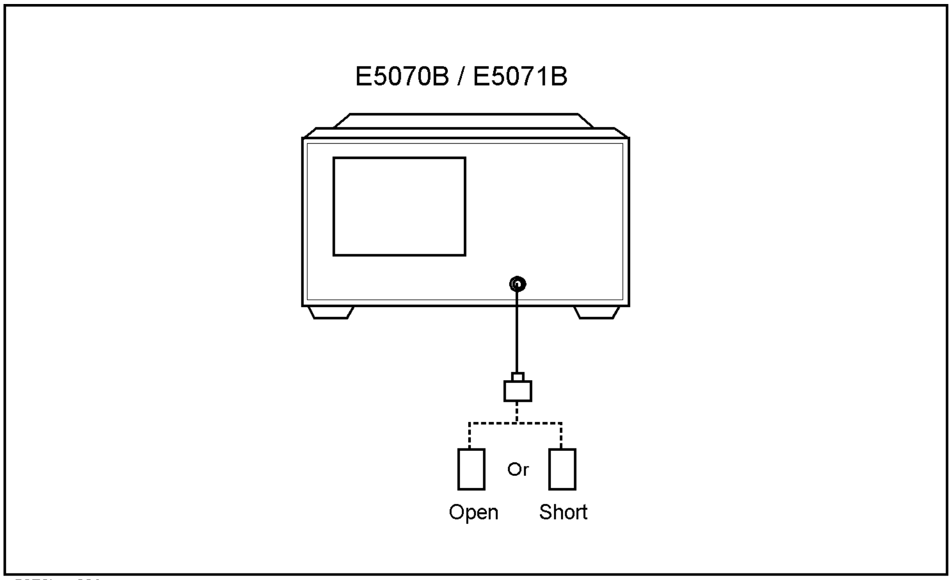
Step 6. Select a test port upon which an OPEN/SHORT response calibration will be performed.

Softkey	Function
1	Selects port 1.
2	Selects port 2.
3	Selects port 3.
4	Selects port 4.

NOTE An asterisk (*) in the upper right of the softkey indicates that, if you select the test port and execute the acquisition of the calibration coefficient (press **Done**), the existing calibration coefficient will be cleared.

Step 7. According to the selection made in Step 4, connect an OPEN or SHORT calibration standard to the test port (connector to which the DUT will be connected) selected in Step 6.

Figure 4-5 **Connecting the standard at OPEN/SHORT Response Calibration**



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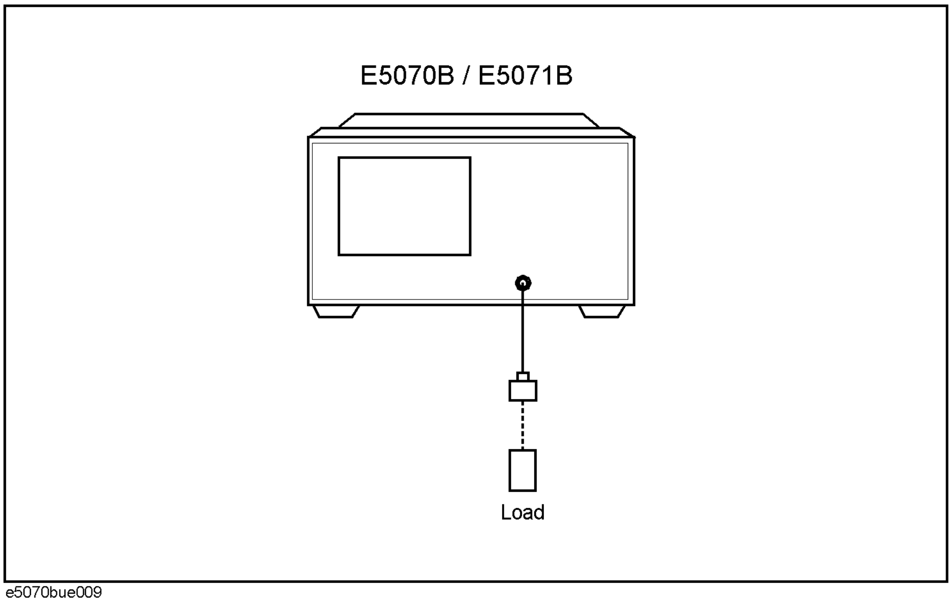
Step 8. Press **Open** or **Short** to start the calibration measurement.

Step 9. If an isolation calibration must be performed using a LOAD standard, follow the procedure below.

a. Connect a LOAD standard to the test port (connector to which the DUT will be connected) selected in Step 6.

Figure 4-6 Connecting the Load Standard



b. Press **Load (Optional)** to start the measurement on the LOAD standard.

Step 10. Press **Done** to terminate the response calibration (and the LOAD isolation calibration) process. Upon pressing the key, calibration coefficients will be calculated and saved. The error correction function will also be automatically enabled.

THRU Response Calibration (Transmission Test)

In THRU response calibration, calibration data are measured by connecting a THRU standard to the desired test port. This calibration effectively eliminates the frequency response transmission tracking error from the test setup in a transmission test using that port (Figure 4-7). It is also possible to carry out an isolation calibration using a LOAD standard in the process of THRU response calibration. An isolation calibration will eliminate isolation error (crosstalk error) from the test setup in a transmission test using that port.

Figure 4-7 **2-Port Error Model (Thru Response)**

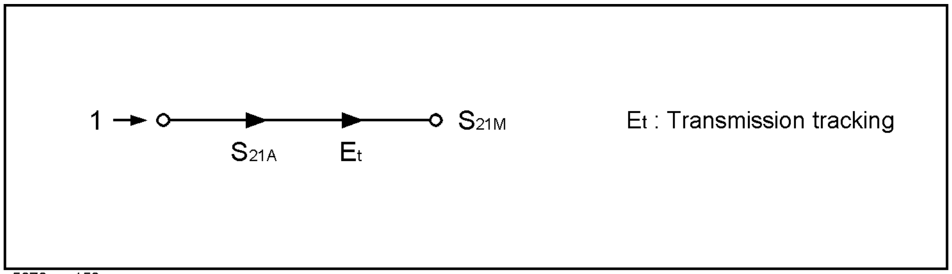


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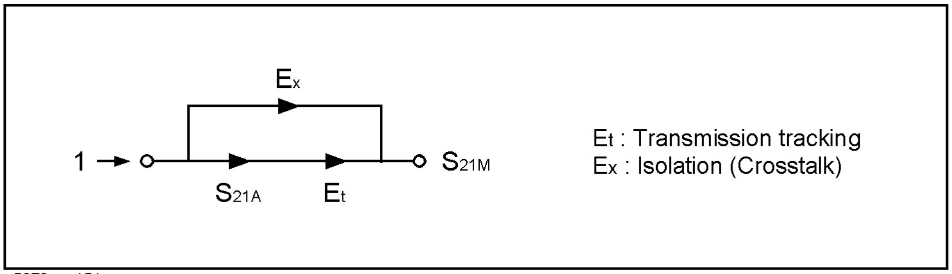
Figure 4-8 **2-Port Error Model (Thru Response + Isolation)**



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Procedure

Step 1. Press `Channel Next` or `Channel Prev` to select the channel for which you want to perform the calibration.

Step 2. Press `Cal`.

Step 3. Press **Calibrate**.

Step 4. Press **Response (Thru)**.

Step 5. Press **Select Ports**.

Step 6. Select the test ports (and corresponding S parameters) upon which a THRU response calibration will be performed.

Softkey	Function
2-1 (S21)	Selects test port 2 (input) and test port 1 (output). Corresponds to the determination of S_{21}.

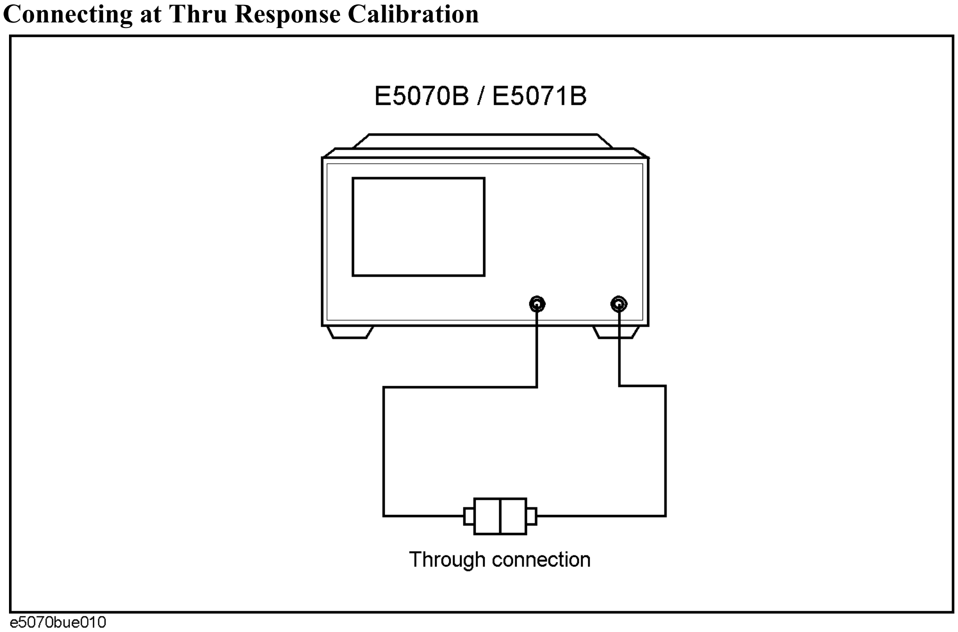
4. Calibration

Softkey	Function
3-1 (S31)	Selects test port 3 (input) and test port 1 (output). Corresponds to the determination of S_{31}.
4-1 (S41)	Selects test port 4 (input) and test port 1 (output). Corresponds to the determination of S_{41}.
1-2 (S12)	Selects test port 1 (input) and test port 2 (output). Corresponds to the determination of S_{12}.
3-2 (S32)	Selects test port 3 (input) and test port 2 (output). Corresponds to the determination of S_{32}.
4-2 (S42)	Selects test port 4 (input) and test port 2 (output). Corresponds to the determination of S_{42}.
1-3 (S13)	Selects test port 1 (input) and test port 3 (output). Corresponds to the determination of S_{13}.
2-3 (S23)	Selects test port 2 (input) and test port 3 (output). Corresponds to the determination of S_{23}.
4-3 (S43)	Selects test port 4 (input) and test port 3 (output). Corresponds to the determination of S_{43}.
1-4 (S14)	Selects test port 1 (input) and test port 4 (output). Corresponds to the determination of S_{14}.
2-4 (S24)	Selects test port 2 (input) and test port 4 (output). Corresponds to the determination of S_{24}.
3-4 (S34)	Selects test port 3 (input) and test port 4 (output). Corresponds to the determination of S_{34}.

NOTE An asterisk (*) in the upper right of the softkey indicates that, if you select the test port and execute the acquisition of the calibration coefficient (press **Done**), the existing calibration coefficient will be cleared.

Step 7. Make a THRU connection between the test ports (between the connectors to which the DUT will be connected) selected in Step 6.

Figure 4-9 **Connecting at Thru Response Calibration**

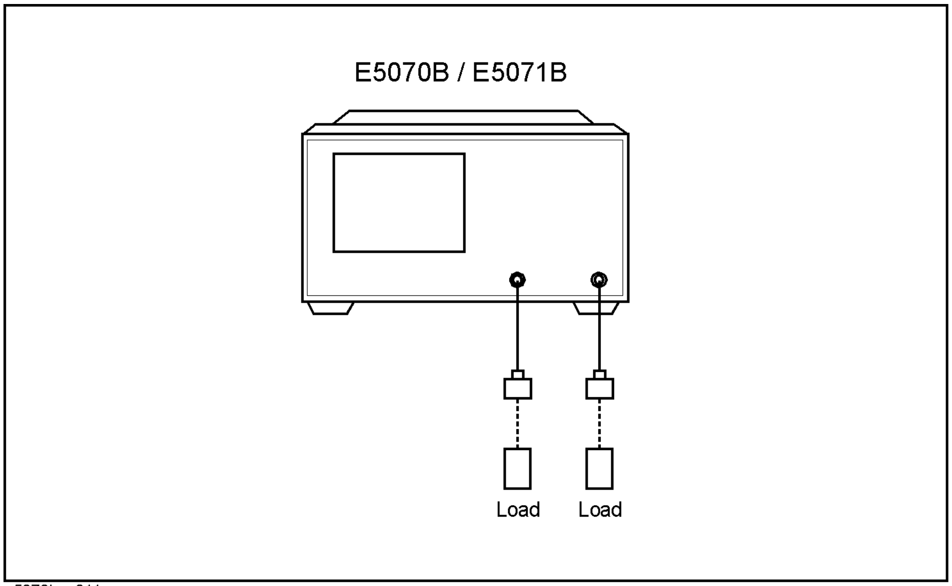


Step 8. Press **Thru** to start the calibration measurement.

Step 9. If an isolation calibration must be performed using a LOAD standard, follow the procedure below.

a. Connect a LOAD standard to each of the two test ports (connectors to which the DUT will be connected) selected in Step 6.

Figure 4-10 **Connecting the Load Standard**



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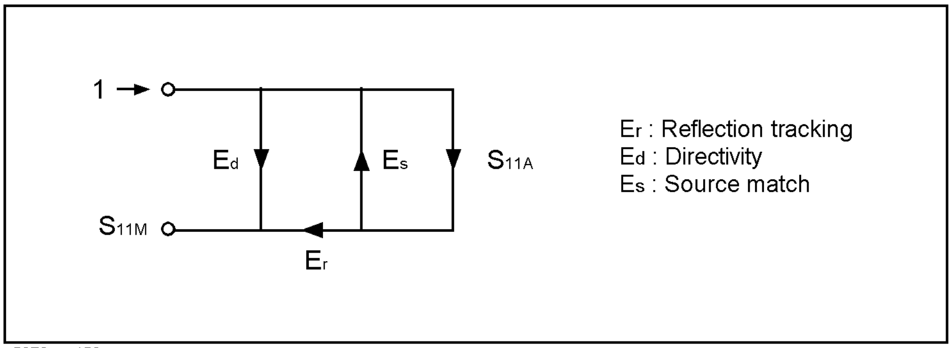
b. Press **Isolation (Optional)** to start the calibration measurement.

Step 10. Press **Done** to terminate the response calibration (and the load isolation calibration) process. Upon pressing the key, calibration coefficients will be calculated and saved. The error correction function will also be automatically enabled.

1-Port Calibration (Reflection Test)

In 1-port calibration, calibration data are measured by connecting an OPEN standard, a SHORT standard, and a LOAD standard to the desired test port. This calibration effectively eliminates the frequency response reflection tracking error, directivity error, and source match error from the test setup in a reflection test using that port (Figure 4-11).

Figure 4-11 **1-Port Error Model (1-Port Calibration)**



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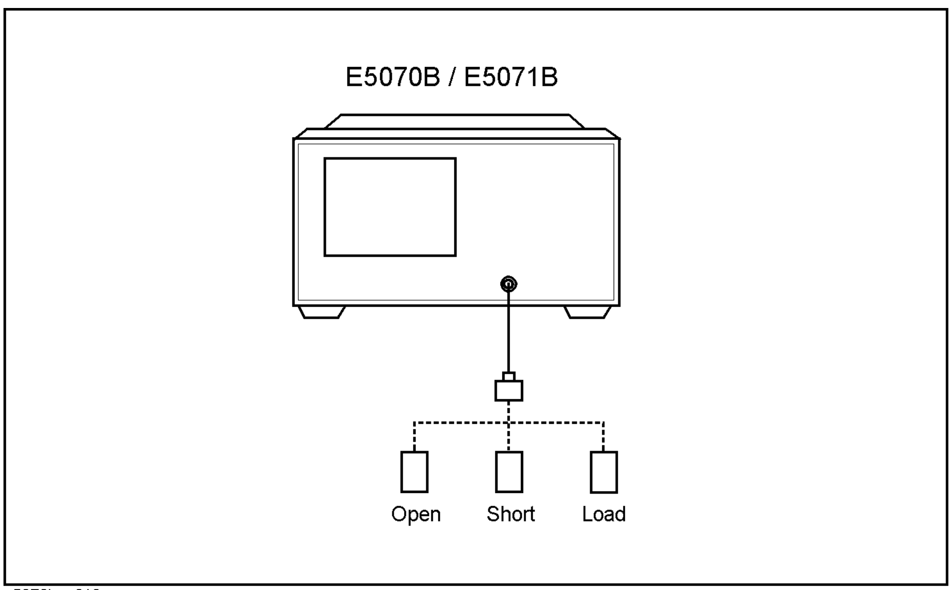
Procedure

Figure 4-12 **Connecting the Standard at 1-Port Calibration**



e5070bue012

Step 1. Press [Channel Next] or [Channel Prev] to select the channel for which you want to perform the calibration.

Step 2. Press [Cal].

Step 3. Press **Calibrate**.

Step 4. Press **1-Port Cal**.

Step 5. Press **Select Port**.

Step 6. Select a test port (and corresponding S parameter) on which a 1-port calibration will be performed.

Softkey	Function
1	Selects port 1.
2	Selects port 2.
3	Selects port 3.
4	Selects port 4.

NOTE An asterisk (*) in the upper right of the softkey indicates that, if you select the test port and execute the acquisition of the calibration coefficient (press **Done**), the existing calibration coefficient will be cleared.

Step 7. Connect an OPEN calibration standard to the test port (connector to which the DUT will be connected) selected in Step 6.

Step 8. Press **Open** to start the calibration measurement.

Step 9. Connect a SHORT calibration standard to the test port (connector to which the DUT will be connected) selected in Step 6.

Step 10. Press **Short** to start the calibration measurement.

Step 11. Connect a LOAD calibration standard to the test port (connector to which the DUT will be connected) selected in Step 6.

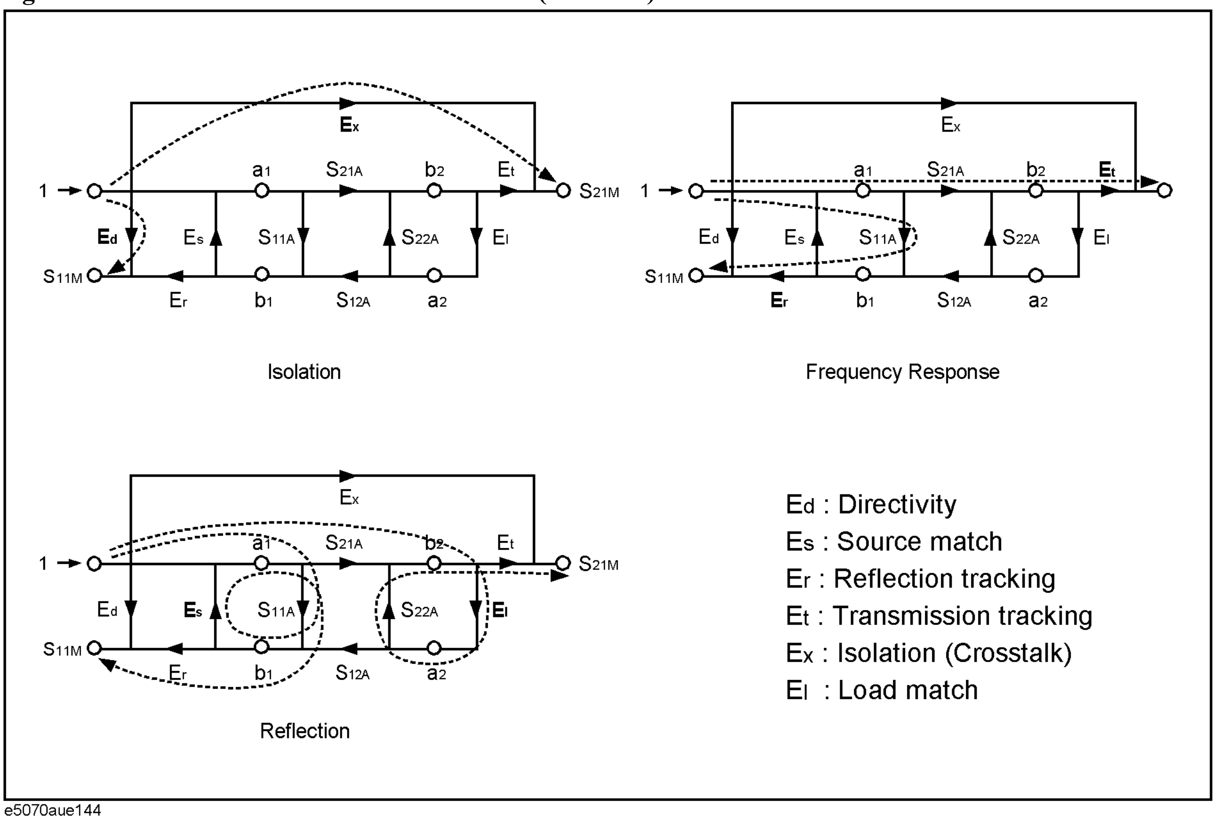
Step 12. Press **Load** to start the calibration measurement.

Step 13. Press **Done** to terminate the 1-port calibration process. Upon pressing the key, calibration coefficients will be calculated and saved. The error correction function will also be automatically enabled.

Full 2-Port Calibration

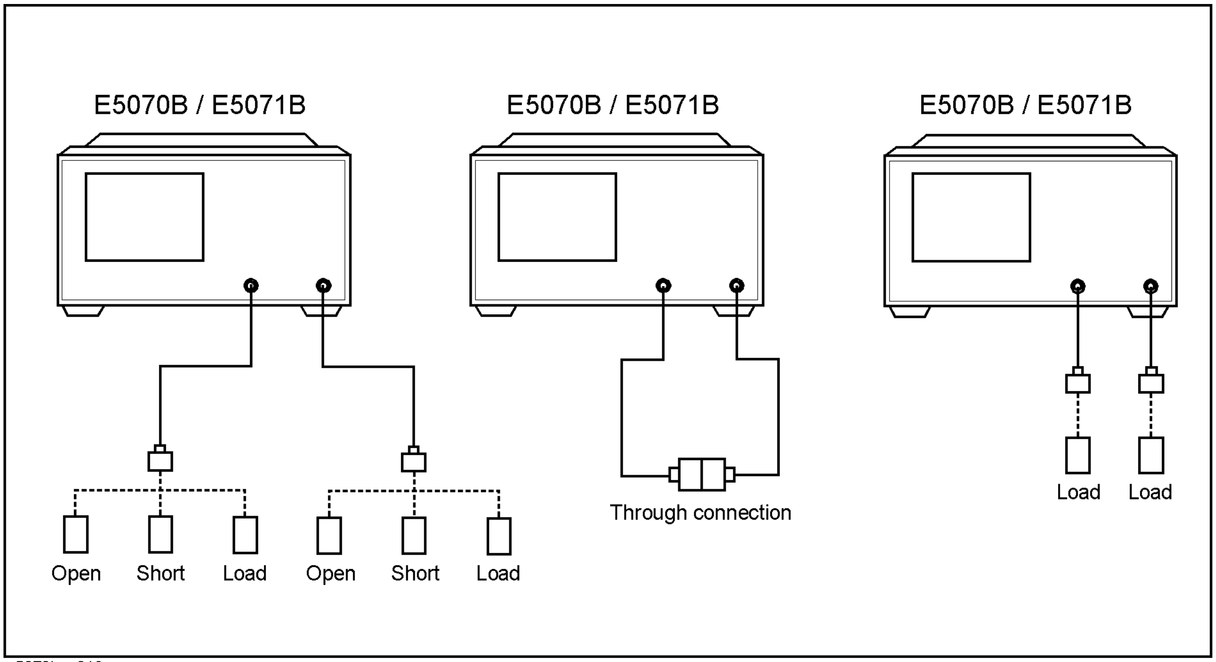
In full 2-port calibration, calibration data are measured by connecting an OPEN standard, a SHORT standard, or a LOAD standard to two desired test ports (or a THRU standard between two ports).This calibration effectively eliminates the directivity error, crosstalk, source match error, frequency response reflection tracking error, and frequency response transmission tracking error from the test setup in a transmission or reflection test using those ports (Figure 4-13). This calibration makes it possible to perform measurements with the highest possible accuracy. A total of twelve error terms, six each in the forward direction and the reverse direction, are used in a calibration.

Figure 4-13 **Full 2-Port Error Model (Forward)**



Procedure

Figure 4-14 Connecting the Standard at Full 2-Port Calibration



Step 1. Press Channel Next or Channel Prev to select the channel for which you want to perform the calibration.

Step 2. Press Cal.

Step 3. Press **Calibrate**.

Step 4. Press **2-Port Cal**.

Step 5. Press **Select Ports**.

Step 6. Select the test ports on which a full 2-port calibration will be performed. (In the procedure below, the selected test ports are denoted as x and y.)

Softkey	Function
1-2	Selects test ports 1 and 2.
1-3	Selects test ports 1 and 3.
1-4	Selects test ports 1 and 4.
2-3	Selects test ports 2 and 3.
2-4	Selects test ports 2 and 4.
3-4	Selects test ports 3 and 4.

NOTE An asterisk (*) in the upper right of the softkey indicates that, if you select the test port and execute the acquisition of the calibration coefficient (press **Done**), the existing calibration coefficient will be cleared.

Step 7. Press **Reflection**.

Step 8. Connect an OPEN calibration standard to test port x (the connector to which the DUT will be connected) selected in Step 6.

Step 9. Press **Port x Open** to start the calibration measurement (**x** denotes the test port to which the standard is connected).

Step 10. Disconnect the OPEN calibration standard that was connected in Step 8 and replace it with a SHORT calibration standard.

Step 11. Press **Port x Short** to start the calibration measurement (**x** denotes the test port to which the standard is connected).

Step 12. Disconnect the SHORT calibration standard that was connected in Step 8 and replace it with a LOAD standard.

Step 13. Press **Port x Load** to start the calibration measurement (**x** denotes the test port to which the standard is connected).

Step 14. Repeat Step 8 to Step 13 for port y.

Step 15. Press **Return**.

Step 16. Press **Transmission**.

Step 17. Make a THRU connection between ports x and y (between the connectors to which the DUT will be connected) selected in Step 6.

Step 18. Press **Port x-y Thru** to start the calibration measurement (**x** and **y** denote the test ports between which the THRU connection is being made).

Step 19. Press **Return**.

Step 20. If an isolation calibration must be performed using a LOAD standard, follow the procedure below.

a. Press **Isolation (Optional)**.

b. Connect a LOAD standard to each of the two test ports (connectors to which the DUT will be connected) selected in Step 6.

c. Press **Port x-y Isol** to start the calibration measurement (**x** and **y** denote the port numbers to which the LOAD standard is connected).

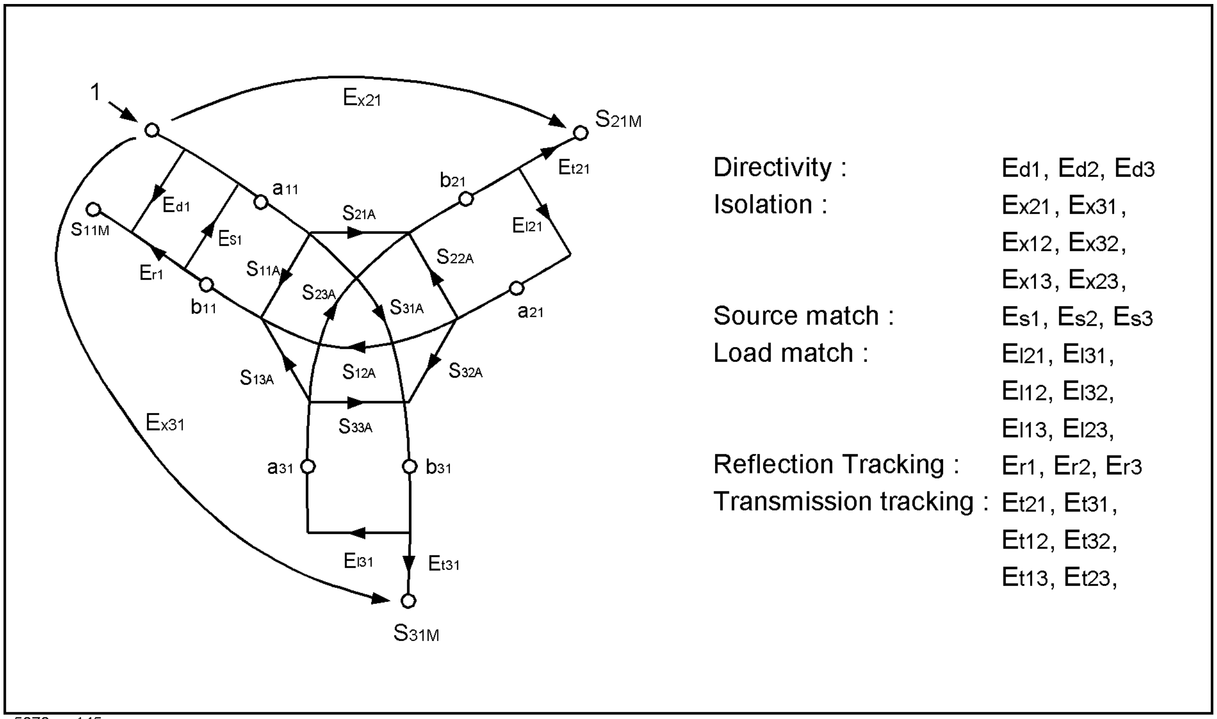
Step 21. Press **Return**.

Step 22. Press **Done** to terminate the full 2-port calibration process. Upon pressing the key, calibration coefficients will be calculated and saved. The error correction function will also be automatically enabled.

Full 3-Port Calibration

In full 3-port calibration, calibration data are measured by connecting an OPEN standard, a SHORT standard, or a LOAD standard to three desired test ports (or a THRU standard between three ports). This calibration effectively eliminates the directivity error, crosstalk, source match error, load match error, frequency response reflection tracking error, and frequency response transmission tracking error from the test setup in a transmission or reflection test using those ports (Figure 4-15). As in full 2-port calibration, this calibration method also makes it possible to perform measurements with the highest possible accuracy. There are unique error terms for directivity, source match, and reflection tracking for each stimulus test port (3 × 3 ports = 9). As for isolation, load match, and transmission tracking errors, there are unique terms for each combination between a stimulus port and a response port (3 × 6 combinations = 18). Therefore, in total, 27 error terms are involved in a full 3-port calibration.

Figure 4-15 Full 3-Port Error Model (Option 313, 314, 413, and 414)



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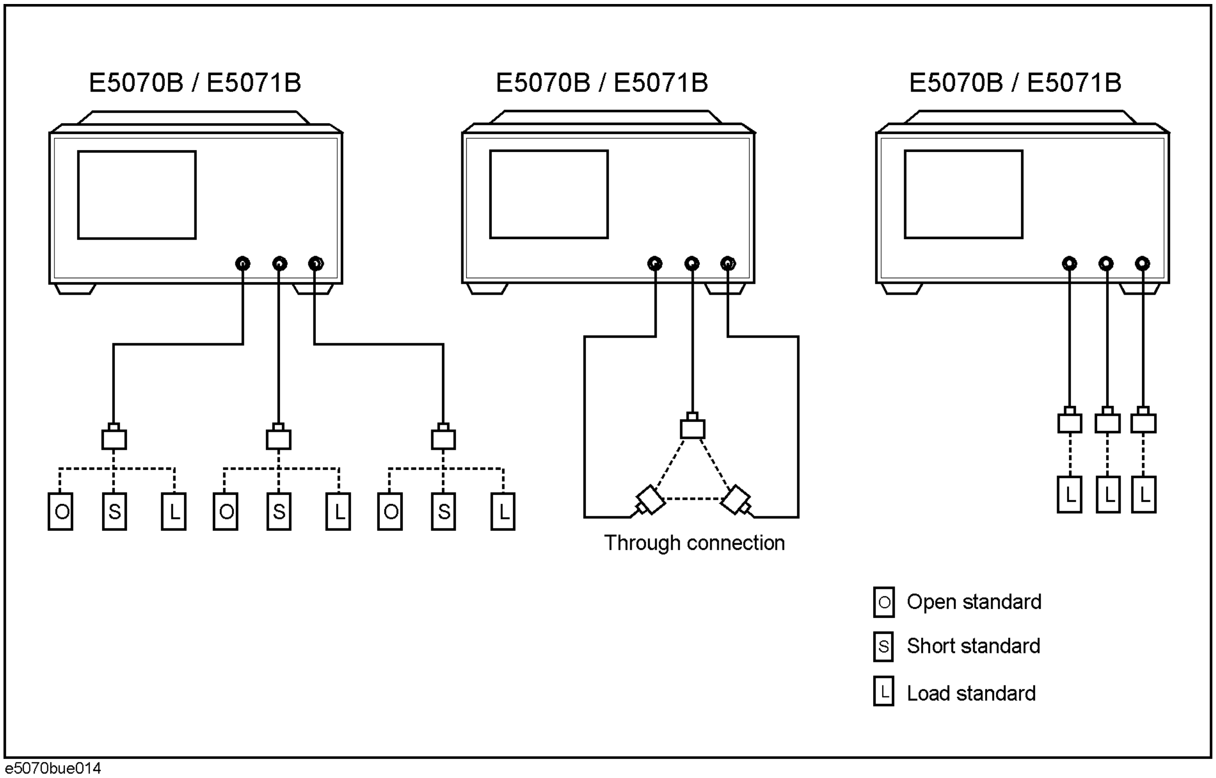
4. Calibration

Procedure

Figure 4-16 **Connecting the Standard at Full 3-Port Calibration**



Step 1. Press Channel Next or Channel Prev to select the channel for which you want to perform the calibration.

Step 2. Press Cal.

Step 3. Press **Calibrate**.

Step 4. Press **3-Port Cal**.

Step 5. Press **Select Ports**.

Step 6. Select the test ports on which a full 3-port calibration will be performed. (In the procedure below, the selected test ports are denoted as x, y, and z.)

Softkey	Function
1-2-3	Selects test ports 1, 2, and 3.
1-2-4	Selects test ports 1, 2, and 4.
1-3-4	Selects test ports 1, 3, and 4.
2-3-4	Selects test ports 2, 3, and 4.

NOTE An asterisk (*) in the upper right of the softkey indicates that, if you select the test port and execute the acquisition of the calibration coefficient (press **Done**), the existing calibration coefficient will be cleared.

Step 7. Press **Reflection**.

Step 8. Connect an OPEN calibration standard to test port x (the connector to which the DUT will be connected) selected in Step 6.

Step 9. Press **Port x Open** to start the calibration measurement (**x** denotes the test port to which the standard is connected).

Step 10. Disconnect the OPEN calibration standard that was connected in Step 8 and replace it with a SHORT calibration standard.

Step 11. Press **Port x Short** to start the calibration measurement (**x** denotes the test port to which the standard is connected).

Step 12. Disconnect the SHORT calibration standard that was connected in Step 8 and replace it with a LOAD standard.

Step 13. Press **Port x Load** to start the calibration measurement (**x** denotes the test port to which the standard is connected).

Step 14. Repeat Step 8 to Step 13 on port y.

Step 15. Repeat Step 8 to Step 13 on port z.

Step 16. Press **Return**.

Step 17. Press **Transmission**.

Step 18. Make a THRU connection between ports x and y (between the connectors to which the DUT will be connected) selected in Step 6.

Step 19. Press **Port x-y Thru** to start the calibration measurement (**x** and **y** denote the test ports between which a THRU connection is being made).

Step 20. Repeat Step 18 and Step 19 on ports x and z.

Step 21. Repeat Step 18 and Step 19 on ports y and z.

Step 22. Press **Return**.

Step 23. If an isolation calibration must be performed using a LOAD standard, follow the procedure below.

- **a.** Press **Isolation (Optional)**.
- **b.** Connect a LOAD standard to each of the three test ports x, y, and z (the connectors to which the DUT will be connected) selected in Step 6.
- **c.** Press **Port x-y Isol** to start the calibration measurement.
- **d.** Press **Port x-z Isol** to start the calibration measurement.
- **e.** Press **Port y-z Isol** to start the calibration measurement.

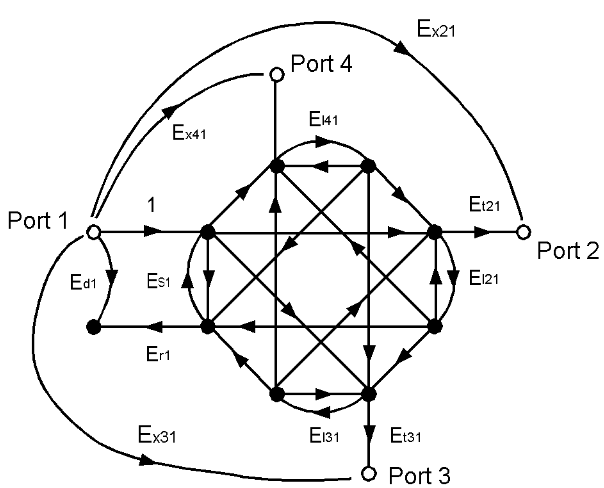
Step 24. Press **Return**.

Step 25. Press **Done** to terminate the full 3-port calibration process. Upon pressing the key, calibration coefficients will be calculated and saved. The error correction function will also be automatically enabled.

Full 4-Port Calibration

In full 4-port calibration, calibration data are measured by connecting an OPEN standard, a SHORT standard, or a LOAD standard to the four test ports (or a THRU standard between the four ports). This calibration effectively eliminates the directivity error, crosstalk, source match error, load match error, frequency response reflection tracking error, and frequency response transmission tracking error from the test setup in a transmission or reflection test using those ports (Figure 4-17). As in full 2-port calibration, this calibration method also makes it possible to perform measurements with the highest possible accuracy. There are unique error terms for directivity, source match, and reflection tracking for each stimulus test port (3 × 4 ports = 12). As for isolation, load match, and transmission tracking errors, there are unique terms for each combination between a stimulus port and a response port (3 × 12 combinations = 36). Therefore, in total, 48 error terms are involved in a full 4-port calibration.

Figure 4-17 Full 4-Port Error Model (Option 413 and 414)



Directivity :	E_{d1}, E_{d2}, E_{d3}, E_{d4}
Isolation :	E_{x21}, E_{x31}, E_{x41}, E_{x12}, E_{x32}, E_{x42}, E_{x13}, E_{x23}, E_{x43}, E_{x14}, E_{x24}, E_{x34},
Source match :	E_{s1}, E_{s2}, E_{s3}, E_{s4}
Load match :	E_{l21}, E_{l31}, E_{l41}, E_{l12}, E_{l32}, E_{l42}, E_{l13}, E_{l23}, E_{l43}, E_{l14}, E_{l24}, E_{l34},
Reflection Tracking :	E_{r1}, E_{r2}, E_{r3}, E_{r4}
Transmission tracking :	E_{t21}, E_{t31}, E_{t41}, E_{t12}, E_{t32}, E_{t42}, E_{t13}, E_{t23}, E_{t43}, E_{t14}, E_{t24}, E_{t34},

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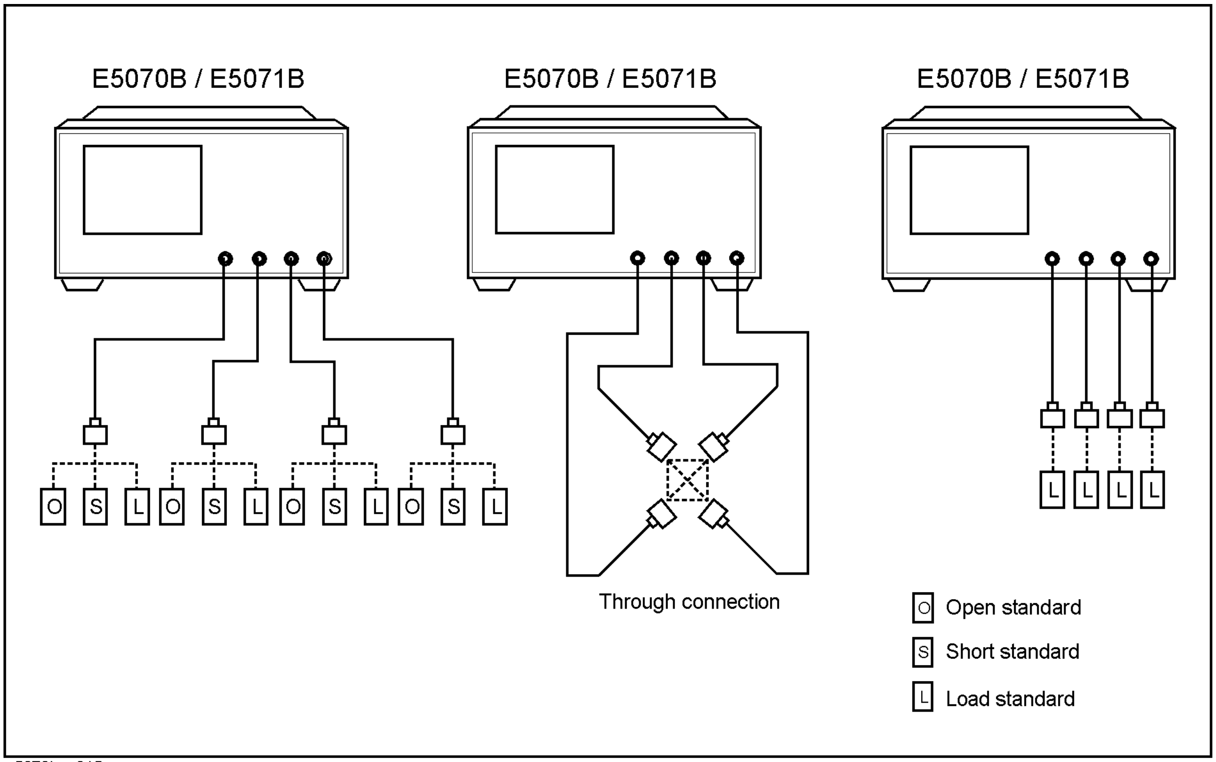
Procedure

Figure 4-18 Connecting the Standard at Full 4-Port Calibration



Step 1. Press Channel Next or Channel Prev to select the channel for which you want to perform the calibration.

Step 2. Press Cal.

Step 3. Press **Calibrate**.

Step 4. Press **4-Port Cal**.

Step 5. Press **Reflection**.

Step 6. Connect an OPEN calibration standard to test port 1 (the connector to which the DUT will be connected).

Step 7. Press **Port 1 Open** to start the calibration measurement.

Step 8. Disconnect the OPEN calibration standard connected in Step 6 and replace it with a SHORT calibration standard.

Step 9. Press **Port 1 Short** to start the calibration measurement.

Step 10. Disconnect the SHORT calibration standard connected in Step 8 and replace it with a LOAD calibration standard.

Step 11. Press **Port 1 Load** to start the calibration measurement.

Step 12. Repeat Step 6 to Step 11 on test port 2.

Step 13. Repeat Step 6 to Step 11 on test port 3.

Step 14. Repeat Step 6 to Step 11 on test port 4.

Step 15. Press **Return**.

Step 16. Press **Transmission**.

Step 17. Make a THRU connection between ports 1 and 2 (between the connectors to which the DUT will be connected).

Step 18. Press **Port 1-2 Thru** to start the calibration measurement.

Step 19. Repeat Step 17 and Step 18 on ports 1 and 3.

Step 20. Repeat Step 17 and Step 18 on ports 1 and 4.

Step 21. Repeat Step 17 and Step 18 on ports 2 and 3.

Step 22. Repeat Step 17 and Step 18 on ports 2 and 4.

Step 23. Repeat Step 17 and Step 18 on ports 3 and 4.

Step 24. Press **Return**.

Step 25. If an isolation calibration must be performed using a LOAD standard, follow the procedure below.

- **a.** Press **Isolation (Optional)**.
- **b.** Connect a LOAD standard to each of the four test ports (connectors to which the DUT will be connected).
- **c.** Press **Port 1-2 Isol** to start the calibration measurement.
- **d.** Press **Port 1-3 Isol**to start the calibration measurement.
- **e.** Press **Port 1-4 Isol** to start the calibration measurement.
- **f.** Press **Port 2-3 Isol** to start the calibration measurement.
- **g.** Press **Port 2-4 Isol** to start the calibration measurement.
- **h.** Press **Port 3-4 Isol** to start the calibration measurement.

Step 26. Press **Return**.

Step 27. Press **Done** to terminate the full 4-port calibration process. Upon pressing the key, calibration coefficients will be calculated and saved. The error correction function will also be automatically enabled. By pressing **Done**, previously saved calibration coefficients will be overwritten with new calibration coefficients.

ECal (Electronic Calibration)

ECal is a calibration method that uses solid state circuit technology. ECal has following advantages:

- Simplifies the calibration process.
- Shortens the time required for calibration.
- Reduces the chances for erroneous manipulation.
- Prevents inferior performance due to wear because the ECal module employs PIN diodes and FET switches.

1-Port Calibration Using a 2-Port ECal Module

Follow the procedure below to perform a 1-port calibration using the 2-port ECal module.

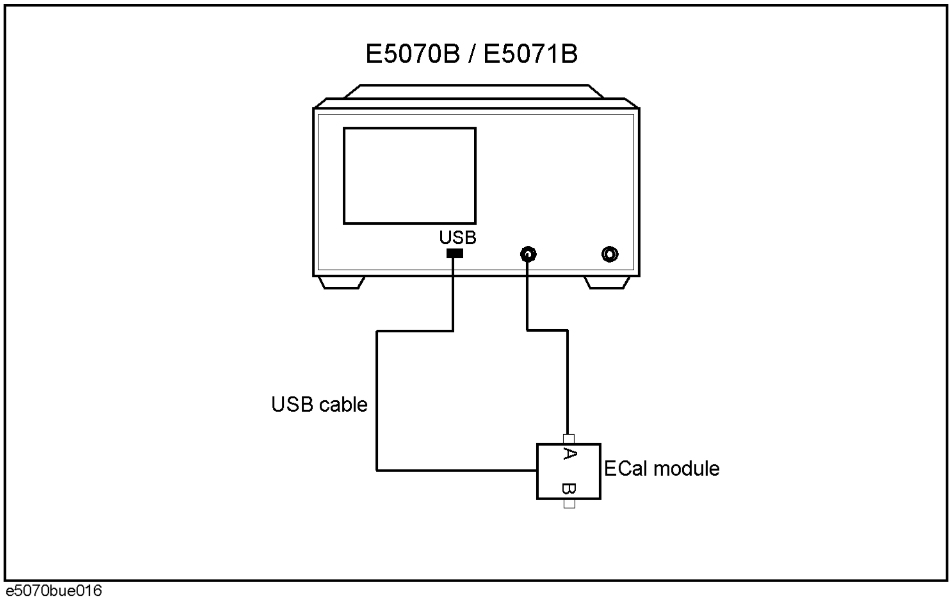
Step 1. Connect the USB port on the ECal module with the USB port on the E5070B/E5071B using a USB cable. This connection may be done with the E5070B/E5071B power on.

Step 2. Connect port on the ECal module to the test port that needs to be calibrated.

NOTE You can connect the ports of the ECal and the test ports of the E5070B/E5071B arbitrarily. The connected ports are detected before data measurement.

NOTE If you don't use all ports of the ECal, connect terminations to the unused ports.

Figure 4-19 **Connecting the ECal Module (1-Port Calibration)**



Step 3. Press Channel Next or Channel Prev to select the channel for which you want to perform the calibration.

Step 4. Press Cal.

Step 5. Press **ECal**.

Step 6. Press **1 Port ECal**.

Step 7. Perform a 1-port calibration.

Softkey	Function
Port 1	Performs a 1-port calibration on test port 1.
Port 2	Performs a 1-port calibration on test port 2.
Port 3*1	Performs a 1-port calibration on test port 3.
Port 4*2	Performs a 1-port calibration on test port 4.

*1. Only with Options 313, 314, 413, and 414.
*2. Only with Options 413 and 414.

Full 2-Port Calibration Using the 2-Port ECal Module

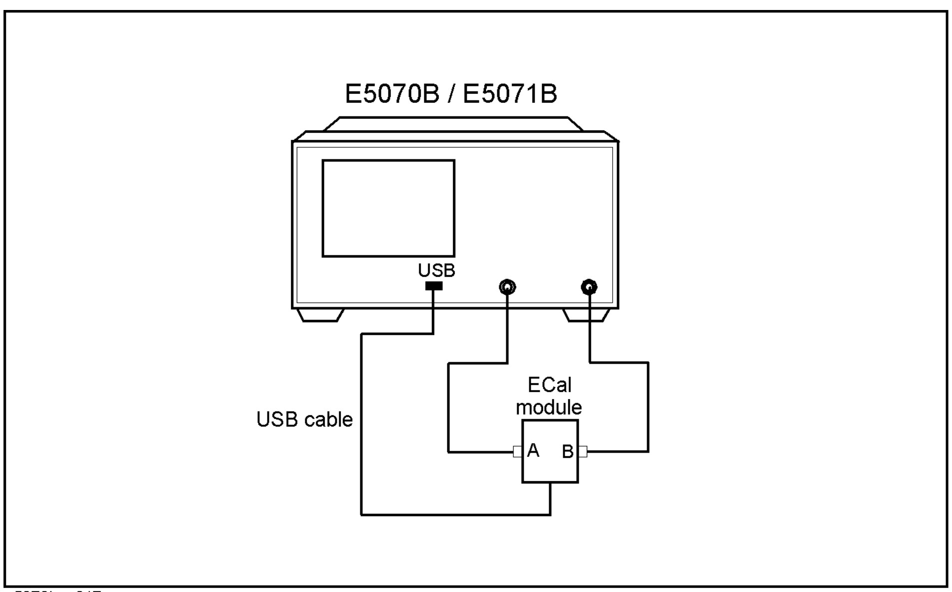
Follow the procedure below to perform a full 2-port calibration using the 2-port ECal module.

Step 1. Connect the USB port on the ECal module with the USB port on the E5070B/E5071B using a USB cable. This connection may be done with the E5070B/E5071B power on.

Step 2. Connect port A and port B on the ECal module to the test ports that need to be calibrated.

NOTE You can connect the ports of the ECal and the test ports of the E5070B/E5071B arbitrarily.

Figure 4-20 **Connecting the ECal Module (Full 2-Port Calibration)**



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Step 3. Press Channel Next or Channel Prev to select the channel for which you want to perform the calibration.

Step 4. Press Cal.

Step 5. Press **ECal**.

Step 6. To enable isolation calibration, press **Isolation** and confirm that the display turns **ON**.

Step 7. Press **2 Port ECal**. When using a 2-port E5070B/E5071B (Option 213 or 214), pressing this key performs a 2-port ECal.

Step 8. When using a 3-port or 4-port E5070B/E5071B (Option 313, 314, 413, or 414), press one of the softkeys below to start a full 2-port calibration.

Softkey	Function
Port 1-2	Performs a full 2-port calibration between test ports 1 and 2.
Port 1-3	Performs a full 2-port calibration between test ports 1 and 3.
Port 1-4[*1]	Performs a full 2-port calibration between test ports 1 and 4.
Port 2-3	Performs a full 2-port calibration between test ports 2 and 3.
Port 2-4[*1]	Performs a full 2-port calibration between test ports 2 and 4.
Port 3-4[*1]	Performs a full 2-port calibration between test ports 3 and 4.

*1. Only with Options 413 and 414.

4. Calibration

Full 3-Port and Full 4-Port Calibration Using the 2-Port ECal

A VBA macro (ECal Assistant) is pre-installed in the E5070B/E5071B to carry out a full 3-port or a full 4-port calibration using the 2-port ECal.

NOTE ECal Assistant does not perform the isolation calibration.

Operation Method

Step 1. Connect the USB port of the ECal module and the USB port on the E5070B/E5071B with a USB cable. The connection may be made with the E5070B/E5071B powered on.

Step 2. Press Macro Setup.

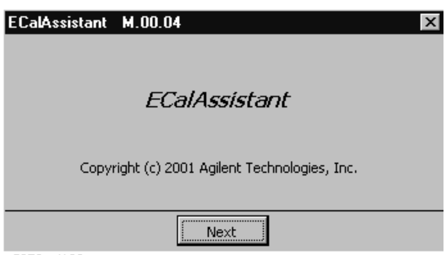
Step 3. Press **Load Project**.

Step 4. From the Open dialog box, select the VBA project file "D:\Agilent\ECalAssistant.VBA" and press the **Open** button.

Step 5. Press Macro Run.

A dialog box as shown in Figure 4-21 appears.

Figure 4-21 **ECalAssistant (Start) Dialog Box**



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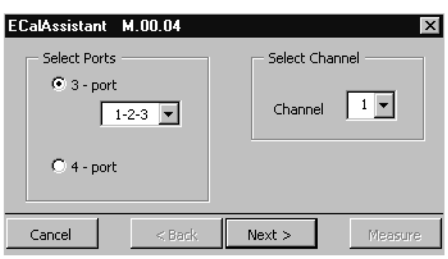
Step 6. Press the **Next** button.

A dialog box as shown in Figure 4-22 appears.

Figure 4-22 **ECalAssistant (Port/Channel Selection) Dialog Box**



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Step 7. In the Select Ports area, click and select the **3-Port** (for a full 3-port calibration) or the

4-Port (for a full 4-port calibration) radio button.

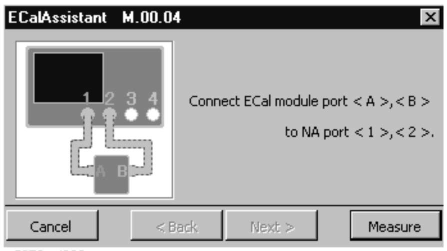
Step 8. When a full 3-port calibration is carried out on an E5070B/E5071B with option 413 or 414, select the test ports to be calibrated on the drop down list box below the **3-Port** button (either **1-2-3**, **1-2-4**, **1-3-4**, or **2-3-4**).

Step 9. In the Select Channel area, select the channel to be calibrated (one of the channels **1** ~ **9**).

Step 10. Press the **Next** button.

A dialog box as shown in Figure 4-23 appears.

Figure 4-23 **ECalAssistant (Connection) Dialog Box**



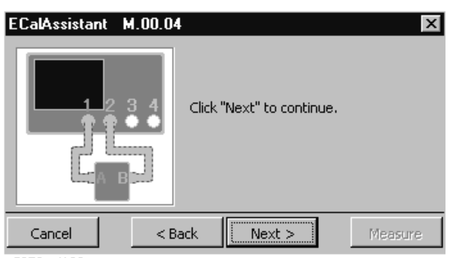
Step 11. Following the connection diagram shown in the dialog box (Figure 4-23), connect port A and B of the ECal module to test ports on the E5070B/E5071B.

Note that the connection diagram shown in each dialog box that appears in each step depends on the number of test ports on the E5070B/E5071B (option 313/314 or 413/414), and the test port selection made in Step 8.

Step 12. Press the **Measure** button to start the measurement of calibration data.

Upon completion of the measurement, a dialog box as shown in Figure 4-24 will be displayed.

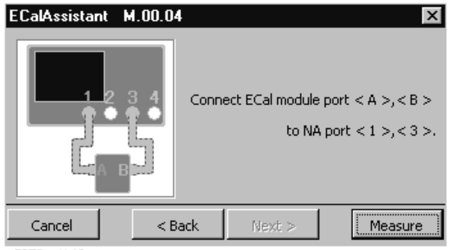
Figure 4-24 **ECalAssistant (Measurement Complete) Dialog Box**



Step 13. Press the **Next** button.

A dialog box as shown in Figure 4-25 appears.

Figure 4-25 **ECalAssistant (Connection) Dialog Box**



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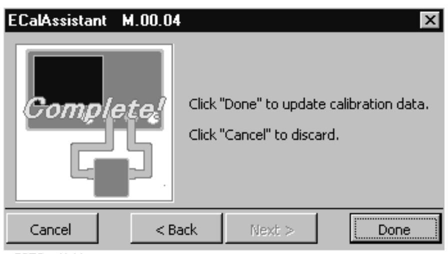
Step 14. Re-connect the ECal module following the instructions given in each dialog box and continue the calibration process.

Step 15. When all calibration data have been collected, a dialog box with the *Complete!* sign appears as shown in Figure 4-26. Press the **Done** button to finish the calibration. If you wish to cancel the calibration, press the **Cancel** button.

Figure 4-26 **EcalAssistant (Finish) Dialog Box**



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Calibration using 4-port ECal

The E5070B/E5071B allows you to perform calibration using the 4-port ECal module. It provides much simpler operation than when using the 2-port ECal. Especially when using a multi-port test set, calibration time and operator's mistakes can be reduced significantly.

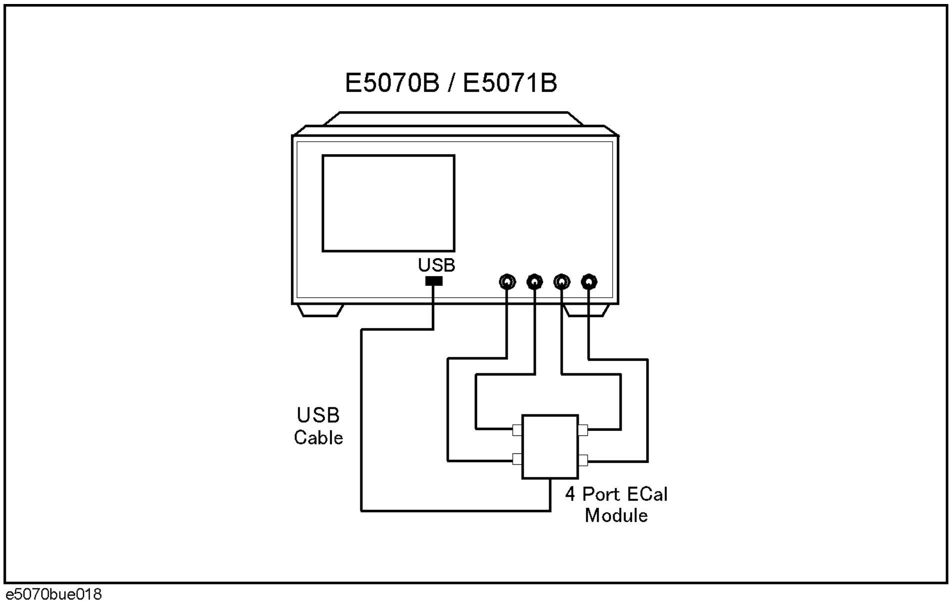
Operational procedure

To execute full 2-port calibration using the 4-port ECal module, follow these steps.

Step 1. Connect the USB cable between the USB port of the 4-port ECal module and the USB port of the E5070B/E5071B. You can make this connection with the E5070B/E5071B ON.

Step 2. Connect the ports of the 4-port ECal module to the test ports you want to calibrate.

Figure 4-27 **Connecting 4-port ECal module (for full 4-port calibration)**



NOTE You can connect the ports of the 4-port ECal and the test ports of the E5070B/E5071B arbitrarily. The connected ports are detected before data measurement.

NOTE If you don’t use all ports of the ECal, connect terminations to the unused ports.

Step 3. Press [Channel Next] or [Channel Prev] to select the channel for which you want to perform the calibration.

Step 4. Press [Cal].

Step 5. Press **ECal**.

Step 6. When you want to turn ON the isolation calibration, press **Isolation** (set to **ON**).

Step 7. Select the calibration type.

Softkey	Function
1-Port ECal	Full 1-port calibration.
2-Port ECal	Full 2-port calibration.
3-Port ECal[*1]	Full 3-port calibration.
4-Port ECal[*2]	Full 4-port calibration.
Thru ECal	Thru calibration.

*1. Options 313, 314, 413, and 414 only
*2. Options 413 and 414 only

Step 8. If you must select a port, the softkey to select a port is displayed. Select a port and start calibration. If you do not have to, this step is skipped.

Step 9. The E5070B/E5071B detects the test ports connected to the ECal and then measurement starts.

NOTE If a test port to be calibrated is not connected to the ECal module, an error occurs.

Performing TRL Calibration

Use the following VBA macro to perform the TRL calibration.

Folder	VBA macro name (project name)
D:\Agilent	TRL_Calibration.vba

NOTE Don't delete this VBA macro. This VBA macro can not be restored by executing system recovery.

This VBA macro lets you perform the 2/3/4 port TRL calibration for any selected port.

NOTE You cannot perform the TRM calibration using this VBA macro.

The TRL calibration provides accuracy equivalent to full 2/3/4/ port calibration using short, open, load, and thru (SOLT) standards.

To perform the TRL calibration, you need to prepare thru, reflection (open or short), and line standards. The thru and line must have the same reference impedance Z0 and the transfer constant (same material).

NOTE You can perform the LRL calibration using a line standard instead of the thru standard because this VBA macro lets you define arbitrary value as the delay of the thru standard. To perform the LRL calibration, define the delay value of the line at the thru definition, and then measure the thru calibration data using the line standard.

Note on use

Set the power level to -10 dBm or less in order to accurately measure a DUT close to open or short state.

Operating procedure

1. Setting stimulus conditions

Set the stimulus conditions of the channel for which you perform the calibration.

For information on the setting procedure, see Chapter 3, “Setting Measurement Conditions.”

2. Starting VBA macro

Load the VBA project for the TRL calibration and run it.

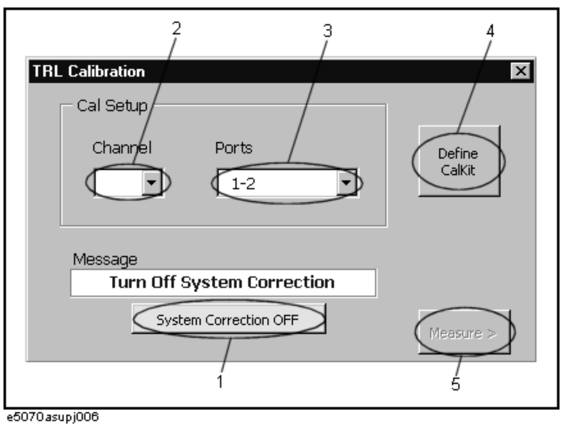
Step 1. Press **[Macro Setup]**.

Step 2. Press **Load Project**.

Step 3. The Open dialog box appears. Specify the file name “D:\AgilentTRL_Calibration.vba” and press the **Open** button.

Step 4. Press **[Macro Run]** to start the macro. (See Figure 4-28.)

Figure 4-28 **TRL_Calibration macro**



3. Turning off system correction

Press the **System Correction OFF** button (1 in Figure 4-28) to turn off system error correction.

NOTE The **System Correction OFF** button does not appear when system error correction has been already turned off.

4. Selecting channel and ports

Select a channel (2 in Figure 4-28) and test ports (3 in Figure 4-28).

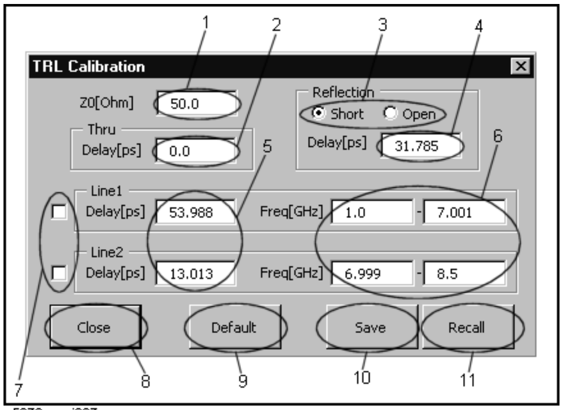
NOTE The channel selected in this step has no relation to active channel.

5. Defining calibration kit

Define the calibration kit you use.

Step 1. Press the **Define Cal kit** button (4 in Figure 4-28) to bring up the calibration kit definition screen shown in Figure 4-29.

Figure 4-29 **Calibration kit definition screen**



e5070asupj007

Step 2. Define each standard as follows:

Reference impedance (Z0)

Enter a value of the reference impedance of thru/line (1 in Figure 4-29).

Thru

Enter a delay value (2 in Figure 4-29) in ps.

Reflection

Select a standard type (3 in Figure 4-29) and enter a delay value (4 in Figure 4-29) in ps.

Line

You can define 2 lines: Line 1 and Line 2.

Enter a delay value (5 in Figure 4-29) in ps and enter a frequency range (6 in Figure 4-29) in GHz.

Check the lines you use for calibration (7 in Figure 4-29).

NOTE When you use Line 1 and Line 2, 10 kHz or more overlapped within their defined frequency ranges must be required.

Saving and loading calibration kit definitions

Press the **Save** button (10 in Figure 4-29) to save the definition of the current calibration kit to your desired file. Press the **Recall** button (11 in Figure 4-29) to recall the definition of a calibration kit from a previously saved file.

NOTE If you save as “D:\Agilent\Trldata\Default.dat,” the file is handled as the default definition file. The default definition file is automatically recalled when the macro starts.

NOTE The factory-shipped default definition file has the same content as “D:\Agilent\Trldata\SysDefault.dat.” Copy “D:\Agilent\Trldata\SysDefault.dat” to the default definition file in order to restore the default definition file to its factory-shipped condition.

Don’t change “D:\Agilent\Trldata\SysDefault.dat.”

Initializing calibration kit definition

Press the **default** button (9 in Figure 4-29) to recall the definition of a calibration kit from the default definition file (“D:\Agilent\Trldata\Default.dat”).

Step 3. Press the **Close** button (8 in Figure 4-29) to finish defining the calibration kit.

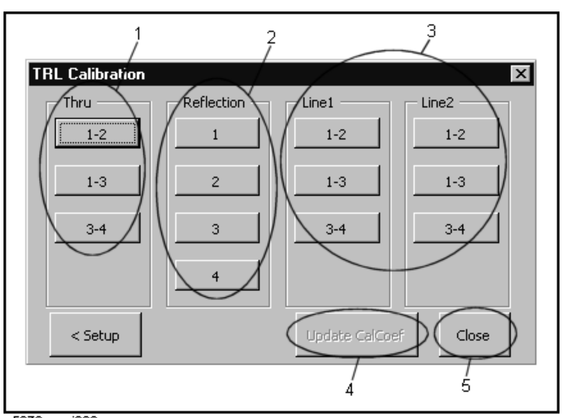
6. Performing calibration

Measure necessary calibration data and enable error correction.

NOTE The definition of the frequency range of the line standard used for measurement must cover the sweep range of the channel for which you perform calibration.

Step 1. Press the **Measure** button (5 in Figure 4-28) to bring up the TRL calibration execution screen. Depending on the port selection and the calibration kit definition, a button appears for data that must be measured. Figure 4-30 is an example when selecting “1-2-3-4” as ports and enabling Line 1 and Line 2.

Figure 4-30 **Example of the TRL calibration execution screen**

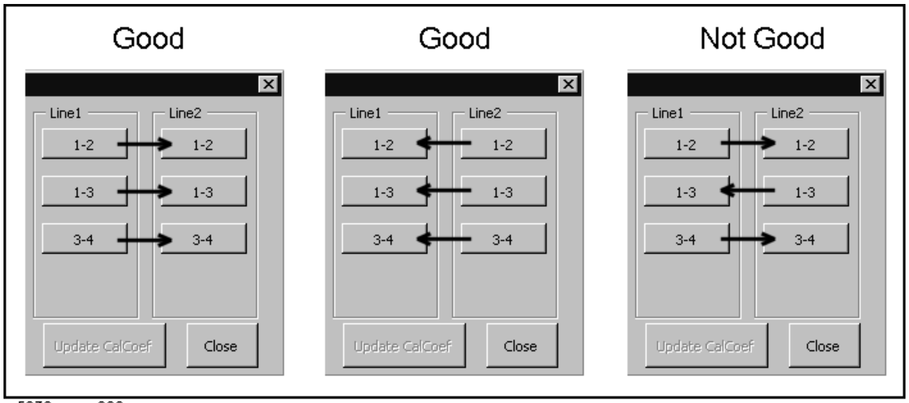


Step 2. Measure calibration data.

For thru and line, connect the standard between the ports shown on the button and then press the button (1,3 in Figure 4-30). The data between the ports is measured and the button changes into light blue.

For reflection, connect the standard to the port shown on the button and then press the button (2 in Figure 4-30). The data of the port is measured and the button changes into light blue.

NOTE When you want to measure calibration data between two or three pairs of ports using Line 1 and Line 2, the order to use the Line 1 and Line 2 must be same for all the pairs of ports. For example, when you measure the calibration data between ports 1-2, 1-3 and 3-4 and use the Line 1 and Line 2 in order for ports 1-2, you have to use the Line 1 and Line 2 in the same order for ports 1-3 and 3-4.



e5070asupe009

NOTE When you use Line 1 and Line 2 and their frequency ranges overlap, data of the line measured later is used.

NOTE The isolation measurement is not available.

Step 3. When measuring all the data is complete, press the **Update Cal Coef** button (4 in Figure 4-30). The calibration coefficient is calculated and the error correction is turned ON. In the calibration property display (ON/OFF with **[Cal]** - **Property**), the state is indicated by “F” (same as the full n port SOLT calibration).

7. Closing macro

Press the **Close** button (5 in Figure 4-30) to exit from the macro.

Calibration between Ports of Different Connector Types

When you perform calibration between ports of different connector type, you need to use a different calibration kit for each test port. In addition, for transmission measurement between 2 ports, you need to use adapters suitable for the connector types of both ports.

For example, in order to perform the full 2-port calibration between port 1 of the N-type connector and port 2 of the 3.5-mm connector, you need to use an N-type connector calibration kit (for example, 85032F) for reflection measurement of port 1, a 3.5-mm connector calibration kit (for example, 85033E) for reflection measurement of port 2, and an N-3.5 mm adapter for transmission measurement between ports 1 and 2.

Because you cannot use a different calibration kit for each port in normal calibration of the E5070B/E5071B, you have to use the following VBA macro to perform calibration between ports of different connector type.

Storage folder	VBA macro name (project name)
D:\Agilent	AdapterCharacterization.vba

NOTE Never delete this VBA macro. Even if you execute system recovery, this VBA macro will not be recovered.

This VBA macro lets you select a calibration kit for each test port and each pair of test ports when performing calibration and, in addition, it lets you select any adapter (2-port touchstone file) whose characteristics have been determined for a standard between test ports.

NOTE This VBA macro has the adapter characterization function to obtain the characteristics of an adapter and save them into a 2-port touchstone file. For more information, see “Adapter Characterization” on page 127.

Operating procedure

NOTE This VBA macro changes definition of the label of calibration kit 10 (calibration kit corresponding to the lowest softkey) temporarily, performs calibration, and restore the definition after completion of the calibration. Therefore, if the VBA macro is aborted for some reason, the definition of the label of calibration kit 10 may be lost.

When you use this VBA macro, it is recommended that you do not use calibration kit 10. If you are using calibration kit 10, it is recommended that you back up calibration kit 10 before using this VBA macro.

To back up a calibration kit, use the VBA macro (SavRecCalKit.vba). You can download this VBA macro through Internet from our product information web site of the Agilent Technologies E5070B/E5071B.

1. Setting stimulus condition

Set the stimulus condition of the channel for which you perform the calibration.

For information on the setting procedure, see Chapter 3, “Setting Measurement Conditions.”

2. Starting VBA macro

Load the VBA project and run it.

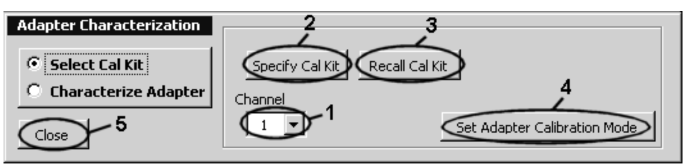
Step 1. Press Macro Setup.

Step 2. Press **Load Project**.

Step 3. The Open dialog box appears. Specify the file name “D:\Agilent\AdapterCharacterization.vba” and press the **Open** button.

Step 4. Press Macro Run to start the macro. (See Figure 4-28)

Figure 4-31 **The Adapter Characterization macro**



e5070bsupj011

3. Selecting a channel

Select a channel (1 in Figure 4-28).

NOTE The selected channel does not relate to the active channel.

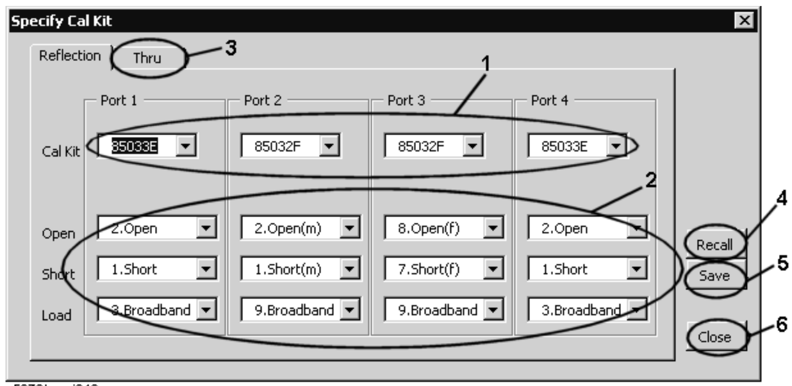
4. Setting calibration kit

Select a calibration kit for each test port and each pair of test ports and select a standard you use for each reflection/transmission measurement.

Step 1. Press the **Specify Cal Kit** button (2 in Figure 4-28).

The Specify Cal Kit dialog box (Reflection tab) as shown in Figure 4-32 appears.

Figure 4-32 **Specify Cal Kit dialog box (Reflection tab)**

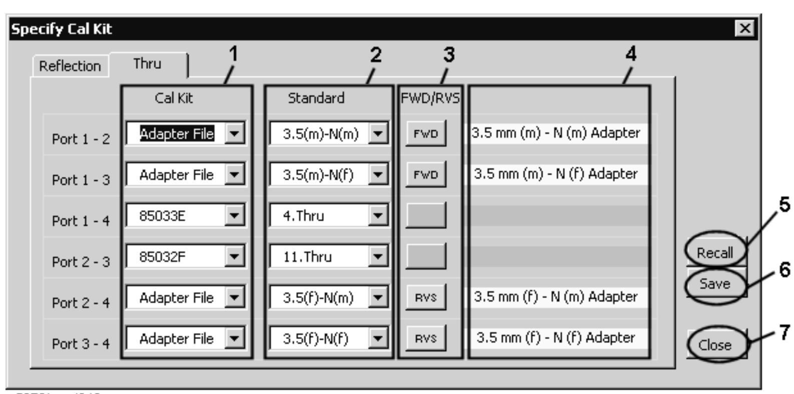


e5070bsupj012

Step 2. For each test port, select a calibration kit you use (1 in Figure 4-32) and select a standard you use in the open/short/load reflection measurement from the calibration kits (2 in Figure 4-32).

Step 3. Select the **Thru** tab (3 in Figure 4-32). The Specify Cal Kit dialog box (Thru tab) as shown in Figure 4-33appears.

Figure 4-33 **Specify Cal Kit dialog box (Thru tab)**



e5070bsupj013

Step 4. For each test port, select a calibration kit you use (1 in Figure 4-33). In addition to the 10 calibration kits you can select for normal calibration, you can select Adapter File. When you want to use the adapter as the standard, select Adapter File.

From the calibration kits you have selected, select a standard you use for transmission measurement (2 in Figure 4-33). If you select Adapter File as the calibration kit, you can select an adapter file (2-port touchstone file) under the D:\Agilent\Data\AdapterCharacterization folder as the standard. In this case, you have to specify the port connection mode (FWD/RVS) between the E5070B/E5071B and the adapter (3 in Figure 4-33).

FWD	Port 1 of the adapter (port 1 of the 2-port touchstone file) is connected to the test port of the smaller port number of the E5070B/E5071B.
RVS	Port 2 of the adapter (port 2 of the 2-port touchstone file) is connected to the test port of the smaller port number of the E5070B/E5071B.

For example, when setting ports 2 to 4, if you want to connect port 1 of the adapter to test port 4 of the E5070B/E5071B and port 2 of the adapter to test port 2 of the E5070B/E5071B, select RVS as the port connection mode.

When you select Adapter File, the comment contained in the adapter file is displayed at 4 in Figure 4-33.

NOTE If the system Z0 written in the adapter file is different from the system Z0 of the E5070B/E5071B, "file error" is displayed at 4 in Figure 4-33. In this case, you cannot set the E5070B/E5071B to the adapter calibration mode.

Saving and loading calibration kit settings

You can save the selection of the calibration kit and standard for each test port (the setting in the Reflection tab) and that for each pair of test ports (the setting in the Thru tab), as well as load them for restoring whenever needed.

Press the **Save** button (5 in Figure 4-32/6 in Figure 4-33) to save the setting into a file.

Press the **Recall** button (4 in Figure 4-32/5 in Figure 4-33) or the **Recall Cal Kit** button (3 in Figure 4-28) to recall the setting from the file.

NOTE If the calibration kit definition is changed after saving the file resulting contradiction between information in the file and the calibration kit definition, you can no longer recall the settings from the file.

Step 5. Press the **Close** button (6 in Figure 4-32/7 in Figure 4-33) to finish the setting of the calibration kits.

5. Performing calibration

Set the E5070B/E5071B to the special calibration mode in which you can use a different calibration kit for each test port (adapter calibration mode) and then perform the calibration.

Step 1. Press the **Set Adapter Calibration Mode** button (4 in Figure 4-28) to set the E5070B/E5071B to the adapter calibration mode.

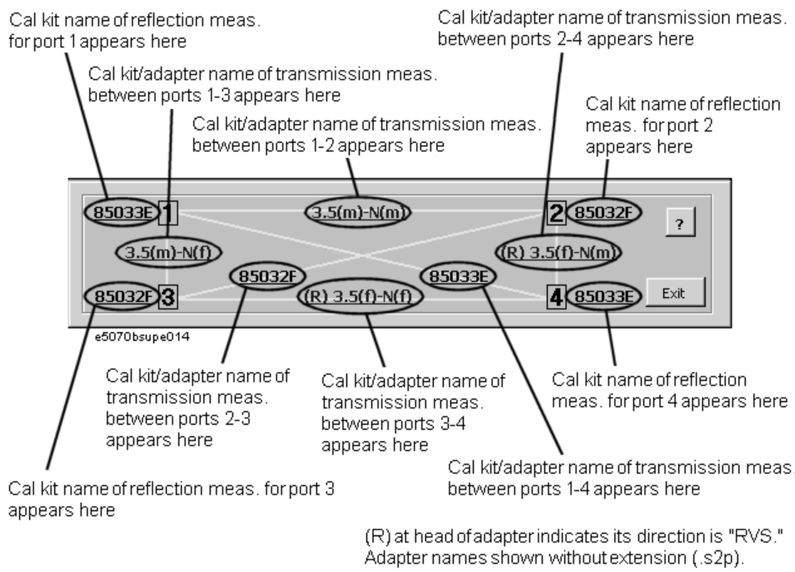
NOTE **Do not terminate the VBA macro forcefully.**

In the adapter calibration mode, if you terminate the VBA macro forcefully, for example, with the [Macro Break] key before returning to the normal calibration mode with the **Exit** button, normal calibration can no longer be performed and the label of calibration kit 10 remains altered. To return to the normal calibration mode, restart the firmware of the

E5070B/E5071B. In this case, you cannot restore the label of calibration kit 10.

Step 2. The screen showing the selected calibration kits for each test port and each pair of test ports based on the setting in “4. Setting calibration kit” on page 124 appears (see Figure 4-34).

Figure 4-34 **Calibration kit setting display screen for adapter calibration mode**



Calibration procedure in the adapter calibration mode is the same as that in the normal calibration except that the standard connected for each calibration data measurement differs. Therefore, when performing the calibration, you use the softkeys (the menu displayed by Cal - **Calibrate**) you use in the normal calibration.

In the adapter calibration mode, the standard name is displayed in the softkey to perform each calibration data measurement based on the setting in “4. Setting calibration kit” on page 124.

According to the on-screen information in Figure 4-34 and the softkey label, connect the appropriate standard and measure each type of calibration data to perform calibration.

Step 3. After the calibration, press the **Exit** button to return the E5070B/E5071B to the normal calibration mode.

6. Closing VBA macro

Press the **Close** button (5 in Figure 4-28) to close the macro.

Adapter Characterization

To perform calibration between ports of different connector types, you have to obtain characteristics of the adapter you use in transmission measurement in advance.

The adapter characterization function lets you obtain the characteristics of the adapter (S-parameter) and save them into a 2-port touchstone file.

Use the following VBA macro to execute the adapter characterization.

Storage folder	VBA macro name (project name)
D:\Agilent	AdapterCharacterization.vba

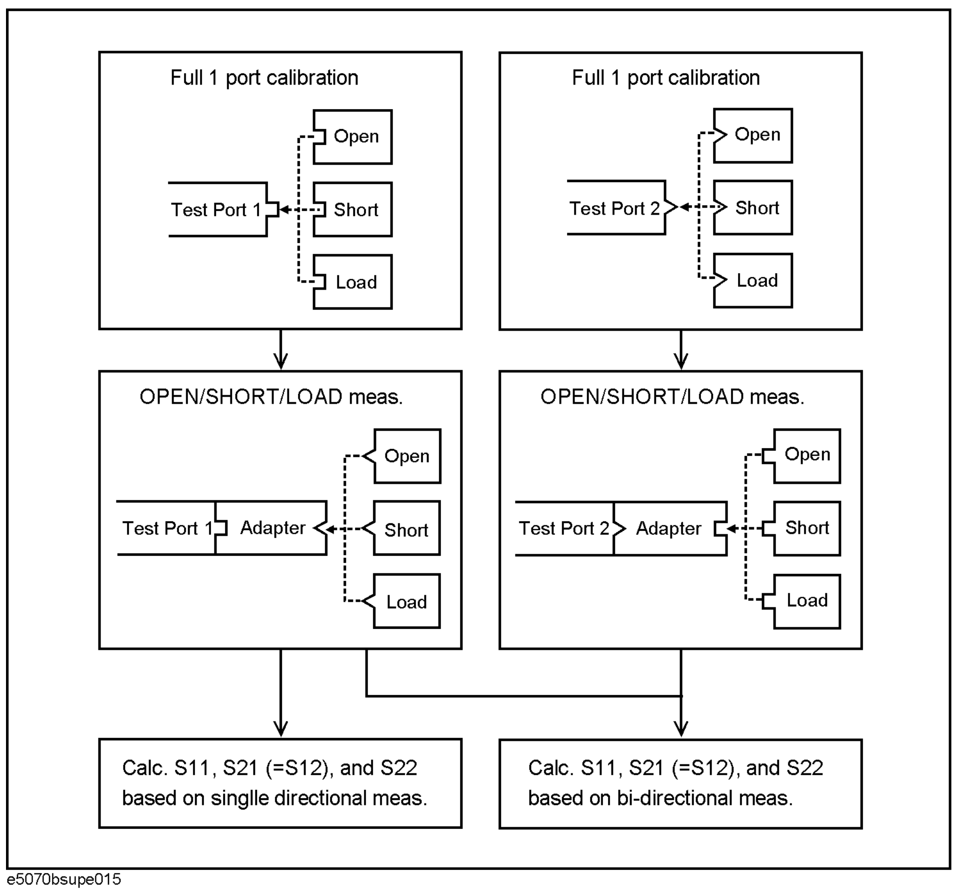
NOTE Never delete this VBA macro. Even if you execute system recovery, this VBA macro will not be recovered.

Concept

The adapter characterization is a function to calculate S-parameters of an adapter based on 3 measurement results with open/short/load standards that are connected to the test port, via the adapter, for which full 1-port calibration has been performed. This VBA macro uses test port 1 for this measurement.

The S-parameters of the adapter can be calculated from the above 3 measurement results. However, you can calculate the S-parameters more accurately by connecting the adapter to the test port in the reverse direction, measuring 3 more results in the same way as above, and using the above 3 results and these 3 results (the total of the 6 measurement results). This VBA macro uses test port 2 for the measurement in which the adapter is connected in the reverse direction.

Figure 4-35 **Adapter characterization**



How to execute adapter characterization

1. Setting stimulus conditions

Set stimulus conditions of the channel for which you execute the adapter characterization.

For information on the setting procedure, see Chapter 3, “Setting Measurement Conditions.”

2. Performing calibration

Perform full 1-port calibration for test port 1 and test port 2 in the channel for which the stimulus condition has been set. Use the connector type appropriate for the adapter for the calibration surface of test port 1 and test port 2.

For information on the performing procedure, see “1-Port Calibration (Reflection Test)” on page 98.

3. Starting VBA macro

Step 1. Press Macro Setup .

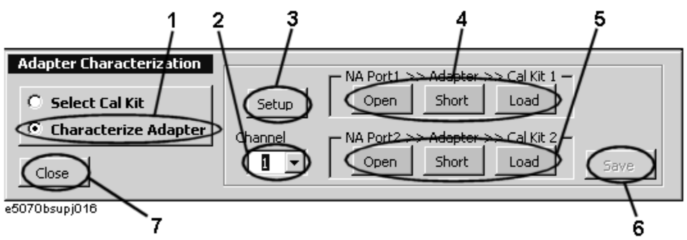
Step 2. Press **Load Project**.

Step 3. The Open dialog box appears. Specify the file name “D:\Agilent\AdapterCharacterization.vba” and press the **Open** button.

Step 4. Press Macro Run to start the macro.

Step 5. Select **Characterize Adapter** (1 in Figure 4-36) to display the Adapter Characterization screen.

Figure 4-36 **Adapter Characterization macro (Adapter Characterization screen)**



4. Selecting channel

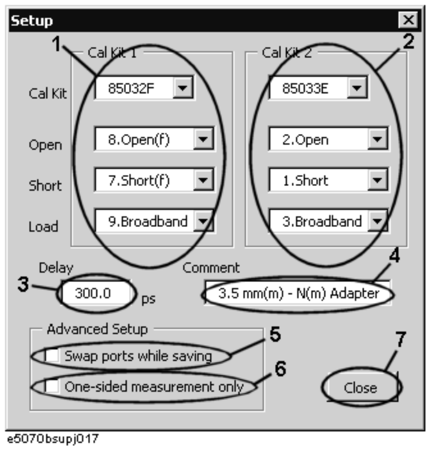
Select the channel for which calibration has been performed (2 in Figure 4-36).

NOTE The selected channel does not relate to the active channel.

5. Setting adapter characterization

Step 1. Press the **Setup** button (3 in Figure 4-36). The Setup dialog box as shown in Figure 4-37 appears.

Figure 4-37 **Setup dialog box**



Step 2. Make the setting of the calibration kit you connect to the adapter that is connected to test port 1 of the E5070B/E5071B in Cal Kit 1 (1 in Figure 4-37).

Step 3. Make the setting of the calibration kit you connect to the adapter that is connected to test port 2 of the E5070B/E5071B in Cal Kit 2 (2 in Figure 4-37).

When you calculate the S-parameters using measurement data in one direction only, you do not have to make the setting in Cal Kit 2. In this case, give a check mark to the left of One-sided measurement Only (6 in Figure 4-37).

Step 4. Enter the Delay of the adapter (3 in Figure 4-37) within an error of $\pm\frac{1}{4 \times f}$ [s]. Where f is the maximum measurement frequency [Hz]. For example, when the maximum value is 1 GHz, enter a value within an error of ±250 ps.

Step 5. Enter a comment about the adapter (4 in Figure 4-37). The comment entered here is displayed in the comment field in the Specify Cal Kit dialog box (4 in Figure 4-32).

Step 6. By default, the S-parameters are saved so that the port of the adapter connected to test port 1 of the E5070B/E5071B corresponds to port 1 of the 2-port touchstone file. To save the S-parameters in the reverse order, which means that the port of the adapter connected to test port 1 of the E5070B/E5071B corresponds to port 2 of the 2-port touchstone file, give a check mark to the left of Swap ports while saving (5 in Figure 4-37).

Step 7. Press the **Close** button (7 in Figure 4-37) to finish the setting of the adapter characterization.

6. Measuring data

Measure data when each standard is connected.

Step 1. Connect the adapter to test port 1 of the E5070B/E5071B.

Step 2. According to the setting of Cal Kit 1, connect each standard to the adapter and then press the corresponding button (4 in Figure 4-36). When the data measurement is complete, the button turns to yellow.

When you calculate the S-parameters using measurement data in one direction only, the data measurement is complete here.

Step 3. Connect the adapter to test port 2 of the E5070B/E5071B in the reverse direction.

Step 4. According to the setting of Cal Kit 2, connect each standard to the adapter and then press the corresponding button (5 in Figure 4-36). When the data measurement is complete, the button turns to yellow.

7. Saving to file

Calculate the S-parameters and save them into a file.

Step 1. Press the **Save** button (6 in Figure 4-36).

Step 2. The Save As dialog box appears. Enter a file name and press the **Save** button.

If you save the file under the D:\Agilent\Data\AdapterCharacterization folder, you can select it as the standard when selecting Adapter file when you make the setting for the adapter calibration mode in the Specify Cal Kit dialog box.

8. Closing VBA macro

Press the **Close** button (7 in Figure 4-36) to close the macro.

Execution procedure of characterization for test fixture using probe

The adapter characterization function also lets you obtain characteristics of a test fixture inserted between a DUT that cannot be connected directly to the instrument and the instrument using a probe, and save them into a 2-port touchstone file. The obtained result can be eliminated using the network de-embedding function of the fixture simulator function, which provides measurement where the effect of the test fixture is eliminated.

NOTE For more information on the test fixture characterization using a probe, see Product Note E5070/71-4.

1. Setting stimulus conditions

Set the stimulus condition of the channel for which you execute the test fixture characterization.

2. Performing calibration

Perform full 1-port calibration for the probe in the channel for which the stimulus condition has been set.

3. Starting VBA macro

Start the VBA macro to display the Adapter Characterization screen (Figure 4-36).

4. Selecting channel

Select the channel for which calibration has been performed (2 in Figure 4-36).

5. Setting characterization

Step 1. Press the **Setup** button (3 in Figure 4-36) to display the Setup dialog box (Figure 4-37).

Step 2. Make the setting of the calibration kit you use in Cal Kit 1 (1 in Figure 4-37).

Step 3. Enter the Delay of the test fixture (3 in Figure 4-37).

Step 4. Enter a comment about the test fixture (4 in Figure 4-37). This comment is added to the comment line at the beginning of the touchstone file.

Step 5. Give a check mark to the left of Swap ports while saving (5 in Figure 4-37) in order to align the direction when specifying a file in the network de-embedding function.

Step 6. Give a check mark to the left of One-sided measurement Only (6 in Figure 4-37).

Step 7. Press the **Close** button (7 in Figure 4-37) to close the Setup dialog box.

6. Measuring data

Step 1. Connect the probe to the DUT side end of the test fixture.

Step 2. According to the setting of Cal Kit 1, connect each standard to the connector side of the test fixture and then press the corresponding button (4 in Figure 4-36). When the data measurement is complete, the button turns to yellow.

7. Saving to file

Press the **Save** button (6 in Figure 4-36) to save the calculated S-parameters into a 2-port touchstone file.

8. Closing VBA macro

Press the **Close** button (7 in Figure 4-36) to close the macro.

User Characterized ECal

NOTE This function is available with the firmware version 3.50 or greater.

The E5070B/E5071B allows you to execute the ECal with user-defined characteristic instead of the ECal characteristic that is defined as the factory default. This feature is called the user Characterized ECal and used when you need to execute the ECal connecting an adapter to the ECal module.

Before executing the user Characterized ECal, you have to measure data such as characteristic when connecting the adapter to the ECal module and store them into the built-in flash memory of the ECal module as the user characteristic.

Use the following VBA macro to acquire user characteristic and store them into the ECal module built-in memory.

Storage folder	VBA macro name (project name)
D:\Agilent	EcalCharacterization.vba

NOTE Never delete this VBA macro. Even system recovery cannot restore this VBA macro.

Precautions on using VBA macro

- ❑ Never connect/disconnect the USB cable.

  Never connect/disconnect the USB cable between the ECal module and the E5070B/E5071B during executing the VBA macro.

CAUTION **In particular, the above precaution must always be observed while the VBA macro is storing data into the ECal's built-in flash memory; disconnecting the USB cable may result in ECal module defect.**

- ❑ Back up the contents of the flash memory.

  The VBA macro provides a feature to back up the contents of the ECal module's built-in flash memory. Before storing user characteristic into the ECal module, be sure to use this feature to back up the contents of the flash memory.

Storing user characteristic into ECal module

Follow these steps to measure characteristic under the condition that an adapter is connected to the ECal module and then to store them into the ECal module's built-in flash memory as user characteristic.

NOTE For the E5070B/E5071B with 2/3 ports (options 213, 214, 313, or 314), you cannot measure the user characteristic of the 4-port ECal module and store them into the memory using this VBA macro.

1. Connecting ECal module

Connect the USB cable between the USB port of the ECal module and that of the E5070B/E5071B. You can make this connection with the E5070B/E5071B ON.

2. Setting stimulus condition

Set the stimulus condition of the channel for which you measure the user characteristic. For best accuracy, the IF bandwidth should be set to 1 kHz or less.

3. Executing calibration

For the channel for which you have set the stimulus condition, execute the full 4-port calibration for the 4-port ECal module or the full 2-port calibration between the test ports you use for the 2-port ECal module, defining the calibration surface as the connector surface connected to each port of the ECal module in the state to measure characteristic.

For information on how to perform calibration when the connector types of individual ports differ, refer to “Calibration between Ports of Different Connector Types” on page 122.

4. Starting the VBA macro

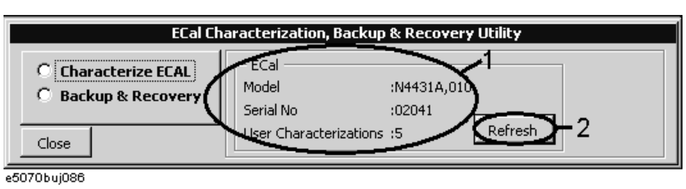
Step 1. Press Macro Setup.

Step 2. Press **Load Project**.

Step 3. The Open dialog box appears. Specify the file name "D:\Agilent\EcalCharacterization.vba" and press the **Open** button.

Step 4. Press Macro Run to start the macro. The ECal part (1 in Figure 4-38) displays the information of the ECal module connected to the E5070B/E5071B. press the **Refresh** button (2 in Figure 4-38) to update the information if you connect another ECal module after the macro has been started.

Figure 4-38 **EcalCharacterization macro**

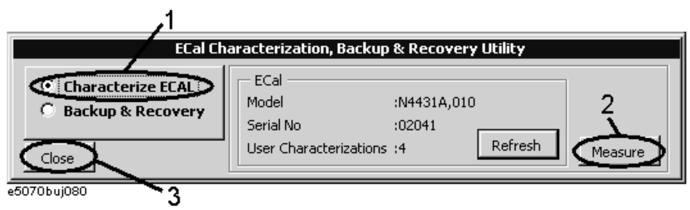


4. Calibration

5. Measuring user characteristic

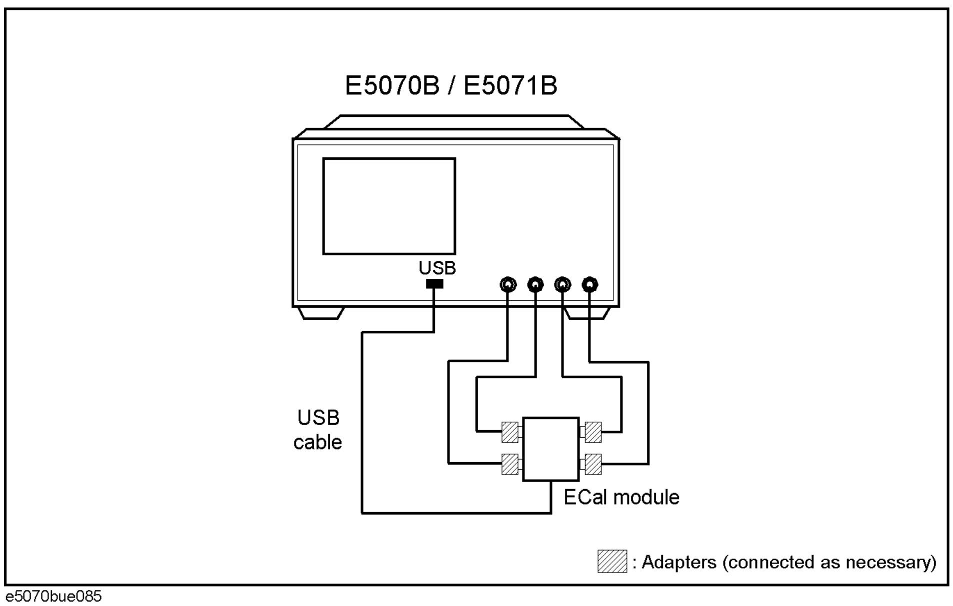
Step 1. Select **Characterize ECAL** (1 in Figure 4-39) to display the User Characteristic Measurement screen.

Figure 4-39 **EcalCharacterization macro (User Characteristic Measurement screen)**



Step 2. After connecting the adapter to the ECal module as necessary, connect each port of the ECal module and the test port of the E5070B/E5071B.

Figure 4-40 **Connecting ECal module (for 4 ports)**



NOTE You can select any ports of the ECal module and any test ports of the E5070B/E5071B for connection; the E5070B/E5071B automatically recognizes the connected ports before measurement.

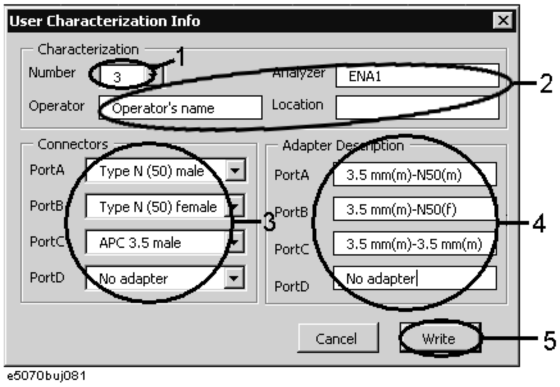
Step 3. Press the **Measure** button (2 in Figure 4-39) to start measurement.

6. Storing the user characteristic into the memory

Step 1. When the measurement is complete, the User Characteristic Store screen as shown in Figure 4-41 appears.

Specify a user number (a location number in the memory where you want to store the user characteristic) using 1 in Figure 4-41. If the specified location number is not used for storage, the parts Characterization, Connectors, and Adapter Description are left blank; if already used, the stored contents are displayed.

Figure 4-41 **User Characteristic Store screen**



Step 2. Enter the following information.

Characterization (2 in Figure 4-41)	Enter the information (an operator, a used analyzer, and so on) when measuring the user characteristic, as necessary
Connectors (3 in Figure 4-41)	Select the connector types of the adapters for the ECal module test ports. Male and female in the list of connected types indicate male and female of the adapter, respectively. Select “No adapter” if no adapter is used on a port.
Adapter Description (4 in Figure 4-41)	Enter the detailed information on the adapters connected to each port, as necessary

The information you have entered is displayed when checking the user characteristic information using the key stroke: Cal - **ECal** - **Characterization Info**.

Step 3. Press the **Write** button (5 in Figure 4-41).

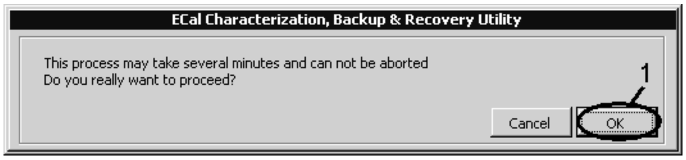
At this time, if user characteristic is already stored for the specified user number, a dialog appears to confirm overwriting. Click the **OK** button.

NOTE Although the maximum number of user characteristic stored into the ECal’s memory is usually five, the maximum number may be reduced by the limitation of the memory size because the size of user characteristic’s data is not fixed and is increased in proportion to the number of measurement points. An error occurs when the **Write** button is pressed if the total size added the new user characteristic is over the limitation of the memory size.

Step 4. A dialog as shown in Figure 4-42 appears to confirm execution. Press the **OK** button (1 in Figure 4-42) to start storing the user characteristic.

CAUTION **Do not disconnect the USB cable or terminate the VBA macro forcefully while the VBA macro is storing data into the ECal's built-in flash memory. Doing so may result in ECal module defect.**

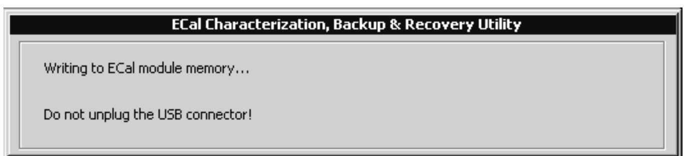
Figure 4-42 **Execution Confirmation screen**



e5070buj082

A dialog as shown in Figure 4-43 appears while the VBA macro is storing data into the memory. Storing the user characteristic will be complete in several minutes.

Figure 4-43 **Screen while the macro is storing data**



e5070buj087

Step 5. A dialog appears to notify completion. Click **OK**.

8. Closing the VBA macro

Press the **Close** button (3 in Figure 4-39) to close the macro.

Backup and recovery of ECal module's built-in flash memory

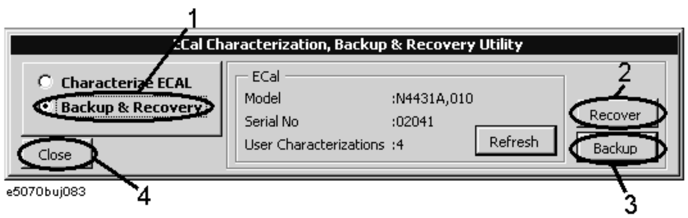
Follow these steps to back up the contents of the ECal module's built-in flash memory.

Step 1. Connect the USB cable between the USB port of the ECal module and that of the E5070B/E5071B. You can make this connection with the E5070B/E5071B ON.

Step 2. Start the VBA macro according to “4. Starting the VBA macro” on page 135.

Step 3. Select **Backup Flash ROM** (1 in Figure 4-44) to display the Backup screen.

Figure 4-44 **EcalCharacterization macro (Backup screen)**



Step 4. Recovery

1. Press the **Recover** button (2 in Figure 4-44).

2. The Open dialog box appears. Enter a file name in which the contents you want to recover and press the **Open** button.

   If the serial number information stored in the file does not match with that of the ECal module connected to the E5070B/E5071B, a confirmation dialog appears. Only when the mismatch between those serial numbers is allowed, press the **OK** button to continue the recovery.

3. A dialog as shown in Figure 4-42 appears to confirm execution. Press the **OK** button (1 in Figure 4-42) to start the recovery of the flash memory. A dialog as shown in Figure 4-43 appears while the VBA macro is storing data into the memory. The recovery of the flash memory will be complete in several minutes.

CAUTION **Do not disconnect the USB cable or terminate the VBA macro forcefully while the VBA macro is storing data into the ECal's built-in flash memory. Doing so may result in ECal module defect.**

4. The Completion screen appears. Click **OK**.

Backup

1. Press the **Backup** button (3 in Figure 4-44).

2. The Save As dialog box appears. Enter a file name you want to save and press the **Save** button.

Step 5. Press the **Close** button (4 in Figure 4-44) to close the macro.

Executing user Characterized ECal

The execution procedure for the user Characterized ECal is the same as for normal ECal except that it requires the user characteristic to be selected in advance.

Follow these steps to select the user characteristic.

Step 1. Press Channel Next or Channel Prev to select the channel for which you want to execute calibration.

Step 2. Press Cal.

Step 3. Press **ECal**.

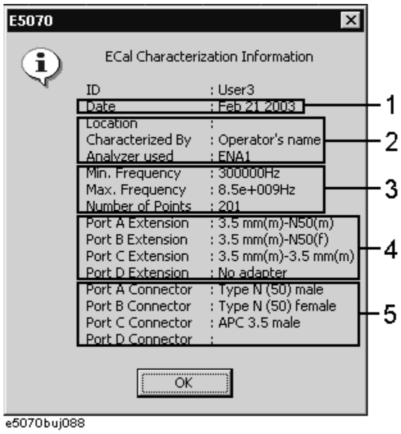
Step 4. Press **Characterization**.

Step 5. Select a user characteristic.

Softkey	Function
Factory	Factory-default characteristic (for normal ECal)
User1	User characteristic stored at location number 1 in the ECal's flash memory.
User2	User characteristic stored at location number 2 in the ECal's flash memory.
User3	User characteristic stored at location number 3 in the ECal's flash memory.
User4	User characteristic stored at location number 4 in the ECal's flash memory.
User5	User characteristic stored at location number 5 in the ECal's flash memory.

Step 6. To check the information on the user characteristic you have selected, press **Characterization Info**. A dialog as shown in Figure 4-43 appears.

Figure 4-45 **ECal Characterization Information screen**



1: The date when the user characteristic was measured

2: The information you entered in Characterization (1 in Figure 4-41)

3: The stimulus conditions when the user characteristic was measured

4: The information you entered in Adapter Description (3 in Figure 4-41)

5: The information you entered in Connectors (2 in Figure 4-41)

4. Calibration

Confidence check on calibration coefficients using ECal

NOTE This function is available with the firmware version 3.50 or greater.

The E5070B/E5071B lets you verify the obtained calibration coefficients (whether correct measurement is possible using the obtained calibration coefficients) using the ECal module.

The E5070B/E5071B can set ECal into the state for verifying the measurement parameters and copy the appropriate characteristics in that verification state to the memory trace from the ECal's built-in memory, according to the measurement parameters of the active trace of the active channel. While measuring ECal in this specified state, you can compare the measurement result with the E5070B/E5071B and the appropriate measurement result stored in ECal in several different ways, including simultaneously displaying the data and memory traces or displaying the math operation result between the data and memory traces. This enables you to verify the correctness of measurement for each measurement parameter when the obtained calibration coefficients are used.

Operational procedure

Follow these steps to perform the reliability verification of the calibration coefficients.

Step 1. Connect the USB cable between the USB port of the ECal module and the USB port of the E5070B/E5071B. You can make this connection with the E5070B/E5071B ON.

Step 2. Press Channel Next or Channel Prev to select the channel for which you want to perform the verification.

Step 3. Press Meas.

Step 4. Select an S-parameter you want to verify.

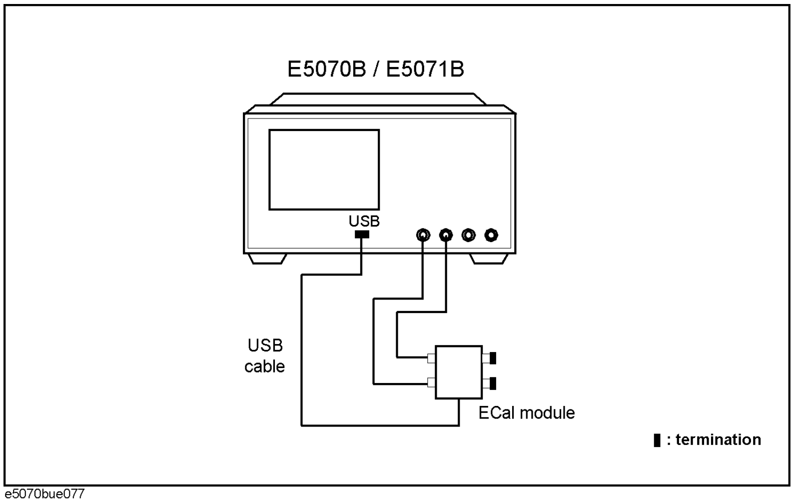
NOTE You cannot verify the mixed mode S-parameter.

Step 5. Connect the test port of the E5070B/E5071B corresponding to the selected S-parameter (for example, when the S-parameter is S21, ports 1 and 2) and the port of the ECal module.

NOTE **If you don’t use all ports of the ECal, connect terminations to the unused ports.**

NOTE You can use any port of the ECal for this connection. The connected port is automatically detected and measurement is performed.

Figure 4-46 **Connecting ECal module (for verification of S21)**



Step 6. Press Cal.

Step 7. Press **ECal**.

Step 8. When using an adapter to the ECal, press **Characterization** and then press the softkey corresponding to the characterization for the adapter you use.

Step 9. Press **Confidence Check**.

Step 10. Compare the data trace and the memory trace and verify whether measurement is correct.

The following is the procedure when displaying the data trace and the memory trace simultaneously for the comparison.

a. Press Display.

b. Press **Display**.

c. Press **Data & Mem**.

d. Press Scale.

e. Press **Auto Scale**.

f. Check whether the difference between the traces is acceptable.

Step 11. For all parameters you want to verify, repeat Step 3 through Step 10.

Changing the Calibration Kit Definition

In most measurements, the user can use pre-defined calibration kits as they are. However, it may be necessary to change the definition of a calibration kit (or create a new one) when changing pre-defined connector male and female (eg. from OPNE (f) to OPEN (m)[*1]) or a special standard is used or a high degree of accuracy is demanded. When it is necessary to change the definition of a calibration kit that contains a calibration device but no calibration kit model, the user must fully understand error correction and the system error model.

A user-defined calibration kit may be used in the following circumstances.

- When the user wants to use connectors other than those pre-defined in the calibration kits for the E5070B/E5071B (e.g., a SMA connector).
- When the user wants to use different standards in place of one or more standards pre-defined in the E5070B/E5071B. For example, when three offset SHORT standards are used instead of OPEN, SHORT, and LOAD standards.
- When the user wants to modify the standard model of a pre-defined calibration kit and turn it into a more accurate model. It is possible to perform better calibration if the performance of the actual standard is reflected in the standard model better. For example, define the 7 mm load standard as 50.4 Ω instead of 50.0 Ω.

Definitions of Terms

The terms used in this section are defined as follows:

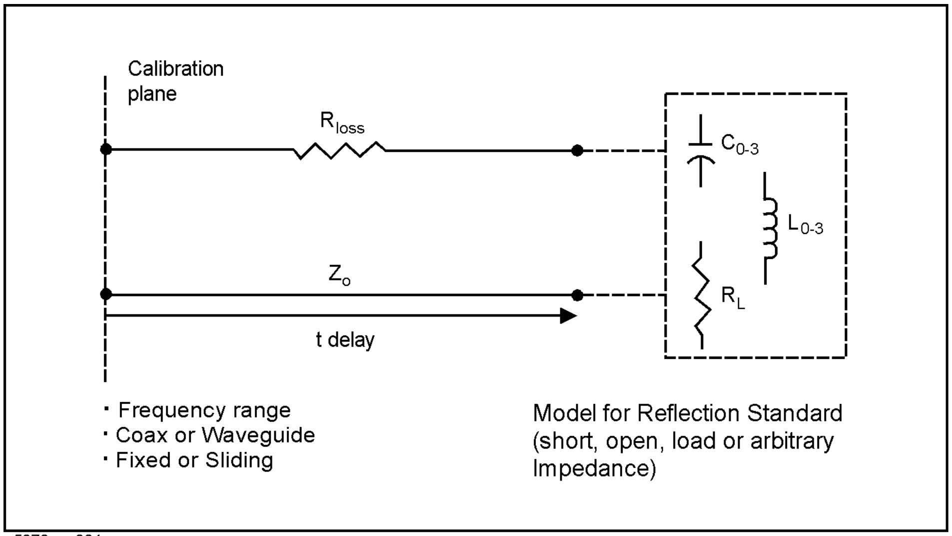
Standard	An accurate physical device, for which the model is clearly defined, and is used to determine system errors. With the E5070B/E5071B, the user may define up to 21 standards per calibration kit. Each standard is numbered, from 1 through 21. For example, standard 1 for the 85033E 3.5 mm calibration kit is a SHORT standard.
Standard type	The type of standard used to classify a standard model based on its form and construction. Five standard types are available: SHORT, OPEN, LOAD, delay/THRU, and arbitrary impedance.
Standard coefficient	The numeric characteristics of the standard used in the selected model. For example, the offset delay (32 ps) of the SHORT standard in the 3.5 mm calibration kit is a standard coefficient.
Standard class	A group of standards used in a calibration process. For each class, the user must select the standards to use from the 21 available standards.

*1. (m) and (f) in the name (label) of the standard indicate male (m) and female (f) of the connector of the analyzer, respectively.

Defining Parameters for Standards

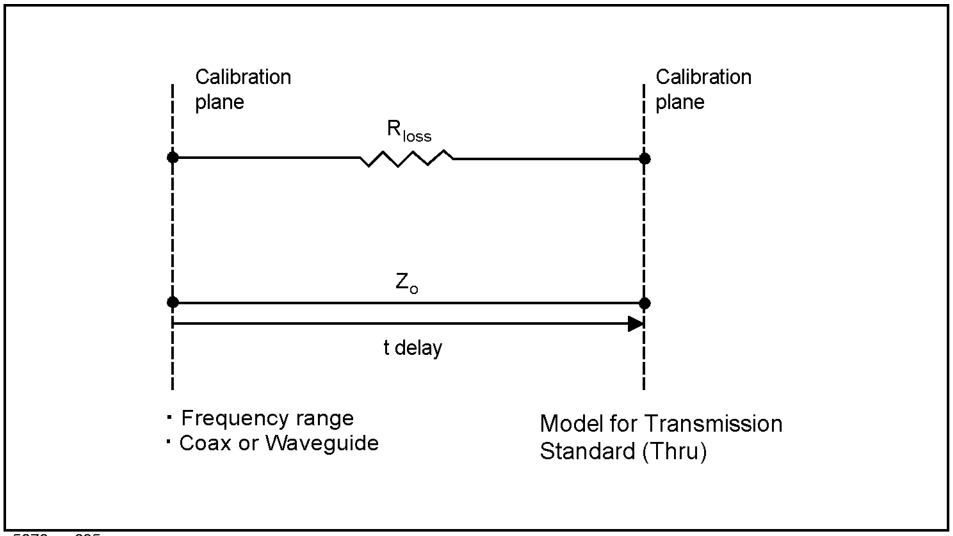
Figure 4-47 and Figure 4-48 show the parameters used in defining standards.

Figure 4-47 Reflection Standard Model (SHORT, OPEN, or LOAD)



e5070aue004

Figure 4-48 Transmission Standard Model (THRU)



e5070aue005

Z0 The offset impedance between the standard to be defined and the actual measurement plane. Normally, this is set to the characteristic impedance of the system.

Delay The delay occurs depending on the length of the transmission line between the standard to be defined and the actual measurement plane. In an OPEN, SHOT, or LOAD standard, the delay is defined as one-way propagation time (sec.) from the measurement plane to the standard. In a THRU standard, it is defined as one-way propagation time (sec.) from one measurement plane to the other. The delay can be determined through measurement or by dividing the exact physical length of the standard by the velocity coefficient.

Loss This is used to determine the energy loss caused by the skin effect for the length (one-way) of the coaxial cable. Loss is defined using the unit of Ω/s at 1 GHz. In many applications, using the value ì0î for the loss should not result in significant errors. The loss of a standard is determined by measuring the delay (sec.) and the loss at 1 GHz and then substituting them in the formula below.

$$Loss\left(\frac{\Omega}{s}\right) = \frac{loss(dB) \times Z_0(\Omega)}{4.3429(dB) \times delay(s)}$$

C0, C1, C2, C3 It is extremely rare for an OPEN standard to have perfect reflection characteristics at high frequencies. This is because the fringe capacitance of the standard causes a phase shift that varies along with the frequency. For internal calculation of the analyzer, an OPEN capacitance model is used. This model is described as a function of frequency, which is a polynomial of the third degree. Coefficients in the polynomial may be defined by the user. The formula for the capacitance model is shown below.

$$C = (C0) + (C1 \times F) + (C2 \times F^2) + (C3 \times F^3)$$

F: measurement frequency
C0 unit: (Farads) (constant in the polynomial)
C1 unit: (Farads/Hz)
C2 unit: (Farads/Hz^2)
C3 unit: (Farads/Hz^3)

L0, L1, L2, L3 It is extremely rare for a SHORT standard to have perfect reflection characteristics at high frequencies. This is because the residual inductance of the standard causes a phase shift that varies along with the frequency. It is not possible to eliminate this effect. For internal calculation of the analyzer, a short-circuit inductance model is used. The model is described as a function of frequency, which is a polynomial of the third degree. Coefficients in the polynomial may be defined by the user. The formula for the inductance model is shown below.

$$L = (L0) + (L1 \times F) + (L2 \times F^2) + (L3 \times F^3)$$

F: Measurement frequency
L0 unit: [Farads] (the constant in the polynomial)
L1 unit: [Farads/Hz]
L2 unit: [Farads/Hz^2]
L3 unit: [Farads/Hz^3]

In most existing calibration kits, THRU standards are defined as “zero-length THRU,” i.e., the delay and loss are both “0”. Such a THRU standard does not exist, however. Calibration must be done with two test ports interconnected directly.

NOTE The measurement accuracy depends on the conformity of the calibration standard to its definition. If the calibration standard has been damaged or worn out, the accuracy will decrease.

Redefining a Calibration Kit

To change the definition of a calibration kit, follow the procedure below.

For new calibration kit define

1. Select a calibration kit to be redefined.
2. Define the type of standard. Select one from among the OPEN, SHORT, LOAD, delay/THRU, and arbitrary impedance standards.
3. Define the standard coefficient.
4. Designate a standard class for the standard.
5. Save the data for the calibration kit that has been redefined.

For changing the pre-defined connector male and female (eg. OPNE (f) to OPEN (m))

1. Select a calibration kit to be redefined.
2. Designate a standard class for the standard.
3. Save the data for the calibration kit that has been redefined.

Redefining a Calibration Kit

Step 1. Press Cal.

Step 2. Press **Cal Kit**.

Step 3. Select the calibration kit to be redefined.

Softkey	Function
85033E	Selects the “85033E” calibration kit.
85033D	Selects the “85033D” calibration kit.
85052D	Selects the “85052D” calibration kit.
85032F	Selects the “85032F” calibration kit.
85032B	Selects the “85032B” calibration kit.
85036B/E	Selects the “85036B/E” calibration kit.
User	Selects a user-defined calibration kit.
User	Selects a user-defined calibration kit.
User	Selects a user-defined calibration kit.
User	Selects a user-defined calibration kit.

NOTE If the names (labels) of calibration kits were changed prior to operation, the new names will appear as respective softkeys.

Step 4. Press **Modify Kit**. For changeing the pre-defined connector connector type (eg. OPEN(f) to OPEN (m)) **skip to Step 14**

Step 5. Press **Define STDs**.

4. Calibration

Step 6. Select the standard to be redefined from among standards numbered 1 through 21.

Step 7. Press **STD Type**.

Step 8. Select a type of standard.

Softkey	Function
Open	Selects the OPEN standard.
Short	Selects the SHORT standard.
Load	Selects the LOAD standard.
Delay/Thru	Selects the delay/THRU standard.
Arbitrary	Selects the arbitrary impedance.
None	Selects no standard type.

Step 9. Set the standard coefficient.

Softkey	Function
C0	Sets C0.
C1	Sets C1.
C2	Sets C2.
C3	Sets C3.
L0	Sets L0.
L1	Sets L1.
L2	Sets L2.
L3	Sets L3.
Offset Delay	Sets the offset delay.
Offset Z0	Sets the offset Z0.
Offset Loss	Sets the offset loss.
Arb. Impedance	Sets an arbitrary impedance.

Step 10. Press **Label** and input a new label for the standard using the keypad displayed on the screen.

Step 11. Press **Return**.

Step 12. Repeat Step 6 to Step 11 to redefine all standards for which changes are necessary.

Step 13. Press **Return**.

Step 14. Press **Specify CLSs**.

Step 15. Select the class to be redefined.

Softkey	Function
Open	Selects the OPEN class.
Short	Selects the SHORT class.
Load	Selects the LOAD class.
Thru	Selects the THRU class.

Step 16. Select a test port.

Softkey	Function
Port 1	Selects port 1.
Port 2	Selects port 2.
Port 3	Selects port 3.
Port 4	Selects port 4.

NOTE Select **Set All** to use the same standards for all test ports.

Step 17. Select the standards to be registered in the class from among standards numbered 1 through 21. To change connector's male and female (eg. OPEN (f) to OPEN (m)), select the proper labeled standards here.

Step 18. Repeat Step 16 and Step 17 until classes are defined for all test ports that need to be redefined.

Step 19. Press **Return**.

Step 20. Repeat Step 15 to Step 19 to redefine all classes that need to be modified.

Step 21. Press **Return**.

Step 22. Press **Label Kit** and input a new label for the calibration kit using the keypad displayed on the screen.

Default Settings of Pre-defined Calibration Kits

Calibration kits 85033E, 85033D, 85052D, 85032F, 85032B, and 85036B/E are pre-defined with default settings.

85033E

	1. Short	2. Open	3. Broadband	4. Thru
Label	Short	Open	Broadband	Thru
STD Type	Short	Open	Load	Delay/Thru
C0 [$\times10^{-15}$ F]	0	49.43	0	0
C1 [$\times10^{-27}$ F/Hz]	0	-310.13	0	0
C2 [$\times10^{-36}$ F/Hz^2]	0	23.17	0	0
C3 [$\times10^{-45}$ F/Hz^3]	0	-0.16	0	0
L0 [$\times10^{-12}$ H]	2.0765	0	0	0
L1 [$\times10^{-24}$ H/Hz]	-108.54	0	0	0
L2 [$\times10^{-33}$ H/Hz^2]	2.1705	0	0	0
L3 [$\times10^{-42}$ H/Hz^3]	0.01	0	0	0
Offset Delay [s]	31.808 p	29.243 p	0	0
Offset Z0 [Ω]	50	50	50	50
Offset Loss [Ω/s]	2.36 G	2.2 G	2.2 G	2.2 G
Arb. Impedance [Ω]	50	50	50	50

85033D

	1. Short	2. Open	3. Broadband	4. Thru
Label	Short	Open	Broadband	Thru
STD Type	Short	Open	Load	Delay/Thru
C0 [$\times10^{-15}$ F]	0	49.43	0	0
C1 [$\times10^{-27}$ F/Hz]	0	-310.13	0	0
C2 [$\times10^{-36}$ F/Hz^2]	0	23.17	0	0
C3 [$\times10^{-45}$ F/Hz^3]	0	-0.16	0	0
L0 [$\times10^{-12}$ H]	2.0765	0	0	0
L1 [$\times10^{-24}$ H/Hz]	-108.54	0	0	0
L2 [$\times10^{-33}$ H/Hz^2]	2.1705	0	0	0
L3 [$\times10^{-42}$ H/Hz^3]	0.01	0	0	0
Offset Delay [s]	31.808 p	29.243 p	0	0
Offset Z0 [Ω]	50	50	50	50
Offset Loss [Ω/s]	2.36 G	2.2 G	2.2 G	2.2 G
Arb. Impedance [Ω]	50	50	50	50

85052D

	1. Short	2. Open	5. 3.5/2.92	6. 3.5/SMA	7. 2.92/SMA
Label	Short	Open	3.5/2.92	3.5/SMA	3.5/SMA
STD Type	Short	Open	Open	Open	Open
C0 [$\times 10^{-15}$ F]	0	49.433	6.9558	5.9588	13.4203
C1 [$\times 10^{-27}$ F/Hz]	0	-310.131	-1.0259	-11.195	-1.9452
C2 [$\times 10^{-36}$ F/Hz^2]	0	23.1682	-0.01435	0.5076	0.5459
C3 [$\times 10^{-45}$ F/Hz^3]	0	-0.15966	0.0028	-0.00243	0.01594
L0 [$\times 10^{-12}$ H]	2.0765	0	0	0	0
L1 [$\times 10^{-24}$ H/Hz]	-108.54	0	0	0	0
L2 [$\times 10^{-33}$ H/Hz^2]	2.1705	0	0	0	0
L3 [$\times 10^{-42}$ H/Hz^3]	0.01	0	0	0	0
Offset Delay [s]	31.785 p	29.243 p	0	0	0
Offset Z0 [Ω]	50	50	50	50	50
Offset Loss [Ω/s]	2.36 G	2.2 G	0	0	0
Arb. Impedance [Ω]	50	50	50	50	50

	8. 2.4/1.85	9. Broadband	11. Thru	13. Adapter
Label	2.4/1.85	Broadband	Thru	Adapter
STD Type	Open	Load	Delay/Thru	Delay/Thru
C0 [$\times 10^{-15}$ F]	8.9843	0	0	0
C1 [$\times 10^{-27}$ F/Hz]	-13.9923	0	0	0
C2 [$\times 10^{-36}$ F/Hz^2]	0.3242	0	0	0
C3 [$\times 10^{-45}$ F/Hz^3]	-0.00112	0	0	0
L0 [$\times 10^{-12}$ H]	0	0	0	0
L1 [$\times 10^{-24}$ H/Hz]	0	0	0	0
L2 [$\times 10^{-33}$ H/Hz^2]	0	0	0	0
L3 [$\times 10^{-42}$ H/Hz^3]	0	0	0	0
Offset Delay [s]	0	0	0	94.75 p
Offset Z0 [Ω]	50	50	50	50
Offset Loss [Ω/s]	0	0	0	2.51 G
Arb. Impedance [Ω]	50	50	50	50

85032F

	1. Short(m)	2. Open(m)	7. Short(f)	8. Open(f)
Label	Short(m)	Open(m)	Short(f)	Open(f)
STD Type	Short	Open	Short	Open
C0 [$\times10^{-15}$ F]	0	89.939	0	89.939
C1 [$\times10^{-27}$ F/Hz]	0	2536.8	0	2536.8
C2 [$\times10^{-36}$ F/Hz^2]	0	-264.99	0	-264.99
C3 [$\times10^{-45}$ F/Hz^3]	0	13.4	0	13.4
L0 [$\times10^{-12}$ H]	3.3998	0	3.3998	0
L1 [$\times10^{-24}$ H/Hz]	-496.4808	0	-496.4808	0
L2 [$\times10^{-33}$ H/Hz^2]	34.8314	0	34.8314	0
L3 [$\times10^{-42}$ H/Hz^3]	-0.7847	0	-0.7847	0
Offset Delay [s]	45.955 p	41.19 p	45.955 p	40.8688 p
Offset Z0 [Ω]	49.99	50	49.99	50
Offset Loss [Ω/s]	1.087 G	930 M	1.087 G	930 M
Arb. Impedance [Ω]	50	50	50	50
	9. Broadband	**11. Thru**	**13. (f/f)Adapter**	**14. (m/m)Adapter**
Label	Broadband	Thru	(f/f)Adapter	(m/m)Adapter
STD Type	Load	Delay/Thru	Delay/Thru	Delay/Thru
C0 [$\times10^{-15}$ F]	0	0	0	0
C1 [$\times10^{-27}$ F/Hz]	0	0	0	0
C2 [$\times10^{-36}$ F/Hz^2]	0	0	0	0
C3 [$\times10^{-45}$ F/Hz^3]	0	0	0	0
L0 [$\times10^{-12}$ H]	0	0	0	0
L1 [$\times10^{-24}$ H/Hz]	0	0	0	0
L2 [$\times10^{-33}$ H/Hz^2]	0	0	0	0
L3 [$\times10^{-42}$ H/Hz^3]	0	0	0	0
Offset Delay [s]	0	0	339 p	339 p
Offset Z0 [Ω]	50	50	50	50
Offset Loss [Ω/s]	0	0	2.2 G	2.2 G
Arb. Impedance [Ω]	50	50	50	50

NOTE (m) and (f) in the name (label) of the standard indicate male (m) and female (f) of the connector of the analyzer, respectively.

85032B

	1. Short(m)	2. Open(m)	3. Broadband	4. Thru
Label	Short(m)	Open(m)	Broadband	Thru
STD Type	Short	Open	Load	Delay/Thru
C0 [$\times 10^{-15}$ F]	0	119.09	0	0
C1 [$\times 10^{-27}$ F/Hz]	0	-36.955	0	0
C2 [$\times 10^{-36}$ F/Hz^2]	0	26.258	0	0
C3 [$\times 10^{-45}$ F/Hz^3]	0	5.5136	0	0
L0 [$\times 10^{-12}$ H]	0	0	0	0
L1 [$\times 10^{-24}$ H/Hz]	0	0	0	0
L2 [$\times 10^{-33}$ H/Hz^2]	0	0	0	0
L3 [$\times 10^{-42}$ H/Hz^3]	0	0	0	0
Offset Delay [s]	93 f	0	0	0
Offset Z0 [Ω]	49.992	50	50	50
Offset Loss [Ω/s]	700 M	700 M	700 M	700 M
Arb. Impedance [Ω]	50	50	50	50

	7. Short(f)	8. Open(f)
Label	Short(f)	Open(f)
STD Type	Short	Open
C0 [$\times 10^{-15}$ F]	0	62.14
C1 [$\times 10^{-27}$ F/Hz]	0	-143.07
C2 [$\times 10^{-36}$ F/Hz^2]	0	82.92
C3 [$\times 10^{-45}$ F/Hz^3]	0	0.76
L0 [$\times 10^{-12}$ H]	0	0
L1 [$\times 10^{-24}$ H/Hz]	0	0
L2 [$\times 10^{-33}$ H/Hz^2]	0	0
L3 [$\times 10^{-42}$ H/Hz^3]	0	0
Offset Delay [s]	17.817 p	17.411 p
Offset Z0 [Ω]	50.209	50
Offset Loss [Ω/s]	2.1002 G	700 M
Arb. Impedance [Ω]	50	50

NOTE (m) and (f) in the name (label) of the standard indicate male (m) and female (f) of the connector of the analyzer, respectively.

85036B/E

	1. Short(m)	2. Open(m)	3. Broadband	4. Thru
Label	Short(m)	Open(m)	Broadband	Thru
STD Type	Short	Open	Load	Delay/Thru
C0 [$\times 10^{-15}$ F]	0	63.5	0	0
C1 [$\times 10^{-27}$ F/Hz]	0	84	0	0
C2 [$\times 10^{-36}$ F/Hz^2]	0	56	0	0
C3 [$\times 10^{-45}$ F/Hz^3]	0	0	0	0
L0 [$\times 10^{-12}$ H]	0	0	0	0
L1 [$\times 10^{-24}$ H/Hz]	0	0	0	0
L2 [$\times 10^{-33}$ H/Hz^2]	0	0	0	0
L3 [$\times 10^{-42}$ H/Hz^3]	0	0	0	0
Offset Delay [s]	0	0	0	0
Offset Z0 [Ω]	75	75	75	75
Offset Loss [Ω/s]	1.13 G	1.13 G	1.13 G	1.13 G
Arb. Impedance [Ω]	50	50	75	50

	7. Short(f)	8. Open(f)
Label	Short(f)	Open(f)
STD Type	Short	Open
C0 [$\times 10^{-15}$ F]	0	41
C1 [$\times 10^{-27}$ F/Hz]	0	40
C2 [$\times 10^{-36}$ F/Hz^2]	0	5
C3 [$\times 10^{-45}$ F/Hz^3]	0	0
L0 [$\times 10^{-12}$ H]	0	0
L1 [$\times 10^{-24}$ H/Hz]	0	0
L2 [$\times 10^{-33}$ H/Hz^2]	0	0
L3 [$\times 10^{-42}$ H/Hz^3]	0	0
Offset Delay [s]	17.544 p	17.544 p
Offset Z0 [Ω]	75	75
Offset Loss [Ω/s]	1.13 G	1.13 G
Arb. Impedance [Ω]	50	50

NOTE (m) and (f) in the name (label) of the standard indicate male (m) and female (f) of the connector of the analyzer, respectively.

Power Calibration

The E5070B/E5071B has a calibration feature for power level output using the power meter (power calibration).

The power calibration is the function to output the stimulus signal of more accurate (closer to the set value) power level by measuring calibration data (power level) in advance using the power meter (sensor) and performing error correction for the power level using the calibration data.

Turning On or Off Power Level Error Correction

Power calibration data is acquired for each channel/test port. You can turn on/off the power level error correction independently for them.

The status of the power level error correction of each channel is indicated with the symbols shown in Table 4-2 in the channel status bar in the lower part of the window.

Table 4-2 Power calibration status

Symbol	Status of the power level error correction
PC (displayed in blue)	Error correction is performed for all stimulus ports.
PC (displayed in gray)	Error correction is performed for some stimulus ports.
PC? (displayed in blue)	Error correction is performed for all stimulus ports. Interpolated calibration data*1 is used.
PC? (displayed in gray)	Error correction is performed for some stimulus ports. Interpolated calibration data*1 is used.
--- (displayed in gray)	Error correction is not performed. (There are some stimulus ports for which error correction is set to on, but there is no valid calibration data.)
None	Error correction is not performed. (Error correction is off for all stimulus ports.)

*1. If you turn on the error correction when the stimulus setting is different from that when power calibration data is acquired, power level error correction is performed using interpolated calibration data only when calibration data can be interpolated. (Extrapolation for calibration data is not performed.)

Procedure to turn on/off

The power level error correction is automatically turned on when you execute the measurement of calibration data. You can turn it on or off as necessary using the following procedure.

Step 1. Press Cal.

Step 2. Press **Power Calibration**.

Step 3. Select a port. (see “Selecting target port of error correction”.)

Step 4. Press **Correction**. Each press toggles between on/off.

4. Calibration

Preparing power meter and sensor

To execute power calibration, you need to prepare the power meter and the power sensor to acquire power calibration data. Table 4-3 shows available power meters and recommended power sensors for power calibration.

Table 4-3 Available power meters and recommended power sensors

	Model name
Power meter	Agilent 437B
	Agilent 438A
	Agilent E4416A
	Agilent E4417A
	Agilent E4418A
	Agilent E4418B
	Agilent E4419A
	Agilent E4419B
	HP EPM-441A
	HP EPM-442A
Power sensor	Agilent 8482A
	Agilent E4412A
	HP ECP-E18A

Preparing for controlling the power meter

When acquiring power calibration data, the power meter is controlled via GPIB from the E5070B/E5071B.

To control the power meter from the E5070B/E5071B, connect the USB port of the E5070B/E5071B and the GPIB connector of the power meter through the USB/GPIB interface as shown in Figure 4-49 and set the GPIB address of the connected power meter with the E5070B/E5071B.

NOTE The USB/GPIB interface must be ready to use. For more information, see “Setting the GPIB” on page 298.

Setting GPIB address of power meter

The setting procedure of the GPIB address of the power meter is as follows:

Step 1. Press System .

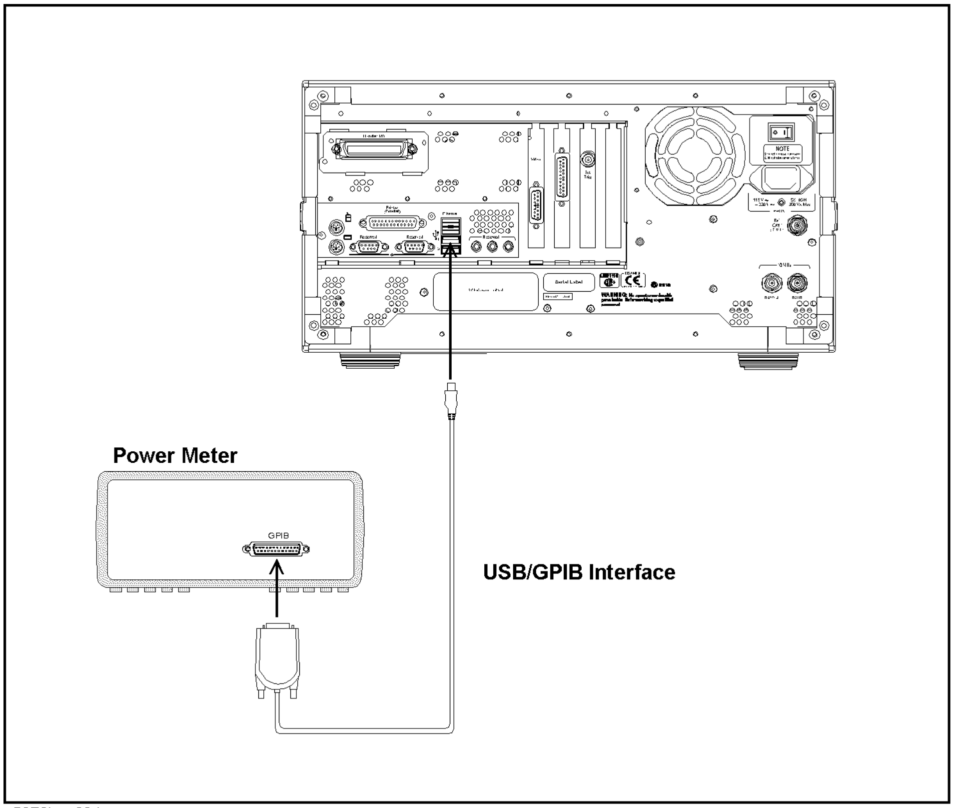
Step 2. Press **Misc Setup**.

Step 3. Press **GPIB Setup**.

Step 4. Press **Power Meter Address**.

Step 5. Enter the GPIB address of the power meter you use.

Figure 4-49 Connection between power meter and E5070B/E5071B



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Setting power sensor calibration factor table

NOTE When using the power sensor calibration factor table of the E5070B/E5071B, set the calibration factor to 100% and execute the calibration of the power sensor.

When you use the 437B or 438A as the power meter, you need to set the power sensor calibration factor table with the E5070B/E5071B.

If you use a power meter other than the 437B or 438A, see the following table.

Power sensor	Setting of the calibration factor table
8482A	Only when you have not set the calibration factor table with the power meter, set the calibration factor table with the E5070B/E5071B. If you have set the calibration factor table with the power meter and set the calibration factor table with the E5070B/E5071B, calibration is executed by both of the power meter and the E5070B/E5071B and you cannot obtain correct measurement results.
E4412A ECP-E18A	You do not need to set the calibration factor table with the E5070B/E5071B. Even if you set the calibration factor table with the E5070B/E5071B, it is ignored.

NOTE If you use the E4418A, E4419A, EPM-441A, and EPM-442A with the firmware version Ax.02.00 or earlier and you set the calibration factor table with the E5070B/E5071B, calibration is executed by both of the power meter and the E5070B/E5071B because of this firmware version and you cannot obtain correct measurement results, therefore never set the calibration factor table with the E5070B/E5071B.

The setting procedure of the calibration factor table of the power sensor is as follows:

Step 1. Press [Cal].

Step 2. Press **Power Calibration**.

Step 3. Press **Sensor A Settings** (for the power sensor connected to channel A) or **Sensor B Settings** (for the power sensor connected to channel B).

Step 4. Press **Ref Cal Factor**.

Step 5. Enter the reference calibration factor (the calibration factor at 50 MHz).

Step 6. According to the calibration factor data attached to the power sensor, set the frequency (**Frequency**) and the coefficient (**Factor**) of the calibration factor table using the following keys.

NOTE Pressing [Preset] - **OK** does not affect the current setting of the reference calibration factor and the calibration factor table.

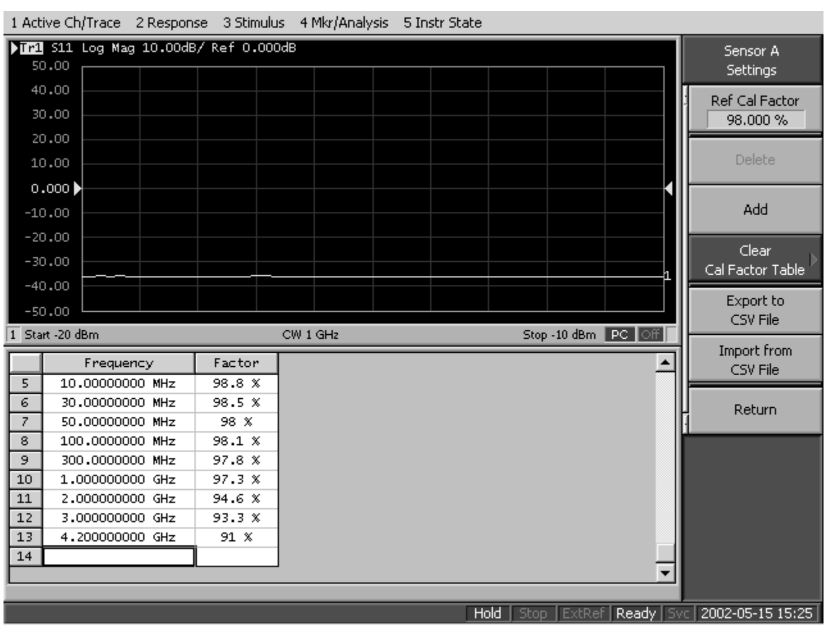
NOTE For a frequency other than set in the table, a value obtained by linear interpolation of the calibration factors at the 2 points adjacent to the frequency is used. Note that, if a frequency is lower than the lowest frequency in the table, the calibration factor at the lowest frequency is used; if larger than the highest frequency in the table, the calibration factor at the highest frequency is used.

Hardkey	Function
Enter	If you select a cell and then press this key, you enter into the mode in which you can edit the cell character by character. If you change a value and then press this key, the value is entered into the cell.
↑ ↓	Move up and down in the cell selected in the table. In the character-by-character edit mode, you can select an item or perform the step change of data.
⇤ ⇥	Move right and left in the cell selected in the table.
0 1 2 ... 9 . +/- G/n M/μ k/m x1	Enters a value in the cell.

Softkey	Function
Delete	Deletes the line in which the selected cell is included.
Add	Adds a new line above the line in which the selected cell is included.
Clear Cal Factor Table - OK	Resets the table.

NOTE When setting the table using the front panel keys or keyboard, you need to place focus on (select) the operation target (table or softkey) first. You can change the focus by pressing Focus in the ENTRY block. When the focus is placed on the table, the window frame of the table is displayed as bright as the window frame of the active channel. When the focus is placed on the softkey menu, the softkey menu title area is displayed in blue.

Figure 4-50 Example of creating power sensor calibration factor table



Saving power sensor calibration factor table

You can save the power sensor calibration factor table as a CSV (Comma Separated Value) format file.

Step 1. Press Cal.

Step 2. Press **Power Calibration**.

Step 3. Press **Sensor A Settings** or **Sensor B Settings**.

Step 4. Press **Export to CSV File** to open the Save As dialog box. For information on the Save As dialog box, see the description in Figure 9-9, “Printers window,” on page 260. At this time, CSV Files (extension*.csv) is selected as the file type.

Step 5. Enter a file name in the **File Name** box and press the **Save** button to save the power sensor calibration factor table.

Recalling power sensor calibration factor table

By recalling a power sensor calibration factor table saved in the CSV format according to the “Saving power sensor calibration factor table” on page 160, you can set the power sensor calibration factor table.

Step 1. Press Cal.

Step 2. Press **Power Calibration**.

Step 3. Press **Sensor A Settings** or **Sensor B Settings**.

Step 4. Press **Import from CSV File** to open the Open dialog box. For information on the Open dialog box, see the description in Figure 9-10, “File menu in the Printers window,” on page 261. At this time, CSV Files (extension*.csv) is selected as the file type.

Step 5. Select the CSV format file you want to import and press the **Open** button to recall the power sensor calibration factor table.

NOTE If you import a CSV format file created/edited on a spreadsheet program, the operation is not guaranteed. Also, if you import a CSV format file that has been exported according to “Saving power sensor calibration factor table” on page 160 and then modified, the operation is not guaranteed.

Selecting target port of error correction

The power level error correction is executed for each channel/test port. You can set the following items for each channel/test port:

- On/off of error correction
- Setting of loss compensation
- Selection of the power sensor
- Number of power level measurements at one measurement point
- Calibration data

Follow the steps below to select the test port for which you want to set/execute power level error correction.

Step 1. Press Cal.

Step 2. Press **Power Calibration**.

Step 3. Press Channel Next or Channel Prev to select the channel.

Step 4. Press **Select Port**.

Step 5. Press the softkey corresponding to the test port you want to select.

Setting loss compensation

If you need to apply a signal of a more accurate power level to DUT, you can use the loss compensation feature to obtain calibration data for which difference in power loss due to difference in connection method (cable, adapter, and so on) between when the power calibration data is measured and when actual DUT is measured is corrected.

The loss compensation is a feature to correct the power measurement result based on the preset power loss data. More specifically, if you turn on the loss compensation, the measurement result of the power level obtained in the power calibration data measurement is a value obtained by adding the loss value set in the loss compensation table to the measured power value.

On/off of loss compensation

Follow these steps to turn on/off the loss compensation.

Step 1. Press Cal.

Step 2. Press **Power Calibration**.

Step 3. Select a port. (See “Selecting target port of error correction” on page 161.)

Step 4. Press **Loss Compen**.

Step 5. Press **Compensation**. Each press toggles between on/off.

Creating loss compensation table

Follow these steps to set the loss compensation table.

Step 1. Press Cal.

Step 2. Press **Power Calibration**.

Step 3. Select a port. (See “Selecting target port of error correction” on page 161.)

Step 4. Press **Loss Compen**.

Step 5. Set the frequency (**Frequency**) and the loss (**Loss**) of the loss compensation table using the following keys.

NOTE Pressing Preset - **OK** does not affect the current setting of the loss compensation table.

NOTE For a frequency other than set in the table, a value obtained by linear interpolation of the losses at the 2 points adjacent to the frequency is used. Note that, if a frequency is lower than the lowest frequency in the table, the loss at the lowest frequency is used; if larger than the highest frequency in the table, the loss at the highest frequency is used.

Hardkey	Function
Enter	If you select a cell and then press this key, you enter into the mode in which you can edit the cell character by character. If you change a value and then press this key, the value is entered into the cell.
↑ ↓	Move up and down in the cell selected in the table. In the character-by-character edit mode, you can select an item or perform the step change of data.
⇤ ⇥	Move right and left in the cell selected in the table.
0 1 2 ... 9 . +/- G/n M/μ k/m x1	Enters a value in the cell.

Softkey	Function
Delete	Deletes the line in which the selected cell is included.
Add	Adds a new line above the line in which the selected cell is included.
Clear Loss Table - OK	Resets the table.

NOTE When setting the table using the front panel keys or keyboard, you need to place focus on (select) the operation target (table or softkey) first. You can change the focus by pressing Focus in the ENTRY block. When the focus is placed on the table, the window frame of the table is displayed as bright as the window frame of the active channel. When the focus is placed on the softkey menu, the softkey menu title area is displayed in blue.

Saving loss compensation table

You can save the loss compensation table as a CSV (Comma Separated Value) format file.

Step 1. Press Cal.

Step 2. Press **Power Calibration**.

Step 3. Select a port. (See "Selecting target port of error correction" on page 161.)

Step 4. Press **Loss Compen**.

Step 5. Press **Export to CSV File** to open the Save As dialog box. For information on the Save As dialog box, see the description in Figure 9-9, "Printers window," on page 260. At this time, CSV Files (extension*.csv) is selected as the file type.

Step 6. Enter a file name in the **File Name** box and press the **Save** button to save the loss compensation table.

Recalling loss compensation table

By recalling a loss compensation table saved in the CSV format according to the "Saving loss compensation table" on page 163, you can set the loss compensation table.

NOTE It is possible to recall a file from a different channel/port where it was saved.

Step 1. Press Cal.

Step 2. Press **Power Calibration**.

Step 3. Select a port. (See "Selecting target port of error correction" on page 161.)

Step 4. Press **Loss Compen**.

Step 5. Press **Import from CSV File** to open the Open dialog box. For information on the Open dialog box, see the description in Figure 9-10, "File menu in the Printers window," on page 261. At this time, CSV Files (extension*.csv) is selected as the file type.

Step 6. Select the CSV format file you want to import and press the **Open** button to recall the loss compensation table.

NOTE If you import a CSV format file created/edited on a spreadsheet program, the operation is not guaranteed. Also, if you import a CSV format file that has been exported according to "Saving loss compensation table" on page 163 and then modified, the operation is not guaranteed.

Measuring calibration data

NOTE Before measuring calibration data, you need to execute the zero adjustment and calibration of the power sensor. For information on how to execute them, see the manual of the power meter you use.

When using the power sensor calibration factor table of the E5070B/E5071B, set the calibration factor to 100% and execute the calibration of the power sensor.

Step 1. Press Cal.

Step 2. Press **Power Calibration**.

Step 3. Select a port. (See "Selecting target port of error correction" on page 161.)

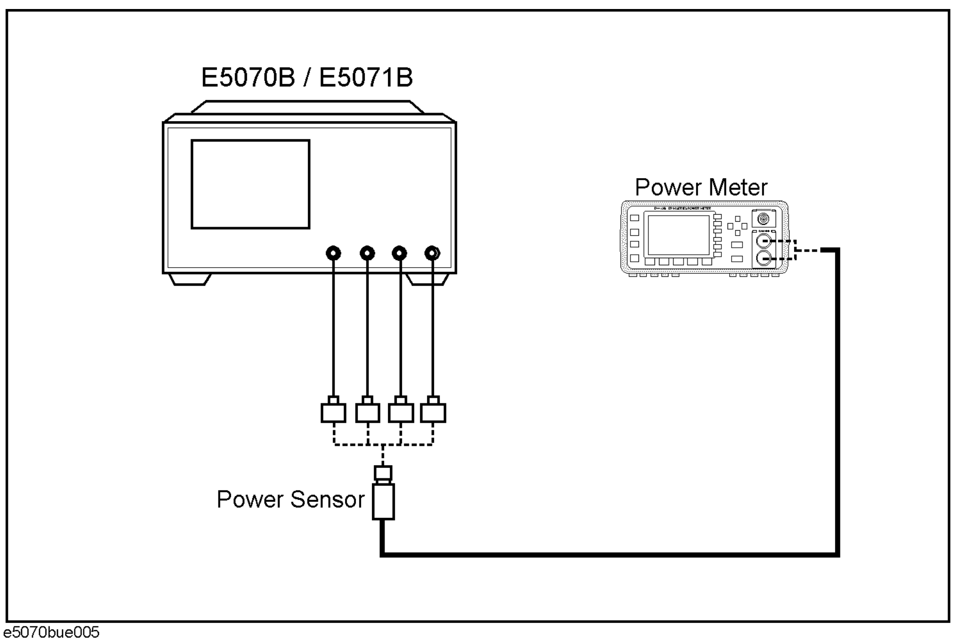
Step 4. Press **Use Sensor**. Each press toggles between channel A and channel B. If you use a power meter with one channel, channel A is always selected.

Step 5. Press **Num of Readings**.

Step 6. Enter the number of power level measurements at one measurement point (averaging factor).

Step 7. Connect the power sensor of the channel you select to the port you select as shown in the figure below.

Figure 4-51 **Connection of power sensor**



Step 8. Press **Take Cal Sweep** to start the measurement of calibration data.

NOTE If the power meter GPIB address is not set correctly or if the power sensor is not connected to the specified channel, an error occurs and calibration data is not measured.

You can abort the measurement by pressing **Abort** during the measurement.

When the measurement is complete, the power level error correction is automatically turned on.

NOTE If appropriate calibration data cannot be obtained, an error may occur for each sweep after the measurement of calibration data is complete. Turn off the power level error correction, check the connection and setting, and then measure calibration data again.

5 Making Measurements

This chapter describes how to carry out measurements with the Agilent E5070A/E5071A by using the trigger function.

Setting Up the Trigger and Making Measurements

The E5070B/E5071B has one trigger source. When this trigger source detects a trigger signal that has occurred, a sweep is performed for channels that were “Initiate” state in the order from channel 1 to channel 16. You set the “Initiate” or “Idle” status of each channel as the trigger mode. For details about the trigger system, refer to *Programmer's Guide*.

NOTE

The execution of measurement for each channel does not depend on how the channel is displayed. Channels that have been started up can be used for measurement even if they are not displayed.

For each channel, a sweep is performed only for stimulus ports required to update parameters of the displayed trace.

Sweep Order in Each Channel

In a channel, each test port is set to stimulus port in the order of port number and updates each trace (Table 5-1).

Table 5-1 Sweep Order in Each Channel

Sweep Order	Stimulus Port	Updated Trace
↓	Port 1	S_{11}, S_{21}, S_{31}*1, S_{41}*2
	Port 2	S_{12}, S_{22}, S_{32}*1, S_{42}*2
	Port 3*1	S_{13}*1, S_{23}*1, S_{33}*1, S_{43}*2
	Port 4*2	S_{14}*2, S_{24}*2, S_{34}*2, S_{44}*2

*1. Option 313, 314, 413, or 414 only
*2. Option 413 or 414 only

NOTE

If full 2, 3, or 4 port error correction is valid, any traces related to the calibrated ports are not updated before the last calibrated port is swept as a stimulus port.

Sweep is not executed for the stimulus port which is not required for updating traces.

Trigger Source

The trigger source generates a cue signal that initiates a measurement process. Four types of trigger sources are available as shown in Table 5-2.

Table 5-2 Trigger Sources and Their Functions

Trigger Sources	Function
Internal (**Internal**)	Uses a consecutive signal generated by the firmware as a trigger source. Triggers are sent immediately following the completion of each measurement.
External (**External**)	Uses the external trigger input terminal (BNC) as a trigger source.
Manual (**Manual**)	A trigger will be generated by pressing Trigger - **Trigger**.
Bus (**Bus**)	A trigger will be generated by executing a ***TRG** command.

Trigger Modes

You can set the trigger mode for each channel independently. You can control the operation of each channel when a trigger signal is detected by setting the status of each channel as the trigger mode.

Table 5-3 Trigger mode

Trigger mode name	Function
Sweep stop (**Hold**)	The status ("Idle" status) in which the sweep is stopped. When a trigger signal is detected, the sweep is not performed.
Single sweep (**Single**)	An "Initiate" status. When a trigger signal is detected, a sweep is performed. After completion of the sweep, the "Idle" status occurs.
Continuous sweep (**Continuous**)	An "Initiate" status. When a trigger signal is detected, the sweep is performed. After completion of the sweep, the "Initiate" status is kept. The sweep is repeated each time a trigger signal is detected.

Setting Up the Trigger and Making Measurements

1. Selecting a Trigger Source

Follow the procedure below to select a trigger source.

Step 1. Press [Trigger]

Step 2. Press **Trigger Source**

Step 3. Press the softkey that corresponds to the desired trigger source.

Softkey	Function
Internal	Selects the internal trigger source.
External	Selects the external trigger source.
Manual	Selects the manual trigger source.
Bus	Selects the bus trigger source.

2. Selecting a Trigger Mode

Follow the procedure below to select a trigger mode.

Step 1. Press [Channel Next] (or [Channel Prev]) to select a channel for which the trigger mode will be set.

Step 2. Press [Trigger].

Step 3. Press the softkey that corresponds to the desired trigger mode.

Softkey	Function
Hold	Sets the active channel trigger mode to the hold sweep mode
Single	Sets the active channel trigger mode to the single sweep mode.
Continuous	Sets the active channel trigger mode to the continuous sweep mode.
Hold All Channels	Sets all channel trigger modes to the hold sweep mode.
Continuous Disp Channels	Sets trigger modes of all displayed channels ([Display] - **Display**) to the continuous sweep mode.

Step 4. Repeat Step 1 to Step 3 until all channels are set for the respective trigger mode.

3. Generating the Trigger

Next, it is necessary to generate a trigger using the trigger source selected in "1. Selecting a Trigger Source" on page 170.

NOTE

Once the internal trigger source is selected, a series of triggers will be continuously generated as soon as the setting becomes effective.

Pressing [Trigger] - **Restart** during a sweep forces the analyzer to abort the sweep.

6 Data Analysis

This chapter explains how to use the analytical functions of the Agilent E5070B/E5071B.

Analyzing Data on the Trace Using the Marker

About Marker Functions

The marker can be used in the following ways:

- Reading a measured value as numerical data (as an absolute value or a relative value from the reference point)
- Moving the marker to a specific point on the trace (marker search)
- Analyzing trace data to determine a specific parameter
- Using the value of the marker to change the stimulus (sweep range) and scale (value of the reference line)

For the procedure to change the sweep range and scale by using the marker, refer to “Setting the Sweep Range Using the Marker” on page 62 and “Setting the Value of a Reference Line Using the Marker” on page 76.

The E5070B/E5071B is capable of displaying up to 10 markers on each trace. Each marker has a stimulus value (the value on the X-axis in rectangular display format) and a response value (the value on the Y-axis in rectangular display format). The Smith chart and polar formats each have two marker response values (log amplitude and phase).

Reading Values on the Trace

You can read the value of a marker displayed on the trace.

In rectangular display format, the marker response value is always in the same data format as that of the Y-axis. On the contrary, one format for the marker response values (two values: main and auxiliary) can be selected from among several types. The selection is performed in the data format.

Table 6-1 Marker Response Values for Smith Chart/Polar Data Formats

Softkey for selecting the data format	Marker response value	
	Main	Auxiliary
Smith - **Lin / Phase**	Linear amplitude	Phase
Smith - **Log / Phase**	Log amplitude	Phase
Smith - **Real / Imag**	Real component	Imaginary component
Smith - **R + jX**	Resistance	Reactance*1
Smith - **G + jX**	Conductance	Susceptance*1
Polar - **Lin / Phase**	Linear amplitude	Phase
Polar - **Log / Phase**	Log amplitude	Phase
Polar - **Real / Imag**	Real component	Imaginary component

*1. The inductance or capacitance is also displayed.

For setting up data formats, refer to “Selecting a Data Format” on page 70.

Reading a Value on the Trace

Step 1. Press Channel Next or Channel Prev to activate the channel on which a marker is used.

Step 2. Press Trace Next or Trace Prev to activate the channel on which a marker is used.

Step 3. Press Marker.

NOTE At this point in time, marker 1 is turned on and becomes active (you can operate the marker). When using marker 1, you can omit Step 4.

Step 4. Select a marker and turn it on. The softkey used to turn on a marker is used to activate that marker.

Softkey	Function
Marker 1	Turn on marker 1, which has been turned off; activate marker 1.
Marker 2	Turn on marker 2, which has been turned off; activate marker 2.
Marker 3	Turn on marker 3, which has been turned off; activate marker 3.
Marker 4	Turn on marker 4, which has been turned off; activate marker 4.
More Markers - **Marker 5**	Turn on marker 5, which has been turned off; activate marker 5.
More Markers - **Marker 6**	Turn on marker 6, which has been turned off; activate marker 6.
More Markers - **Marker 7**	Turn on marker 7, which has been turned off; activate marker 7.
More Markers - **Marker 8**	Turn on marker 8, which has been turned off; activate marker 8.
More Markers - **Marker 9**	Turn on marker 9, which has been turned off; activate marker 9.
Ref Marker	Turn on the reference marker, which has been turned off; activate the reference marker.

Step 5. Change the marker stimulus value in the entry area. This operation enables you to move the marker to a point on the desired trace.

The value in the entry area can be changed by one of the following methods.

NOTE To change the value in the entry area, the figure in the box should be highlighted. If the figure is not highlighted, press the softkey for the marker you are using (**marker 1** to **marker 9**, **Ref Marker**), or [Focus] to highlight the figure.

- Enter a numeric value using the ENTRY block key on the front panel.
- Turn the rotary knob ( ) on the front panel.
- Press the up or down arrow key ( ) on the front panel.
- Using the mouse, click one of the buttons (▲▼) on the right side of the entry area.

You can move the marker by dragging and dropping either one of the marker position pointers above and below the graph (▼▲) (pressing the button on the object to be moved and releasing the button on the destination). In rectangular display format, you can move a marker itself by dragging and dropping it.

Step 6. When using other markers, repeat Step 4 and Step 5.

Step 7. Read the marker stimulus value and marker response value displayed in the upper-left part of the trace screen.

Step 8. To turn off marker(s), press the **Clear Marker Menu** and then press one of the softkeys as follows:

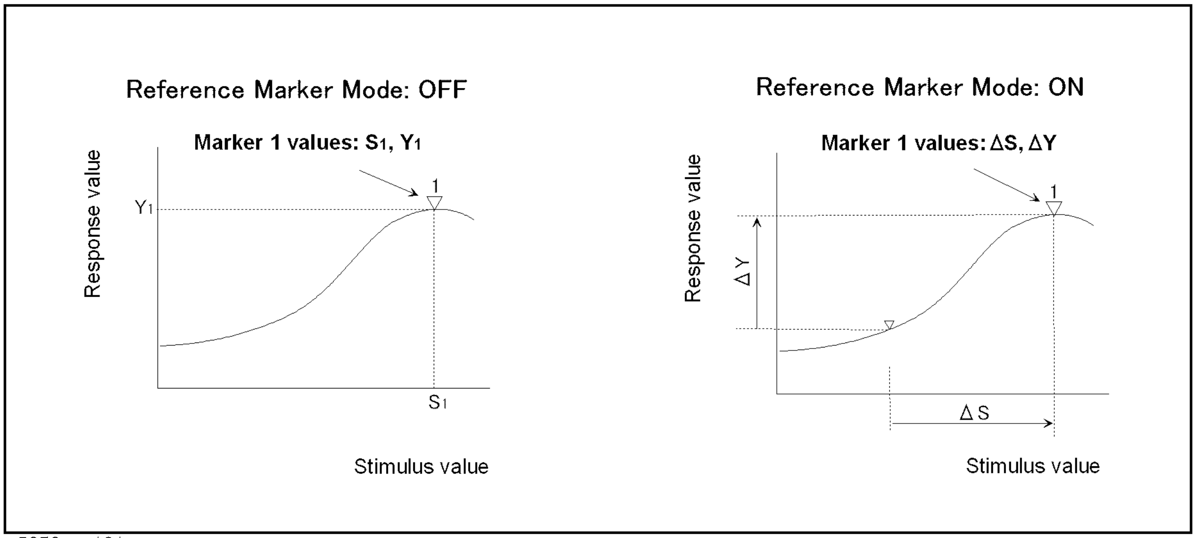
Softkey	Function
All OFF	Turns off all of the markers on the active trace.
Marker 1 to **Marker 9**	Turns off one of the markers 1 through 9 on the active trace.
Ref Marker	Turns off the reference markers on the active trace.

NOTE In the preset configuration, the marker settings on traces in a channel are coupled (Marker Couple is turned on). For marker coupling, refer to "Setting Up Markers for Each Trace/Setting Up Markers for Coupled Operations Between Traces" on page 178.

Reading the Relative Value From the Reference Point on the Trace

You can convert the marker reading into a relative value from the reference point.

Figure 6-1 Delta marker mode



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Converting From a Reference Point to a Relative Value

Step 1. Following Step 1 to Step 5 in “Reading Values on the Trace” on page 173, place the reference marker on the point to be used as the reference.

Step 2. Press **Ref Marker Mode** to turn on the reference mode.

With the reference mode turned on, the stimulus values and response values are indicated in relative values referred to by the position of the reference marker.

Step 3. Following Step 4 to Step 5 in “Reading Values on the Trace” on page 173, place markers 1 through 9 on the desired points to read the values.

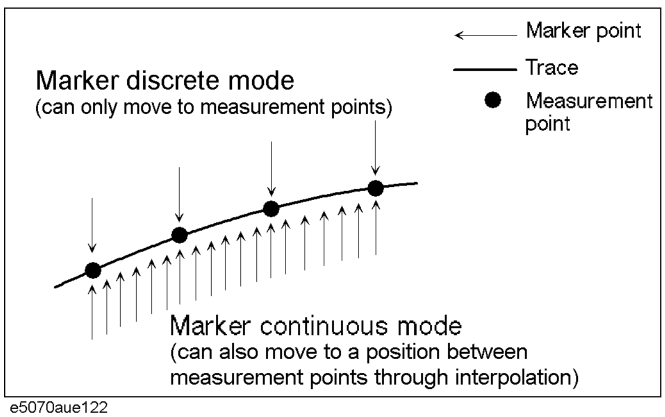
NOTE Pressing **Marker** → **Ref Marker** enables you to place the reference marker at the position of the currently active marker. The reference mode will then turn on automatically.

Reading Only the Actual Measurement Point/Reading the Value Interpolated Between Measurement Points

The point on the trace on which a marker can be placed differs depending on how the discrete marker mode is set up.

Turning on discrete mode (Discrete ON)	A marker moves only between actual measurement points. When a specific marker stimulus value is specified as a numerical value, the marker is placed at the measurement point closest to the specified value. A marker that is placed between interpolated points with the discrete mode off automatically moves to the nearest measurement point when the discrete mode turns on.
Turning off discrete mode (Discrete OFF)	The marker can move from one actual measurement point to another. Because it is interpolated, it can also move in the space between measurement points.

Figure 6-2 **Marker Discrete Mode**



Turning Discrete Mode On or Off

Step 1. Press Channel Next (or Channel Prev) and Trace Next (or Trace Prev) to activate the trace on which the discrete mode is set up.

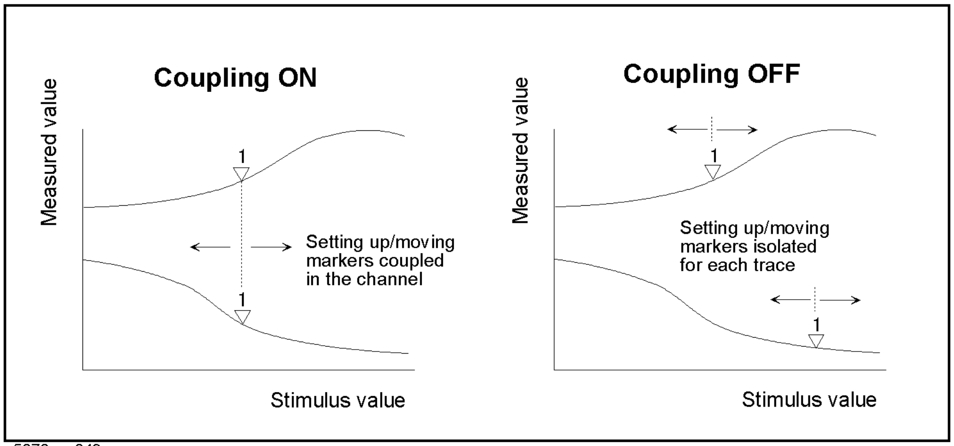
Step 2. Press Marker Fctn.

Step 3. Press **Discrete** to turn the discrete mode on or off.

Setting Up Markers for Each Trace/Setting Up Markers for Coupled Operations Between Traces

The setting up and moving of markers can be performed either in coupled operation for all traces in a channel or independently for each trace.

Figure 6-3 **Marker Coupling**



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Marker Couple is on. (Coupling ON)	The setting up and moving of markers is performed in coupled operation on all traces in a channel.
Marker Couple is off. (Coupling OFF)	The setting up and moving of markers is performed independently for each trace.

Turning Marker Coupling On or Off

Step 1. Press Channel Next (or Channel Prev) to activate the channel on which the marker couple will be set.

Step 2. Press Marker Fctn.

Step 3. Press **Couple** to turn the marker coupling on or off.

Listing All the Marker Values in All the Channels Displayed

You can list all the marker values in all the displayed channels on the screen.

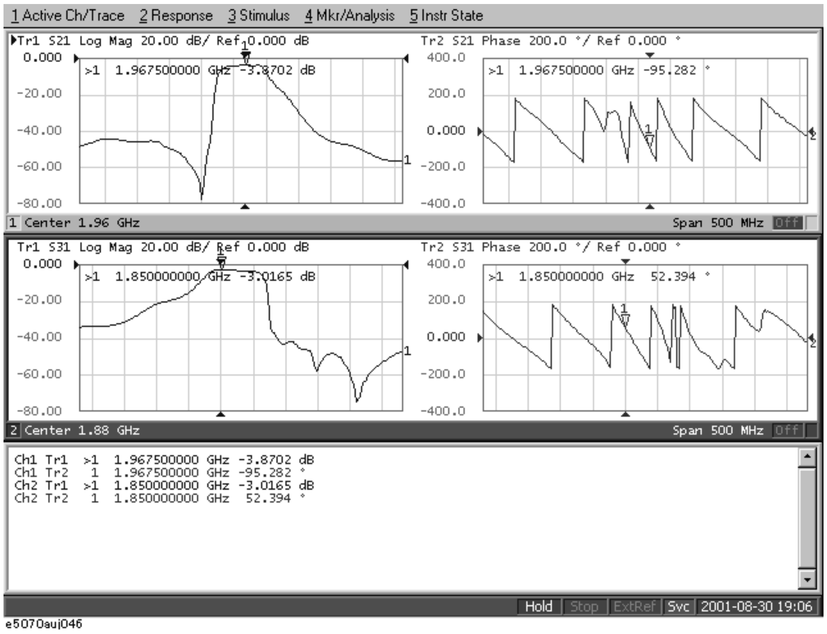
Turning On the Marker Table Display

Step 1. Press Marker Fctn.

Step 2. Press **Marker Table** to turn on the marker table display.

The marker table appears in the lower part of the screen. (See Figure 6-4.)

Figure 6-4 **Marker Table ON**



Searching for Positions that Match Specified Criteria

You can search for a position that matches your specified criteria using the Marker Search feature.

Marker Search allows you to search for a position that matches the following criteria.

- ❑ Maximum value
- ❑ Minimum value
- ❑ Target (a point that has a target measurement value)
  - Target nearest to the marker position
  - Target nearest to the left-hand side of the marker position
  - Target nearest to the right-hand side of the marker position
- ❑ Peak
  - Maximum peak (for a positive peak), minimum peak (for a negative peak)
  - Peak nearest to the left-hand side of the marker position
  - Peak nearest to the right-hand side of the marker position

Setting Search Range

The Marker Search feature allows you to set part of the sweep range as the search target (Partial Search feature) as well as the entire search range. For the Partial Search feature, you can select whether to couple traces in the channel.

Procedure to turn on/off trace coupling within search range

Step 1. Press [Channel Next] or [Channel Prev] to activate a channel for which you want to set the search range.

Step 2. Press [Trace Next] or [Trace Prev] to activate a trace for which you want to set the search range.

Step 3. Press [Marker Search].

Step 4. Press **Search Range**.

Step 5. Press **Couple** to toggle on/off the trace coupling within the search range.

Procedure to set search range

Step 1. Press Channel Next or Channel Prev to activate a channel for which you want to set the search range.

Step 2. If the trace coupling within the search range is off, press Trace Next or Trace Prev to activate a trace for which you want to set the search range.

Step 3. Press Marker Search.

Step 4. Press **Search Range**.

Step 5. Press **Search Range** to turn on the Partial Search feature.

Step 6. Press **Start**.

Step 7. Enter the start value (lower limit) of the search range using the ENTRY block keys on the front panel.

Step 8. Press **Stop**.

Step 9. Enter the stop value (upper limit) of the search range using the ENTRY block keys on the front panel.

Automatically Executing a Search Each Time a Sweep is Done (Search Tracking)

Search tracking is a function that causes a search to be repeated every time a sweep is done even if the execution key for the search (maximum, minimum, peak, and target) is not pressed. This function facilitates that measurement dispersion be observed, such as the maximum value of traces (e.g., the insertion loss of a band pass filter).

Performing Search Tracking

Step 1. Press Channel Next (or Channel Prev) and Trace Next (or Trace Prev) to activate the trace on which search tracking is set up.

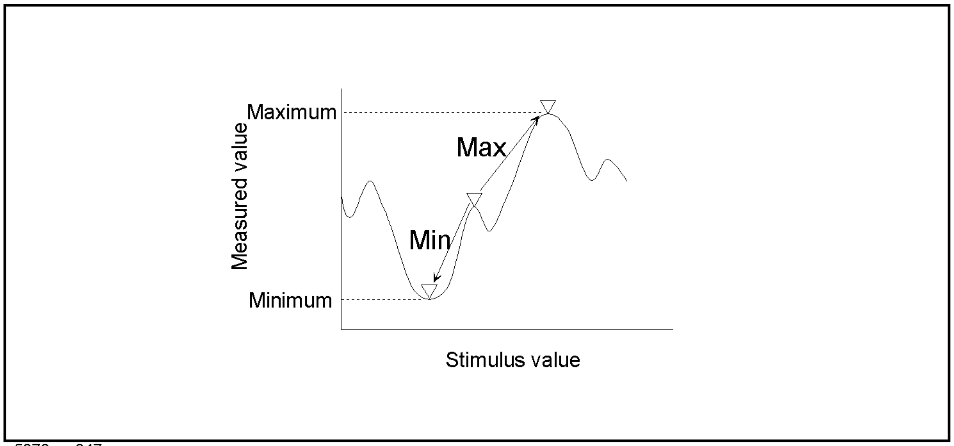
Step 2. Press Marker Search.

Step 3. Press **Tracking**, and turn the search tracking function on or off.

Searching for the Maximum and Minimum Measured Values

You can search for the maximum or minimum measured value on the trace and move a marker to that point. (See Figure 6-5.)

Figure 6-5 **Searching for the Maximum and Minimum Measured Values**



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Search for the maximum (Max)	Move the active marker to the point on the trace where the measured value is greatest.
Search for the minimum (Min)	Move the active marker to the point on the trace where the measured value is lowest.

Searching for Maximum and Minimum Values

Step 1. Following Step 1 to Step 4 in “Reading Values on the Trace” on page 173, activate the marker you are using to search for the maximum and minimum values.

Step 2. Press Marker Search.

Step 3. Press the corresponding softkey to move the marker to the maximum or minimum measured value.

Softkey	Function
Max	Perform a search for the maximum value.
Min	Perform a search for the minimum value.

NOTE When the data format is in Smith chart or polar format, execute the search for the main response value of the two marker response values.

Searching for the Target Value (Target Search)

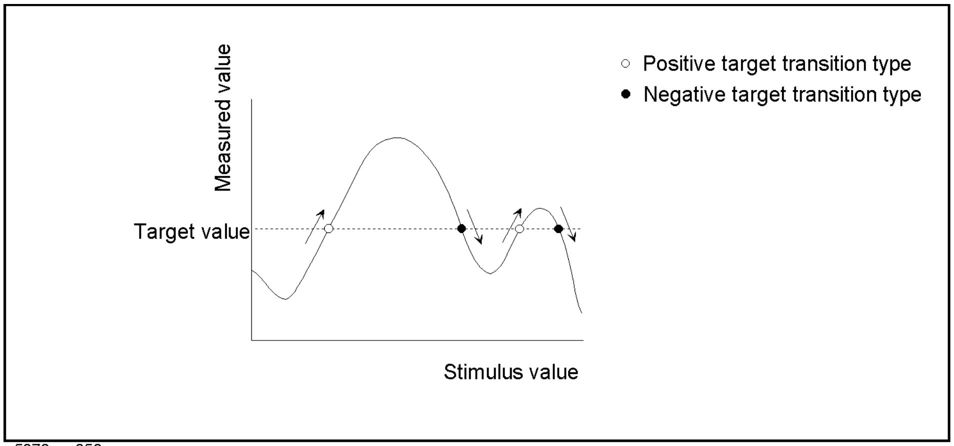
The target search function enables you to move the marker to the point having the target measured value.

Target and Transition Types

A target is a point that has a specific measured value on the trace. Targets can be divided into the two groups shown below depending on their transition type.

Transition type: Positive (Positive)	When the value of the target is larger than the measured value that immediately precedes (on the left)
Transition type: Negative (Negative)	When the value of the target is smaller than the measured value that precedes immediately (on the left)

Figure 6-6 **Target and Transition Types**



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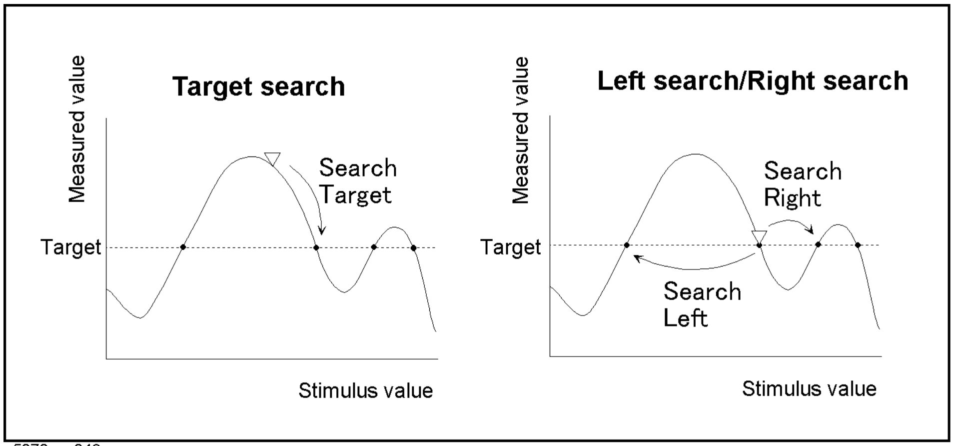
About the target search function

The target search is a function that searches for a target that matches the pre-defined target value and transition type(s) (positive, negative, or both positive and negative) and then moves the marker to the target being searched.

The following three methods are available for executing the target search:

Target search (Search Peak)	The marker will move to the peak with maximum response value if the peak polarity is **Positive** or **Both** or to the peak with minimum response value if the peak polarity is **Negative**.
Search Left (Search Left)	Execute the search from the current marker position to the smaller stimulus values, and move the marker to the first target encountered.
Search Right (Search Right)	Execute the search from the current marker position to the larger stimulus values, and move the marker to the first target encountered.

Figure 6-7 **Target Search (when transition type is set to “both positive and negative”)**



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Executing a Target Search

Step 1. Following Step 1 to Step 4 in “Reading Values on the Trace” on page 173, activate the marker you are using for the target search.

Step 2. Press Marker Search .

Step 3. Press **Target**.

Step 4. Press **Target Value**, and enter the target value in the entry area that appears.

This causes the target search to be executed based on the definitions of the newly set the target value and currently set the transition type.

Step 5. Press **Target Transition**.

Step 6. Select a transition type.

Softkey	Function
Positive	Select Positive as the transition type.
Negative	Select Negative as the transition type.
Both	Select both Positive and Negative as the transition type.

This causes the target search to be executed based on the definitions of the currently set the target value and newly set the transition type.

Step 7. Press the corresponding softkey to move the marker to the target.

Softkey	Function
Search Target	Execute the target search.
Search Left	Execute the left search.
Search Right	Execute the right search.

NOTE When the data format is in Smith chart or polar format, execute the search for the main response value of the two marker response values.

Searching for the Peak

The peak search function enables you to move the marker to the peak on the trace.

Definition of the Peak

A peak is a measurement point whose value is greater or smaller than the adjoining measurement points on its right and left sides. Peaks are classified into the following two types depending on the difference in magnitude from the measurement points on either side of it.

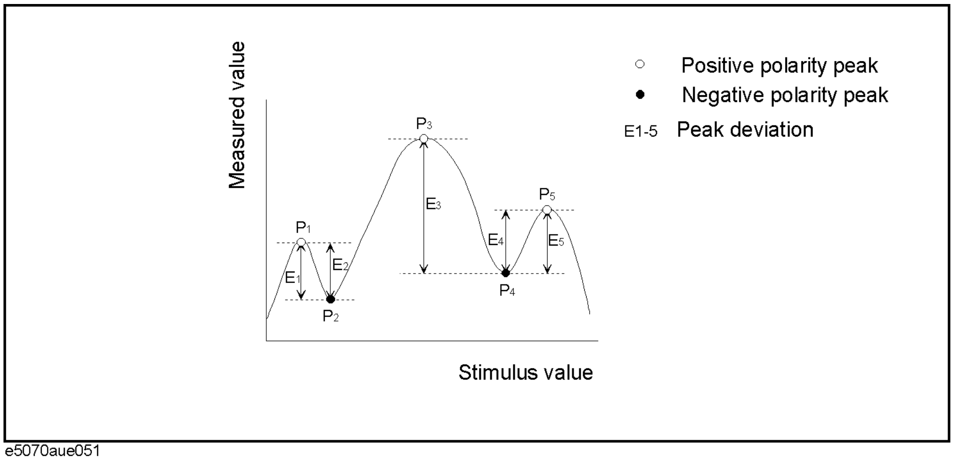
Positive peak (Positive)	A peak whose measured value is greater than those of the measurement points on either side of it (peak polarity: positive).
Negative peak (Negative)	A peak whose measured value is smaller than those of the measuring points on either side of it (peak polarity: negative).

About the Peak Search Function

The peak search is a function that searches for a peak that matches a pre-defined lower limit for the peak excursion value and peak polarity (positive or negative) and then moves the marker to the peak being searched.

The peak excursion value is the smaller of the differences in measured values from the adjoining peaks of the opposite polarity.

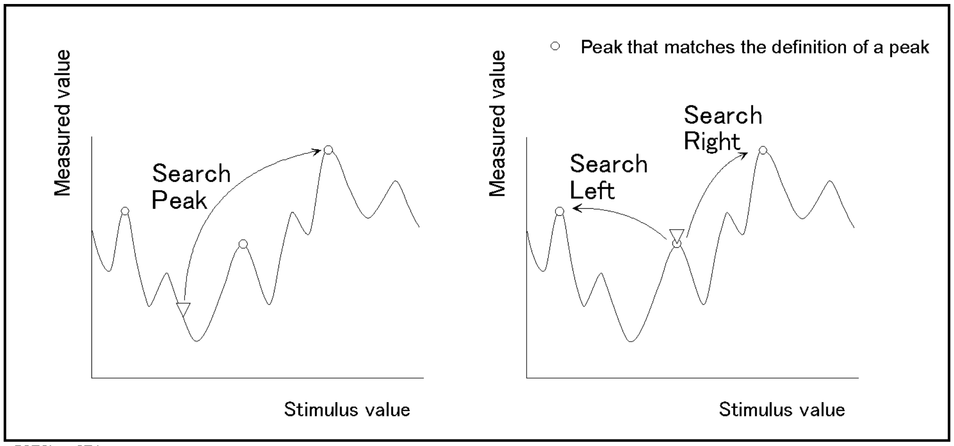
Figure 6-8 Positive Peak/Negative Peak and Peak Excursion Value



The following three methods are available for executing the peak search:

Peak search (Search Peak)	Move the marker to the maximum peak when for the peak polarity is **Positive** or **Both**. Move the marker to the minimum peak when for the peak polarity is **Negative**.
Left search (Search Left)	Execute the search from the current marker position to the smaller stimulus values, and move the marker to the first peak encountered.
Right search (Search Right)	Execute the search from the current marker position to the larger stimulus values, and move the marker to the first peak encountered.

Figure 6-9 **Peak Search (when peak polarity is positive)**



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Executing a Peak Search

Step 1. Following Step 1 to Step 4 in “Reading Values on the Trace” on page 173, activate the marker you are using for the peak search.

Step 2. Press Marker Search.

Step 3. Press **Peak**.

Step 4. Press **Peak Excursion**, and enter the lower limit for the peak excursion value.

This causes the peak search to be executed based on the definitions of the newly set the lower limit for the peak excursion value and currently set the peak polarity.

Step 5. Press **Peak Polarity**.

Step 6. Select a peak polarity.

Softkey	Function
Positive	Select Positive as the peak polarity.
Negative	Select Negative as the peak polarity.
Both	Select both Positive and Negative as the peak polarity.

This causes the peak search to be executed based on the definitions of the currently set the lower limit for the peak excursion value and newly set the peak polarity.

Step 7. Press the corresponding softkey to move the marker to the peak.

Softkey	Function
Search Peak	Execute the peak search.
Search Left	Execute the left search.
Search Right	Execute the right search.

NOTE When the data format is in Smith chart or polar format, execute the search for the main response value of the two marker response values.

Determining the Bandwidth of the Trace (Bandwidth Search)

The bandwidth search is a function for determining the bandwidth of the trace, center frequency, cut-off points (on the higher frequency and the lower frequency sides), Q, and insertion loss, based on the position of the active marker. The definitions of the parameters determined through the bandwidth search are shown in Figure 6-5 and Table 6-2. The user specifies the defined bandwidth value in Figure 6-10.

Figure 6-10 Bandwidth Parameters

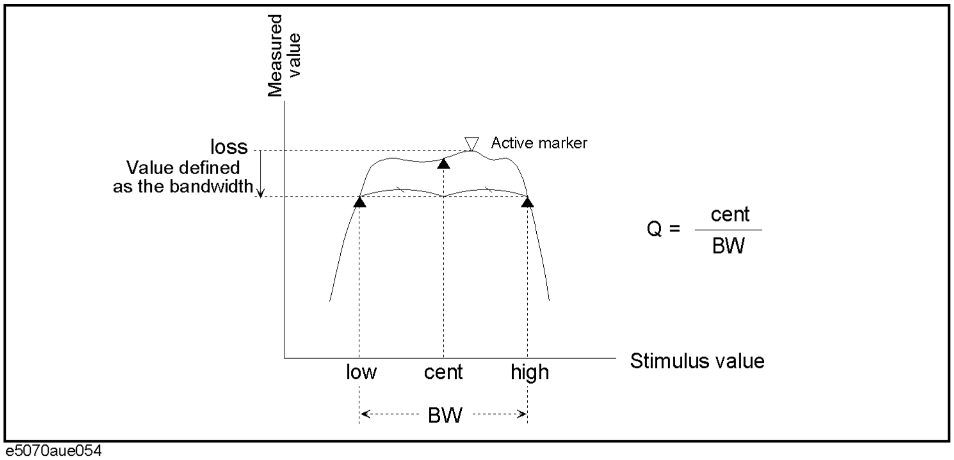


Table 6-2 Definitions of Bandwidth Parameters

Bandwidth Parameter	Definition
Insertion loss (**loss**)	The measured value of the position of the active marker at the time the bandwidth search is executed.
Lower frequency cut-off point (**low**)	Frequency at one of two measurement points, both separated by the defined bandwidth value from the active marker position, which corresponds to the lower of the two frequencies.
Higher frequency cut-off point (**high**)	Frequency at one of two measurement points, both separated by the defined bandwidth value from the active marker position, which corresponds to the higher of the two frequencies.
Center frequency (**cent**)	Frequency at the midpoint between the lower frequency cut-off and higher frequency cut-off points. ($\frac{high + low}{2}$).
Bandwidth (**BW**)	The difference in frequency between the higher frequency cut-off and lower frequency cut-off points ($high - low$).
Q	Value obtained by dividing the center frequency by the bandwidth ($\frac{cent}{BW}$).

Executing a Bandwidth Search

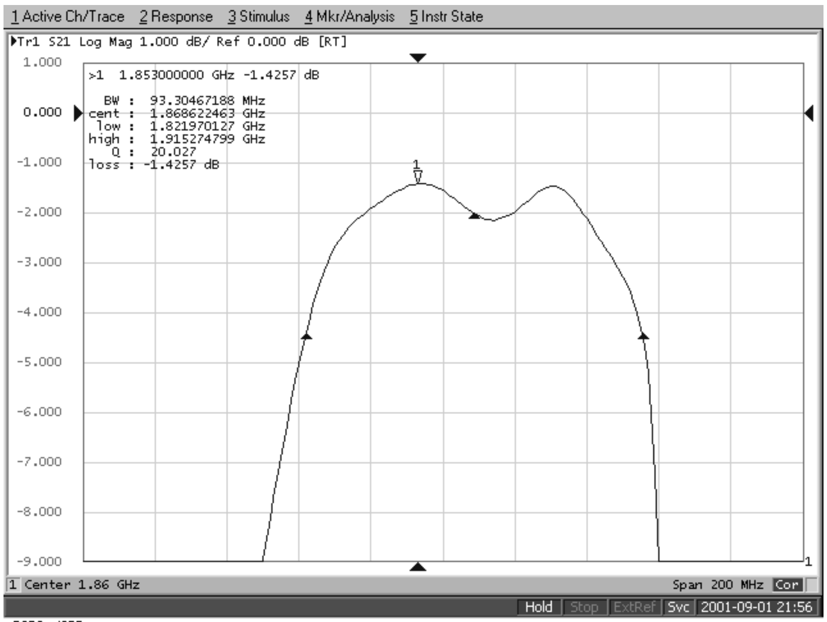
Step 1. Place the active marker on the desired point on the trace on which the bandwidth search is executed. The response value of this active marker itself is the insertion loss in the bandwidth search (**loss**).

Step 2. Press Marker Search.

Step 3. Press **Bandwidth Value** and enter the defined bandwidth value in the entry area that appears.

Step 4. Press **Bandwidth** to turn on the bandwidth search. In the upper left of the trace display, six bandwidth parameters are displayed. (See Figure 6-11.)

Figure 6-11 **Bandwidth Search Results (defined bandwidth = –3 dB)**



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Determining the Mean, Standard Deviation, and p-p of the Trace

You can easily determine the statistics data for a trace (mean, standard deviation, and peak-to-peak). Figure 6-12 and Table 6-3 show the definitions for the statistics data elements.

Figure 6-12 **Parameters Used for Calculating Statistics Data**

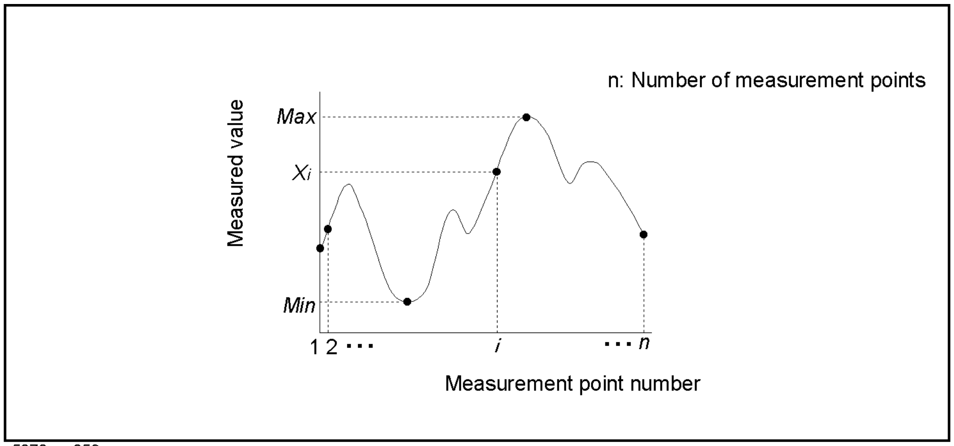

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Table 6-3 **Definitions of Statistics Data**

Statistics data element	Definition
Mean (**mean**)	$\frac{\sum_{i=1}^{n} x_i}{n}$ (n: number of points; x_i: i measured value at the ith measurement point)
Standard deviation (**s. dev**)	$\sqrt{\frac{\sum_{i=1}^{n} \langle x_i - mean\rangle^2}{n-1}}$ (n: number of points; x_i: F i measured value at the ith measurement point mean: Mean)
Peak-to-peak (**p - p**)	$Max - Min$ (Max: greatest measured value; Min: smallest measured value

Displaying Statistics Data

Step 1. Press Channel Next (or Channel Prev) and Trace Next (or Trace Prev) to activate the trace for which statistics data is required.

Step 2. Press Marker Fctn.

Step 3. Press **Statistics** to turn on the display of statistics data.

Comparing Traces/Performing Data Math

Each of the traces for which measured data is displayed is provided with an additional trace, called a memory trace, that temporarily stores measured data. You can use the memory trace to compare traces on the screen or to perform complex data math between it and measured data.

The following data math operations are available:

Data / Memory	Divides the measured data by the data in the memory trace. This function can be used to evaluate the ratio of two traces (e.g., evaluating gain or attenuation).
Data * Memory	Multiplies the measured data by a memory trace.
Data – Memory	Subtracts a memory trace from the measured data. This function can be used, for example, to subtract a vector error that has been measured and stored (e.g., directivity) from later data measured on a device.
Data + Memory	Adds the measured data and the data in the memory trace.

Performing Data Math Operations

Step 1. Press Channel Next (or Channel Prev) and Trace Next (or Trace Prev) to activate the trace to be stored in memory.

Step 2. Press Display.

Step 3. Press **Data → Mem** to store the measured data in memory.

Step 4. Press **Data Math**.

Step 5. Select the data math operation to perform.

Softkey	Function
OFF	Turns off data math functions (Do not perform data math.).
Data / Mem	Divide the measured data by the memory trace and store the result in the data trace.
Data * Mem	Multiply the data trace by the memory trace and store the result in the data trace.
Data – Mem	Subtract the memory trace from the data trace and store the result in the data trace.
Data + Mem	Add the data trace and memory trace and store the result in the data trace.

Step 6. Press **Display**.

Step 7. Select the type of data to display on the screen.

Softkey	Function
Data	Display only the data trace on the screen.
Mem	Display only the memory trace stored by the operation **Data** → **Mem** on the screen.
Data & Mem	Display the data trace and memory trace on the screen. You can now easily compare the data trace and memory trace on the screen.
Off	Do not display the trace.

Step 8. Apply the trigger to make measurements.

Performing parameter conversion of measurement result

You can use the parameter conversion function to convert the measurement result of the S-parameter (S_{ab}) to the following parameters.

- ❑ Equivalent impedance (Z_r) and equivalent admittance (Y_r) in reflection measurement

$$Z_r = Z_{0a} \times \frac{1 + S_{ab}}{1 - S_{ab}},\ Y_r = \frac{1}{Z_r}$$

- ❑ Equivalent impedance (Z_t) and equivalent admittance (Y_t) in transmission measurement

$$Z_t = \frac{2 \times \sqrt{Z_{0a} \times Z_{0b}}}{S_{ab}} - (Z_{0a} + Z_{0b}),\ Y_t = \frac{1}{Z_t}$$

- ❑ Inverse S-parameter ($\frac{1}{S_{ab}}$)

Where,

Z_{0a}	Characteristic impedance of port a*1
Z_{0b}	Characteristic impedance of port b*1

Operational procedure

ON/OFF

Step 1. Press `Channel Next` or `Channel Prev` to activate a channel on which you want to use the marker.

Step 2. Press `Trace Next` or `Trace Prev` to activate a trace on which you want to use the marker.

Step 3. Press `Analysis`.

Step 4. Press **Conversion**.

Step 5. Press **Conversion** to turn ON the conversion function.

*1. When the fixture simulator function is ON and the port impedance function is ON, the value set in the port impedance conversion is used. In other cases, the system Z0 (preset value: 50Ω) is used.

Selecting conversion target parameter

Step 1. Press Channel Next or Channel Prev to activate a channel on which you want to use the marker.

Step 2. Press Trace Next or Trace Prev to activate a trace on which you want to use the marker.

Step 3. Press Analysis.

Step 4. Press **Conversion**.

Step 5. Press **Function**.

Step 6. Press the softkey corresponding to the parameter to which you want to convert.

When the conversion function is ON, the selected parameter is displayed in the “5-5. Trace Status Area” on page 42.

7 Fixture Simulator

This chapter explains how to use the fixture simulator functions of the Agilent E5070B/E5071B.

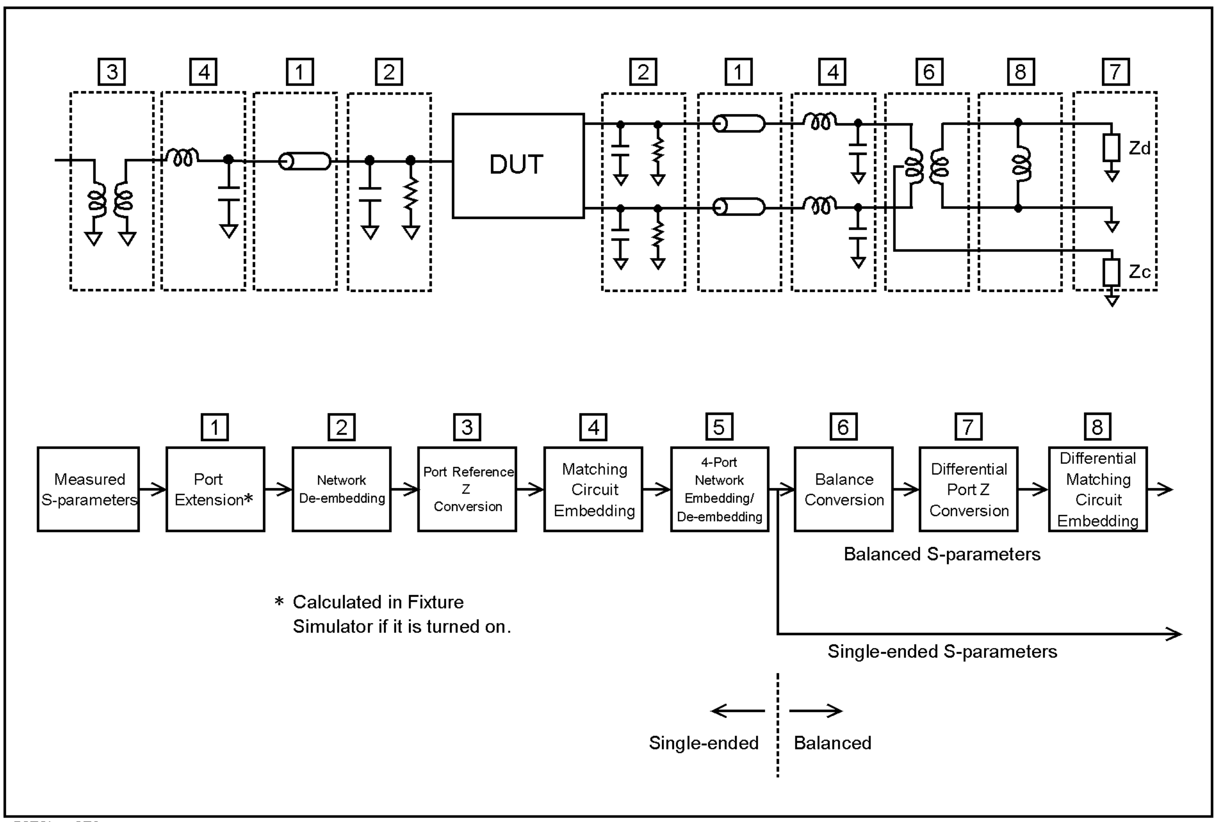
Overview of Fixture Simulator

The fixture simulator is a function that uses software in the E5070B/E5071B to simulate various measurement conditions based on the measurement results. The six functions are as follows.

- Network de-embedding
- Port reference impedance conversion
- Matching circuit embedding
- 4-port network embedding/de-embedding
- Balance-unbalance conversion[*1]
- Differential/Common port reference impedance conversion[*1]
- Differential matching circuit embedding[*1]

Figure 7-1 shows the data processing flow diagram of the fixture simulator.

Figure 7-1 **Data Processing Flow Diagram of Fixture Simulator**



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*1.Option 313, 314, 413, or 414 only.

Port extension is an independent function from the fixture simulator, but if the fixture simulator function is on, data processing is automatically executed as a part of fixture simulator to improve the data processing efficiency. (Measurement result is the same as when the fixture simulator is turned off.) Port extension moves the calibration reference location by setting an electrical delay for a single-ended port. Port extension can eliminate only electrical delay (phase shift) for each single-ended port. Loss or mismatch cannot be eliminated by this function.

Functions for single-ended (unbalanced) port

The following three functions are applied to single-ended ports (unbalanced ports). Balance-unbalance conversion can additionally be applied to such single-ended ports.

Network de-embedding

A function that uses software to remove an arbitrary network (50 Ω system) defined by a two-port Touchstone data file from each test port (single-ended) and to extend the calibration plane. This makes it possible to remove networks that create error elements between the calibration plane and the DUT, thereby enabling a more realistic evaluation of the DUT.

For the setup procedure of network de-embedding function, see “Extending the Calibration Plane Using Network De-embedding” on page 199.

Port reference impedance conversion

A function that uses software to convert an S-parameter measured with a 50 Ω port reference impedance into a value measured with an arbitrary impedance.

For the setup procedure of port reference impedance conversion, see “Converting the Port Impedance of the Measurement Result” on page 200.

Matching circuit embedding

A function for converting an original measurement result into a characteristic determined under the condition of inserting a matching circuit between the DUT and the test port (single-ended). The matching circuit to be inserted is either selected from the five predetermined circuit models or provided by a designated arbitrary circuit defined in a two-port Touchstone file.

For the setup procedure of matching circuit embedding, see “Determining Characteristics After Adding a Matching Circuit” on page 201.

4-port network embedding/de-embedding

This is a feature to embed (in terms of numerical calculation) your desired network that you have defined in a 4-port touchstone data file into measurement results or de-embed it from them.

For information on how to operate this function, refer to “Obtaining characteristics after embedding/de-embedding 4-port network” on page 204.

Balance-unbalance conversion (option 313, 314, 413, or 414)

A function that uses software to convert the measurement results in an unbalanced DUT state, which are obtained by connecting the DUT to the test port of the E5070B/E5071B, into measurement results in a balanced state. Two test ports of the E5070B/E5071B are connected to one balanced port of the DUT.

For the setup procedure of balance-unbalance conversion, see “Evaluating Balanced Devices (balance-unbalance conversion function)” on page 207.

Functions for balanced port (option 313, 314, 413, or 414)

The following two functions are applied to a balanced (differential) port converted by balance-unbalance conversion.

Differential port impedance conversion

A function for converting the differential mode port impedance of a balanced port after an balance-unbalance conversion. Balance-unbalance conversion automatically converts the differential mode port impedance at the balanced port into 2Z0 and the common mode port impedance into Z0/2, compared with the two pre-conversion port impedances of Z0. Differential port impedance conversion further converts a differential port impedance after balance-unbalance conversion into an arbitrary port impedance.

For the setup procedure of differential port impedance conversion, see “Converting reference impedance of balanced port” on page 214.

Differential matching circuit embedding

A function for converting the measurement results obtained from balance-unbalance conversion into a characteristic under the condition of inserting a matching circuit in the balanced port.

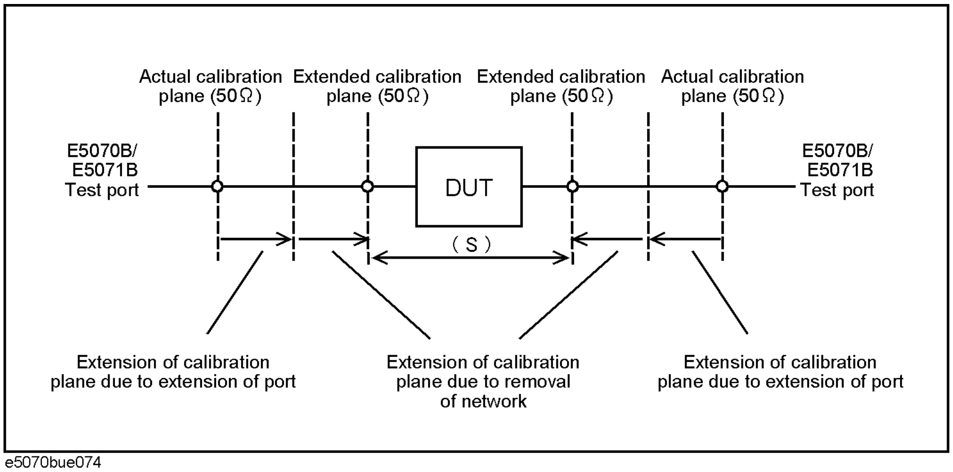
For setup procedure of differential matching circuit embedding, see “Determining the Characteristics that Result from Adding a Matching Circuit to a Differential Port” on page 216.

7. Fixture Simulator

Extending the Calibration Plane Using Network De-embedding

Network de-embedding is a function for performing measurements, test port by test port, by removing the characteristics of an arbitrary network defined by a Touchstone data file. By removing the characteristics of the cable, test fixtures, etc. between the actual calibration plane and the DUT, the calibration plane can be correspondingly extended. The network de-embedding function can be used together with the port extension function (see Figure 7-2).

Figure 7-2 **Port Extension and Calibration Plane Extension Using Network De-embedding**



Using the Network De-embedding Function

Step 1. Prepare a two-port Touchstone data file (.s2p format) corresponding to the network to be removed.

Step 2. Press Analysis - **Fixture Simulator** - **De-Embedding**.

Step 3. Press **Select Port**.

Step 4. Press **1**, **2**, **3**, or **4** to select the test port from which the network de-embedding is performed.

Step 5. Press **User File**.

Step 6. Using the dialog box that appears, select the Touchstone data file defining the characteristics of the network to be removed. Once the file is selected, the selection of **Select Type** automatically changes to **User**. To cancel a user-defined file that has been set up, press **Select Type - None**.

Step 7. Repeat Step 3 to Step 6 to set up the Touchstone data file for each port from which a network is to be removed.

Step 8. Press **De-Embedding** to turn the network de-embedding function **ON**.

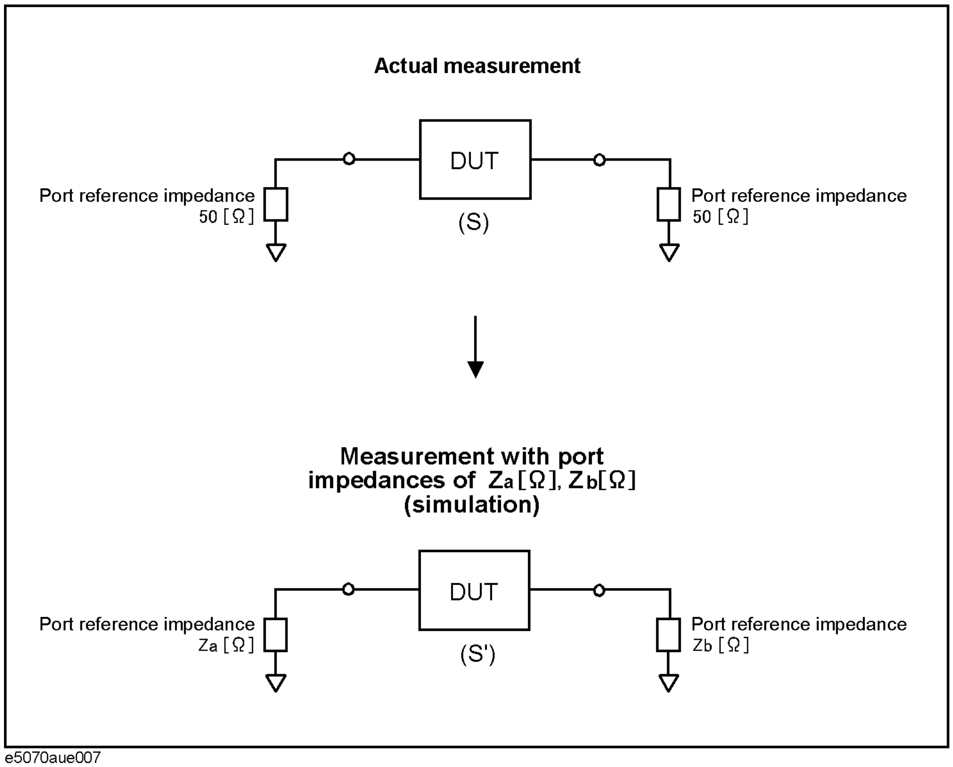
Step 9. Press **Return**.

Step 10. If **Fixture Simulator** is **OFF**, press the key again to turn it **ON**.

Converting the Port Impedance of the Measurement Result

The measured value obtained by using a port impedance of 50 Ω can be converted into a measured value at an arbitrary port impedance.

Figure 7-3 **Port Impedance Conversion Function**



Converting the Port Impedance

Step 1. Press Analysis - **Fixture Simulator - Port Z Conversion**.

Step 2. Press **Port 1 Z0**, **Port 2 Z0**, **Port 3 Z0**, or **Port 4 Z0** to select the port whose impedance will be changed.

Step 3. Enter the port impedance as a numeric value.

Step 4. Repeat Step 2 and Step 3 to specify the port impedance for each port changed.

Step 5. Press **Port Z Conversion** to change the port impedance conversion function to the **ON** state.

Step 6. Press **Return**.

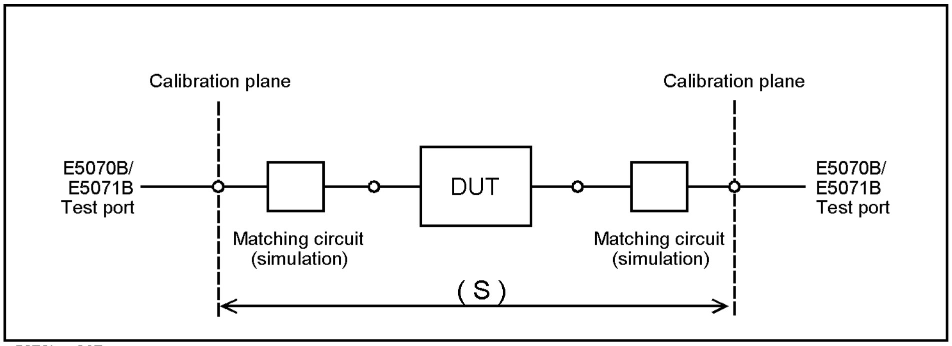
Step 7. If **Fixture Simulator** is **OFF**, press the key again to turn it **ON**.

7. Fixture Simulator

Determining Characteristics After Adding a Matching Circuit

Using the matching circuit embedding function, you can easily obtain the resulting characteristics after adding a matching circuit for each test port (see Figure 7-4).

Figure 7-4 **Matching Circuit Function**



Define the matching circuit to be added by one of the following methods:

- Select one from the five predetermined circuit models and specify the values for the elements in the circuit model.
- Use a user file (in two-port Touchstone data format) that defines the matching circuit to be added.

The circuit models used for defining matching circuits are shown in Figure 7-5.

Using the Matching Circuit Function

Step 1. Press Analysis - **Fixture Simulator - Port Matching**.

Step 2. Press **Select Port**.

Step 3. Press **1**, **2**, **3**, or **4** to select the port to which a matching circuit is to be added.

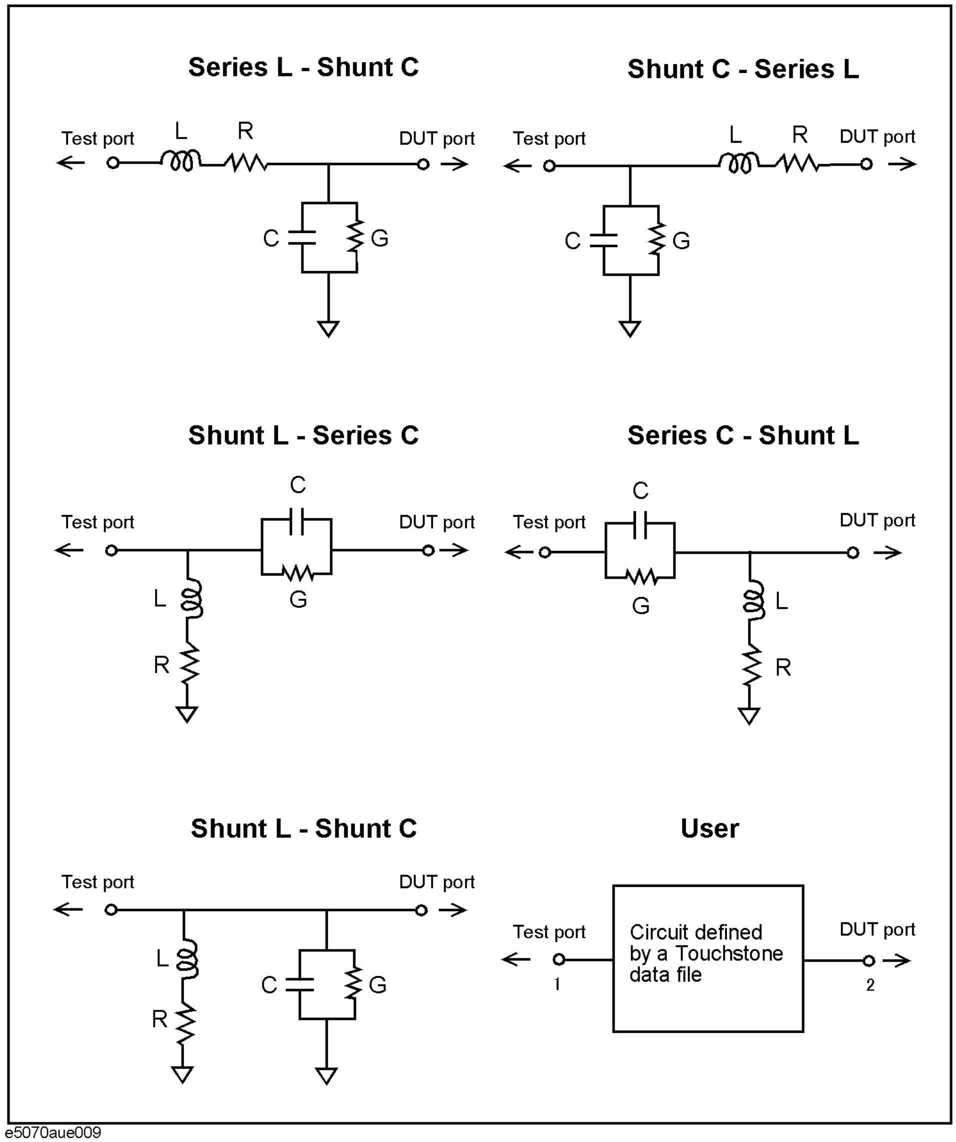
Step 4. To add a matching circuit defined in a user file, execute the following operations:

a. Press **User File**.

b. In the dialog box that appears, select the two-port Touchstone data file (.s2p format) for the matching circuit to be added.

Once a user file is specified, the selection of **Select Circuit** automatically changes to **User**. In this case, you do not need to execute Step 5 and Step 6.

Figure 7-5 **Circuit Models for Defining Matching Circuits**



NOTE

In the 2-port matching circuit embedding or the 2-port network de-embedding feature, if the normalized impedance value specified in the user file (2-port Touchstone data file) is different from the port reference impedance setting value of the analyzer, it is automatically converted to adapt to the analyzer setting.

When a 2-port Touchstone data file is read in, data for up to 3202 frequency points are read in using interpolation according to the measurement frequency point setting of the analyzer.If the number of frequency points in the file is greater than 3202, excess data are ignored.

For a network defined in the user file, it is assumed that port 1 is connected to the test port and port 2 is connected to the DUT.

Step 5. Press **Select Circuit**.

Step 6. Select a matching circuit model (see Figure 7-5).

Softkey	Function
None	No matching circuit is added.
Series L - Shunt C	Select a circuit model consisting of a series inductor and a shunt capacitor.
Shunt C - Series L	Select a circuit model consisting of a shunt capacitor and a series inductor.
Shunt L - Series C	Select a circuit model consisting of a shunt inductor and a series capacitor.
Series C - Shunt L	Select a circuit model consisting of a series capacitor and a shunt inductor.
Shunt L - Shunt C	Select a circuit model consisting of a shunt inductor and a shunt capacitor.
User	Select the circuit model defined in the user file imported by performing Step 4.

Step 7. Specify the values of the elements in the selected circuit model.

Softkey	Function
C	Specifies the capacitance [F].
G	Specifies the conductance [S].
L	Specifies the inductance [H].
R	Specifies the resistance [Ω].

Step 8. Repeat Step 3 to Step 7 to set up the matching circuit for each port used.

Step 9. Press **Port Matching** to turn the matching circuit function **ON**.

Step 10. Press **Return**.

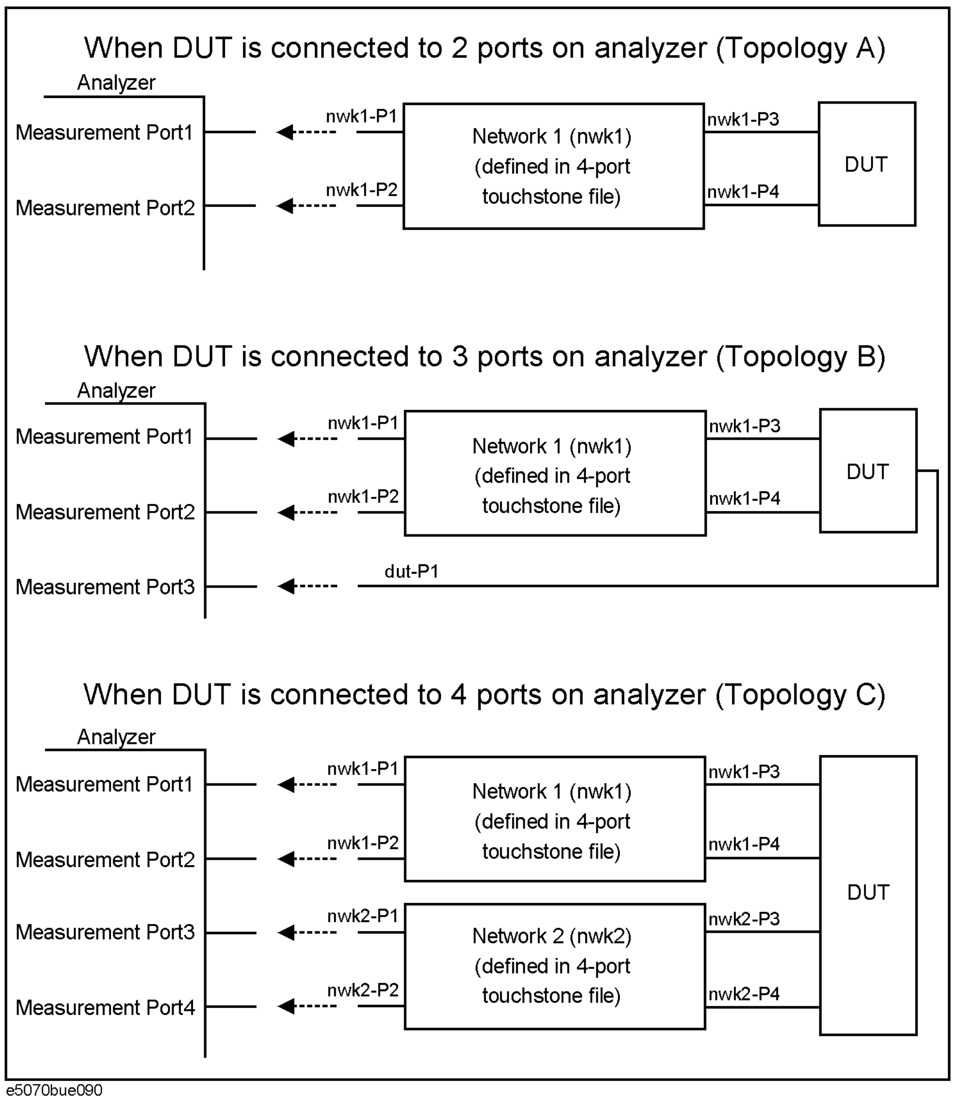
Step 11. If **Fixture Simulator** is **OFF**, press the key again to turn it **ON**.

Obtaining characteristics after embedding/de-embedding 4-port network

The 4-port network embedding/de-embedding feature allows you to add (embed) or remove (de-embed) data of your desired 4-port network defined in a 4-port Touchstone data file to or from measurement values through software-based processing. The embedding/de-embedding supports three types of connection as shown in Figure 7-6.

NOTE This function is available with the firmware version 3.50 or greater.

Figure 7-6 **Connection that enables embedding/de-embedding network (4-port touchstone data)**



Operational procedure

Step 1. Prepare a 4-port touchstone data file (.s4p format) corresponding to a network you want to embed/de-embed.

Step 2. Press Analysis - **Fixture Simulator** - **De-Embedding S4P**.

Step 3. Press **Topology - Select Topology** and select a network connection type (topology) from A, B, or C (see Figure 7-6).

Step 4. Press **Ports** to select measurement port numbers of the analyzer to which you want to connect the ports 1 and 2 of the 4-port network.

For topology **A**: Select measurement port numbers of the analyzer to which you want to connect nwk1-P1 and nwk1-P2 in Figure 7-6. For example, when you connect nwk1-P1 and nwk1-P2 to the measurement ports 1 and 2 respectively as shown in Figure 7-6, specify Ports = "1-2".

For topology **B**: Select measurement port numbers of the analyzer to which you want to connect nwk1-P1, nwk1-P2, and dut-P1 in Figure 7-6. For example, when you connect nwk1-P1, nwk1-P2, and dut-P1 to the measurement ports 1, 2, and 3 respectively as shown in Figure 7-6, specify Ports="1-2-3".

For topology **C**: Select measurement port numbers of the analyzer to which you want to connect nwk1-P1, nwk1-P2, nwk2-P1, and nwk2-P2 in Figure 7-6. For example, when you connect nwk1-P1, nwk1-P2, nwk2-P1, and nwk2-P2 to the measurement ports 1, 2, 3, and 4 respectively as shown in Figure 7-6, specify Ports="1-2-3-4".

NOTE

When defined in the 4-port Touchstone data file, a 4-port networks assumes that the ports 1 and 2 are connected to the analyzer and the ports 3 and 4 to the DUT.

For measuring a 4-port DUT with a 4-port network embed/de-embed only on one side, select topology C instead of A, set embedding/de-embedding on a desired side, and specify no processing (None) on the other side.[*1]

For measuring a 3-port DUT with a 4-port network embed/de-embed on one side and a 2-port network on the other side, select topology B instead of A, embed/de-embed a 4-port network on one side, and embed/de-embed a 2-port network on the other side using the 2-port matching circuit embedding feature or the 2-port network de-embedding feature.[*1]

Step 5. Press **User File (nwk1)** and select a 4-port Touchstone data file you want to use for network 1.

*1. Selecting topology A will result in unexpected measurement.

Step 6. Press **Type (nwk1)** and select a processing type for network 1.

Softkey	Function
None	Specifies no-processing (equivalent to turning off the feature).
Embed	Selects embedding.
De-Embed	Selects de-embedding.

NOTE If you have not specified an appropriate file in Step 5, you cannot select embedding (**Embed**) or de-embedding (**De-embed**). If you have not specified an appropriate file and you try to select embedding/de-embedding, an error occurs and no-processing (**None**) is automatically selected.

Step 7. If you have selected topology C, make necessary settings also for network 2 (**nwk2**) accordingly.

Step 8. Press **De-Embedding S4P** to turn **ON** the 4-port network embedding/de-embedding feature.

Step 9. Press **Return**.

Step 10. If **Fixture Simulator** is **OFF**, press the key to turn it **ON**.

NOTE When the 4-port network embedding/de-embedding feature reads a 4-port Touchstone data file, it does not automatically convert the normalized impedance value in the file in order to adapt to the port reference impedance setting value of the analyzer. If a 4-port Touchstone data file that has a different normalized impedance value than that of the port reference impedance setting value is read in, correct measurement results will not be obtained. Therefore, when you create a 4-port Touchstone file, be sure that the normalized impedance value in the data file is the same as the port reference impedance value of the analyzer specified for actual measurement. When you create a 4-port Touchstone file using the VBA macro on the E5070B/E5071B, set the port reference impedance value to your desired value before executing the macro.

A Touchstone data file is defined for a single normalized impedance value. Thus, when reading in a Touchstone data file with the 4-port network embedding/de-embedding feature, be sure to specify the same port reference impedance value to every measurement port pair connected to the same 4-port network. Taking the topology C in Figure 7-6 for example, the port reference impedance of the analyzer measurement port pair of ports 1 and 2 and that of the measurement port pair of ports 3 and 4 must be set to the same value respectively.

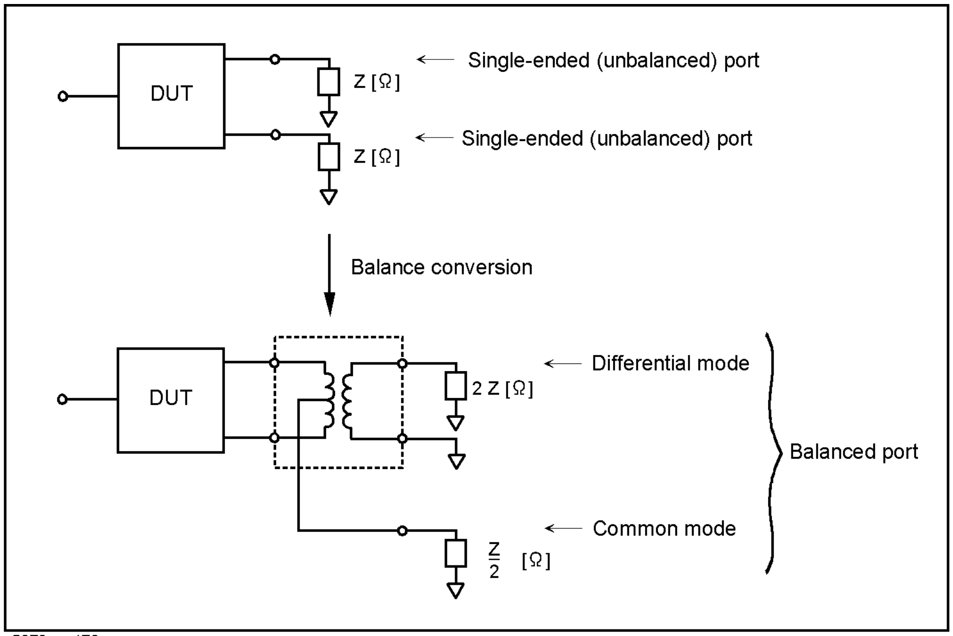
When a 4-port Touchstone data file is read in, data for up to 3202 frequency points are read in using interpolation according to the measurement frequency point setting of the analyzer. If the number of frequency points in the file is greater than 3202, excess data are ignored.

Evaluating Balanced Devices (balance-unbalance conversion function)

The balance-unbalance conversion function simulates a measurement under a balanced state based on measurement results obtained in an unbalanced state (Figure 7-7). This function enables you to evaluate devices with balanced ports.

NOTE Be sure to set the impedances of the two unbalanced ports equal to each other. For more details on setting up port impedance for unbalanced ports, refer to “Converting the Port Impedance of the Measurement Result” on page 200.

Figure 7-7 **Balance-unbalance conversion**

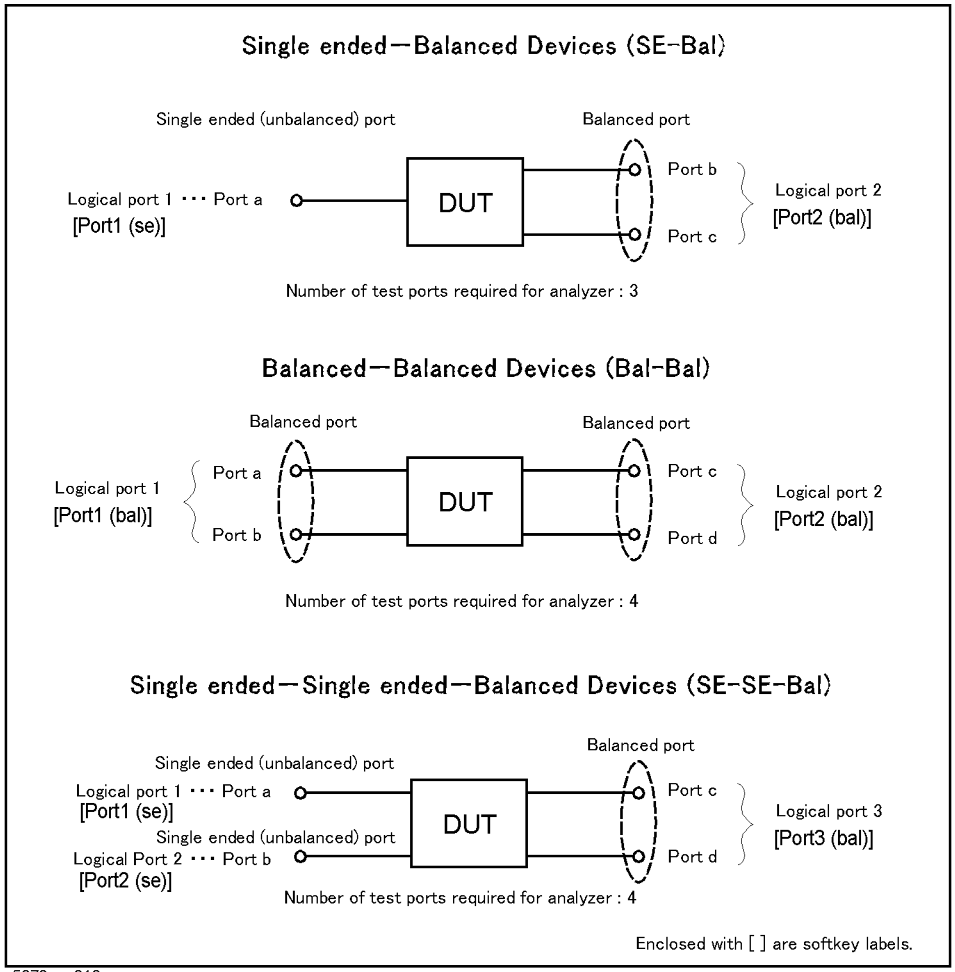


e5070aue170

The types of devices that can be evaluated using the E5070B/E5071B are shown in Figure 7-8.

NOTE To evaluate a balanced device, an E5070B/E5071B with at least three test ports (option 313, 314, 413, or 414) is required.

Figure 7-8 **Type of balanced devices that can be evaluated with E5070B/E5071B**



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In the terminology of the E5070B/E5071B, ports after the balance conversion are called logical ports (or DUT ports).

You can assign the test ports of the E5070B/E5071B to logical ports (a to d in Figure 7-8) freely.

Measurement parameters of balanced devices

Turn on the balance-unbalance conversion function to measure the following parameters.

- ❏ Mixed mode S-parameter
- ❏ Imbalance parameter
- ❏ CMRR (Common Mode Rejection Ratio)

Mixed mode S-parameter

By turning on the balance-unbalance conversion function, you can obtain the S-parameter of the balanced port separately for 2 modes, the differential mode and the common mode.Figure 7-9 shows the notation of the S-parameter in balance measurement (mixed mode S-parameter).

Figure 7-9 **Notation of mixed mode S-parameter**

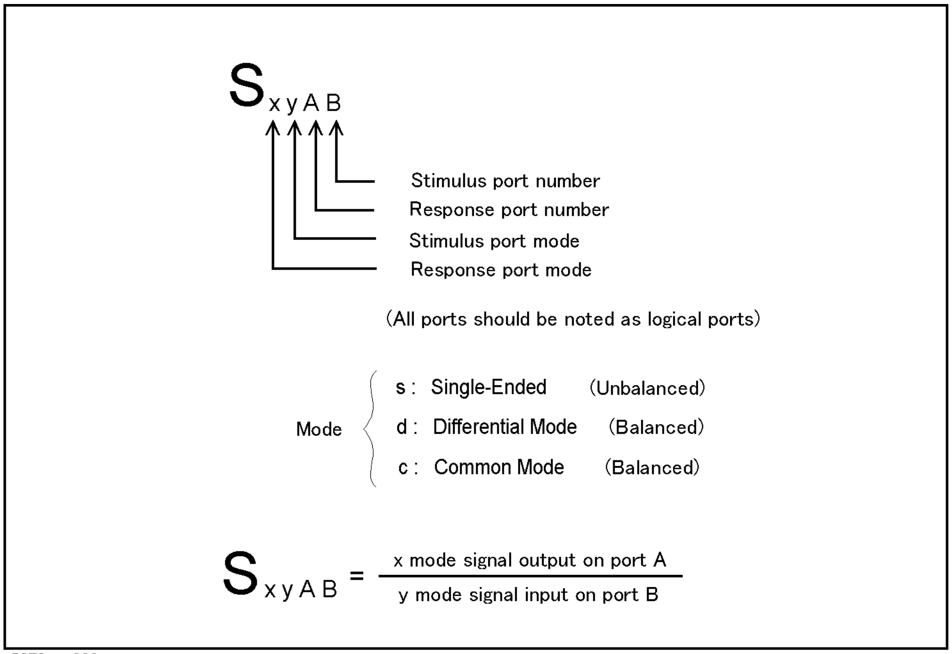

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Figure 7-10 to Figure 7-12 show the mixed mode S-parameter when measuring each balanced device.

Figure 7-10 **Mixed mode S-parameter when measuring a single-ended - balanced device**

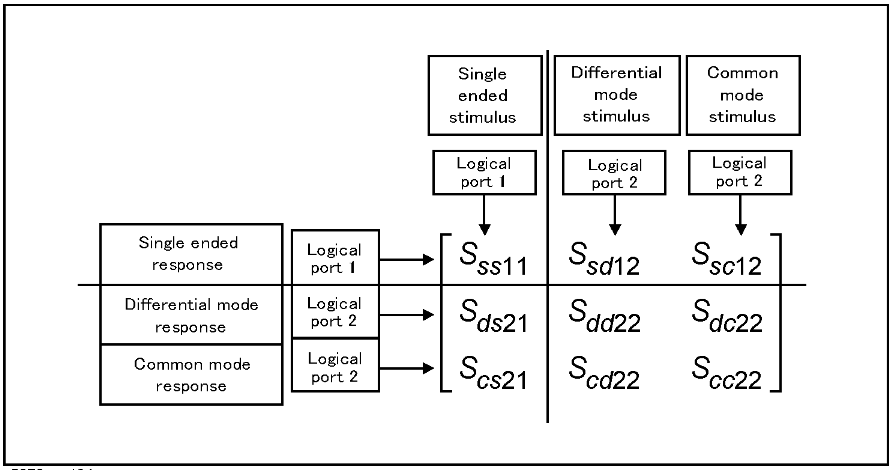

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Figure 7-11 **Mixed mode S-parameter when measuring a balanced - balanced device**

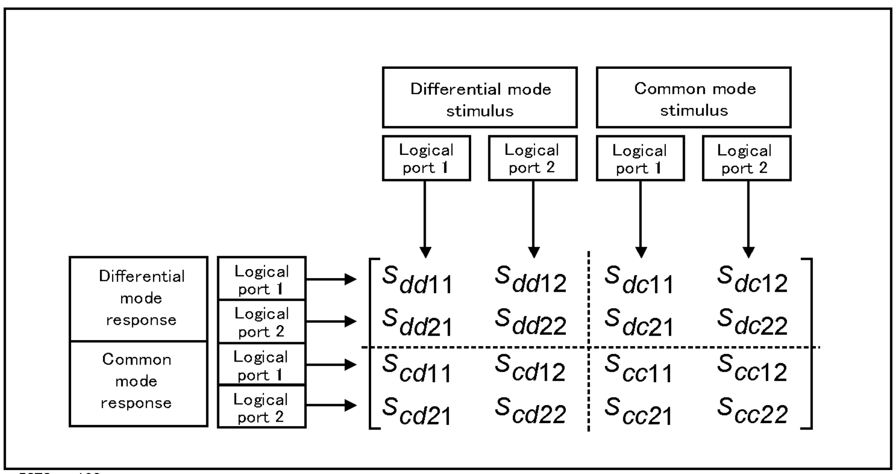

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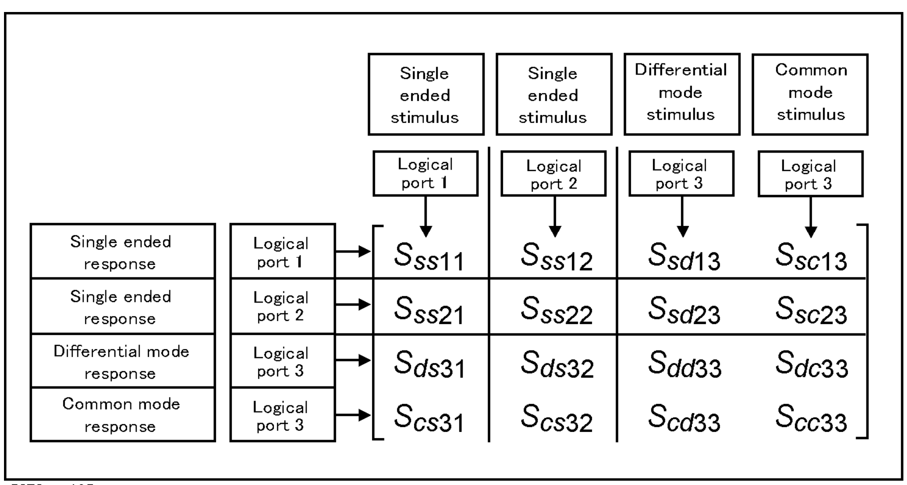
Figure 7-12 **Mixed mode S-parameter when measuring a single-ended - single-ended - balanced device**



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Imbalance parameter

By turning on the balance-unbalance conversion function, you can select the imbalance parameter of the balanced port as the measurement parameter. Figure 7-13 to Figure 7-15 show the imbalance parameter you can select when measuring each balanced device.

Figure 7-13 **Parameter when measuring a single-ended - balanced device (Imbalance)**

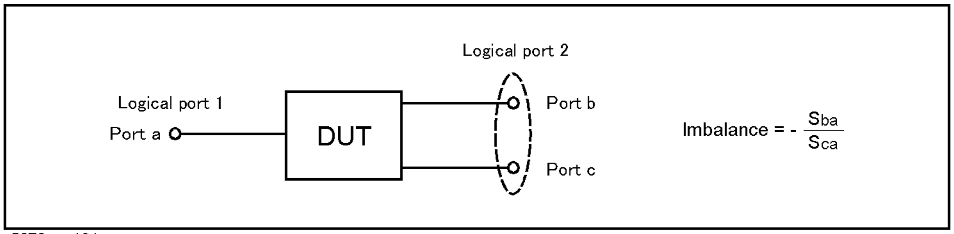

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Figure 7-14 **Parameter when measuring a balanced - balanced device (Imbalance1, Imbalance2)**

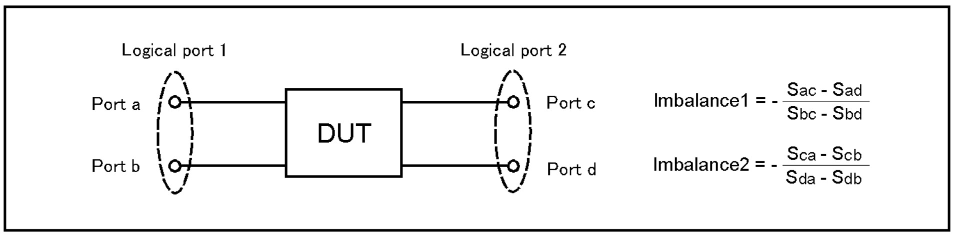

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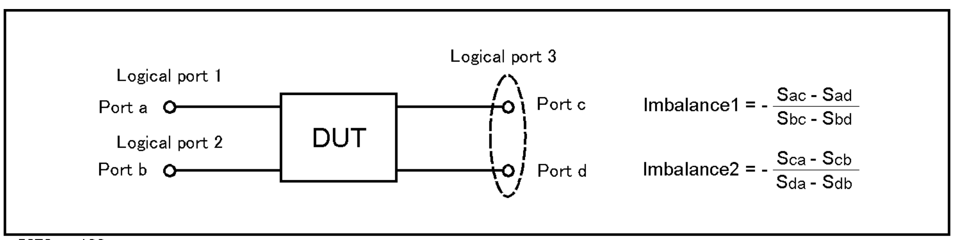
Figure 7-15 **Parameter when measuring a single-ended - single-ended - balanced device (Imbalance1, Imbalance2)**



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CMRR (Common Mode Rejection Ratio)

By turning on the balance-unbalance conversion function, you can select CMRR (ratio between the transmission characteristic in the differential mode and that in the common mode) of the balanced port as the measurement parameter. The table below shows the CMRR parameter you can select when measuring each balanced device.

Single-ended - balanced device	$\frac{S_{ds21}}{S_{cs21}}$ and $\frac{S_{sd12}}{S_{sc12}}$
Balanced - balanced device	$\frac{S_{dd21}}{S_{cc21}}$
Single-ended - single-ended - balanced device	$\frac{S_{ds31}}{S_{cs31}}$ and $\frac{S_{ds32}}{S_{cs32}}$

Steps for Balance-Unbalance Conversion

NOTE

When using three test ports, perform a full three-port calibration on the test ports to be used. When using four test ports, perform a full four-port calibration.

Extend the calibration plane, if necessary, by using the port extension function or network de-embedding function. For more on the port extension and network de-embedding functions, see "Extending the Calibration Plane Using Network De-embedding" on page 199.

Step 1. Press Analysis.

Step 2. Press **Fixture Simulator**.

Step 3. Press **Topology**.

Step 4. Press **Device**.

Step 5. Select the balanced/unbalanced topology.

Softkey	Function
SE-Bal	Establish port 1 on the DUT as an unbalanced port and port 2 as a balanced port.
Bal-Bal	Establish both port 1 and port 2 on the DUT as balanced ports.
SE-SE-Bal	Establish port 1 and port 2 on the DUT as unbalanced ports and port 3 as a balanced port.

Step 6. Select each port on the analyzer to which a port on the DUT is connected.

· When you have selected **SE-Bal** in Step 5:

Softkey	Function
Port 1 (se)	Select a port on the analyzer from among **1**, **2**, **3**, and **4** for connection to logical 1 (Port a in Figure 7-8).
Port 2 (bal)	Select two ports on the analyzer from among **1-2**, **1-3**, **1-4**, **2-1**, **2-3**, **2-4**, **3-1**, **3-2**, **3-4**, **4-1**, **4-2**, and **4-3** for connection to logical port 2 (Port b and Port c in Figure 7-8).

· When you have selected **Bal-Bal** in Step 5:

Softkey	Function
Port 1 (bal)	Select two ports on the analyzer from among **1-2**, **1-3**, **1-4**, **2-1**, **2-3**, **2-4**, **3-1**, **3-2**, **3-4**, **4-1**, **4-2**, and **4-3** for connection to logical port 1 (Port a and Port b in Figure 7-8).
Port 2 (bal)	Select two ports on the analyzer from among **1-2**, **1-3**, **1-4**, **2-1**, **2-3**, **2-4**, **3-1**, **3-2**, **3-4**, **4-1**, **4-2**, and **4-3** for connection to logical port 2 (Port c and Port d in Figure 7-8).

· When you have selected **SE-SE-Bal** in Step 5:

Softkey	Function
Port 1 (se)	Select a port on the analyzer from among **1**, **2**, **3**, and **4** for connection to logical 1 (Port a in Figure 7-8).

Softkey	Function
Port 2 (se)	Select a port on the analyzer from among **1**, **2**, **3**, and **4** for connection to logical 2 (Port b in Figure 7-8).
Port 3 (bal)	Select two ports on the analyzer from among **1-2**, **1-3**, **1-4**, **2-1**, **2-3**, **2-4**, **3-1**, **3-2**, **3-4**, **4-1**, **4-2**, and **4-3** for connection to logical port 3 (Port c and Port d in Figure 7-8).

Step 7. Press **Return**.

Step 8. Press **BalUn** to turn on the balanced/unbalanced state conversion function.

Step 9. Press **Fixture Simulator** to turn on the fixture simulator function.

Steps for Measurement Parameter Setups

Performing balance-unbalance conversion enables you to make measurements with mixed mode S-parameters, imbalance parameters and CMRR. Parameters that can be used differ depending on the balance-unbalance topology specified in Step 5 in “Steps for Balance-Unbalance Conversion” on page 212.

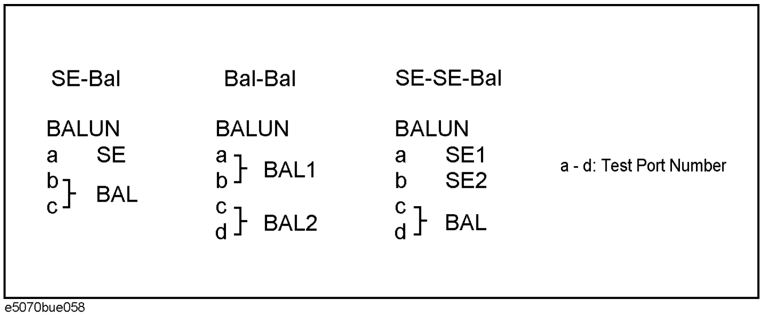
Step 1. Press Meas (or Analysis - **Fixture Simulator** - **Measurement**).

Step 2. Select the measurement parameter.

Checking device type and port assignment

You can check the device type and the port assignment for the balance-unbalance conversion by displaying the balance measurement topology property as shown in Figure 7-16.

Figure 7-16 **Balance measurement topology property**



Procedure to turn on/off balance measurement topology property display

Follow these steps to turn on/off the balance measurement topology property display.

Step 1. Press Analysis.

Step 2. Press **Fixture Simulator**.

Step 3. Press **Topology**.

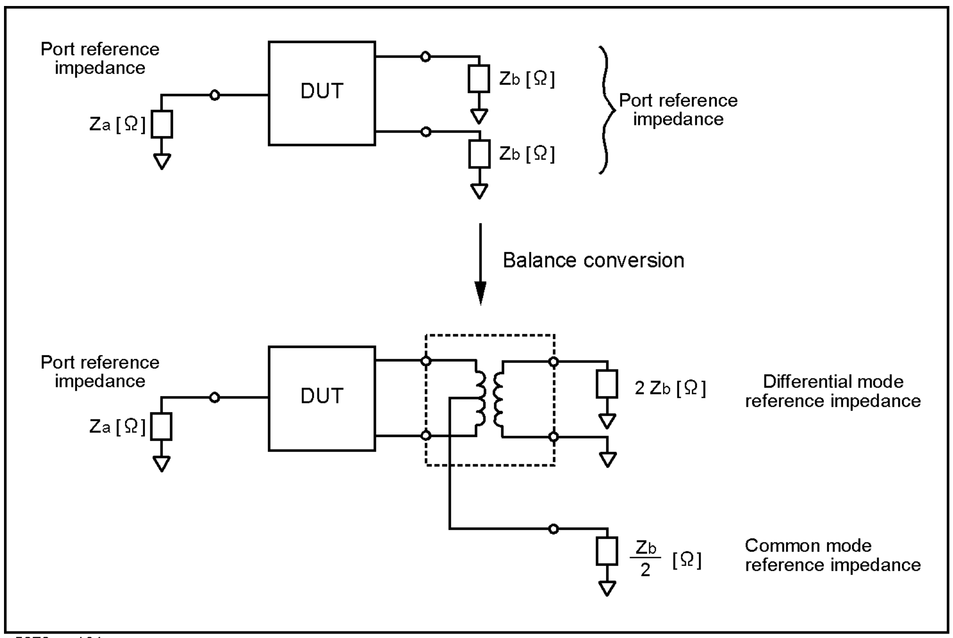
Step 4. Press **Property**. Each press toggles between on/off.

Converting reference impedance of balanced port

By using the port impedance conversion function, you can specify the impedance of each test port. As a result of this conversion, the impedance of the balanced port in differential mode is set to a value twice as large as the impedance of the two unbalanced ports before conversion, and in common mode to a value one-half as large (see Figure 7-17).

NOTE Be sure to set the impedances of the two unbalanced ports equal to each other. For more details on setting up port impedance for unbalanced ports, refer to "Converting the Port Impedance of the Measurement Result" on page 200.

Figure 7-17 **Port Impedance After a Balance-Unbalance Conversion**



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As described above, the impedance of the balanced port is automatically specified as the result of specifying the impedance of the two unbalanced ports prior to balance-unbalance conversion. However, the port impedance can be changed to an arbitrary value using the differential port impedance conversion function and the common port impedance conversion function.

Converting port reference impedance in differential mode

If you turn on the differential port impedance conversion function, the port reference impedance in the differential mode is converted to an arbitrary value specified with this function instead of the value in Figure 7-17.

Procedure to turn on/off differential port reference impedance conversion function

Step 1. Analysis - Press **Fixture Simulator** - **Diff Z Conversion**.

Step 2. Press **Diff Z Conversion** to set the differential impedance conversion function to **ON**.

You can only turn on or off Differential Port Impedance Conversion for all the balanced ports, but not for each port individually. If you want to turn off a specific port only, set the reference impedance of the port to the value in Figure 7-17.

Procedure to set differential port reference impedance

Step 1. Analysis - Press **Fixture Simulator** - **Diff Z Conversion**.

Step 2. Press **Port 1 (bal)**, **Port 2 (bal)**, or **Port 3 (bal)** to select the balanced port.

Step 3. Enter a value of the port reference impedance in the differential mode.

Converting port reference impedance in common mode

If you turn on the common port impedance conversion function, the port reference impedance in the common mode is converted to an arbitrary value specified with this function instead of the value in Figure 7-17.

Procedure to turn on/off common port reference impedance conversion

Step 1. Analysis - Press **Fixture Simulator** - **Cmn Z Conversion**.

Step 2. Press **Cmn Z Conversion** to set the differential impedance conversion function to **ON**.

You can only turn on or off Common Port Impedance Conversion for all the ports, but not for each port individually. If you want to turn off a specific port only, set the impedance of the port to the value in Figure 7-17.

Procedure to set common port reference impedance

Step 1. Analysis - Press **Fixture Simulator** - **Cmn Z Conversion**.

Step 2. Press **Port 1 (bal)**, **Port 2 (bal)**, or **Port 3 (bal)** to select the balanced port.

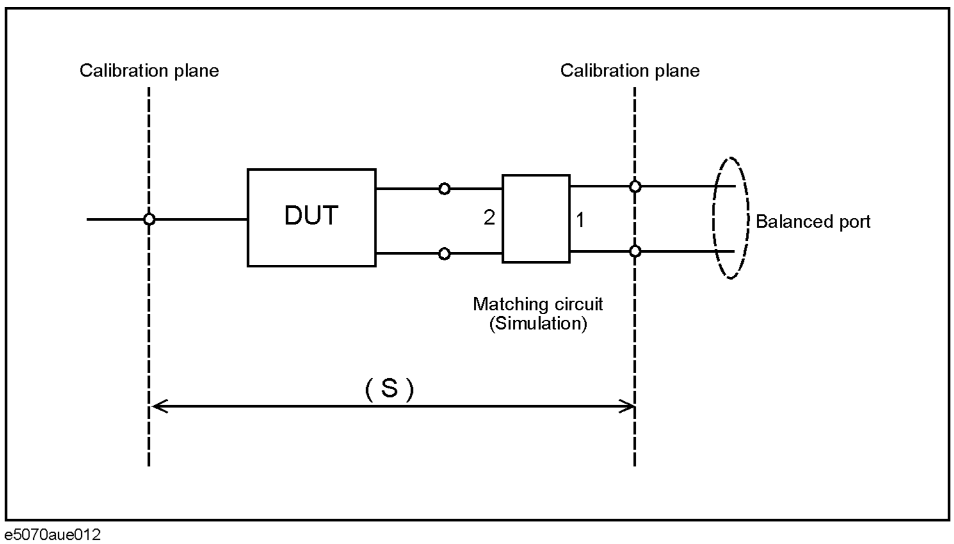
Step 3. Enter a value of the port reference impedance in the common mode.

Determining the Characteristics that Result from Adding a Matching Circuit to a Differential Port

You can obtain the characteristics resulting from the pseudo addition of a balance matching circuit to a balanced port created by balance-unbalance conversion.

By using the matching circuit function, you can obtain the characteristics resulting from the addition of an arbitrary matching circuit for each test port (see Figure 7-18).

Figure 7-18 **Balance Matching Circuit Function**

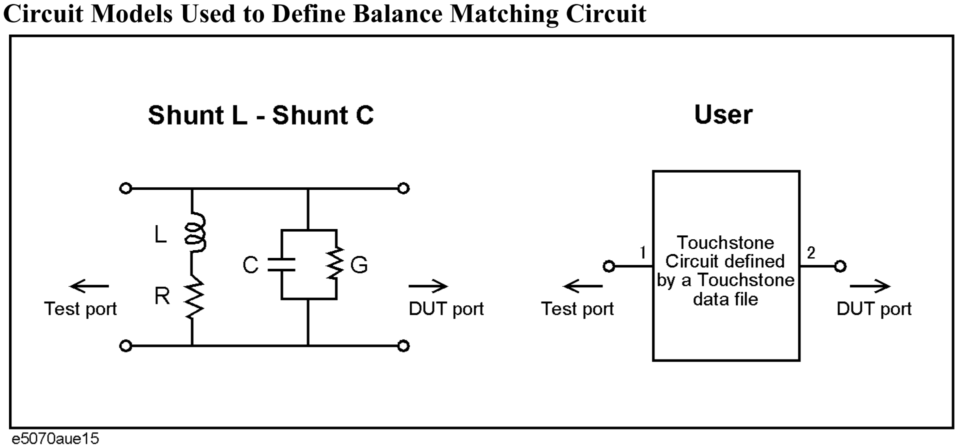


Define the matching circuit to be added by one of the following methods:

- Use a predetermined circuit model and specify the values for the elements in the circuit model.
- Use a user file (in two-port Touchstone format) to define the matching circuit to be added.

Figure 7-19 shows the circuit models used in defining a balance matching circuit.

Figure 7-19 **Circuit Models Used to Define Balance Matching Circuit**



NOTE For a network defined in a user file, it is assumed that port 1 is connected to the test port and port 2 is connected to the DUT.

The setup steps are shown below.

Step 1. Press Analysis - **Fixture Simulator - Diff. Matching**.

Step 2. Press **Select Port**.

Step 3. Press **1**, **2**, or **3** to select the port on the DUT to which a differential matching circuit will be added.

Step 4. To add a matching circuit defined in a user file, perform the following operations:

a. Press **User File**.

b. Using the dialog box that appears, select the 2-port Touchstone data file (.s2p format) for the matching circuit to be added.

Once you have specified the user file, the selection of **Select Circuit** automatically changes to **User**. In this case, you do not have to execute Step 5 and Step 6.

Step 5. Press **Select Circuit**.

Step 6. Select a differential matching circuit model (see Figure 7-19).

Softkey	Function
None	The matching circuit is not added.
Shunt L - Shunt C	Selects a circuit model consisting of a shunt inductor and a shunt capacitor.
User	Selects the circuit model defined in the user file imported in Step 4.

Step 7. Specify the values for the elements in the circuit model selected.

Softkey	Function
C	Specifies the capacitance [F].
G	Specifies the conductance [S].
L	Specifies the inductance [H].
R	Specifies the resistance [Ω].

Step 8. Repeat Step 3 to Step 7 to set up the differential matching circuit to be added to the selected ports on the DUT.

Step 9. Press **Diff. Matching** to turn the differential matching circuit **ON**.

Step 10. Press **Return**.

Step 11. If **Fixture Simulator** is **OFF**, press the key again to turn it **ON**.

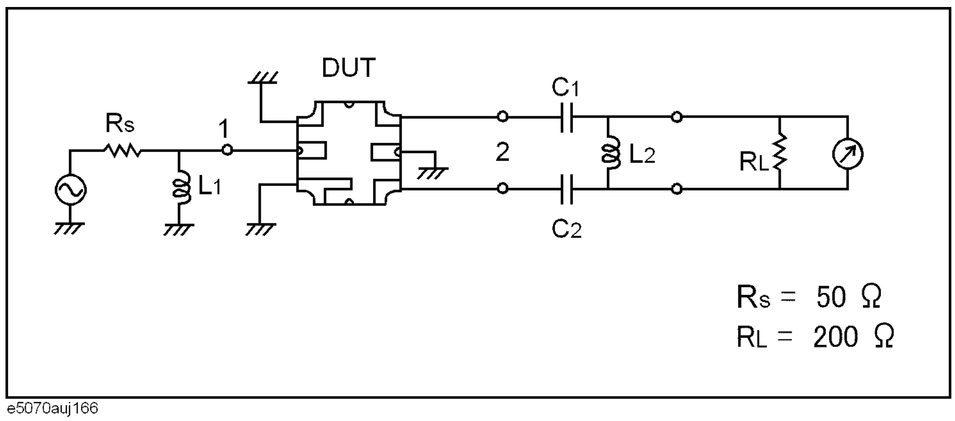
Example of using fixture simulator

In this section, the fixture simulation function is explained based on an evaluation example for a DUT (balanced SAW filter) with a balanced port.

Measurement circuit example for a DUT with balanced port

Figure 7-20 shows an example of a measurement circuit used to evaluate a balanced SAW filter. DUT port 1 is an unbalanced port connected to source impedance Rs and input matching circuit L1. DUT port 2 is a balanced port connected to an output matching circuit (C1, C2, and L2) and load resistance RL.

Figure 7-20 **Measurement circuit of balance SAW filter**

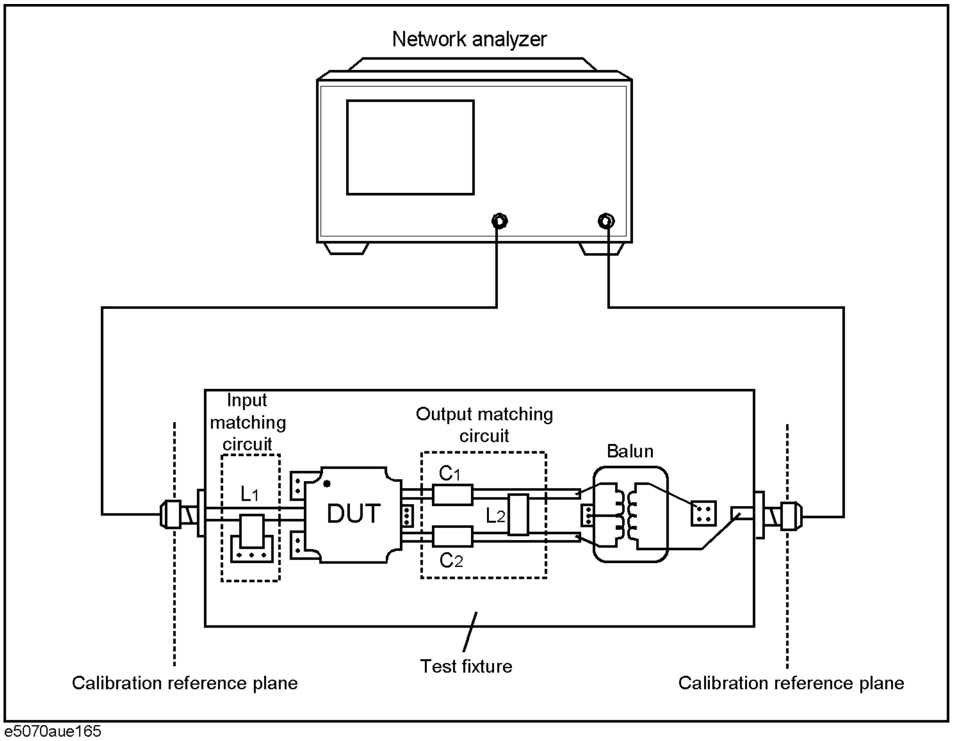


Evaluation using an actual test fixture

Generally, a test fixture as shown in Figure 7-21 is fabricated for evaluating the characteristics of a DUT in a measurement circuit by using a network analyzer.

Generally, a network analyzer performs measurements at a 50 Ω port reference impedance and in a single-ended (unbalanced) state. Therefore, DUT port 1 can be connected directly to the test port of the network analyzer. On the other hand, DUT port 2 is a balanced port that cannot be connected directly to the test port of the network analyzer. Usually, a balun (BALance-UNbalance transformer) is used to convert the DUT’s balanced port to an unbalanced port and to connect the converted port to the test port of the network analyzer. Matching circuits are mounted in the test fixture as shown in the figure.

Figure 7-21 **DUT evaluation using an actual test fixture**



Problems in measurement with an actual test fixture

Evaluating a balanced device with an actual test fixture has the following problems:

- Calibration cannot be performed at the DUT’s terminals. (A DUT’s terminals are in the test fixture and calibration standards cannot be connected to them. In addition, it is very difficult to obtain calibration standards that can be used to calibrate a balanced port.) As a result, calibration is performed at appropriate connectors connected to the test fixture, and the network between the calibration reference plane and the DUT’s terminals induces measurement errors.
- Different test fixtures must be fabricated for evaluating different types of DUTs because they require different characteristic impedances and matching circuits.
- An actual balun does not have an ideal characteristics. Measurement error cannot be avoided. Furthermore, a common mode signal evaluation cannot be performed when an actual balun is used.

DUT evaluation using the E5070B/E5071B's fixture simulator

The E5070B/E5071B's fixture simulator function simulates a test fixture by using internal software instead of using an actual test fixture for evaluating DUTs.

Figure 7-22 shows an example connection for evaluating a DUT with the E5070B/E5071B's fixture simulator function. The unbalanced port of the DUT should be directly connected to a test port of the E5070B/E5071B and the balanced port of the DUT should be connected to two other test ports of the E5070B/E5071B. The actual measurement by the E5070B/E5071B is performed at single-ended ports with a 50 Ω port reference impedance.

Figure 7-22 DUT connection when fixture simulator is used

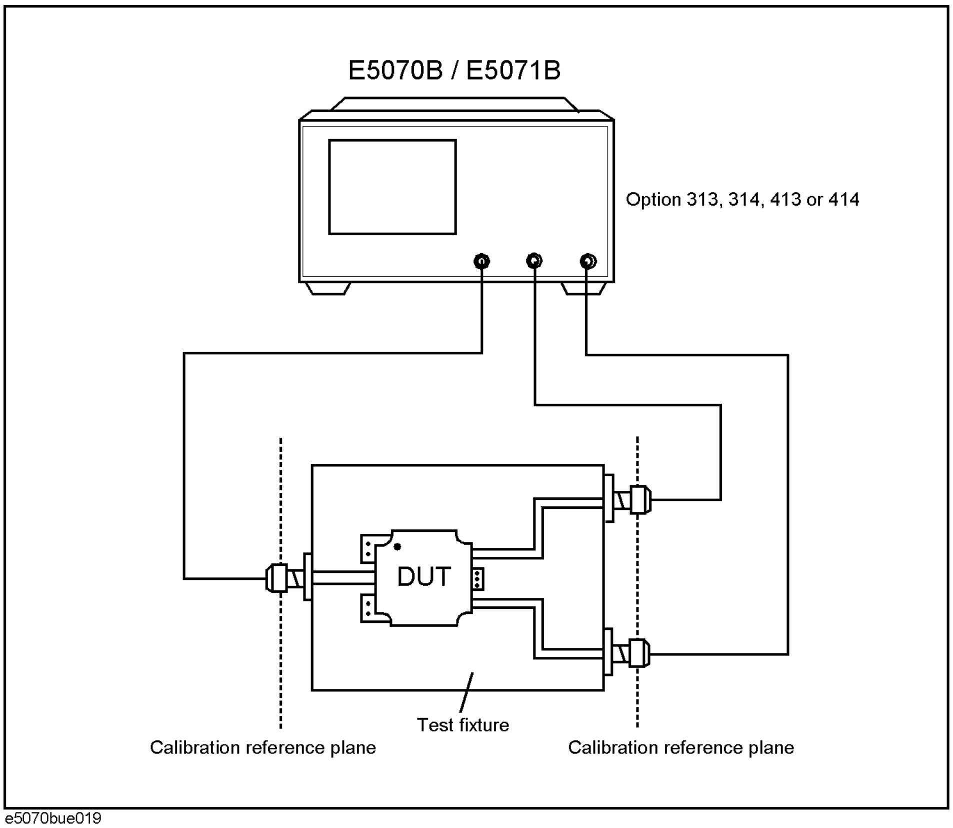
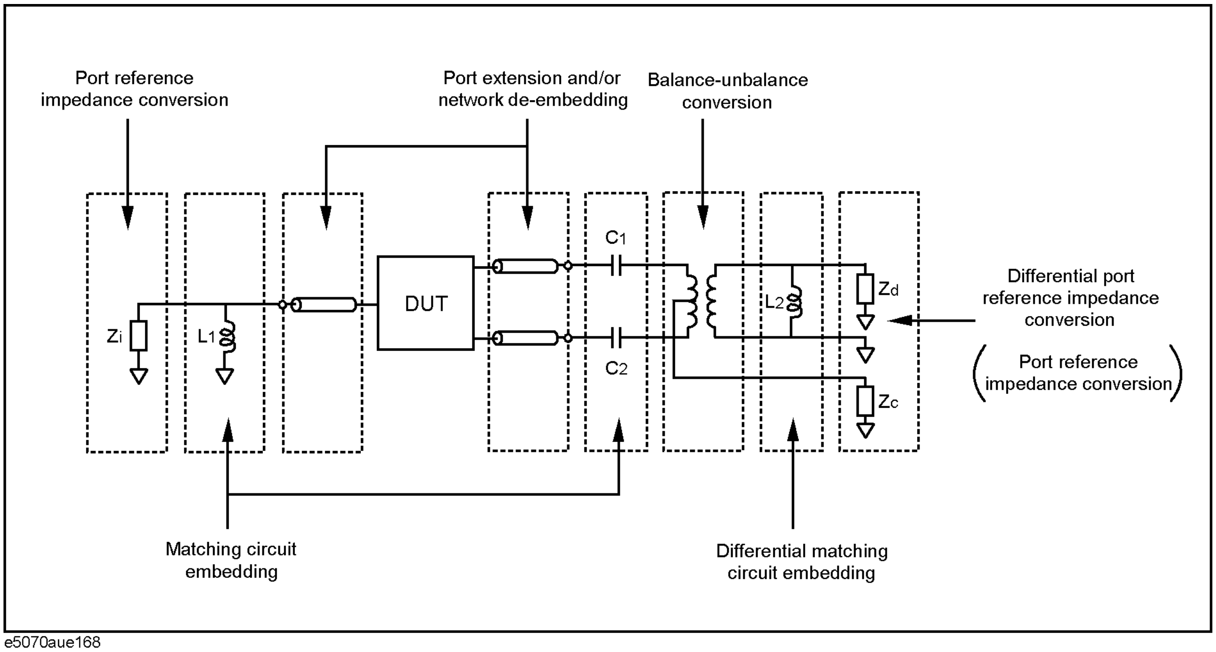


Figure 7-23 shows the measurement circuit simulated by the fixture simulator based on actual measurement with the test fixture shown in Figure 7-22.

Figure 7-23 **Measurement circuit simulated by fixture simulator**



First, the effect of an undesired network can be eliminated by port extension and/or network de-embedding. In Figure 7-22, since calibration standards cannot be connected to the DUT terminals to perform calibration, calibration should be performed at the connectors to the test fixture. Using port extension and/or network de-embedding enables you to remove an undesired network by using data processing and moving the calibration reference plane to the DUT's side equivalently. This function is performed for a single-ended port even if balance-unbalance conversion is applied to the port.

Port reference impedance conversion converts measured S-parameters to those at arbitrary port reference impedance. In Figure 7-22, since the single-ended port of the DUT is connected to the E5070B/E5071B's test port (50 Ω, single-ended), port reference impedance conversion is not required. This function is performed for a single-ended port even if balance-unbalance conversion is applied to the port.

Matching circuit embedding converts measured S-parameters to those when a matching circuit is added to the DUT's terminal. This function is performed for a single-ended port even if balance-unbalance conversion is applied to the port.

Balance-unbalance conversion converts S-parameters measured at an unbalanced state to mixed-mode S-parameters measured at a balanced state. The balanced port signal can be evaluated by using differential mode and common mode signals.

Differential matching circuit embedding converts measured S-parameters to those when a matching circuit is added to the DUT's differential mode port.

Differential port reference impedance conversion converts a differential port reference impedance to a arbitrary impedance. Port reference impedance Z [Ω] at the two single-ended ports before balance conversion is automatically converted to 2Z [Ω] for differential mode port and Z/2 [Ω] for common mode port after balance conversion. Accordingly, if port reference impedance conversion is not performed for the two single-ended ports before balance conversion, differential mode port reference impedance Zd becomes 50 Ω × 2 = 100 Ω, and common mode port reference impedance Zc becomes 50 Ω / 2 = 25 Ω. Since the differential port is terminated with 200 Ω in Figure 7-20, differential port reference impedance Zd should be set to 200 Ω.

Advantages of balanced DUT evaluation using fixture simulator

Balanced device evaluation using the fixture simulator has the following advantages:

- Calibration reference plane can be easily moved to the DUT's terminal after calibration is performed at the connectors where calibration standards can be connected. Undesired network can be removed to eliminate measurement errors (port extension, network de-embedding).
- Characteristics of a DUT, including desired matching circuits, can be obtained easily (matching circuit embedding, differential matching circuit embedding). Port reference impedance can be set freely (port reference impedance conversion, differential port reference impedance conversion).
- Differential mode and common mode signal evaluation (mixed-mode S-parameter evaluation) can be performed easily (balance-unbalance conversion).

8 Analysis in Time Domain (Option 010)

This chapter describes how to deal responses in time domain using the time domain function (Option 010).

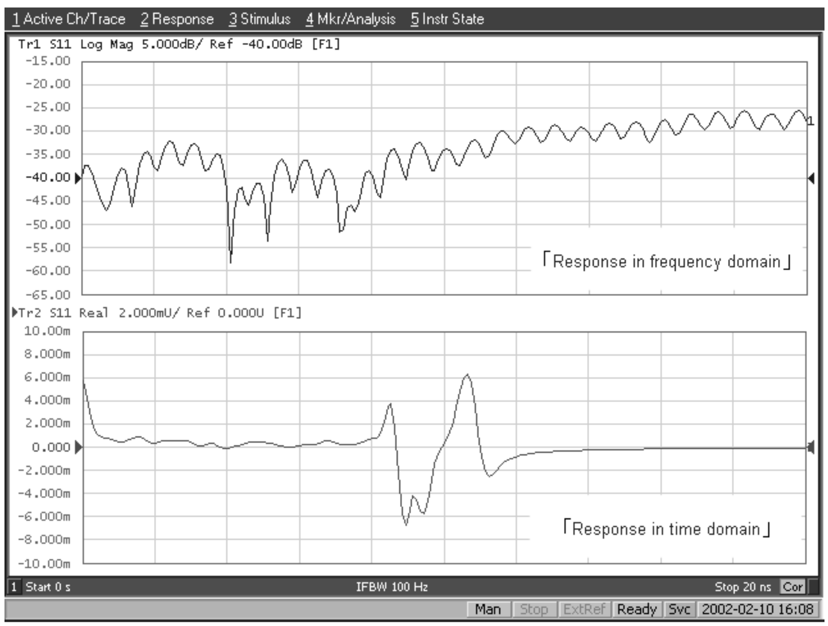
Overview

Overview of time domain measurement

The E5070B/E5071B Option 010 provides the time domain function. The time domain function is a function to mathematically transform waveforms in frequency domain that can be measured with a general network analyzer to waveforms in time domain.

Figure 8-1 shows the waveforms in frequency domain and in time domain for the same cable. The waveform in frequency domain shows ripples due to mismatches, but it is difficult to estimate their locations. On the other hand, from the waveform in time domain, you can find out the locations and magnitudes of mismatches.

Figure 8-1 **Example of measurement in time domain and in frequency domain**



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Comparison to time domain reflectometry (TDR) measurement

The time domain function of the E5070B/E5071B is similar to the time domain reflectometry (TDR) measurement in it displays the response in time domain.

In the TDR measurement, a pulse or step signal is inputted to the DUT and the change of the reflected wave over time is measured.

On the other hand, the time domain function of the E5070B/E5071B changes the frequency of the input signal to the DUT, performs measurement in frequency domain, and transforms the result to the response in time domain using the inverse Fourier transform.

Time domain function of E5070B/E5071B

The time domain function of the E5070B/E5071B is divided into the following 2 types of functions. You can use them at the same time.

- Transformation function

  Transforms measurement data in frequency domain to data in time domain. For more information, refer to “Transformation to time domain” on page 226.

- Gating function

  Deletes unnecessary data in time domain from original data in time domain. For more information, refer to “Deleting unnecessary data in time domain (gating)” on page 236.

Transformation to time domain

The transformation function lets you transform the response in frequency domain to the response in time domain.

Flow of measurement

Table 8-1 shows the flow of measurement.

Table 8-1 Flow of transformation to time domain

Item	Description
"Selecting a type" on page 227	Select the transformation type from the following. • Band pass mode You can set the sweep range arbitrarily. This is suitable for devices through which signals within a certain frequency range pass such as filters. • Low pass mode Simulates the TDR measurement. This mode is suitable for devices through which dc current or signals of many frequencies pass such as cables. The low pass mode provides 2 types of modes: low pass step and low pass impulse.
"Setting the window" on page 229	To reduce a phenomenon (ringing) in which a waveform waves caused because the frequency domain is finite, set the window.
"Calculating necessary measurement conditions" on page 230	To obtain the necessary resolution and measurement range in time domain, calculate the following values. • Sweep range • Number of points • Window width
"Setting the frequency range and the number of points" on page 234	Set the sweep range and the number of points to the values calculated above.
"Setting display range" on page 234	Set the range displayed on the graph.
"Enabling transformation function" on page 235	Enables the transformation function.

Selecting a type

There are 2 types of transformation to time domain: band pass and low pass. The appropriate transformation type differs depending on the DUT.

Comparison between the band pass mode and the low pass mode

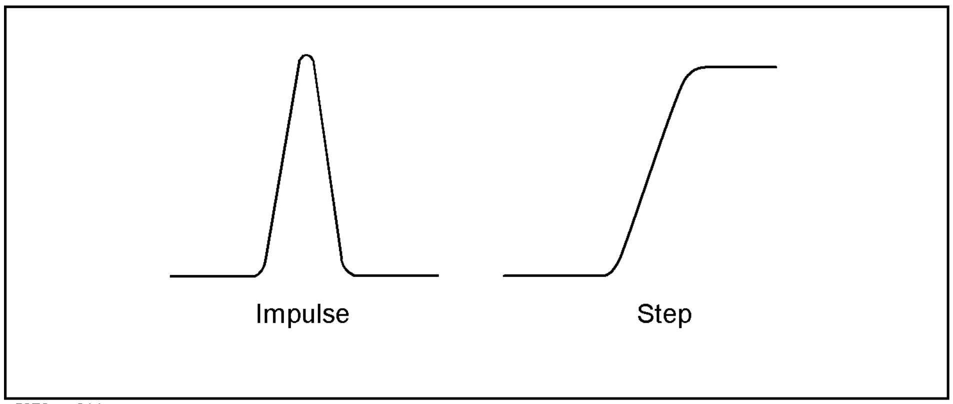
<table>
<tr><th>Item</th><th>Band pass</th><th>Low pass</th></tr>
<tr><td>Appropriate DUT</td><td>DUTs that do not operate with dc current such as band pass filters.</td><td>DUTs that operate with dc current such as cables.</td></tr>
<tr><td>Input signal</td><td>You can simulate the response to the impulse signal.</td><td>You can simulate the TDR measurement. You can simulate the response to both the impulse signal and step signal.</td></tr>
<tr><td>Selection of the sweep range</td><td>You can select the sweep range arbitrarily.</td><td>Because dc data is estimated from the first several points, the frequencies of measurement points must be multiples of the start frequency.</td></tr>
<tr><td>Transmission/reflection measurement</td><td>You can perform both transmission and reflection measurements.</td><td>You can perform both transmission and reflection measurements.</td></tr>
<tr><td>Identification of mismatches</td><td>You can identify the locations of mismatches.</td><td>You can identify the locations of mismatches and the type of impedance (capacitive or inductive).</td></tr>
<tr><td>Resolution</td><td></td><td>The resolution in time domain improves two times compared to the band pass mode.</td></tr>
<tr><td>Available data format</td><td>❑ Liner magnitude format
In the reflection measurement, it indicates the mean of the reflection coefficient within the frequency sweep range.
In the transmission measurement, it indicates the mean of the transmission coefficient within the frequency sweep range.
❑ Log magnitude format
In the reflection measurement, it indicates the mean of the return loss within the frequency sweep range.
In the transmission measurement, it indicates the mean of the transmission gain within the frequency sweep range.
❑ SWR format
In the reflection measurement, it indicates the mean of SWR (standing wave ratio) within the frequency sweep range.</td><td>❑ Real format
In the low pass mode, the real format is useful because the time axis data does not have phase information.</td></tr>
</table>

Impulse signal and step signal

The E5070B/E5071B lets you simulate the response from the DUT to 2 types of signals: impulse signal and step signal. The impulse signal is a pulse-shape signal in which the voltage rises from 0 to a certain value and returns to 0 again. The pulse width depends on the frequency sweep range. The step signal is a signal in which the voltage rises from 0 to a certain value. The rise time depends on the maximum frequency within the frequency sweep range.

NOTE For more information on how the frequency span setting affects the pulse width and the rise time, refer to "Calculating necessary measurement conditions" on page 230.

Figure 8-2 **Step signal and impulse signal**



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Operation

Step 1. Press Channel Next (or Channel Prev) and Trace Next (or Trace Prev) to activate a trace for which you want to set the transformation type.

Step 2. Analysis - Press **Transform** to display the "Transform" menu.

Press

Step 3. **Type** and then press one of the following softkeys to specify the type.

Softkey	Function
Bandpass	Sets the transformation type to "band pass."
Lowpass Step	Sets the transformation type to "lowpass step."
Lowpass Imp.	Sets the transformation type to "lowpass impulse."

Step 4. Press Format to display the "Format" menu and then select the data format.

Setting the window

Because the E5070B/E5071B transforms data within a finite frequency domain to data in time domain, unnatural change of data at the end points within the frequency domain occurs. For this reason, the following phenomena occur.

- The width of the impulse signal and the rise time of the step signal

  The time width occurs in the impulse signal and the rise time occurs in the step signal.

- Sidelobe

  Sidelobes (small peaks around the maximum peak) occur in the impulse signal and the step signal. Ringing occurs on the trace due to sidelobes, which reduces the dynamic range.

By using the window function, you can lower the level of sidelobes. However, the width of the impulse and the rise time of the step become larger as a penalty. You can select from 3 types of windows: maximum, normal, and minimum. Table 8-1 shows the relation between the window and the sidelobe/impulse width.

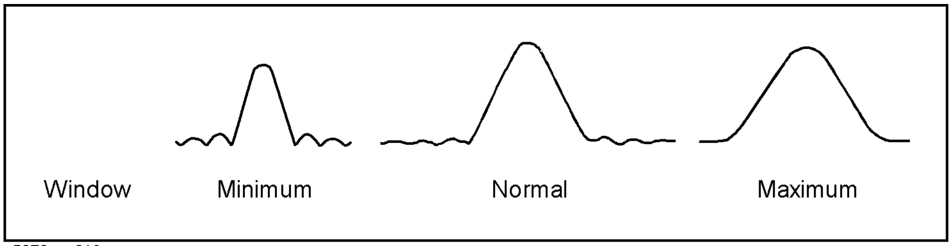
Table 8-2 Characteristics of window

Window	Sidelobe level of the impulse signal	Width of the impulse (50% in low pass mode[*1])	Sidelobe level of the step signal	Rise time of the step signal (10 – 90%)
Minimum	−13 dB	0.60/frequency span	−21 dB	0.45/frequency span
Normal	−44 dB	0.98/frequency span	−60 dB	0.99/frequency span
Maximum	−75 dB	1.39/frequency span	−70 dB	1.48/frequency span

*1. The value in the band pass mode is 2 times the value in the low pass mode.

The window function is available only when the response in time domain is displayed. It dose not have any effect when the response in frequency domain is displayed. Figure 8-3 shows the effect of the window when measuring the reflection of a short circuit in time domain.

Figure 8-3 Effect of window on response from a short circuit in time domain



Operation

Step 1. Press Channel Next (or Channel Prev) and Trace Next (or Trace Prev) to activate a trace for which you want to set the window.

Step 2. Press Analysis - Press **Transform** to display the “Transform” menu.

Step 3. **Window** and then select a window type.

Softkey	Function
Maximum	Sets the window type to maximum. β of the Kaiser Bessel function is set to 13.
Normal	Sets the window type to normal. β of the Kaiser Bessel function is set to 6.
Minimum	Sets the window type to minimum. β of the Kaiser Bessel function is set to 0.
Rise Time	Sets the window by specifying the impulse width or the step rise time. The lower limit you can set is the value when the window is the minimum; the upper limit when the window is the maximum.
Kaiser Beta	Sets the window by specifying the β value of the Kaiser Bessel function. The Kaiser Bessel function is a function to determine the shape of the window. The allowable setting range is 0 to 13.

NOTE By specifying **Kaiser Beta, Impulse Width**, or **Rise Time**, you can specify a window that is not classified into the 3 window types. When you specify a window type, these values are set automatically.

Calculating necessary measurement conditions

To use the transformation function efficiently, you need to make the following 2 settings appropriately.

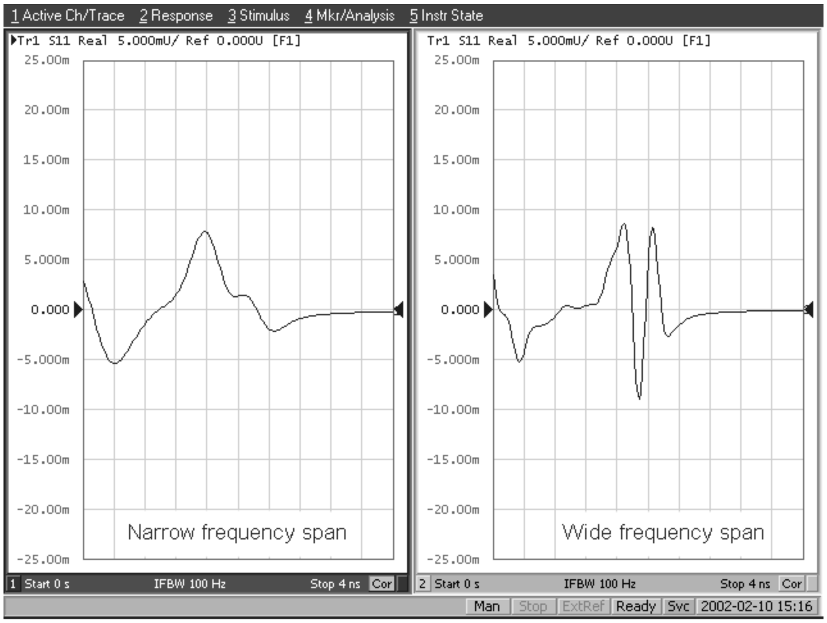
- Resolution of the response
- Measurement range
- Sidelobe

This section describes the settings of these conditions.

Effect of frequency sweep range on response resolution

Figure 8-3 shows an example when measuring the same cable while changing the sweep span. When measured in a narrower sweep range, the overlap between 2 peaks is larger than when measured in a wider sweep range. By performing measurement in a wider sweep range, adjacent peaks can be clearly separated, which means that the response resolution is smaller.

Figure 8-4 **Effect of frequency sweep range on resolution**



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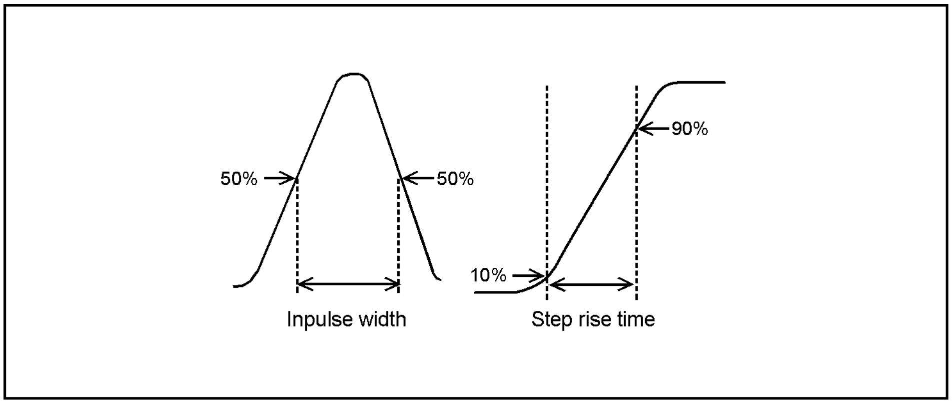
The sweep range affects the width of the impulse signal and the rise time of the step signal. The width of the impulse signal and the rise time of the step signal are inversely proportional to the sweep range. Therefore, the wider the sweep range is, the shorter these times are.

The resolution is equal to the width defined at the point of 50% of the impulse signal or the rise time defined at the points of 10% and 90% of the step signal. (Figure 8-5)

Figure 8-5 **Definition of the impulse width and the step rise time**



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Effect of the window function on the response resolution

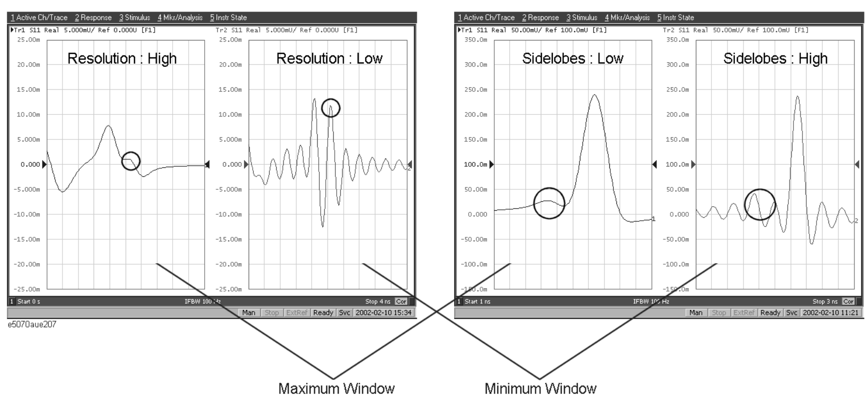
Lowering the sidelobe level with the window function elongates the width of the impulse signal and the rise time of the step signal. As described in “Effect of frequency sweep range on response resolution” on page 231, because the response resolution is equal to the width of the impulse signal and the rise time of the step signal, lowering the sidelobe level enlarges the response resolution. Table 8-1 shows the relation between the response resolution and the window setting.

Table 8-3 The shape of window and response resolution

Window	Low pass step	Low pass impulse	Band pass
Minimum	0.45/frequency span	0.60/frequency span	1.20/frequency span
Normal	0.99/frequency span	0.98/frequency span	1.95/frequency span
Maximum	1.48/frequency span	1.39/frequency span	2.77/frequency span

Figure 8-6 shows how the response changes when changing the window shape. You can see that, if the magnitudes of adjacent peaks are comparable, you need to make the resolution higher and, if they differ significantly, you need to set the window so that smaller peaks with lower sidelobes appear.

Figure 8-6 Effect of window on response resolution



Effect of the transformation type on the response resolution

Although both transformation types, band pass and low pass impulse, simulate the response of the impulse signal, the impulse width in the low pass impulse mode is half the width in the band pass mode as shown in Table 8-1. Therefore, the resolution is better in the low pass mode. If the DUT can be measured in the low pass mode, response data with better resolution is obtained in the low pass mode.

Measurement range

In the time domain function, the measurement range means the range within which the response can be measured without repetition. The repetition of the response occurs because measurement in frequency domain is performed discretely instead of continuously. The measurement range is inversely proportional to the frequency difference between adjacent measurement points. The frequency difference between measurement points ΔF is expressed as follows using the span of the sweep frequency F_{span} and the number of points N_{meas}.

$$\Delta F = \frac{F_{span}}{N_{meas} - 1}$$

Therefore, the measurement range is proportional to (the number of points− 1) and inversely proportional to the span of the sweep range. To enlarge the measurement range, use one of the following methods:

- Increase the number of points.
- Narrow the span of the sweep range.

NOTE When you change the above settings after performing calibration, you need to perform calibration again.

The sweep range is expressed as time or distance. The time of the measurement range T_{span} is as follows:

$$T_{span} = \frac{1}{\Delta F}$$

The distance of the measurement range L_{span} is expressed as follows using the velocity factor V and the speed of light in a vacuum c (3×10^8 m/s).

$$L_{span} = \frac{Vc}{\Delta F}$$

NOTE The maximum length of the DUT that can be measured in the transmission measurement is L_{span}. On the other hand, in the reflection measurement, because the signal goes and returns, it is 1/2 of L_{span}.

The velocity factor varies depending on the material through which the signal propagates. For polyethylene, it is 0.66; for Teflon, 0.7.

The change of the setting and the change of the response

Table 8-1 shows the effect of the change of the measurement conditions on the response resolution and the measurement range.

Table 8-4 Effect of setting changes

Change of setting	Response resolution	Measurement range	Sidelobe
Widen the sweep range.	Becomes smaller.	Becomes narrower.	Does not change.
Sets the window type to maximum.	Becomes larger.	Does not change.	Becomes lower.
Increase the number of points.	Does not change.	Becomes wider.	Does not change.

Setting the frequency range and the number of points

Operation

Step 1. Press Channel Next (or Channel Prev) to activate a channel you want to set.

NOTE The frequency range and the number of points are common to all the traces in the channel. If you want to use different settings, make them on another channel.

Step 2. Sweep Setup - Press **Sweep Type** - **Lin Freq** to set the sweep type to “linear sweep.”

NOTE When the sweep type is set to other than the “linear sweep,” the time domain function is not available.

Step 3. Use the following keys to set the sweep range.

Key stroke	Function
Start	Sets the start frequency.
Stop	Sets the stop frequency.
Center	Sets the center frequency.
Span	Sets the frequency span.

Step 4. Sweep Setup - Press **Points** and then enter the number of points.

Step 5. When performing measurement in the low pass mode, press Analysis - **Transform** - **Set Freq Low Pass** to adjust the frequency range so that it is appropriate for the low pass mode. The frequency changes depending on the stop frequency as shown below.

Condition of the stop frequency	Frequency setting
> 300 kHz × the number of points	Start frequency = stop frequency/number of points
< 300 kHz × the number of points	Start frequency: 300 kHz Stop frequency = 300 kHz × number of points

When frequency settings satisfy the conditions as shown above, the **Set Freq Low Pass** key displayed in gray.

Setting display range

The E5070B/E5071B has the following limitations on the display range you can set.

Lower limit $-T_{span}$ [*1]

*1. T_{span} is the measurement range expressed in time obtained in “Measurement range” on page 233.

Upper limit T_{span} *1

The number of response points displayed on the graph is the same as the number of points regardless of the response resolution.

Operation

Step 1. Press Channel Next (or Channel Prev) and Trace Next (or Trace Prev) to activate a trace for which you want to set the display range.

Step 2. Analysis - Press **Transform** to display the "Transform" menu.

Step 3. Press each of the following softkeys and then specify the display range. At the side of the set value in the data entry bar, the distance corresponding to the set time is displayed (Figure 8-7). The displayed distance is a value taking the velocity factor into consideration.

Softkey	Function
Start	Sets the start value of the display range in time.
Stop	Sets the stop value of the display range in time.
Center	Sets the center value of the display range in time.
Span	Sets the span of the display range in time.

NOTE You cannot use hardkeys to set the display. The hardkeys are dedicated to specifying the sweep range.

Figure 8-7 **Data entry bar**

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Enabling transformation function

Operation

Step 1. Press Channel Next (or Channel Prev) and Trace Next (or Trace Prev) to activate a trace for which you want to use the transformation type.

Step 2. Analysis - Press **Transform** to display the "Transform" menu.

Step 3. Press **Transform** to enable (**ON**) the transformation function.

NOTE The following requirement must be met to enable the transformation function.

- The sweep mode is the linear sweep.
- The measurement points is three or more.

Deleting unnecessary data in time domain (gating)

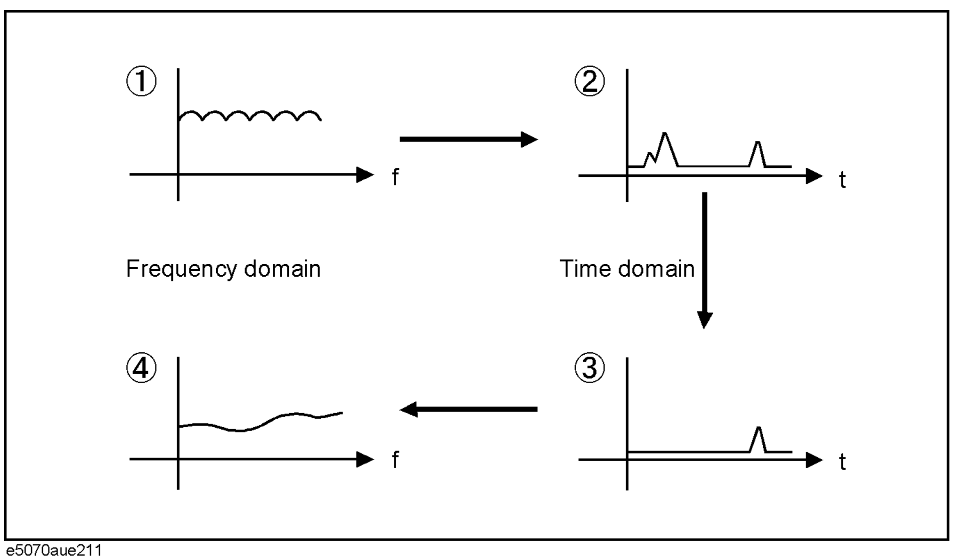
Flow of measurement

Table 8-1 shows the flow of measurement. Figure 8-8 shows the change of the waveform in each flow.

Table 8-5 **Measurement flow**

Item	Description
1. Measurement in frequency domain	Execute measurement in frequency domain.
2. Transformation to time domain	Enable the transformation function and transform measurement data to data in time domain.
3. Setting the gate	To select a necessary domain, make the following settings of the gate. • Gate type • Gate shape • Gate range
4. Transforming the data back to data in frequency domain	Disable the transformation function and display the response in frequency domain corresponding to the data selected with the gate.

Figure 8-8 **Measurement flow**



Setting gate type

The E5070B/E5071B lets you choose from the following 2 gate types:

Gate type	Description
Band pass	Deletes the response outside the gate range.
Notch	Deletes the response inside the gate range.

Operational procedure

Step 1. Press Channel Next (or Channel Prev) and Trace Next (or Trace Prev) to activate a trace for which you want to set the gate type.

Step 2. Analysis - Press **Gating** to display the “Gating” menu.

Step 3. Press **Type** to toggle between band pass (**Bandpass**) and notch (**Notch**).

Setting gate shape

The gate is a filter whose shape looks like a band pass filter. There are several parameters that indicate the gate shape. Figure 8-9 shows the definitions of them.

Figure 8-9 **Parameters of gate shape**

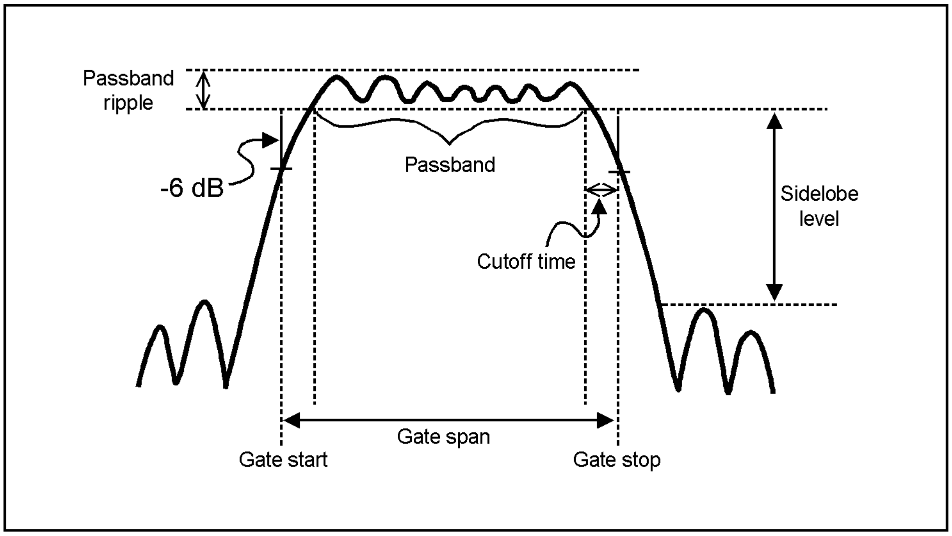


Table 8-1 shows the comparison of the characteristics depending on the gate shape. When the shape is “minimum,” the cutoff time is shorter and the response is deleted abruptly, but the sidelobe level and band pass ripples become larger. When it is “maximum,” cutoff is gentler, but the sidelobe level and the band pass ripple become smaller. The minimum gate span in Table 8-1 is the minimum gate range you can set. This value is defined as the minimum gate span necessary for the existence of the pass band and is equal to 2 times the cutoff time.

Table 8-6 **Comparison of characteristics of gate**

Gate shape	Passband ripple	Sidelobe level	Cutoff time	Minimum gate span
Minimum	±0.13 dB	−48 dB	1.4/frequency span	2.8/frequency span
Normal	±0.01 dB	−68 dB	2.8/frequency span	5.6/frequency span
Wide	±0.01 dB	−57 dB	4.4/frequency span	8.8/frequency span
Maximum	±0.01 dB	−70 dB	12.7/frequency span	25.4/frequency span

Operational procedure

Step 1. Press Channel Next (or Channel Prev) and Trace Next (or Trace Prev) to activate a trace for which you want to set the gate shape.

Step 2. Analysis - Press **Gating** to display the “Gating” menu.

Step 3. Press **Shape** and then select the gate shape from the following.

Softkey	Function
Maximum	Sets the gate shape to “maximum.”
Normal	Sets the gate shape to “normal.”
Wide	Sets the gate shape to “wide.”
Minimum	Sets the gate shape to “minimum.”

Setting gate range

Specify the gate range in time. The ends of the range are defined as the −6 dB attenuation points shown in Figure 8-9. You can set the gate range by specifying the start and stop times or the center and span. The E5070B/E5071B has the following limitations on the gate range you can set.

Lower limit $-T_{span}$ [*1]

Upper limit T_{span} [*1]

Operational procedure

Step 1. Press Channel Next (or Channel Prev) and Trace Next (or Trace Prev) to activate a trace for which you want to set the gate range.

Step 2. Analysis - Press **Gating** to display the “Gating” menu.

Step 3. Press each of the following softkeys to specify the gate range. At the side of the set value in the data entry bar, the distance corresponding to the set time is displayed as shown in Figure 8-7. The displayed distance is a value taking the velocity factor into consideration.

Softkey	Function
Start	Sets the start time.
Stop	Sets the stop time.
Center	Sets the center of the gate in time.
Span	Sets the gate span in time.

NOTE No Hardkey is provided for this setting. The hardkeys are dedicated to setting the sweep range.

*1. T_{span} is the measurement range expressed in time obtained in “Measurement range” on page 233.

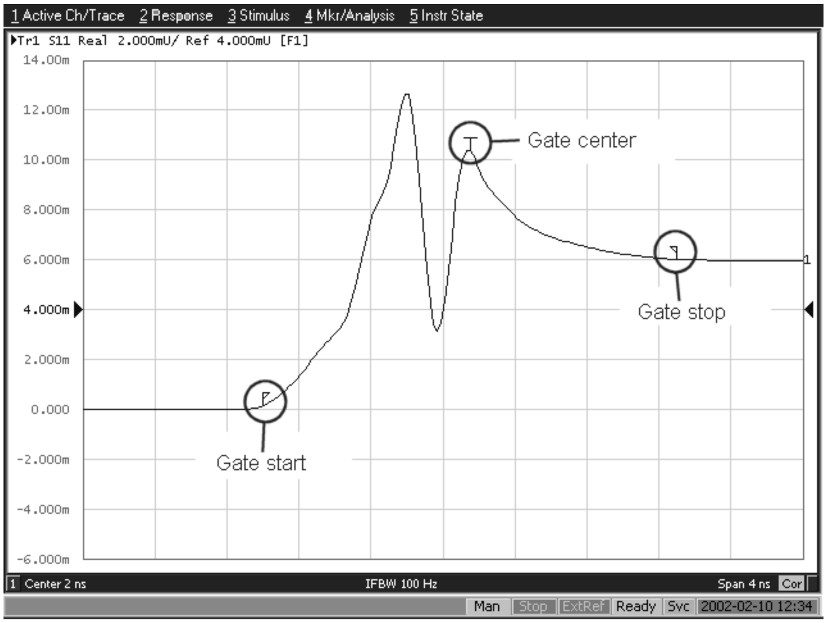
NOTE You can set the center and span by dragging and dropping flags indicating the gate range (Figure 8-10).

Enabling gating function

When you enables the gating function, data within the specified range is deleted. When the transformation function is enabled, the flags indicating the gate range is displayed as shown in Figure 8-10.

NOTE In Figure 8-10, the gate type is set to band pass. When it is set to notch, the directions of the flags indicating the ends of the gate range are reversed.

Figure 8-10 **Screen when transformation function and gate function are enabled**



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Operational procedure

Step 1. Press Channel Next (or Channel Prev) and Trace Next (or Trace Prev) to activate a trace for which you want to use the gate function.

Step 2. Analysis - Press **Gating** to display the "Gating" menu.

Step 3. Use **Gating** to enable (**ON**) the gate function.

Characteristics of response in time domain

This section describes masking and the identification of the mismatch type that are important for analyzing the response in time domain.

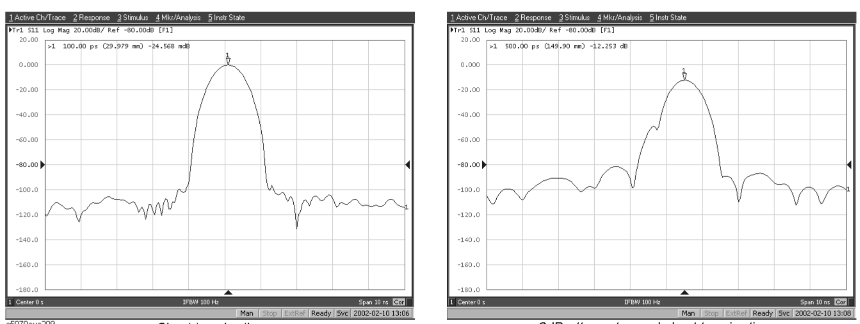
Masking

Masking is a phenomenon in which a mismatch at a location near the calibration surface affects the response at the next mismatch location. This occurs because energy reflected by a mismatch at a location nearest to the calibration surface does not reach the next mismatch location. For example, when you measure the reflection of a cable that has 2 mismatch locations reflecting 50% of the input voltage, the first mismatch reflects 50% of the measurement signal. The remaining 50% reaches the next mismatch and its 50%, which is 25% of the entire measurement signal, is reflected. Therefore, in the response in time domain, the 2nd mismatch looks smaller.

NOTE In this example, the transmission line is assumed to have no loss. However, because there is loss in fact, the signal is attenuated as the distance from the calibration surface becomes greater.

Figure 8-11 shows an example of masking due to loss. It compares masking when a short termination is directly connected to the calibration surface and masking when a 6-dB attenuator is inserted. In either case, total reflection occurs at the short termination. In the latter case, the signal is attenuated in both ways, the return loss looks –12 dB.

Figure 8-11 **Example of masking**



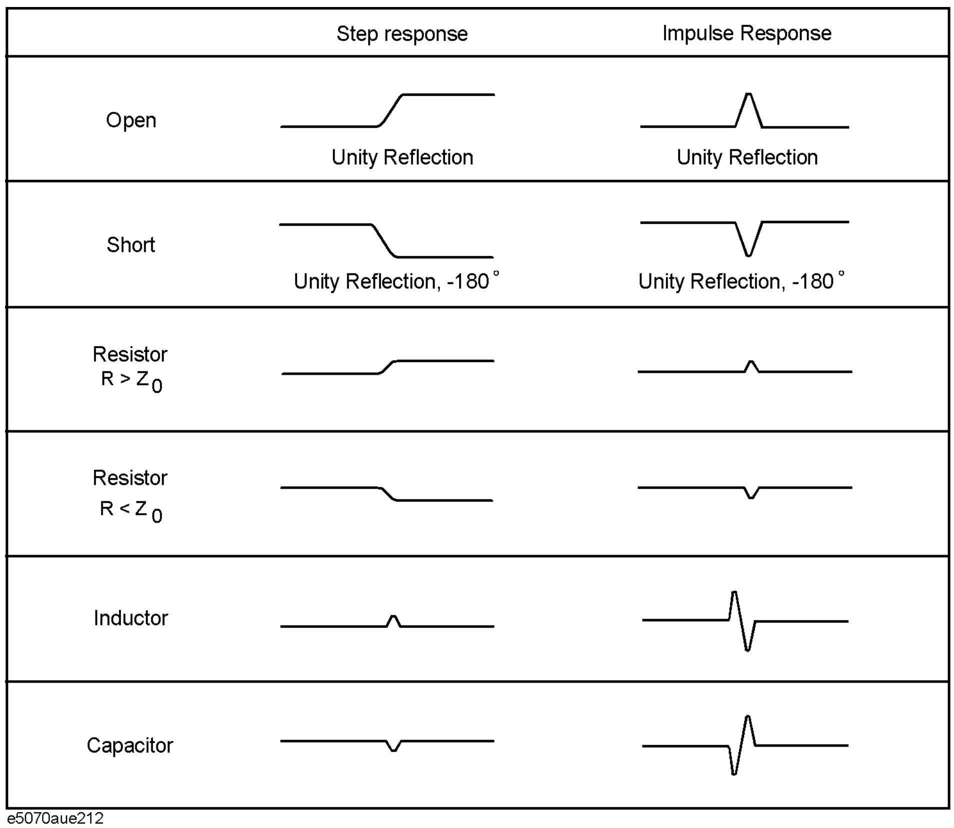
Short termination   6dB attenuator and short termination

Identifying mismatch type

The transformation in the low pass mode simulates the response in the TDR measurement. In addition to mismatch locations, the response includes information on the mismatch type.

Figure 8-12 shows each mismatch type and the response waveform corresponding to it. In the low pass mode, you can simulates the response of the step signal and the impulse signal. From the viewpoint of mathematics, the response of the impulse signal is the waveform obtained by differentiating the response of the step signal.

Figure 8-12 **Mismatch type and response in low pass mode**



9 Data Output

This chapter explains the concepts behind saving/recalling internal data and printing the information that is displayed on the screen. Procedures for performing these tasks with the Agilent E5070B/E5071B are also given.

Saving and Recalling Instrument State

You can save the instrument state of the E5070B/E5071B into a file on the mass storage (hard disk drive or floppy disk drive) and then recall it later to reproduce that state. You can select the stored data from the following 4 types.

Table 9-1 Stored data

Type	Stored data and usage
State only (State Only)	Saves the setting[*1] of the E5070B/E5071B and reproduces the state when it was saved by recalling it later into the E5070B/E5071B.
State and calibration data (State & Cal)	Saves the setting[*1] of the E5070B/E5071B and calibration data (calibration coefficient array [*2]) to reproduce the state when it was saved by recalling it later into the E5070B/E5071B. At this time, you can perform error correction of measured values using the recalled calibration data.
State and trace (State & Trace)	Saves the setting[*1] of the E5070B/E5071B and traces (error corrected data array [*2] and error corrected memory array[*2]) to reproduce the state when it was saved by recalling it later into the E5070B/E5071B. At this time, the traces are also recalled and displayed on the screen.
State, calibration data, and traces (All)	Saves the setting[*1] of the E5070B/E5071B, calibration data, and traces to reproduce the state when it was saved by recalling it later into the E5070B/E5071B. At this time, the calibration data and traces are also recalled.

*1. For information on the saved target, refer to Appendix C, "List of Default Values,".
*2. For information on each array, refer to "Data Processing" on page 514.

Compatibility of files related to saving and recalling

The compatibility of saving/recalling the instrument state file is as follows:

❑ Compatibility between different models

- Files saved with the E5070B cannot be recalled with the E5071B.
- Files saved with the E5070A can be recalled with the E5070B but the opposite is not possible.
- Files saved with the E5071A can be recalled with the E5071B but the opposite is not possible.

		Recall			
		E5070B[*1]	E5071B[*2]	E5070A	E5071A
Saving	E5070B[*1]	Y	N	N	N
	E5071B[*2]	N	Y	N	N
	E5070A	Y	N	Y	N
	E5071A	N	Y	N	Y

Y: Recall is possible. N: Recall is impossible.

*1. The E5070A to which the power sweep feature is added is included.
*2. The E5071A to which the power sweep feature is added is included.

❑ Compatibility between models that have different options (the number of ports and power range expansion)

- If the stored data is “state only (**State Only**),” files saved with a model having a smaller number of ports can be recalled with a model having a larger number of ports but the opposite is not possible.
- Files saved with a model not having the power range expansion feature can be recalled with a model having the power range expansion feature but the opposite is not possible.

				Recall					
	Power range expansion			Without			With		
		Number of ports		2	3	4	2	3	4
			Option number	213	313	413	214	314	414
Saving	Without	2	213	Y	Y/c	Y/c	Y	Y/c	Y/c
		3	313	N	Y	Y/c	N	Y	Y/c
		4	413	N	N	Y	N	N	Y
	With	2	214	N	N	N	Y	Y/c	Y/c
		3	314	N	N	N	N	Y	Y/c
		4	414	N	N	N	N	N	Y

Y: Recall is possible. N: Recall is impossible.

Y/c: Only when the stored data is “state only (**State Only**),” recall is possible.

❑ Compatibility when the maximum number of channels/traces is different

- You cannot recall files saved by specifying all changes/traces (**All**) as the save target.
- If the number channels/traces at recall does not exceed that at save, you cannot recall files saved by specifying the displayed change/trace (**Disp Only**) as the save target.

NOTE If you recall an incompatible file, an error occurs and the presetting is recovered.

Save procedure

Selecting content to be saved

NOTE This setting takes the effect both when saving the entire instrument state into a file and when saving the instrument state for each channel into memory.

Step 1. Press Save/Recall.

Step 2. Press **Save Type**.

Step 3. Press the softkey corresponding to the content of the instrument state you want to save.

Softkey	Function
State Only	Selects saving the state of the E5070B/E5071B only.
State & Cal	Selects saving the state and calibration data of the E5070B/E5071B.
State & Trace	Selects saving the state and traces of the E5070B/E5071B.
All	Selects saving the state, calibration data, and traces of the E5070B/E5071B.

Selecting save target channel/trace

Step 1. Press Save/Recall.

Step 2. Press **Channel/Trace** and select the save target from all channels/traces (**All**) or displayed channel/traces only (**Disp Only**).

If you specify the displayed channel/traces only as the save target, you can reduce the file size. However, for channels/traces that are not displayed, you cannot recall and reproduce the instrument state separately held for each channel/trace at a later time.

Saving Instrument State

Follow the procedure below to save internal data from the E5070B/E5071B.

Step 1. Press Save/Recall.

Step 2. Press **Save State**.

Step 3. When you want to use a pre-defined file name (State01.sta - State08.sta, Autorec.sta)

Press **State01** - **State08** or **Autorec**.

NOTE If “A:\Autorec.sta” or “D:\Autorec.sta” is found on the system at startup, the E5070B/E5071B is automatically configured using the saved settings. When both files are found, “A:\Autorec.sta” is recalled. To disable the auto recall function, delete the Autorec.sta files.

NOTE An asterisk (*) in the upper right of the softkey indicates that, the corresponding file of the softkey already exist. If you save into the existing file, the existing file is copied as “backup.sta” and then it is overwritten.

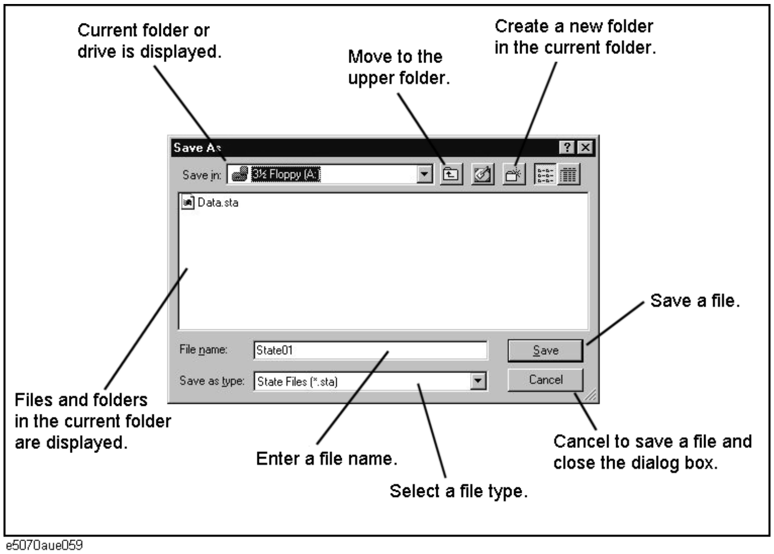
When you want to use other file name or a file name on the floppy disk

1. Press **File Dialog...** to open the Save As dialog box. Figure 9-1 explains the Save As dialog box.

2. Select the folder and input a file name using the external keyboard and mouse.

3. Click **Save**

Figure 9-1 **Save As Dialog Box**



On the E5070B/E5071B, the following drives are available for saving/recalling files. Select the appropriate drive from the **Save In** pull-down menu shown in Figure 9-1

Drive	Description
3 1/2 Floppy [A:]	Select this drive when saving or recalling a file to/from a floppy disk*1.
[D:]	Select this drive when saving or recalling a file to/from the hard disk drive (D drive).

*1. When using the built-in floppy disk drive on the E5070B/E5071B, insert a 1.44 MB floppy disk formatted in DOS format.

NOTE **Do not modify any files and folders in drives other than drive A: and drive D:. Doing so will cause malfunctions.**

NOTE **Do not press the disk eject button while the floppy disk access lamp is on.** Trying to forcefully pull the floppy disk out while the lamp is on may damage the floppy disk or disk drive.

Recall procedure

Follow the procedure below to recall internal data from the E5070B/E5071B.

NOTE If you recall the file that includes traces (its content was set to **State &Trace** or **All** when it was saved), the trigger source is automatically set to Manual.

Step 1. Press Save/Recall.

Step 2. Press **Recall State**.

Step 3. When you want to recall State01.sta - State08.sta, Autorec.sta

Press **State01** - **State08** or **Autorec**.

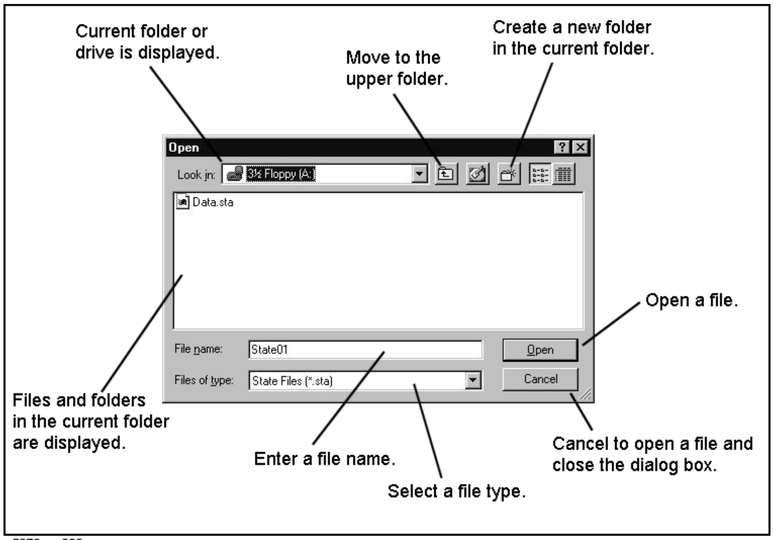
When you want to recall other files

1. Press **File Dialog...** to open the Open dialog box. Figure 9-2 describes the Open dialog box

2. Select the folder and the file using the external keyboard and mouse.

3. Click **Open**.

Figure 9-2 **Open Dialog Box**



e5070aue060

NOTE **Do not press the disk eject button while the floppy disk access lamp is on.** Trying to forcefully pull the floppy disk out while the lamp is on may damage the floppy disk or disk drive.

NOTE When a user file is used in “Extending the Calibration Plane Using Network De-embedding” on page 199, “Determining Characteristics After Adding a Matching Circuit” on page 201, or “Determining the Characteristics that Result from Adding a Matching Circuit to a Differential Port” on page 216 and the setup status is saved, the recall error will occur if the user file is not located in the previous folder when the state is saved.

Saving/recalling instrument state for each channel into/from memory

The E5070B/E5071B allows you to save/recall the instrument state for each channel only. This function lets you save the instrument state of the active channel only that is specified independently for each channel into one of registers A to D (volatile memory) and recall the instrument state saved in one of registers A to D to restore it as the state of the active channel. Like when saving the entire state of the instrument into a file, you can select items to be saved from 4 kinds (refer to Table 9-1).

Because you can call the instrument state for each channel saved with this function from a channel different from the channel used when it was saved, you can use this function to copy an instrument state between channels.

NOTE Unlike when saving the entire instrument state, the instrument state for each channel is saved into volatile memory instead of a file and therefore, if you turn off the power, it is lost.

Operational procedure

Saving instrument state for each channel

Step 1. Press Channel Next or Channel Prev to activate a channel whose state you want to save.

Step 2. Press Save/Recall.

Step 3. Press **Save Channel**.

Step 4. Press one of **State A** to **State D** to save the instrument state of the active channel to the specified register.

NOTE For registers having saved data, the * symbol is displayed to the right of their softkey label. If you specify one of them, it is overwritten.

Recalling instrument state for each channel

Step 1. Press Channel Next or Channel Prev to activate a channel whose state you want to recall and restore.

Step 2. Press Save/Recall.

Step 3. Press **Recall Channel**.

Step 4. Press the softkey of the register in which the state you want to restore is saved. The instrument state for the channel is recalled to the active channel.

Deleting the saved instrument states (clearing all the registers)

Step 1. Press Save/Recall.

Step 2. Press **Save Channel**.

Step 3. Press **Clear States**. The contents of all the registers are deleted.

Saving Trace Data to a File

Saving data as a CSV file

The E5070B/E5071B allows the user to save data for the active trace on the active channel as a CSV file (file extension *.csv) and load the data into PC application software for further processing.

Trace data will be saved in the format shown below.

Example 9-1 **Example of Saved Trace Data**

```
"# Channel 1"
"# Trace 1"
Frequency,            Formatted Data,      Formatted Data
+3.00000000000E+005, +1.41837599227E-002, +1.43446459328E-006
+4.27985000000E+007, +1.41275293412E-002, +2.02407834551E-004
+8.52970000000E+007, +1.41334093048E-002, +4.00643331604E-004
+1.27795500000E+008, +1.41240661092E-002, +6.09250514670E-004
+1.70294000000E+008, +1.41402155348E-002, +8.05620003993E-004
```

The first line shows the number of the active channel at the time the data was saved.

The second line shows the number of the active trace at the time the data was saved.

The third line is a header line indicating the contents of each trace data written on the fourth line onward.

The fourth line onward show the trace data. The amount of data is determined by the number of points (frequency) assigned to the trace.

Saving Trace Data

Follow the procedure below to save trace data from the E5070B/E5071B.

Step 1. Press [Channel Next] or [Channel Prev] to select the channel that contains the trace to be saved.

Step 2. Press [Trace Next] or [Trace Prev] to select the trace to be saved.

Step 3. Press [Save/Recall] to open the Save/Recall menu.

Step 4. Press **Save Trace Data** to open the Save As dialog box. When the dialog box appears, use the external keyboard and mouse to complete the task. For more information on the Save As dialog box, see Figure 9-1, “Save As Dialog Box,” on page 247. Note that “CSV Files (*.csv)” will already be selected as the file type when the dialog box first opens.

Step 5. Select the destination folder and input a file name. Press **Save** to save the file.

NOTE **Do not press the disk eject button while the floppy disk access lamp is on.** Trying to forcefully pull the floppy disk out while the lamp is on may damage the floppy disk or disk drive.

9. Data Output

Saving data in Touchstone format

Use the following VBA macro to save measurement data into a file in Touchstone format.

Folder	VBA macro name (project name)
D:\Agilent	SaveToTouchstone.vba

NOTE Don't delete this VBA macro. This VBA macro can not be restored by executing system recovery.

This VBA macro saves measurement data of any channel into a Touchstone format file, based on 1 to 4 port models.

NOTE You can save data in "real number - imaginary number", "dB - angle" or "amplitude - angle."

You can use data saved in Touchstone format for a circuit simulator such as Agilent Advanced Design System (ADS) on your PC (personal computer) or workstation. For more information on the ADS, refer to the operation manual that comes with the system.

NOTE You cannot recall data saved in Touchstone format on the E5070B/E5071B.

For information on data structure in a saved file, refer to "Data structure in Touchstone file" on page 254.

Note on use

When the fixture simulator is ON and the port impedance conversion is ON, Z0 of all ports to be saved must be set to the same value.

Operating procedure

1. Starting VBA macro

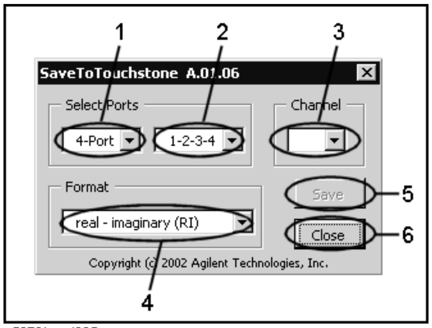
Step 1. Press **[Macro Setup]**.

Step 2. Press **Load Project**.

Step 3. The Open dialog box appears. Specify the file name "D:\Agilent\SaveToTouchstone.vba" and press the **Open** button.

Step 4. Press **[Macro Run]** to start the macro. (Refer to Figure 9-3.)

Figure 9-3 **SaveToTouchstone**



e5070bsupj005

2. Saving data

Step 1. Select the number of ports (1 in Figure 9-3) and test ports (2 in Figure 9-3).

NOTE You can selects 1 port or 2 ports as the number of ports when the maximum number of channels/traces is 16 channels/4 traces or 12 channels/6 traces.

Step 2. Select a channel (3 in Figure 9-3).

NOTE The channel selected in this step has no relation to active channel.

Step 3. Select the data saving format (4 in Figure 9-3).

real - imaginary (RI)	real and imaginary parts
magunitude - angle (MA)	linear magnitude and phase (degree)
dB - angle (DB)	logarithmic magnitude (dB) and phase (degree)

Step 4. Press the **Save** button (5 in Figure 9-3). Measurement of necessary data for the selected channel in Step 2 starts.

NOTE Regardless of state of the trigger system, measurement is automatically performed once.

NOTE Regardless of on/off state of the balance-unbalance conversion, measurement is performed without the balance-unbalance conversion.

Step 5. When the measurement is complete, the Save As dialog box appears. Specify a file name and press the **Save** button.

Step 6. When saving to the file is complete, the start screen appears again.

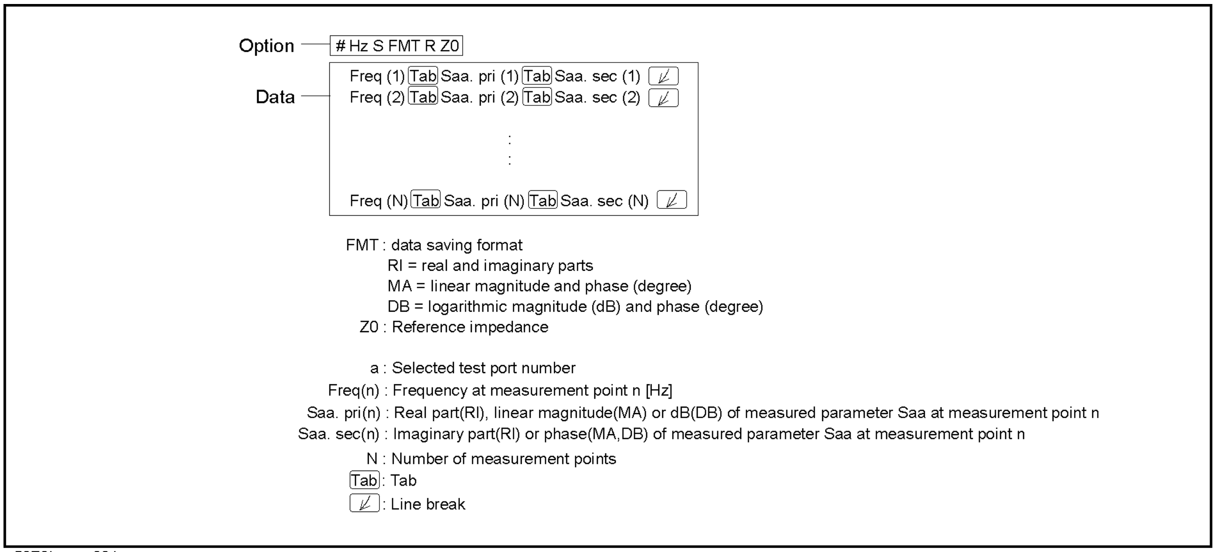
3. Closing VBA macro

Step 1. Press the **Close** button (6 in Figure 9-3) to exit from the macro.

Data structure in Touchstone file

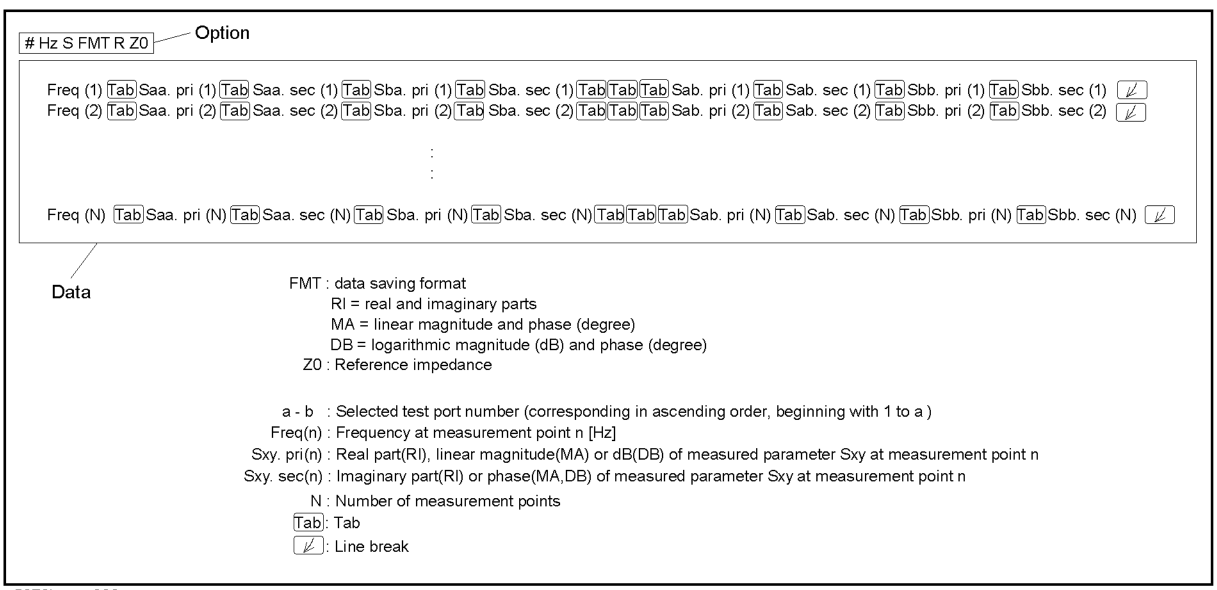
Figure 9-4 through Figure 9-7 show the data structure of a file saved in Touchstone format. Contents of the file is text data, which is ready for being read with your text editor.

Figure 9-4 One port Touchstone file



e5070bsupe001

Figure 9-5 Two port Touchstone file



e5070bsupe002

Figure 9-6 Three port Touchstone file

Option オプション — # Hz S FMT R Z0

Data データ —

```
Freq (1) Tab Saa. pri (1) Tab Saa. sec (1) Tab Sab. pri (1) Tab Sab. sec (1) Tab Sac. pri (1) Tab Sac. sec (1) ↵
Tab Tab Tab Sba. pri (1) Tab Sba. sec (1) Tab Sbb. pri (1) Tab Sbb. sec (1) Tab Sbc. pri (1) Tab Sbc. sec (1) ↵
Tab Tab Tab Sca. pri (1) Tab Sca. sec (1) Tab Scb. pri (1) Tab Scb. sec (1) Tab Scc. pri (1) Tab Scc. sec (1) ↵
Freq (2) Tab Saa. pri (2) Tab Saa. sec (2) Tab Sab. pri (2) Tab Sab. sec (2) Tab Sac. pri (2) Tab Sac. sec (2) ↵
Tab Tab Tab Sba. pri (2) Tab Sba. sec (2) Tab Sbb. pri (2) Tab Sbb. sec (2) Tab Sbc. pri (2) Tab Sbc. sec (2) ↵
Tab Tab Tab Sca. pri (2) Tab Sca. sec (2) Tab Scb. pri (2) Tab Scb. sec (2) Tab Scc. pri (2) Tab Scc. sec (2) ↵
:
:
Freq (N) Tab Saa. pri (N) Tab Saa. sec (N) _Sab. pri (N) Tab Sab. sec (N) Tab Sac. pri (N) Tab Sac. sec (N) ↵
Tab Tab Tab Sba. pri (N) Tab Sba. sec (N) _Sbb. pri (N) Tab Sbb. sec (N) Tab Sbc. pri (N) Tab Sbc. sec (N) ↵
Tab Tab Tab Sca. pri (N) Tab Sca. sec (N) _Scb. pri (N) Tab Scb. sec (N) Tab Scc. pri (N) Tab Scc. sec (N) ↵
```

FMT : data saving format
RI = real and imaginary parts
MA = linear magnitude and phase (degree)
DB = logarithmic magnitude (dB) and phase (degree)
Z0 : Reference impedance

a - c : Selected test port number (corresponding in ascending order, beginning with 1 to a)
Freq(n) : Frequency at measurement point n [Hz]
Sxy. pri(n) : Real part(RI), linear magnitude(MA) or dB(DB) of measured parameter Sxy at measurement point n
Sxy. sec(n) : Imaginary part(RI) or phase(MA,DB) of measured parameter Sxy at measurement point n
N : Number of measurement points
Tab : Tab
↵ : Line break

e5070bsupe003

Figure 9-7 Four port Touchstone file

Hz S FMT R Z0 — Option

```
Freq (1) Tab S11. pri (1) Tab S11. sec (1) Tab S12. pri (1) Tab S12. sec (1) Tab S13. pri (1) Tab S13. sec (1) Tab S14. pri (1) Tab S14. sec (1) ↵
Tab Tab Tab S21. pri (1) Tab S21. sec (1) Tab S22. pri (1) Tab S22. sec (1) Tab S23. pri (1) Tab S23. sec (1) Tab S24. pri (1) Tab S24. sec (1) ↵
Tab Tab Tab S31. pri (1) Tab S31. sec (1) Tab S32. pri (1) Tab S32. sec (1) Tab S33. pri (1) Tab S33. sec (1) Tab S34. pri (1) Tab S34. sec (1) ↵
Tab Tab Tab S41. pri (1) Tab S41. sec (1) Tab S42. pri (1) Tab S42. sec (1) Tab S43. pri (1) Tab S43. sec (1) Tab S44. pri (1) Tab S44. sec (1) ↵
Freq (2) Tab S11. pri (2) Tab S11. sec (2) Tab S12. pri (2) Tab S12. sec (2) Tab S13. pri (2) Tab S13. sec (2) Tab S14. pri (2) Tab S14. sec (2) ↵
Tab Tab Tab S21. pri (2) Tab S21. sec (2) Tab S22. pri (2) Tab S22. sec (2) Tab S23. pri (2) Tab S23. sec (2) Tab S24. pri (2) Tab S24. sec (2) ↵
Tab Tab Tab S31. pri (2) Tab S31. sec (2) Tab S32. pri (2) Tab S32. sec (2) Tab S33. pri (2) Tab S33. sec (2) Tab S34. pri (2) Tab S34. sec (2) ↵
Tab Tab Tab S41. pri (2) Tab S41. sec (2) Tab S42. pri (2) Tab S42. sec (2) Tab S43. pri (2) Tab S43. sec (2) Tab S44. pri (2) Tab S44. sec (2) ↵
:
:
Freq (N) Tab S11. pri (N) Tab S11. sec (N) Tab S12. pri (N) Tab S12. sec (N) Tab S13. pri (N) Tab S13. sec (N) Tab S14. pri (N) Tab S14. sec (N) ↵
Tab Tab Tab S21. pri (N) Tab S21. sec (N) Tab S22. pri (N) Tab S22. sec (N) Tab S23. pri (N) Tab S23. sec (N) Tab S24. pri (N) Tab S24. sec (N) ↵
Tab Tab Tab S31. pri (N) Tab S31. sec (N) Tab S32. pri (N) Tab S32. sec (N) Tab S33. pri (N) Tab S33. sec (N) Tab S34. pri (N) Tab S34. sec (N) ↵
Tab Tab Tab S41. pri (N) Tab S41. sec (N) Tab S42. pri (N) Tab S42. sec (N) Tab S43. pri (N) Tab S43. sec (N) Tab S44. pri (N) Tab S44. sec (N) ↵
```

Data

FMT : data saving format
RI = real and imaginary parts
MA = linear magnitude and phase (degree)
DB = logarithmic magnitude (dB) and phase (degree)
Z0 : Reference impedance

Freq(n) : Frequency at measurement point n [Hz]
Sxy. pri(n) : Real part(RI), linear magnitude(MA) or dB(DB) of measured parameter Sxy at measurement point n
Sxy. sec(n) : Imaginary part(RI) or phase(MA,DB) of measured parameter Sxy at measurement point n
N : Number of measurement points
Tab : Tab
↵ : Line break

e5070bsupe004

9. Data Output

Saving the Screen Image to a File

Along with printing, the E5070B/E5071B allows the user to save screen images as bitmap (.bmp) or portable network graphics (.png) files. Saved files can be loaded into PC application software for further processing.

Saving the Screen Image to a File

Follow the procedure below to save a screen image to a file.

Step 1. Display the screen to be saved as a file.

NOTE If you want to save the screen with white background, set the display mode to inverted display before you save the screen. For details about display mode, see "Selecting display mode" on page 79.

Step 2. Press System to display the System menu. Use the softkey listed below.

Softkey	Function
Dump Screen Image	Saves the screen image to a file.

NOTE The screen image at the time Capture System is pressed is the image that will be saved. For details, see "Printed/saved images" on page 260.

Step 3. Press **Dump Screen Image** to open the Save As dialog box. For more information on the Save As dialog box, see the descriptions associated with Figure 9-1, "Save As Dialog Box," on page 247. Note that "Bitmap Files (*.bmp)" or "Portable Network Graphics (*.png)" is selected as the file type when the dialog box first opens.

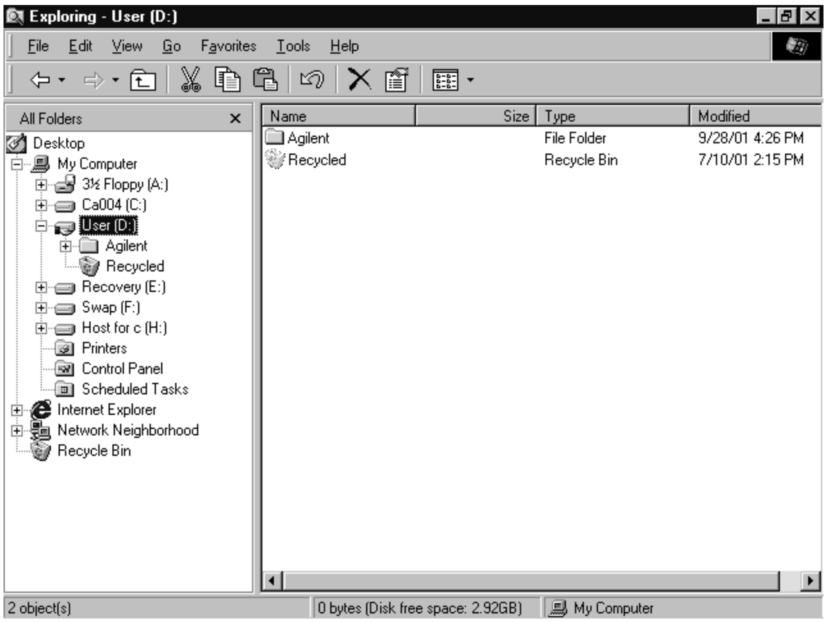
Step 4. Select the file type.

Step 5. Select the destination folder and type a file name. Press **Save** to save the screen image of E5070B/E5071B to a file.

Organizing Files and Folders

You can organize files and folders (copy, move, delete, rename, or format a floppy disk) with Windows© Explorer©.

Figure 9-8 **Windows Explorer**



e5070auj171

NOTE **Do not modify any files and folders in drives other than drive A: and drive D:. Doing so will cause malfunctions.**

To open Windows Explorer

Step 1. Press Save/Recall.

Step 2. Press **Explorer...**.

To copy a file or folder

Step 1. Select a source file or folder on the Windows Explorer.

Step 2. Select **Edit** - **Copy** from the menu bar.

Step 3. Open the destination folder.

Step 4. Select **Edit** - **Paste** from the menu bar.

To move a file or folder

Step 1. Select a source file or folder on the Windows Explorer.

Step 2. Select **Edit** - **Cut** from the menu bar.

Step 3. Open the destination folder.

Step 4. Select **Edit** - **Paste** from the menu bar.

To delete a file or folder

Step 1. Select a file or folder you want to delete on the Windows Explorer.

Step 2. Select **Edit** - **Delete** from the menu bar.

To rename a file or folder

Step 1. Select a file or folder you want to rename on the Windows Explorer.

Step 2. Select **File** - **Rename** from the menu bar.

Step 3. Type the new name of the file or folder, and then press Enter.

To format a floppy disk

NOTE All files and folders in the floppy disk are erased by formatting.

Step 1. Put a floppy disk into the floppy disk drive that you want to format.

Step 2. Use the right mouse button to click the A drive in the Windows Explorer.

Step 3. Click **Format...** in the shortcut menu.

Step 4. Follow the instructions in the dialog box to format the floppy disk.

Printing Displayed Screen

By connecting the printer to the printer parallel port or the USB port of the E5070B/E5071B, you can print the displayed screen of the E5070B/E5071B.

Available printers (supported printers)

Table 9-2 shows the models of the available printers (supported printers) for the E5070B/E5071B, the printer drivers you need to use, and the available ports of the E5070B/E5071B as of August 2002.

For the latest information of the supported printers for the E5070B/E5071B, contact Agilent Technologies. When contacting us, see the list of our customer centers at the end of this manual.

Table 9-2 **Supported printers (as of August 2002)**

Manufacturer	Model name	Printer driver you need to use*1	Available port
Hewlett-Packard	DeskJet 930C	HP Deskjet 930C	Printer parallel port and USB port
Hewlett-Packard	DeskJet 940C	HP Deskjet 940C	Printer parallel port and USB port
Hewlett-Packard	DeskJet 948C	HP Deskjet 948C	Printer parallel port and USB port

*1. The drivers for all supported printers at the time of shipment are installed in the E5070B/E5071B. If you use a printer newly supported after purchasing the product, you need to install the printer driver for the printer in the E5070B/E5071B. For more information on installation, refer to “Installing printer driver” on page 263.

Printed/saved images

The display image saved in the volatile memory (clipboard) is printed/saved. If no image is saved in the clipboard, the image displayed at the execution is printed/saved.

Saving image to clipboard

Capture System has a screen capture feature also. When you press Capture System, the image displayed on the screen immediately before is saved in the clipboard.

NOTE The image in the clipboard is cleared when you execute print/save.

Print procedure

Preparation before print

Follow these steps to make a preparation for print:

Step 1. Turns off the E5070B/E5071B.

Step 2. Turn on the printer and connect it to the E5070B/E5071B.

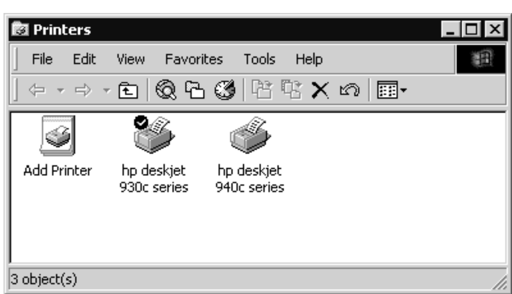
NOTE Do not connect a printer that is not supported to the E5070B/E5071B.

Step 3. Turns on the E5070B/E5071B.

Step 4. Press System.

Step 5. Press **Printer Setup**. The Printers window (Figure 9-9) opens. The icons of the printers that have been connected are displayed in the window. If you connect the print for the first time, it is automatically registered and its icon is added in the window. Figure 9-9 shows an example when the icons of the HP Deskjet 930C and the HP Deskjet 940C are displayed.

Figure 9-9 **Printers window**



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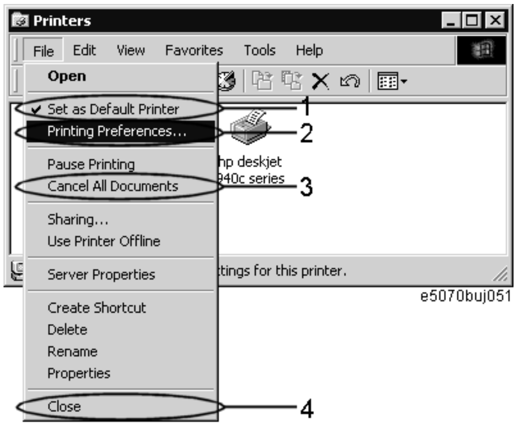
Step 6. The printer with the check mark (✔) on its icon is selected as for printing. If you want to change it, select (highlight) the icon of the printer for printing in the Printers window and then click **Set as Default Printer** (1 in Figure 9-10) in the File menu.

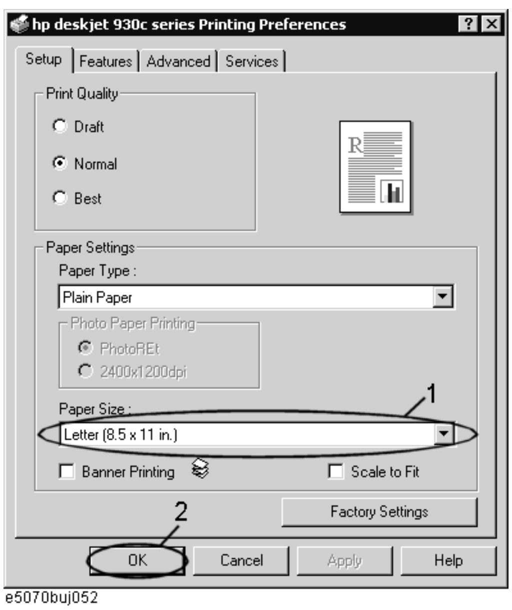
Figure 9-10 **File menu in the Printers window**



Step 7. Click **Printing Preferences...** (2 in Figure 9-10) in the File menu. The Printing Preferences dialog box for the selected printer appears. Set items necessary before print such as Page Size (1 in Figure 9-11) and then click the **OK** button (2 in Figure 9-11).

NOTE For information on the Printing Preferences dialog box, refer to your printer's manual and so on.

Figure 9-11 **Printing Preferences dialog box (for HP Deskjet 930C)**



Step 8. Click **Close** (4 in Figure 9-10) in the File menu.

Executing print

Follow these steps to print the current screen:

Step 1. Display the screen you want to print.

Step 2. Press Capture System to save the currently displayed screen into the clipboard.

Step 3. As necessary, press **Invert Image** to toggle between [OFF] for printing in colors close to the actually displayed screen and [OFF] for printing in inverse colors.

Step 4. Press **Print** to start printing.

To cancel the printing in progress, press **Abort Printing**.

NOTE If you start printing when the printer is not ready (for example, it is not turned on) by mistake, the Printers Folder dialog box as shown in Figure 9-12 may appear. In this case, click **Cancel** to finish the Printers Folder dialog box, prepare your printer, and then start printing again.

Figure 9-12 **Printers Folder dialog box**

Installing printer driver

If you use a printer newly supported after purchasing the product, you need to install the printer driver for the printer in the E5070B/E5071B.

Obtain the driver specific to the E5070B/E5071B that Agilent Technologies provides.

Generally, you can download the printer driver from our product information web site of the Agilent Technologies E5070B/E5071B.

For how to obtain the printer driver, contact Agilent Technologies. To contact us, see the list of our customer centers at the end of this manual or Online assistance homepage (http://www.agilent.com/find/assist).

For information how to install the driver, refer to the manual that comes with the driver you obtained.

10 Limit Test

This chapter describes the concepts behind the limit test and how to perform it using the Agilent E5070B/E5071B.

Limit Test

The limit test feature allows you to set the limit line for each trace and then perform the pass/fail judgment for the measurement result.

Concept of limit test

The limit test is a function to perform the pass/fail judgment based on the limit line you set with the limit table.

In the limit test, if the upper limit or lower limit indicated by the limit line is not exceeded, the judgment result is pass; if it is exceeded, the judgment result is fail for all measurement points on the trace. Measurement points in the stimulus range with no limit line are judged as pass.

NOTE The targets of the pass/fail judgment are measurement points only. Parts interpolated between measurement points are not judged.

You define the limit line by specifying the stimulus value (Begin Stimulus) and response value (Begin Response) of the begin point, the stimulus value (End Stimulus) and response value (End Response) of the end point, and the type (lower limit/upper limit). For more information, refer to “Defining the Limit Line” on page 268.

When the limit test is on, measurement points that fail are displayed in red on the screen and the pass/fail judgment result of the trace based on the judgment result of individual measurement points (fail, if there is one or more measurement points that fail on the trace) is displayed also. You can check the pass/fail judgment result for the channel (fail, if there is one or more traces that fail in the channel) on the screen as well. For more information, refer to “Displaying judgment result of limit test” on page 267.

In addition to viewing the screen, you can check the judgment result of the limit test by the following methods.

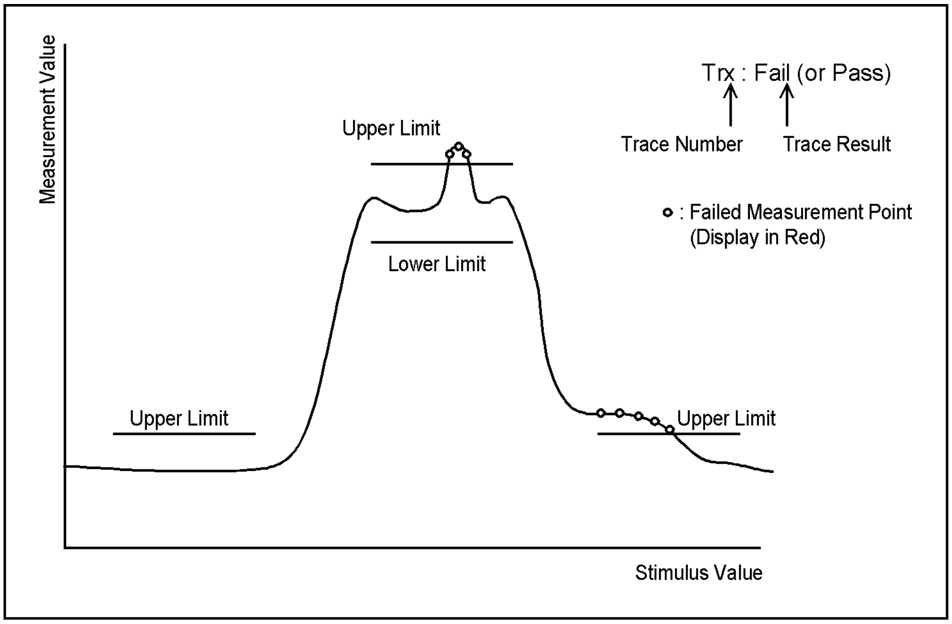
- Beep that occurs when the judgment result is fail.
- Using the status register (for more information, refer to Programmer's Guide).

Displaying judgment result of limit test

Judgment result of measurement points and trace

Measurement points that fail are displayed in red on the screen. The judgment result of the trace is indicated by Pass or Fail displayed in the upper right part of the graph.

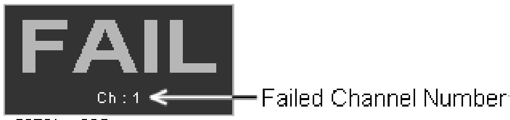
Figure 10-1 Result display of measurement points and trace



Judgment result of channels

If there is a channel whose judgment result is fail, the message shown in Figure 10-2 appears on the screen.

Figure 10-2 Channel fail message



Follow these steps to turn on/off the display of the channel fail message.

Step 1. Press Analysis.

Step 2. Press **Limit Test**.

Step 3. Press **Fail Sign**. Each press toggles between on/off.

Defining the Limit Line

To use the limit test, you must first define the limit line. You can define a limit table for each trace, and you can define up to 100 limit lines (segments) in a limit table.

Defining a Segment

The following steps describe how to define a segment.

Step 1. Press Channel Next or Channel Prev to activate the channel on which the limit test function will be used.

Step 2. Press Trace Next or Trace Prev to activate the trace on which the limit test function will be used.

Step 3. Press Analysis to display the Analysis menu.

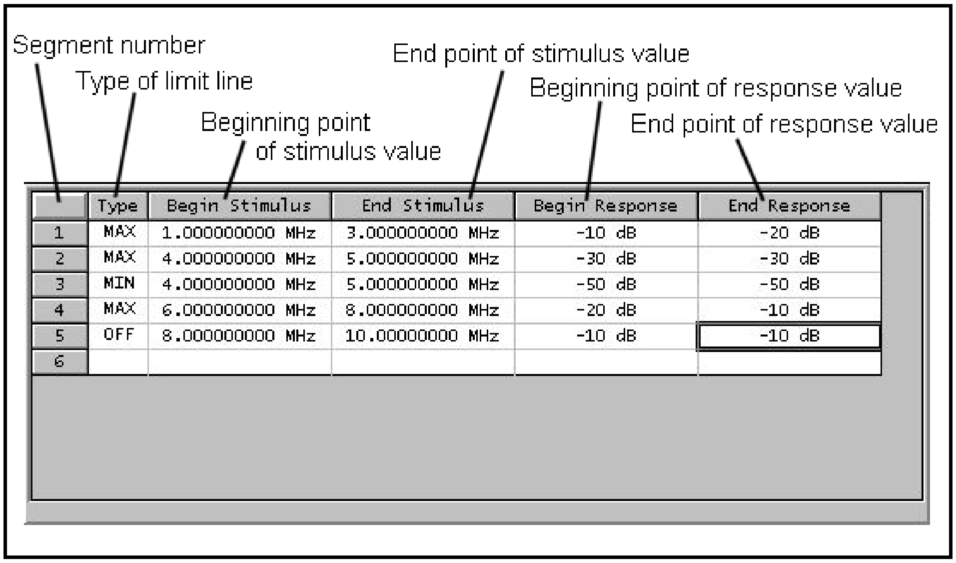
Step 4. Press **Limit Test** to display the softkeys associated with the limit test.

Step 5. Press **Edit Limit Line** to display the limit table shown in Figure 10-3. Using the limit table, create/edit a segment. Initially, no segments are entered in the limit table.

At the same time, the Edit Limit Line menu used to create/edit the limit table is displayed. The following lists the functions that correspond to the softkeys shown.

Softkey	Function
Delete	Deletes the segment containing the selected cell from the limit table.
Add	Adds a segment before the segment containing the selected cell to the limit table.
Clear Limit Table	Clears all the limit table data.
Export to CSV File	Exports the limit table to a file in CSV (comma-separated value) format. For more information, see “Saving/Calling the Limit Table” on page 271.
Import from CSV File	Imports a limit table saved in CSV (separated-separated value) format. For more information, see “Saving/Calling the Limit Table” on page 271.
Return	Exits the Edit Limit Line menu and closes the limit table display.

Figure 10-3 **Limit Table**



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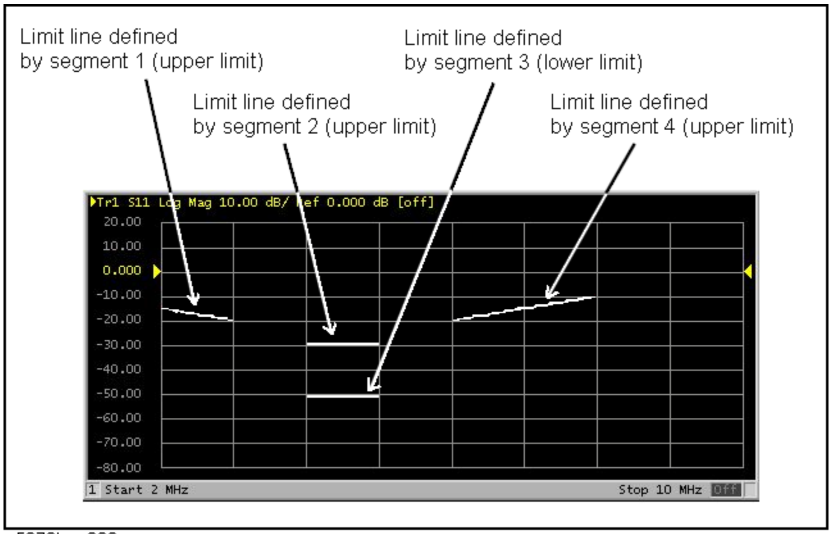
Step 6. Press **Add** to add a segment to the limit table, and then specify the segment parameter values shown below.

Segment Parameter	Description
Type	Select the type of segment from the following: OFF Segment not used for the limit test MIN The segment at which the minimum is specified MAX The segment at which the maximum is specified
Begin Stimulus[*1*2]	Specify the starting point for the stimulus value on the limit line.
End Stimulus[*1*2]	Specify the ending point for the stimulus value on the limit line.
Begin Response[*3*4]	Specify the starting point for the response value on the limit line.
End Response[*3*4]	Specify the ending point for the response value on the limit line.

*1. The range in which stimulus values can be specified is from -500 G to +500 G. When a value outside the range is entered, a suitable value within the range is specified.
*2. Once the stimulus value is specified, changing the sweep range of the E5070B/E5071B does not affect the stimulus value.
*3. The range in which response values can be specified is from -500 M to +500 M. When a value outside the range is entered, a suitable value within the range is specified.
*4. After the response value is specified, changing formats results in changing the units but not the value.

Figure 10-4 **Example of limit lines (when the limit table is set as Figure 10-3)**



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NOTE You can define a limit line that is able to freely overlap with the stimulus range of another limit line.

Defining one limit line having the same type as a second limit line whose stimulus range overlaps with the first one results in two or more limit values at the same measurement point. In this case, the limit value to be used in the limit test is defined as follows:

- When two or more limit values whose type is set to maximum (MAX) exist, the smallest one is used as the maximum.
- When two or more limit values whose type is set to minimum (MIN) exist, the largest one is used as the minimum.

NOTE Even if the span of the sweep range on the E5070B/E5071B is set 0, enter the two parameters, Begin Stimulus and End Stimulus.

NOTE When two or more response values are returned as a result of using the Smith or polar chart format, the first response value of the marker provides the object of the limit test.

Saving/Calling the Limit Table

You can save the limit table to a file, which you can then freely bring up on the screen later and use. You can import a file saved in CSV format (extension: *.csv) into spreadsheet software on a PC for later use. (A numerical value will be saved as strings including its unit).

The limit table is saved in the following format.

Example 10-1 **Limit Table Saved in CSV Format**

```
"# Channel 1"
"# Trace 1"
Type, Begin Stimulus, End Stimulus, Begin Response, End Response
 MAX, 200.0000000 MHz, 400.0000000 MHz, -100 dB, -100 dB
 MAX, 490.0000000 MHz, 510.0000000 MHz, -10 dB, -10 dB
 MIN, 490.0000000 MHz, 510.0000000 MHz, -20 dB, -20 dB
 MIN, 600.0000000 MHz, 800.0000000 MHz, -100 dB, -100 dB
```

On the first line, the channel number of the active channel that was valid when the file was saved is output.

On the second line, the trace number of the active trace that was valid when the file was saved is output.

The third line provides the header showing the items for the segments to be output on the fourth and later lines.

Data on segments are output on the fourth and later lines.

Saving/Calling the Limit Table

The following steps describe how to save/call the limit table. Use the external keyboard and mouse for the operations described below.

Step 1. Display the limit table.

Step 2. In the Edit Limit Line menu, press **Export to CSV File** to open the Save As dialog box. For more information on the Save As dialog box, refer to the description provided in Figure 9-1, “Save As Dialog Box,” on page 247. In this step, CSV Files (extension: *.csv) are selected as the file type.

Step 3. Specify the folder in which to save the file, and enter the file name. Press **Save** to save the limit table displayed on the screen to the file.

Step 4. Conversely, to recall a saved limit table, press **Import from CSV File** in the Edit Limit Line menu to display the Open dialog box. For a description of parts of the Open dialog box, see Figure 9-2, “Open Dialog Box,” on page 249. In this step, CSV Files (extension: *.csv) are selected as the file type.

Step 5. After specifying the folder containing the file, select the file. Press **Open** to display the limit table on the screen.

NOTE You can recall a limit table from a trace on any channel independently of the channel and trace that were active when the limit table was saved to the file.

Turning the Limit Test ON/OFF

You can set the limit test ON/OFF for each trace individually.

Setting the Limit Test ON/OFF

The following steps describe how to set the limit test ON/OFF.

Step 1. Press Channel Next or Channel Prev to activate the channel on which the limit test function will be used.

Step 2. Press Trace Next or Trace Prev to activate the trace on which the limit test function will be used.

Step 3. Press Analysis to display the Analysis menu.

Step 4. Press **Limit Test** to display the Limit Test menu.

Softkey	Function
Limit Test	Sets the limit test ON/OFF.
Limit Line	Sets the limit line display ON/OFF.
Edit Limit Line	Opens the limit table for editing the limit line.*1

*1. To use the limit test function, you must first define the limit line. For more on how to define the limit line, see "Defining the Limit Line" on page 268.

Step 5. Press **Limit Test** to turn the limit test ON. To display the limit line on the screen, press **Limit Line**.

Initializing the Limit Table

The following operations initialize the limit table.

- At power-on
- When presetting
- When calling a limit table with zero segments
- When **Clear Limit Table** - **OK** is pressed in the Edit Limit Line menu

11 Optimizing Measurements

This chapter describes how to optimize your measurements when using the Agilent E5070B/E5071B.

Expanding the Dynamic Range

The dynamic range is the finite difference between the maximum input power level and the minimum measurement power level (noise floor) of the analyzer. In evaluating a characteristic accompanied by a large change in the amplitude (the pass band and stop band of a filter, for example), it is important to increase the dynamic range.

Lowering the Receiver Noise Floor

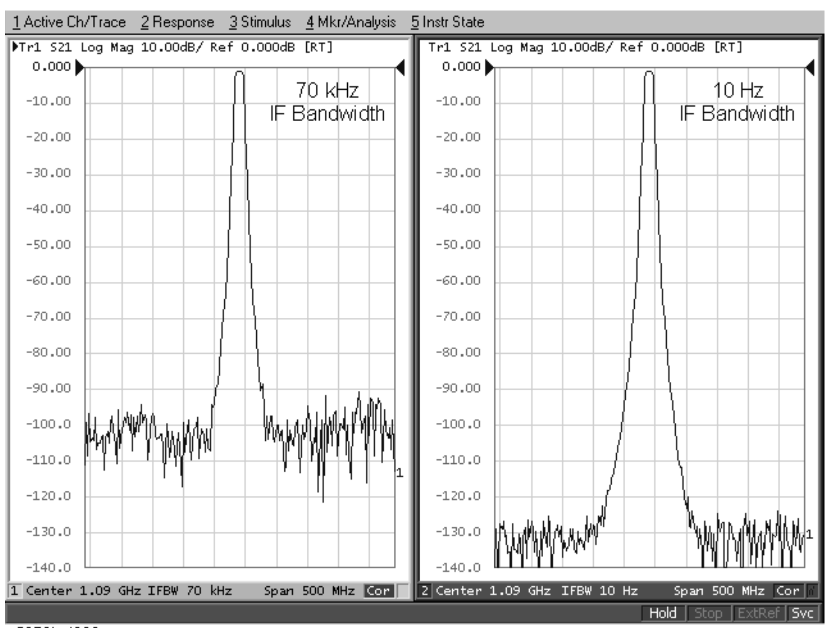
Lowering the noise floor of the receiver enables you to enlarge the dynamic range. The following methods can be used to lower the receiver noise floor.

- "Narrowing the IF Bandwidth" on page 274
- "Turning on Sweep Averaging" on page 275

Narrowing the IF Bandwidth

Narrowing the receiver IF bandwidth enables you to reduce the effect of random noise on measurements. Narrowing the IF bandwidth to 1/10 the original bandwidth causes the receiver noise floor to decrease by 10 dB.

Figure 11-1 **Effects of Narrowing the IF Bandwidth**



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To specify the IF bandwidth, follow the steps described below.

Step 1. Press [Channel Next] or [Channel Prev] to select a channel on which to specify the IF bandwidth.

Step 2. Press [Avg].

Step 3. Press **IF Bandwidth**.

Step 4. Change the IF bandwidth in the data entry area.

Turning on Sweep Averaging

Using sweep averaging also enables you to reduce the effects of random noise on measurements.

Sweep averaging averages data from each point (vector quantity) based on the exponential average of a continuous sweep weighted by the averaging factor specified by the user. Sweep averaging is expressed in Equation 11-1.

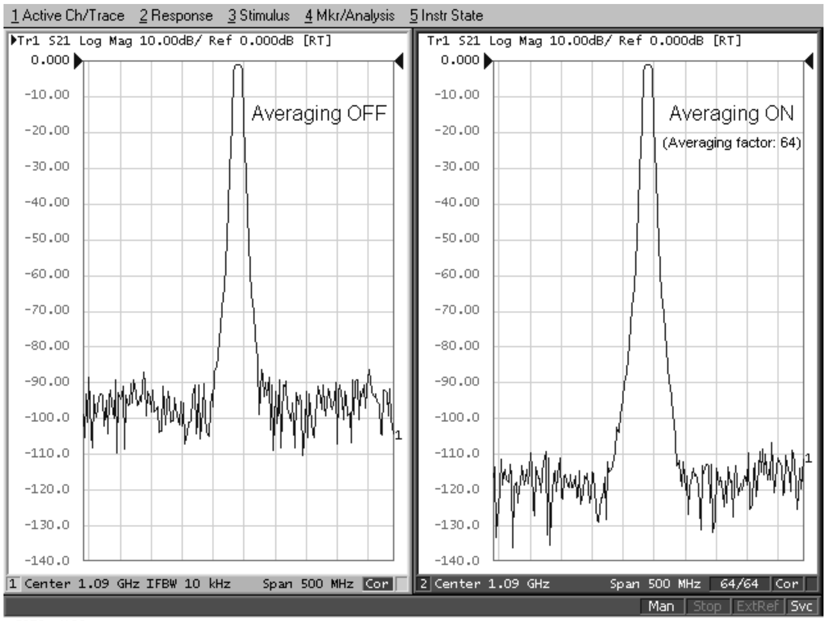
Equation 11-1 **Sweep Averaging**

$$A_n = \frac{S_n}{F} + \left(1 - \frac{1}{F}\right) \times A_{n-1}$$

where:

An = Result of the calculation of sweep averaging for the nth sweep operation at the point in question (a vector quantity).
Sn = Measurement value obtained at the nth sweep operation at the point in question (a vector quantity).
F = Sweep averaging factor (an integer between 1 and 999)

Figure 11-2 **Effects of Sweep Averaging**



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Define the sweep averaging by following the steps below.

Step 1. Press Channel Next or Channel Prev to select a channel on which the sweep averaging will be defined.

Step 2. Press Avg.

Step 3. Press **Avg Factor**.

Step 4. Change the averaging factor in the data entry area.

Step 5. Press **Averaging** to turn **ON** the averaging.

NOTE Pressing **Averaging Restart** resets n to 1 in Equation 11-1 on page 275.

Reducing Trace Noise

Any of the following methods can be used to lower the trace noise.

- Turning on sweep averaging
- Turning on smoothing
- Narrowing the IF bandwidth

For more about sweep averaging and the IF bandwidth, see “Turning on Sweep Averaging” on page 275 and “Narrowing the IF Bandwidth” on page 274.

Turning on Smoothing

Smoothing can be used to reduce noise having relatively small peaks. By turning on smoothing, the value of each point on a trace is represented by the moving average over the values of several nearby points. The smoothing aperture (percentage of sweep span) defines the range of points to be included in the calculation of the moving average.

NOTE You can define the smoothing trace by trace.

Figure 11-3 **Effects of Smoothing (Log Magnitude Format)**

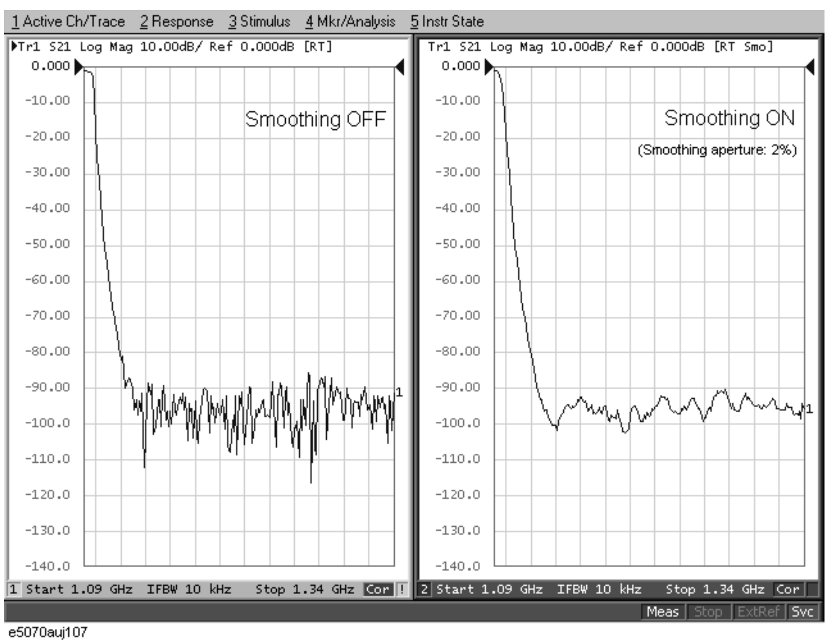
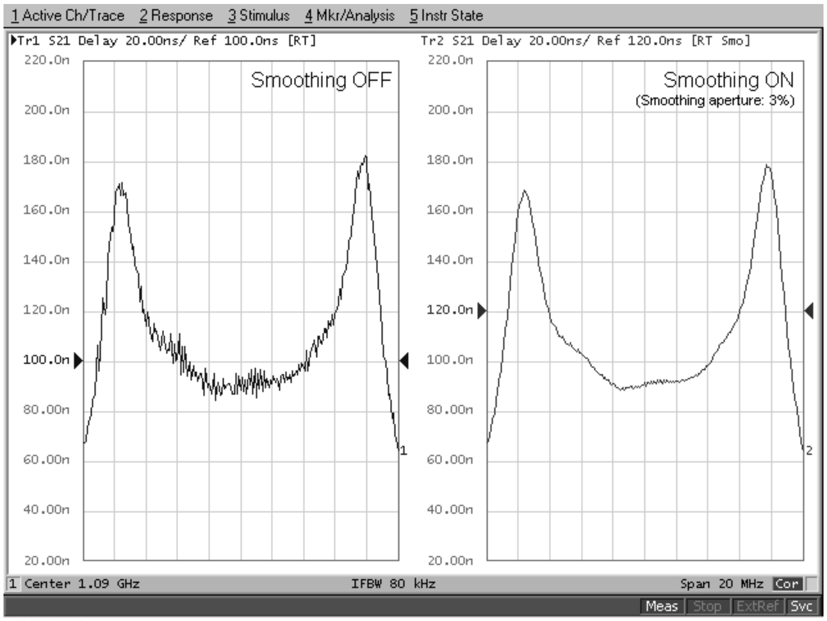


Figure 11-4 **Effects of Smoothing (Group Delay Format)**



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Setting Up Smoothing

Setup the smoothing operation by following the steps below.

Step 1. Press Channel Next (or Channel Prev) and Trace Next (or Trace Prev) to activate the trace on which smoothing will be defined.

Step 2. Press Avg.

Step 3. Press **Smo Aperture**.

Step 4. Change the smoothing aperture (%) in the data entry area.

Step 5. Press **Smoothing** to turn **ON** the smoothing.

Improving the Accuracy of Phase Measurements

This section describes the following functions that can be used to improve phase measurement accuracy.

- "Electrical Delay" on page 278
- "Port Extension" on page 279
- "Phase Offset" on page 280

Electrical Delay

Electrical Delay is a function that adds or removes a pseudo-lossless transmission line with a variable length against the receiver input. Using this function enables you to improve the resolution in phase measurement and thereby measure deviation from the linear phase. You can specify the electrical delay trace by trace.

Procedure

Step 1. Press [Channel Next] (or [Channel Prev]) and [Trace Next] (or [Trace Prev]) to activate the phase trace for which the electrical delay will be specified.

Step 2. Press [Scale].

Step 3. Press **Electrical Delay**.

Step 4. Change the electrical delay (in seconds) in the data entry area.

For how to determine the deviation from a linear phase, see "Measuring the Deviation from a Linear Phase" on page 353.

Procedure using marker

Step 1. Press [Channel Next] (or [Channel Prev]) and [Trace Next] (or [Trace Prev]) to activate a trace for which you want to set the electrical delay.

Step 2. Place the active marker to an appropriate position.

Step 3. Press [Marker Fctn].

Step 4. Press **Marker → Delay** to set the electrical delay to the value of the group delay at the position of the active marker (a value smoothed with the aperture of 20% regardless of the setting of smoothing).

NOTE An absolute value is used regardless of on/off of the reference marker mode.

Port Extension

Port Extension is a function for moving the calibration reference plane by specifying the electrical delay. This function is useful, for example, when you cannot perform calibration at the DUT terminal directly because the DUT is inside the test fixture. In such a case, this function enables you to first perform calibration at the test fixture terminal and then move the calibration plane to the DUT terminal by extending the port.

Port extension corrects the electrical delay of each test port (phase shift) only. It cannot remove errors caused by the loss in and wrong matching of cables, adapters, or test fixtures.

NOTE You can define port extension channel by channel. Even if you set port extension for a channel, it does not affect to the other channels.

Using the Port Extension Function

Step 1. Press [Channel Next] or [Channel Prev] to activate the channel for which port extension will be specified.

Step 2. Press [Cal].

Step 3. Press **Port Extensions**.

Step 4. Specify the port extension for each test port.

Softkey	Function
Extension Port 1	Specify the port extension (in seconds) for test port 1.
Extension Port 2	Specify the port extension (in seconds) for test port 2.
Extension Port 3[*1]	Specify the port extension (in seconds) for test port 3.
Extension Port 4[*2]	Specify the port extension (in seconds) for test port 4.

*1. Only with Options 313, 314, 413, and 414.
*2. Only with Options 413 and 414.

Phase Offset

Phase Offset is a function used to add or subtract a predetermined value relative to the frequency to and from the trace. Using this function enables you to simulate the phase offset occurring as a result of, say, adding a cable.

The phase offset can be specified from −360° to +360°.

Using the Phase Offset Function

Step 1. Press Channel Next (or Channel Prev) and Trace Next (or Trace Prev) to activate the trace for which the phase offset will be specified.

Step 2. Press Scale.

Step 3. Press **Phase Offset**.

Step 4. Enter the phase offset (°) in the data entry area.

Specifying the Velocity Factor

The velocity factor is the ratio of the propagation velocity of a signal in a coaxial cable to the propagation velocity of that signal in free space. The velocity factor for a common cable is about 0.66. The propagation velocity depends on the dielectric constant (ε_r) of the dielectric substance in the cable.

$$\text{Velocity factor} = \frac{1}{\sqrt{\varepsilon_r}}$$

By specifying the velocity factor, you can match the equivalent length (in meters) appearing in the data entry area to the actual physical length when using the "Electrical Delay" on page 278 or "Port Extension" on page 279 to specify the electrical delay (in seconds).

You can define the velocity factor channel by channel.

Using the Velocity Factor

Step 1. Press Channel Next or Channel Prev to activate the channel for which the velocity factor will be specified.

Step 2. Press Cal.

Step 3. Press **Velocity Factor**.

Step 4. Enter the velocity factor in the data entry area.

Reduce Measurement Error in High Temperature Environments

The E5070B/E5071B is designed to obtain the best measurement accuracy at the ambient temperature range of 23°C ± 5°C. The high temperature measurement mode of the E5070A/E5071A reduces measurement error (drift error) at an ambient temperature of 28°C to 33°C.

NOTE The high temperature measurement mode must be turned off when the analyzer is used at an ambient temperature below 28°C. Otherwise, the measurement accuracy may be degraded.

Procedure

Step 1. Press [System].

Step 2. Press **Service Menu**.

Step 3. Press **High Temperature** to turn **ON/OFF** the high temperature measurement mode.

Improving the Measurement Throughput

This section explains the following three methods to improve the measurement throughput.

- "Using Fast Sweep Modes" on page 282
- "Turning Off the Updating of Information Displayed on the LCD Screen" on page 286
- "Turning Off System Error Correction" on page 286

Using Fast Sweep Modes

The E5070B/E5071B provides 4 sweep modes;"Stepped mode" and "swept mode," and their accelerated versions "fast stepped mode" and "fast swept mode." You can shorten sweep time as shown in Table 11-1 using the swept mode or its fast modes.

NOTE If you do not have to shorten sweep time, use the stepped mode (preset configuration).

Table 11-1 Sweep time criteria (each measurement point interval)

Measurement point interval	Shorter (faster sweep)			→			Longer (slower sweep)
2 MHz or less	Swept Fast swept	→	Fast stepped			→	Stepped
2 MHz to 5 MHz	Fast swept	→	Swept	→	Fast stepped	→	Stepped
5 MHz to 8 MHz	Fast swept	→	Swept Fast stepped			→	Stepped
8 MHz to 10 MHz	Fast swept	→	Fast stepped			→	Stepped Swept
10 MHz to 30 MHz	Fast swept	→	Fast stepped	→	Stepped	→	Swept
30 MHz to 50 MHz	Fast swept Fast stepped	→	Stepped			→	Swept
50 MHz to 70 MHz	Fast stepped	→	Fast swept Stepped			→	Swept
70 MHz or more	Fast stepped	→	Stepped	→	Fast swept	→	Swept

Table 11-2 Characteristics of sweep mode

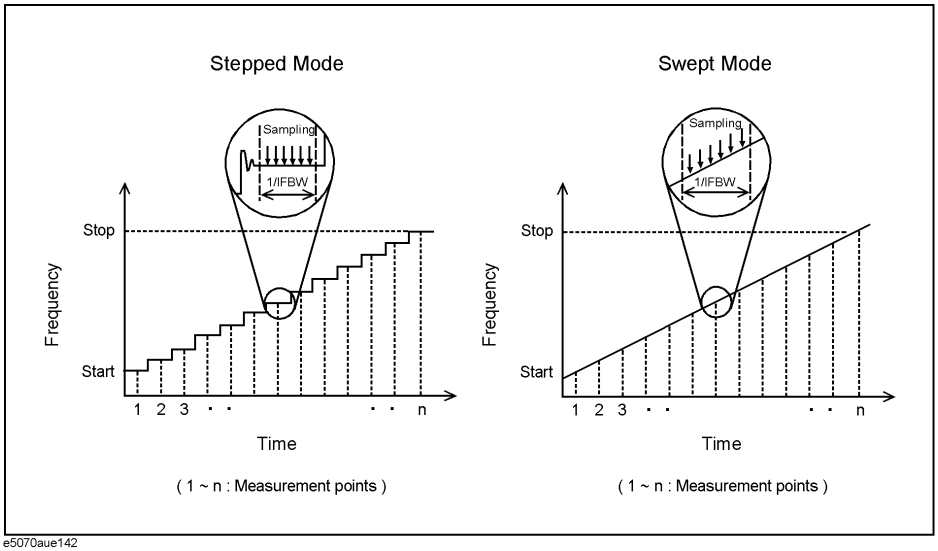
	Stepped	Swept	Fast stepped	Fast swept
Measurement reliability	High	Relatively low	Relatively low	Low
Sweep time	Long (Except when the measurement point interval is approximately 10 MHz or more)	Short (Only when the measurement point interval is approximately 10 MHz or less)	Short (Shortest when the measurement point interval is approximately 30 MHz or more)	Short (Shortest when the measurement point interval is approximately 30 MHz or less)
Restrictions on measurement	No particular restrictions	DUTs whose electrical delay is long cannot be measured correctly.	No particular restrictions	DUTs whose electrical delay is long cannot be measured correctly.

Swept mode

As shown in Figure 11-5, in the stepped mode, the frequency is changed stepwise and sampling is performed at a fixed frequency for each measurement point. On the other hand, in the swept mode, sampling is performed with the frequency always swept for each measurement point.

NOTE When the IF bandwidth is 5 kHz or less, the sweep is performed in the stepped mode even if the swept mode has been specified (the fast stepped mode when the fast swept mode is specified).

Figure 11-5 Difference between stepped and swept modes



In the stepped mode, certain time should be allowed until the frequency gets stable at aech measurement point, because the frequency is changed stepwise. Therefore, the sweep time in the swept mode is generally shorter than that in the stepped mode. However, if the measurement point interval is extremely great, the sweep to the next measurement point frequency cannot be completed within the sampling time due to the limit of the frequency sweep speed of the instrument. This causes certain waiting time until the start of the measurement of the next measurement point, thus the swept mode has a longer sweep time on the contrary.

Although there is some difference depending on the IF bandwidth setting, when the measurement point interval is approximately 10 MHz or less (approximately 30 MHz or less for the fast mode), the sweep time is shorter than that in the stepped mode.

Note that the swept mode has the following demerits.

- DUTs whose electrical delay time is long cannot be measured correctly. For more information, refer to “Notes when measuring DUTs whose electrical delay time is long” on page 284.
- Trace noise may increase compared to the stepped mode because sampling is performed while sweeping the frequency.
- The specifications are not guaranteed

NOTE When you use the swept mode, it is recommended that you check there is no problem related to measurement before performing actual measurement.

Notes when measuring DUTs whose electrical delay time is long

When sweeping the frequency of the signal applied to the DUT (F), due to the delay time that occurs in the DUT (ΔT), the frequency difference between the input side and output side of the DUT occurs. This frequency difference (ΔF) becomes larger as the electrical delay time of the DUT becomes longer and the frequency sweep speed becomes faster as shown in the following equation.

$$\Delta F = \frac{\mathrm{d}F}{\mathrm{d}t} \times \Delta T$$

When measuring a DUT with long electrical delay time, if you perform measurement (sampling) while sweeping the measurement signal as in the swept mode, a measurement error occurs due to the difference between the frequency outputted from the source port and the frequency actually measured at the receiver port. Especially for the fast swept mode, the effect of this error becomes larger due to its faster frequency sweep speed.

Therefore, when measuring a DUT whose electrical delay time is long, generally use the stepped mode to prevent the measurement error described above. However, if you need to shorten the sweep time, check the measurement error as described below and determine the sweep mode you use.

Procedure to select the sweep mode when measuring a DUT whose electrical delay time is long as fast as possible

Step 1. Perform measurement in both the stepped mode and the fast swept mode.

Step 2. Compare the measurement results of both modes to check the measurement error when using the fast swept mode and determine the sweep mode you use as shown below.

<table>
<tr><th colspan="2">Degree of measurement error</th><th>Sweep mode you should use</th></tr>
<tr><td colspan="2">No problem for required accuracy</td><td>Fast swept mode</td></tr>
<tr><td rowspan="2">Problem for required accuracy</td><td>Only part of the sweep range</td><td>For range with problem: Fast stepped mode
For range without problem: Fast swept mode
(Use the segment sweep.)</td></tr>
<tr><td>Entire sweep range</td><td>Fast stepped mode</td></tr>
</table>

NOTE

By changing the sweep conditions as follows, you can decrease the measurement error when using the fast swept mode. (Although the measurement time becomes longer.)

- Narrow the IF bandwidth.
- Elongate the sweep time.

Fast mode

The fast mode is a sweep mode in which the sweep time is shortened by decreasing the waiting time before sampling (stepped mode) or speeding up the sweep (swept mode) to the limit of the analog performance.

You can always shorten the sweep time by using the fast stepped mode compared to the stepped mode. On the other hand, although there is some difference depending on the IF bandwidth setting, when the measurement point interval is approximately 2 MHz or higher, you can shorten the sweep time by using the fast swept mode compared to the swept mode.

Note that, because the instrument is adjusted to the limit of the analog performance when using the fast mode, correct measurement may not be performed due to the factors including increase of trace noise, depending on the DUT and measurement conditions. In addition, for the fast mode, the instrument specifications are not guaranteed.

NOTE When you use the fast mode, it is recommended that you check there is no problem related to measurement before performing actual measurement.

Procedure to select the sweep mode

Step 1. Press Sweep Setup.

Step 2. Press **Sweep Mode**.

Step 3. Press the softkey corresponding to a proper sweep mode.

Softkey	Function
Std Stepped	Selects the stepped mode.
Std Swept	Selects the swept mode.
Fast Stepped	Selects the fast stepped mode.
Fast Swept	Selects the fast swept mode.

Turning Off the Updating of Information Displayed on the LCD Screen

Turning off the updating of information displayed on the LCD screen causes the processing time required to update displays within the analyzer to be omitted, improving measurement throughput. If it is not necessary to check displayed information during measurements, turning off real-time updating is an effective means of improving throughput.

The updating of information displayed on the LCD screen can be switched using the following procedure:

Turning Off the Updating of Information

Step 1. Press Display.

Step 2. Press **Update** to switch the updating of displayed information on the LCD screen on/off.

When the LCD screen update is turned off, **Update Off** appears on “4. Instrument Status Bar” on page 38.

Turning Off System Error Correction

The E5070B/E5071B executes “IF Range Correction” on page 515 and “Port Characteristics Correction” on page 515 in the data processing flow shown in Figure E-2, “Data Processing Flowchart,” on page 514 by using the system calibration data set at the factory. This system error correction process is not required if the user performs proper calibration by using the Cal and subsequently appearing softkeys, which automatically turns on error correction.

By turning off system error correction, you can reduce the data processing time during measurement and thus improve measurement throughput.

NOTE When you turn ON/OFF system error correction, all calibration data set by user calibration is deleted.

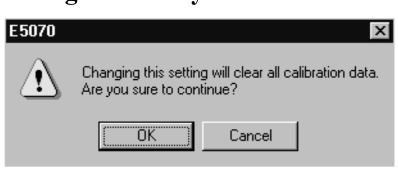
Procedure

Step 1. Press System.

Step 2. Press **Service Menu**.

Step 3. Press **System Correction**. Figure 11-6 appears.

Figure 11-6 **Dialog Box for System Error Correction Change**



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Step 4. Press **OK** to turn ON/OFF system error correction.

Performing a Segment-by-Segment Sweep (Segment Sweep)

This section describes the concept of the segment sweep and how to perform it.

Concept of the Segment Sweep

To perform a segment sweep, you must define two or more frequency ranges called segments, and then specify the number of points, IF bandwidth, power level, sweep mode, sweep delay time, and sweep time for each segment. All segments are swept sequentially as if swept in one sweep operation.

- By skipping the frequency range, which does not need to be measured, you can sweep and measure only the portions you need.
- You can define the optimum measurement conditions for each of the segments you designate. For example, you can specify as many points as possible in a segment requiring high trace resolution and as few points as possible in a segment not requiring high resolution. This shortens the measurement time, enabling you to enhance the overall measurement throughput without the entire measurement operation being drawn into the measurement conditions at a particular frequency range.

To evaluate a band pass filter having the transmission characteristics shown in Figure 11-7, for example, you can select the frequency ranges you need from A through G and determine the measurement conditions shown in the Table . This enables you to measure them simultaneously in one sweep operation.

Figure 11-7 **Characteristics of a DUT on which a Segment Sweep Will be Performed**

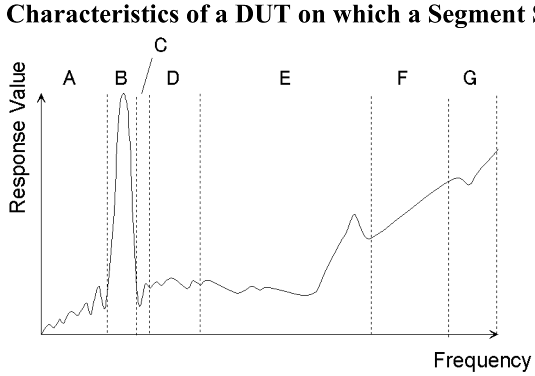


Table 11-3 **Frequency Ranges (Segments) From Figure 11-7 and Their Measurement Conditions**

	Start Frequency	Stop Frequency	Number of Points	IF Bandwidth	Sweep Mode
A	440 MHz	915 MHz	50	50 kHz	Stepped
B	915 MHz	980 MHz	130	70 kHz	Fast Stepped
C	980 MHz	1.035 GHz	60	50 kHz	Stepped
E	1.07 GHz	2 GHz	100	70 kHz	Fast Swept
G	2.6 GHz	3 GHz	40	70 kHz	Fast Swept

Conditions for Setting Up a Segment Sweep

The following conditions apply when setting up a segment sweep.

- The frequency range of a segment must not overlap with that of another segment. (The start frequency of a segment must be higher than the stop frequency of the immediately preceding segment.)
- The start frequency of segment 1 must be greater than 300 kHz and the stop frequency of the last segment less than 3 GHz (E5070A) or 8.5 GHz (E5071A).
- When the start frequency and stop frequency of a segment are not the same, you can define from 2 to 1601 points in a segment.
- When the start frequency and stop frequency of a segment are the same, you can define from 1 to 1601 points in a segment.
- You can set the total number of points in the segment table from 2 to 1601.
- You can set the number of points in the segment table to between 1 and 201.

Items that can be set for each segment

For the segment sweep, you can set the sweep range, the number of points, IF bandwidth, power level, sweep delay time, sweep mode, and sweep time for each segment.

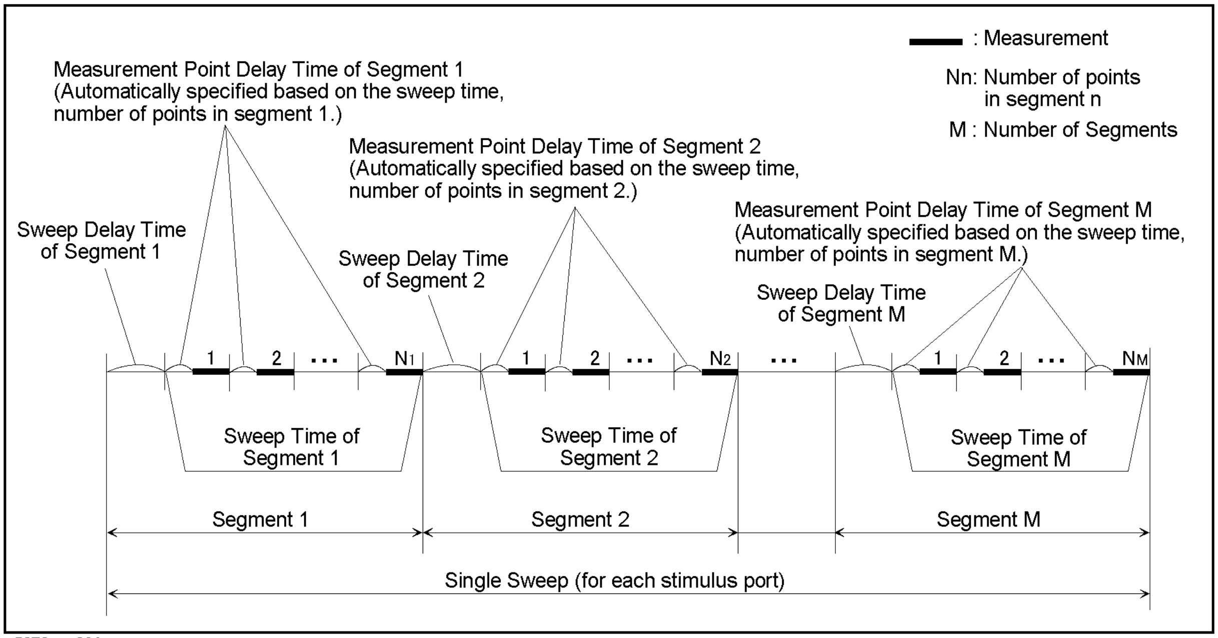
You can set the items in the following table to ON/OFF for each segment. If you enable the segment-by-segment setting, you can make the setting for each segment in the segment table; if you disable it, the setting in the following table is used.

Item	When segment-by-segment setting is disabled
IF bandwidth	For all the segments, the IF bandwidth for the linear/log sweep (set with Avg - **IF Bandwidth**) is set.
Power level	For all the segments, the power level for the linear/log sweep (set with Sweep Setup - **Power**) is set.
Sweep delay time	For all the segments, 0 is set.
Sweep mode	For all the segments, the sweep mode for the linear/log sweep (set with Sweep Setup - **Sweep Mode**) is set.
Sweep time	For all the segments, the auto sweep time mode is set.

Sweep Delay Time and Sweep Time in a Segment Sweep

The definitions for both sweep delay time and sweep time, which you can specify in the segment sweep, are shown in Figure 11-8.

Figure 11-8 Sweep delay time and sweep time in segment sweep



Frequency Base Display and Order Base Display

You can choose between frequency base and order base as the method of displaying traces when executing the segment sweep.

Figure 11-9 Concept of Segment Display

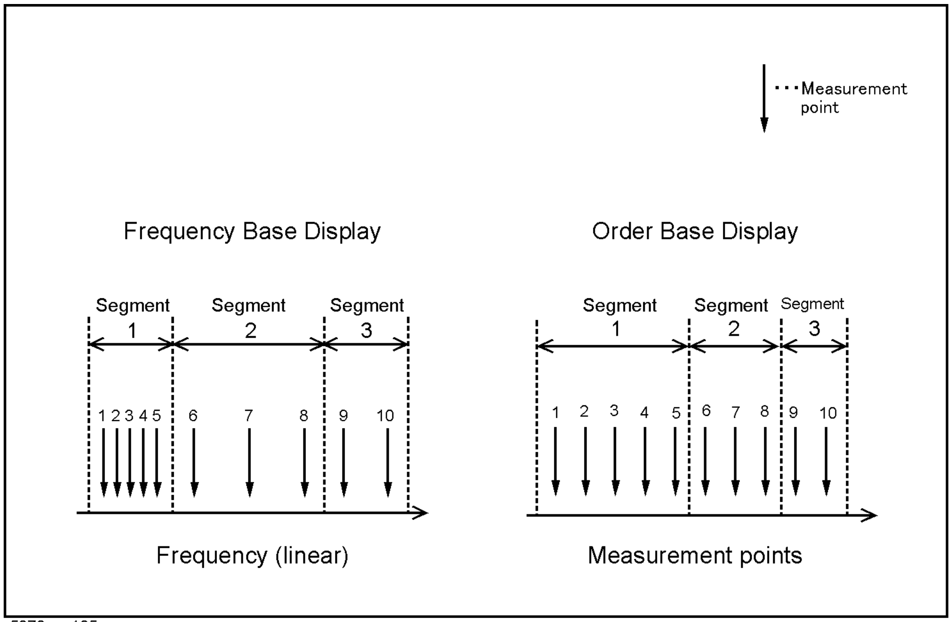
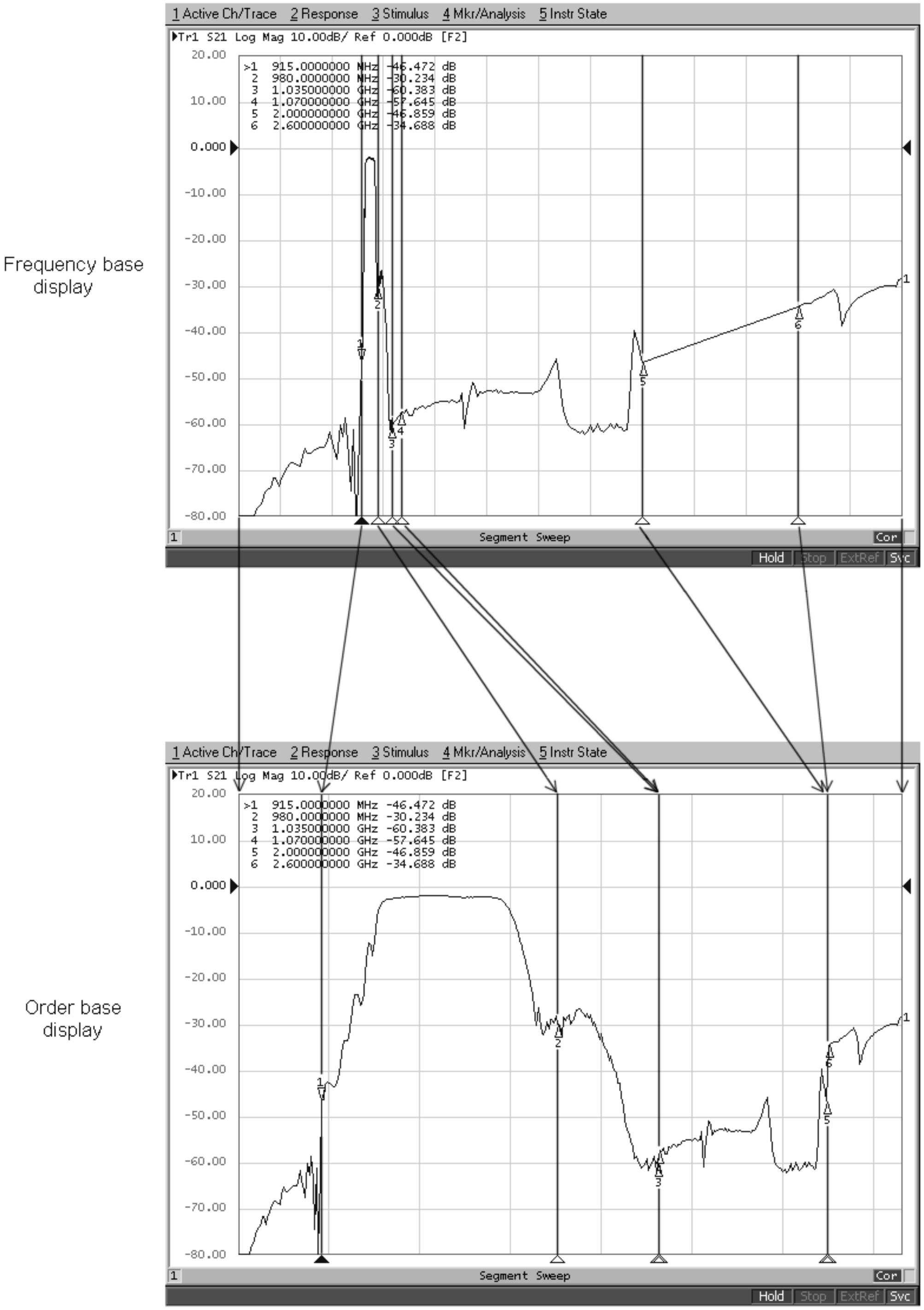


Figure 11-10 Comparing Methods of Displaying Segments



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Procedure

Creating a Segment Table

Step 1. Press Channel Next or Channel Prev to select the channel for which you want to create the segment table.

Step 2. Press Sweep Setup.

Step 3. Press **Edit Segment Table**.

The segment table appears in the lower part of the screen.

Step 4. To change the frequency range setting mode or to set the IF bandwidth, power level, sweep delay time, sweep mode, and sweep time for each segment, use the following softkeys.

NOTE When setting the segment table using the front panel keys or keyboard, you need to place focus on (select) the operation target (segment table of softkey) first. You can change the focus by pressing Focus in the ENTRY block. When the focus is placed on the segment table, the window frame of the segment table is displayed as bright as the window frame of the active channel. When the focus is placed on the softkey menu, the softkey menu title area is displayed in blue.

Softkey	Function
Freq Mode	Switches the frequency range setting mode (start/stop or center/span).
List IFBW	Toggles ON/OFF the IF bandwidth setting for each segment. Only when this setting is ON, the row (**IFBW**) for setting appears in the segment table.
List Power	Toggles ON/OFF the power level setting for each segment. Only when this setting is ON, the row (**Power**) for setting appears in the segment table.
List Delay	Toggles ON/OFF the sweep delay time setting for each segment. Only when this setting is ON, the row (**Delay**) for setting appears in the segment table.
List Sweep Mode	Toggles ON/OFF the sweep mode setting for each segment. Only when this setting is ON, the row (**Sweep Mode**) for setting appears in the segment table.
List Time	Toggles ON/OFF the sweep time setting for each segment. Only when this setting is ON, the row (**Time**) for setting appears in the segment table.

Step 5. Repeat entering each item in the following table and adding a segment (line) to create the segment table.

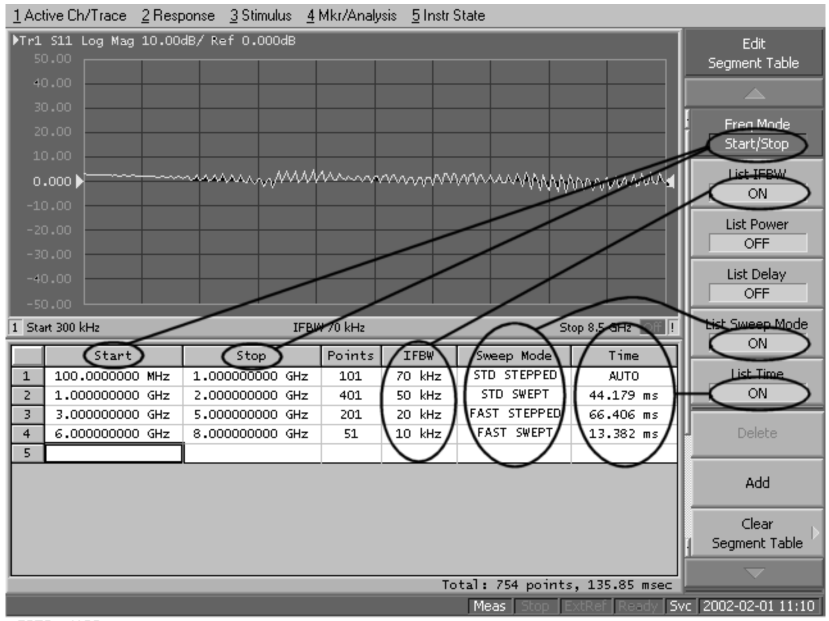
Start	Set the start value of the sweep range.
Stop	Set the stop value of the sweep range.
Center	Set the stop value of the sweep range.
Span	Set the span value of the sweep range.
Points	Set the number of points.
IFBW	Set the IF bandwidth.
Power	Set the power level. The power range is common to the setting for the linear/log sweep (Sweep Setup - **Power Ranges**).
Delay	Set the sweep delay time.
Sweep Mode	Set the sweep mode. Select one of the following items. **STD STEPPED** Stepped mode **STD SWEPT** Swept mode **FAST STEPPED** Fast stepped mode **FAST SWEPT** Fast swept mode
Time	Set the sweep time. To specify the auto setting (**AUTO**), enter 0 as the sweep time.

To create the segment table, use the following keys.

Hardkey	Function
Enter	If you select a cell and then press this key, you enter into the mode in which you can edit the cell character by character. If you change a value and then press this key, the value is entered into the cell.
↑ ↓	Move up and down in the cell selected in the segment table. In the character-by-character edit mode, you can select an item or perform the step change of data.
⇤ ⇥	Move right and left in the cell selected in the segment table.

Softkey	Function
Delete	Deletes the line in which the selected cell is included.
Add	Adds a new line above the line in which the selected cell is included.
Clear Segment Table - OK	Resets the segment table. As a result, segment 1 that is initialized remains.

Figure 11-11 **Example of creating segment table**



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Useful functions when using a mouse

By right-clicking on the selected cell, you can use the following shortcut menu.

Shortcut	Function
Copy	Copies the value in the selected cell into the clipboard (internal temporary storage memory).
Paste	Pastes the value data in the clipboard to a newly selected cell.
Insert	Adds a new line above the selected cell.
Delete	Deletes the line in which the selected cell is included.

In the character-by-character edit mode, you can use the following shortcut menu also.

Shortcut	Function
Undo	Undoes the change and restore the value before the change.
Cut	Cuts the selected string and store it into the clipboard (temporary memory).
Copy	Copies the selected string into the clipboard.
Paste	Pastes the string in the clipboard to a newly selected cell.
Delete	Deletes the selected string.
Select All	Selects the entire string in the cell.

Executing Segment Sweep

To execute a segment sweep by using the segment table you have created, you must specify the sweep type for that sweep operation by following the steps described below.

Step 1. Press Channel Next or Channel Prev to select the channel on which you will execute the segment sweep operation.

Step 2. Press Sweep Setup.

Step 3. Press **Sweep Type**.

Step 4. Press **Segment**.

Setting Up the Segment Display

Define the method of displaying traces when the segment sweep is executed by following the steps described below.

Step 1. Press Channel Next or Channel Prev to select the channel on which you will define the segment display.

Step 2. Press Sweep Setup.

Step 3. Press **Segment Display**.

Step 4. Select segment display.

Softkey	Function
Freq Base	Displays the X-axis as the axis for linear frequencies (frequency base display).
Order Base	Displays the X-axis as the axis for the points (order base display).

Saving a Newly Created Segment Table in CSV Format

As discussed in "Creating a Segment Table" on page 291, you can export the newly created segment table as a CSV (comma-separated value) formatted file (so it can be used easily in software that requires a different format).

Step 1. Press Sweep Setup.

Step 2. Press **Edit Segment Table**.

Step 3. Press **Export to CSV File** to open the Save As dialog box. For more information on the Save As dialog box, see Figure 9-1, "Save As Dialog Box," on page 247. Note that "CSV Files (*.csv)" will already be selected as the file type when the dialog box first opens.

Step 4. Type the file name in the **File Name** area, and press **Save** to save the segment table.

Calling a Segment Table Saved in CSV Format

By importing a segment table created following the steps described in "Saving a Newly Created Segment Table in CSV Format" on page 295 (inputting a file in a different software format), you can set up the segment table.

NOTE It is possible to recall a file from a different channel where it was saved.

Step 1. Press Sweep Setup.

Step 2. Press **Edit Segment Table**.

Step 3. Press **Import from CSV File** to open the Open dialog box. For more information on the Open dialog box, see Figure 9-2, "Open Dialog Box," on page 249. Note that "CSV Files (*.csv)" will already be selected as the file type when the dialog box first opens.

Step 4. Select the CSV format file to be imported, and press **Open** to call up the segment table.

NOTE You cannot import a CSV-formatted file created/edited in spreadsheet software into the E5070B/E5071B. Furthermore, you cannot import a CSV format file exported following the steps described in "Saving a Newly Created Segment Table in CSV Format" on page 295 if a change has been made to that file.

12 Setting and Using the Control and Management Functions

This chapter describes how to set and use the control and management functions not directly linked with measurement or analysis.

Setting the GPIB

This section describes how to set the interface necessary to use the GPIB (General Purpose Interface Bus) of the E5070B/E5071B. For information on the concept and concrete implementation of the auto measurement using GPIB, refer to “Programmers Guide.”

Setting talker/listener GPIB address of E5070B/E5071B

When controlling the E5070B/E5071B using GPIB commands from the external controller connected to the GPIB connector, you need to set the talker/listener GPIB address of the E5070B/E5071B.

Follow these steps to make this setting:

Step 1. Press System.

Step 2. Press **Misc Setup**.

Step 3. Press **GPIB Setup**.

Step 4. Press **Talker/Listener Address**.

Step 5. Enter the address using the ENTRY block keys on the front panel.

Setting system controller (USB/GPIB interface)

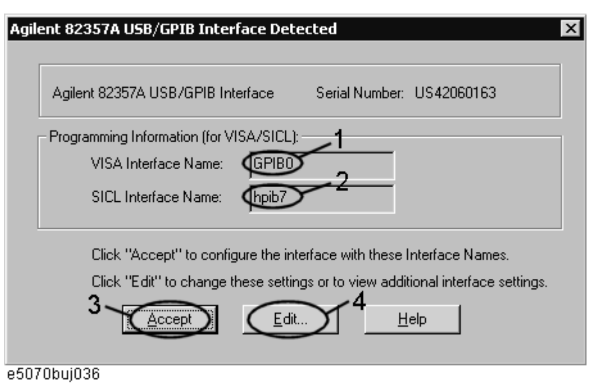
When controlling an external device from the E5070B/E5071B, connect the USB port of the E5070B/E5071B and the GPIB port of the external device through the USB/GPIB interface.

Follow these steps to set the USB/GPIB interface:

Step 1. Connect the USB port of the E5070B/E5071B to the USB/GPIB interface. The USB/GPIB Interface Detected dialog box (Figure 12-1) appears.

NOTE Do not connect two or more USB/GPIB interfaces.

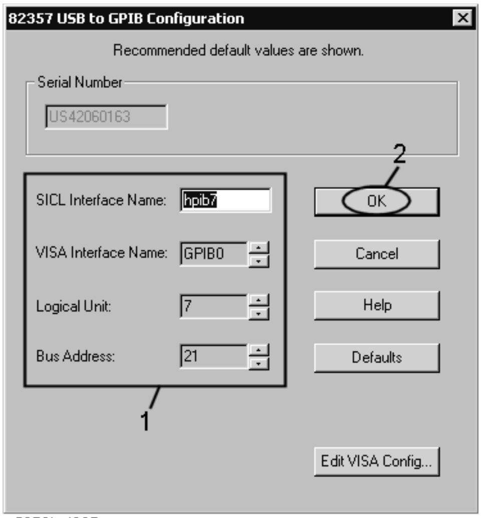
Figure 12-1 **USB/GPIB Interface Detected dialog box**



Step 2. Confirm that VISA Interface Name is set to GPIB0 (1 in Figure 12-1) and SICL Interface Name is set to hpib7 (2 in Figure 12-1) and then click the **Accept** button (3 in Figure 12-1). If the setting is correct, the procedure is complete. If the setting is different, click the **Edit** button (4 in Figure 12-1).

Step 3. The USB to GPIB Configuration dialog box (Figure 12-2) appears. Make the setting enclosed in the thick lines in Figure 12-2 (1 in Figure 12-2) according to the figure and then click the **OK** button (2 in Figure 12-2).

Figure 12-2 **USB to GPIB Configuration dialog box**



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If you need to check/change the setting of the USB/GPIB interface after connecting the USB/GPIB interface, follow these steps:

Step 1. Press System.

Step 2. Press **Misc Setup**.

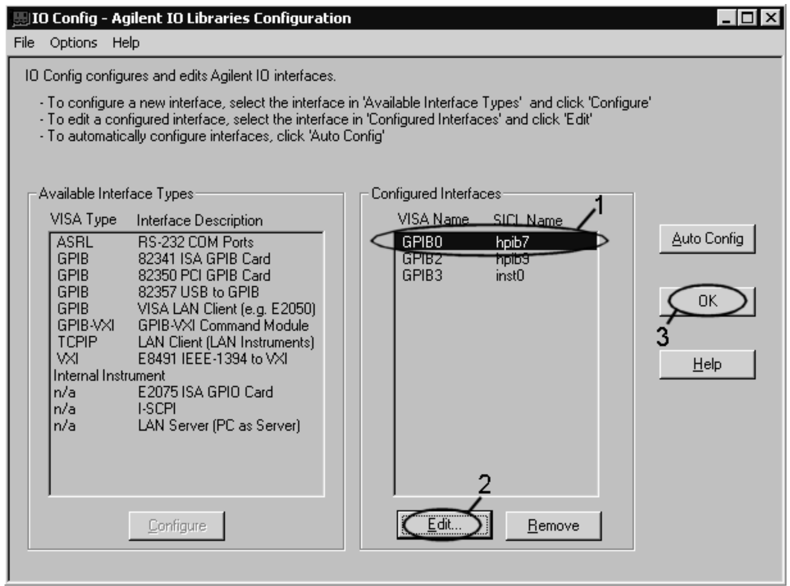
Step 3. Press **GPIB Setup**.

Step 4. Press **System Controller Configuration**.

Step 5. The IO Config dialog box (Figure 12-3) appears. Select (highlight) **GPIB0 hpib7** (1 in Figure 12-3) and then click the **Edit** button (2 in Figure 12-3).

NOTE In the IO Config dialog box, do not click buttons other than specified here or do not change other settings because doing so may cause serious damage to the functions of the E5070B/E5071B.

Figure 12-3 **IO Config dialog box**



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Step 6. The USB to GPIB Configuration dialog box (Figure 12-2) appears. Check/change the setting of the USB/GPIB interface and then click the **OK** button (2 in Figure 12-2).

Step 7. In the USB to GPIB Configuration dialog box, click the **OK** button (3 in Figure 12-3).

Setting the Internal Clock

The E5070B/E5071B has the built-in clock that keeps track of the date and time. This clock is used for the following functions.

- To display the current date and time in the instrument status bar at the lower part of the screen
- To write date and time information when saving internal data or a VBA program

Setting the Date and Time

Step 1. Press System .

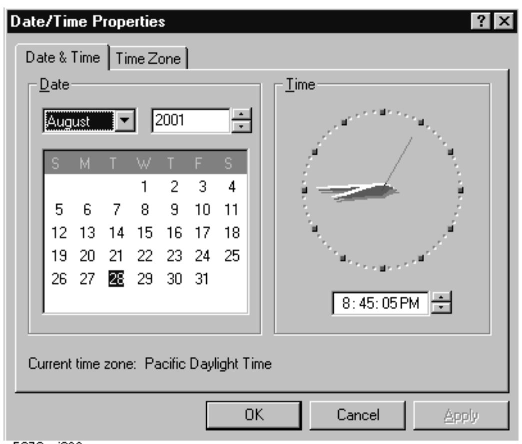
Step 2. Press **Misc Setup**.

Step 3. Press **Clock Setup**.

Step 4. Press **Set Date and Time**.

The dialog box in Figure 12-4 appears.

Figure 12-4 **Date/Time Properties Dialog Box ("Date & Time" Tab)**



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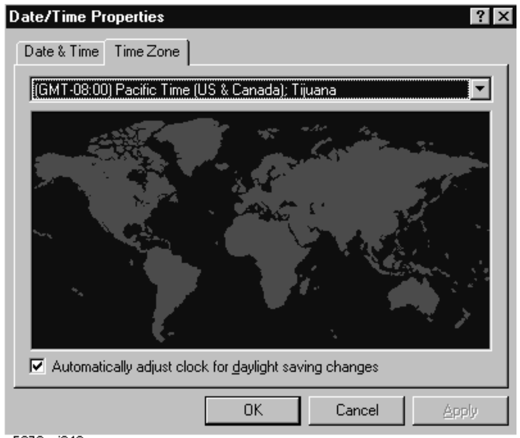
Step 5. Set the date in the **Date** area, and set the time in the **Time** area.

Step 6. Press the **Time Zone** tab.

The dialog box in Figure 12-5 appears.

Figure 12-5 **Date/Time Properties Dialog Box (“Time Zone” Tab)**



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Step 7. In the drop-down list box select a time zone.

Step 8. To make the summertime setting automatically, check **Automatically adjust clock for daylight saving changes** to assign the check mark (√) to it.

Step 9. Press the **OK** button.

Setting the Date/Time Display ON/OFF

The date/time display in the instrument status bar can be switched on/off using the following procedure.

Step 1. Press System .

Step 2. Press **Misc Setup**.

Step 3. Press **Clock Setup**.

Step 4. Press **Show Clock** to switch the date/time display on/off.

Setting the Mouse

The user can change the setup for the mouse connected to the E5070B/E5071B and the movement of the pointer.

Setup Step

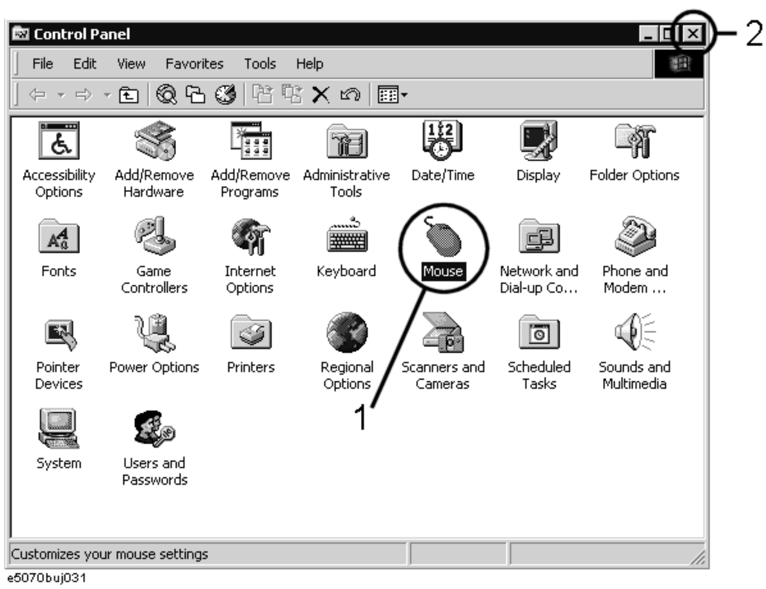
NOTE Be sure to use a mouse and a keyboard for mouse setup operations.

Step 1. Press System .

Step 2. Press **Misc Setup**.

Step 3. Press **Control Panel** to open the Control Panel window.

Figure 12-6 **Control Panel Window**



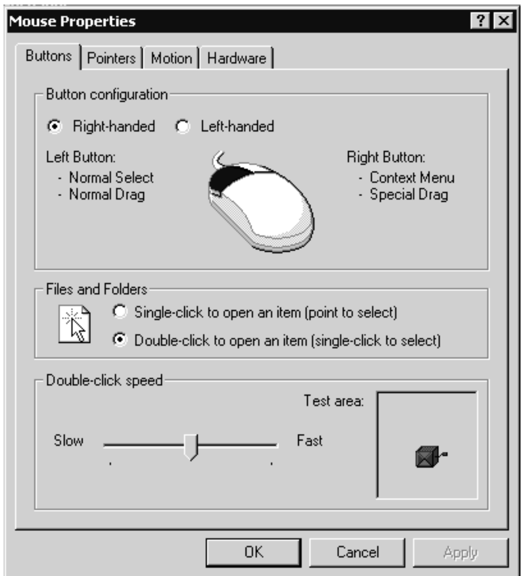
Step 4. Double-click the **Mouse** icon (1 in Figure 12-6) in the Control Panel window.

NOTE Do not click icons other than specified here or do not change other settings because doing so may cause serious damage to the functions of the E5070B/E5071B.

Step 5. The Mouse Properties dialog box (Figure 12-7) is displayed.

Define the setup for a right-handed/left-handed person in the **Buttons configuration** area. Define also the setup for double-click speed in the **Double-click speed** area.

Figure 12-7 Mouse Properties Dialog Box (Buttons tab)



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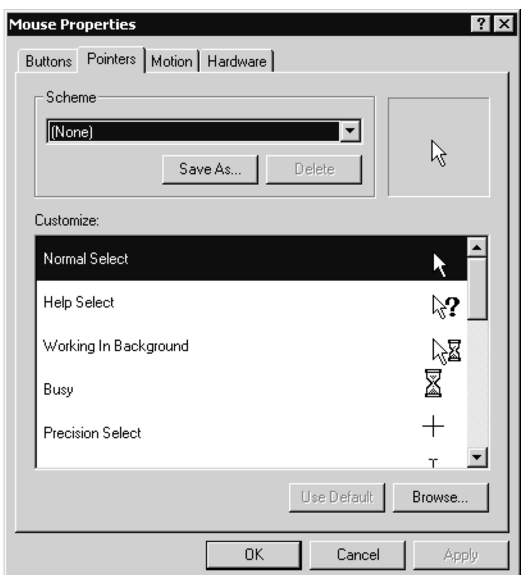
Step 6. Click the **Pointers** tab (Figure 12-8).

Figure 12-8 Mouse Properties Dialog Box (Pointers tab)



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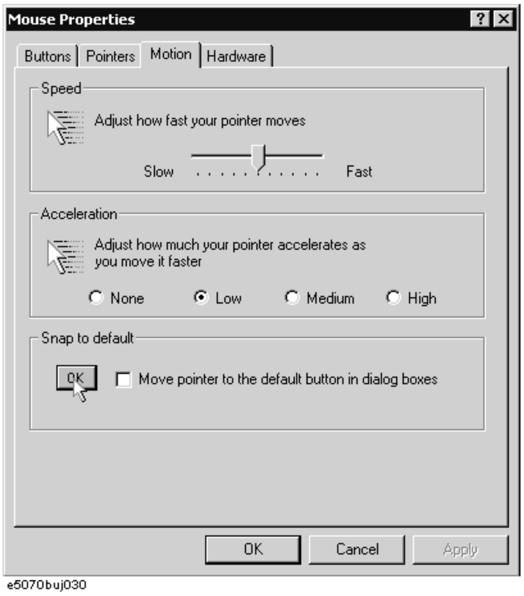
Step 7. Enter a registration name into the **Scheme** box and specify the shapes of pointers for the registration name in the box below.

To create a registration name, click the **Save As...** button. Enter the registration name into the **Save Scheme** dialog box that appears, and click the **OK** button.

Step 8. Click the **Motion** tab (Figure 12-9).

Figure 12-9 **Mouse Properties Dialog Box (Motion tab)**



Step 9. Specify the pointer speed in the **Pointer speed** area and the pointer trail in the **Pointer trail** area.

Step 10. Click the **OK** button.

Step 11. Click the × button (1 in Figure 12-6) at the corner in the Control Panel window.

Configuring the Network

NOTE When you use the E5070B/E5071B by connecting it to your LAN, consult your network administrator and make the setting of the LAN correctly.

This section describes how to set the following basic items necessary to connect the E5070B/E5071B to the LAN (Local Area Network).

- ❏ "Enabling/disabling network" on page 306
- ❏ "Setting IP address" on page 307
- ❏ "Specifying computer name" on page 309

If you need detail network settings, consult your network administrator and perform operation in the same way as the Windows 2000® PC.

Enabling/disabling network

You can enable/disable the network connection function of the E5070B/E5071B.

Follow these steps to enable/disable the network connection function.

Step 1. Use the LAN cable to connect the E5070B/E5071B to the LAN.

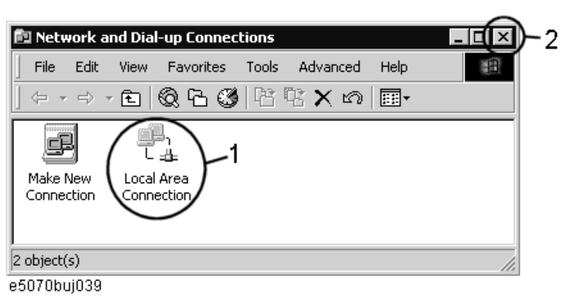
Step 2. Press [System].

Step 3. Press **Misc Setup**.

Step 4. Press **Network Setup**.

Step 5. Press **Network Configuration** to open the Network and Dial-up Connections window (Figure 12-10).

Figure 12-10 **Network and Dial-up Connections window**



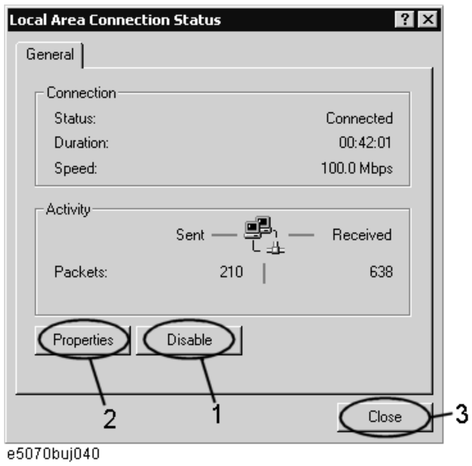
Step 6. When switching from disable to enable:

Double-click the Local Area Connection icon (1 in Figure 12-10) in the Network and Dial-up connections window to enable the network connection function.

When switching from enable to disable:

Double-click the Local Area Connection icon (1 in Figure 12-10) in the Network and Dial-up Connections window. The Local Area Connection Status dialog box (Figure 12-11) appears. Click the **Disable** button (1 in Figure 12-11) to disable the network connection function.

Figure 12-11 Local Area Connection Status dialog box



Step 7. Click the × button (2 in Figure 12-10) in the upper right of the Network and Dial-up Connections window.

Setting IP address

Follow these steps to set the IP address:

Step 1. Press System .

Step 2. Press **Misc Setup**.

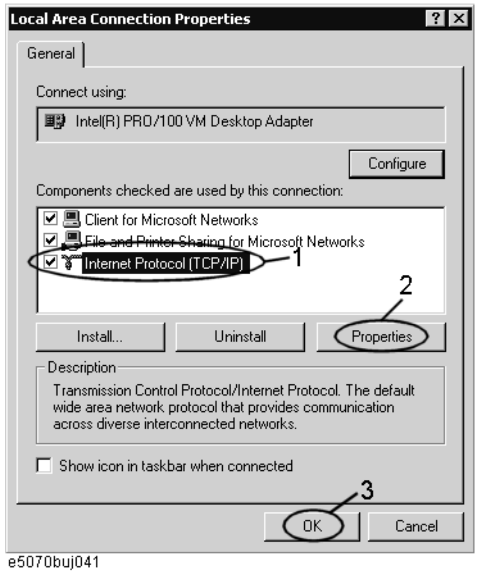
Step 3. Press **Network Setup**.

Step 4. Press **Network Configuration**.

Step 5. Double-click the Local Area Connection icon (1 in Figure 12-10) in the Network and Dial-up Connections window. The Local Area Connection Status dialog box (Figure 12-11) appears. Click the **Properties** button (2 in Figure 12-11).

Step 6. The Local Area Connection Properties dialog box (Figure 12-12) appears. Select (highlight) **Internet Protocol (TCP/IP)** (1 in Figure 12-12) and then click the **Properties** button (2 in Figure 12-12).

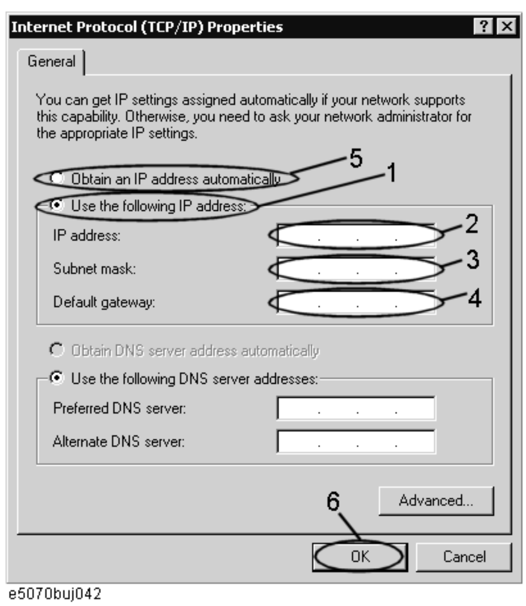
Figure 12-12 **Local Area Connection Properties dialog box**



Step 7. The Internet Protocol (TCP/IP) Properties dialog box (Figure 12-13) appears. Click (select) **Use the following IP address** (1 in Figure 12-13) and then enter the IP address (2 in Figure 12-13), the subnet mask (3 in Figure 12-13), and the gateway address (4 in Figure 12-13).

If the IP address can be obtained automatically (if the DHCP server can be used), click (select) **Obtain an IP address automatically** (5 in Figure 12-13).

Figure 12-13 **Internet Protocol (TCP/IP) Properties dialog box**



Step 8. In the Internet Protocol (TCP/IP) Properties dialog box, click the **OK** button (6 in Figure 12-13).

Step 9. In the Local Area Connection Properties dialog box, click the **OK** button (3 in Figure 12-12).

Step 10. In the Local Area Connection Status dialog box, click the **Close** button (3 in Figure 12-11).

Step 11. Click the × button (2 in Figure 12-10) in the upper right of the Network and Dial-up Connections window.

Specifying computer name

Follow these steps to specify the computer name:

Step 1. Press System .

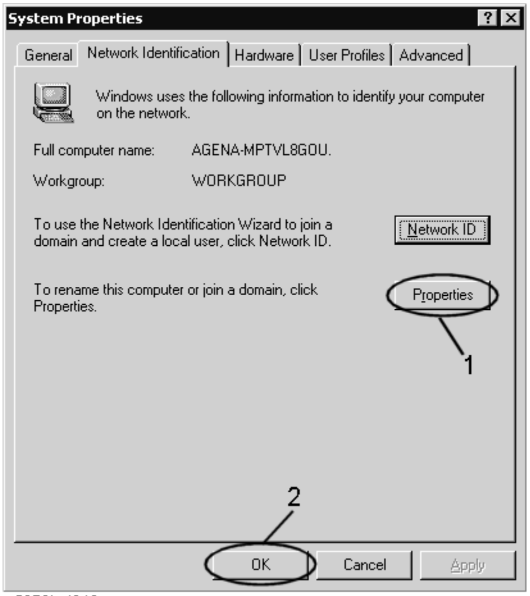
Step 2. Press **Misc Setup**.

Step 3. Press **Network Setup**.

Step 4. Press **Network Identification**.

Step 5. The System Properties dialog box (Figure 12-14) appears. Click the **Properties** button (1 in Figure 12-14).

Figure 12-14 **System Properties dialog box**



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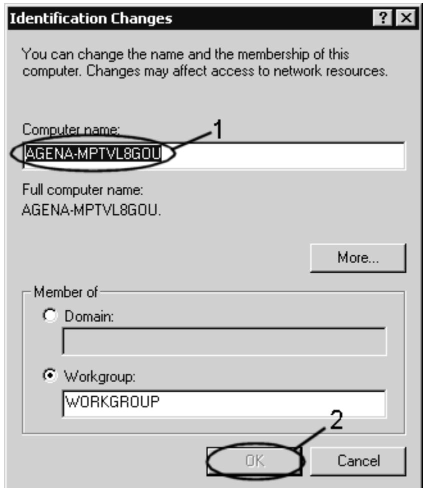
Step 6. The Identification Changes dialog box (Figure 12-15) appears. Enter the computer name in the **Computer Name** box (1 in Figure 12-15).

Figure 12-15 **Identification Changes dialog box**



e5070buj044

Step 7. The Network Identification dialog box (Figure 12-16) appears. Click the **OK** button.

Figure 12-16 **Network Identification dialog box**

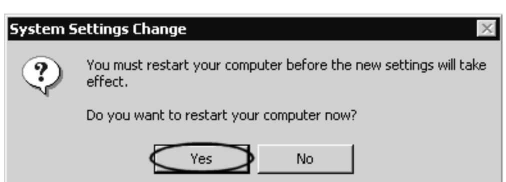
e5070buj045

Step 8. In the Identification Changes dialog box, click the **OK** button (2 in Figure 12-15).

Step 9. In the System Properties dialog box, click the **OK** button (2 in Figure 12-14).

Step 10. The System Settings Change dialog box (Figure 12-17) appears. Click the **Yes** button to restart the E5070B/E5071B.

Figure 12-17 **System Settings Change dialog box**



e5070buj046

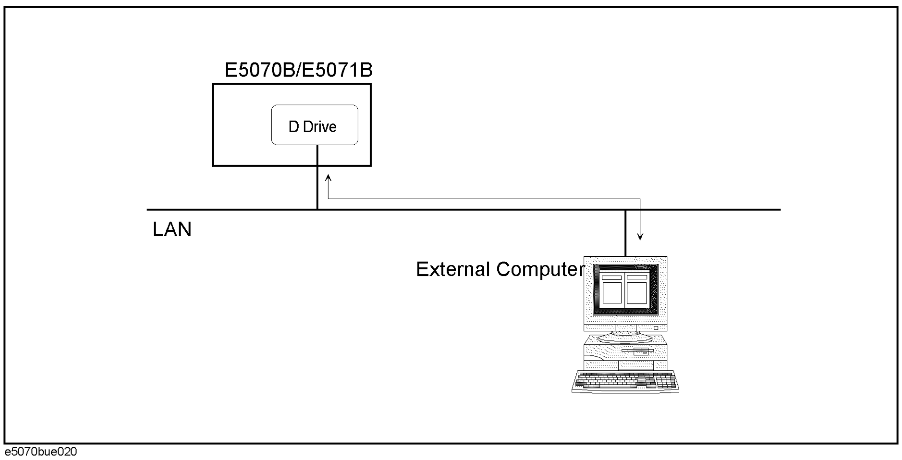
NOTE Until the E5070B/E5071B is restarted, changed setting does not take effect.

Accessing Hard Disk of E5070B/E5071B from External PC

If you connect the E5070B/E5071B to LAN, you can access the hard disk (D drive) in the E5070B/E5071B as a network drive from an external PC connected to the same LAN.

NOTE See “Connecting Hard Disk (Shared Folder) of External PC” of Chapter 6, “Application Programs” in *VBA Programmer's Guide* for information on accessing the hard disk of the external PC connected to the same LAN from the E5070B/E5071B.

Figure 12-18 Accessing to drive D of E5070B/E5071B from external PC



Enabling the access form the external PC

This section shows the simplest procedure to enable the access from the external PC.

NOTE It is recommended that you use setting with higher security consulting your network administrator.

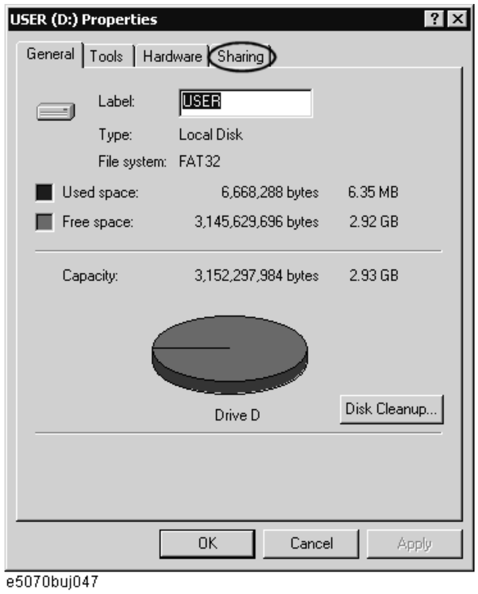
Step 1. Press Save/Recall.

Step 2. Press **Explorer...**.

Step 3. The Windows Explorer (refer to Figure 9-8 on page 257) opens. Select (highlight) **USER (D:)** and then click **Properties** in the File menu.

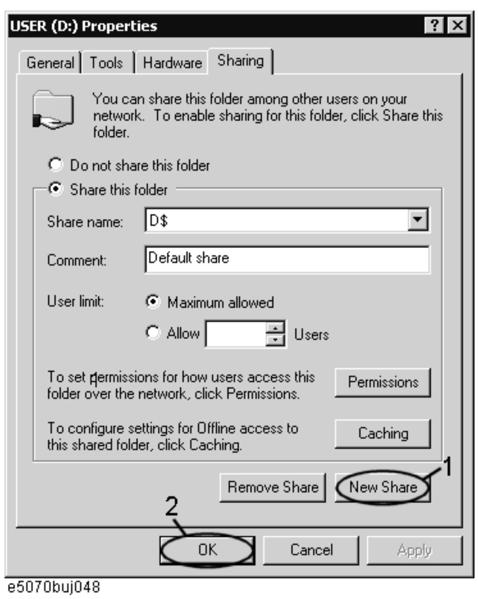
Step 4. The USERS(D:) Properties dialog box (Figure 12-19) appears. Select the **Sharing** tab.

Figure 12-19 **USERS(D:) Properties dialog box (General tab)**



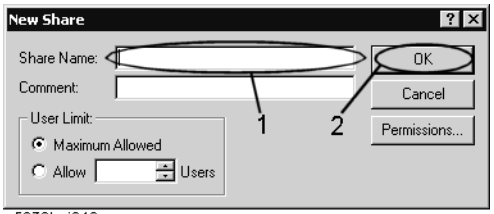
Step 5. Click the **New Share** button (1 in Figure 12-20).

Figure 12-20 **USERS(D:) Properties dialog box (Sharing tab)**



Step 6. The New Share dialog box (Figure 12-21) appears. Enter the share name (name used when accessed from the external PC) in the **Share Name** box (1 in Figure 12-21) and click the **OK** button (2 in Figure 12-21).

Figure 12-21 **New Share dialog box**



e5070buj049

Step 7. In the USERS(D:) Properties dialog box, click the **OK** button (2 in Figure 12-20).

Accessing hard disk of E5070B/E5071B from external PC

This section describes the procedure to connect to the hard disk (D drive) in the E5070B/E5071B to which access has been made possible according to the procedure described in “Enabling the access form the external PC” on page 311 from the external PC, taking Windows NT ® as an example.

NOTE For information on connection, see your PC's operation manual.

Step 1. From the Start menu, click Programs - Windows Explorer to start the Explorer.

Step 2. From the Explorer's menu, click **Tools - Map Network Drive...**.

Step 3. The Map Network Drive dialog box appears. Select an appropriate drive, enter **\\C_NAME\S_NAME** as the network path and then click the **OK** button.

C_NAME in the network path is the computer name of the E5070B/E5071B and **S_NAME** is the share name of the D drive. For information on how to set the computer name, refer to “Specifying computer name” on page 309; for information on how to set the share name, refer to “Enabling the access form the external PC” on page 311.

Step 4. The dialog box to enter the user name and the password appears. Enter an appropriate user name and password and then click the **OK** button.

The user name and password differ depending on the setting made when enabling access from the external PC. When you have set them according to “Enabling the access form the external PC” on page 311, you can make connection using the user name, **agena**, without the password.

Locking the Front Keys, Keyboard, and/or Mouse (Touch Screen)

You can lock (disable) the front keys, keyboard, and/or mouse (touch screen). This feature prevents erroneous operation caused by inadvertently touching any of these devices.

Locking the Front Keys, Keyboard, and/or Mouse

Step 1. Press System.

Step 2. Press **Misc Setup**.

Step 3. Press **Key Lock**.

Step 4. Press the corresponding key to switch the lock on/off.

Softkey	Function
Front Panel & Keyboard Lock	Switches the lock for the front panel keys and keyboard on/off.
Touch Screen & Mouse Lock	Switches the lock for the touch screen and mouse on/off.

NOTE You cannot use a locked device to unlock that same device. To unlock the front panel keys, keyboard, touch screen and mouse that have been locked, press the Standby switch to turn off the power supply and then turn it on again. When setting at power-on, the front panel keys, keyboard, touch screen and mouse are all in an unlocked condition.

Setting the Beeper (Built-in Speaker)

The E5070B/E5071B has a built-in speaker that sounds a beep tone. The beeper allows you to make two types of settings shown in Table 12-1.

Table 12-1 Beeper Functions

Type	Function
Operation complete beeper	Sounds a beep tone to inform the user that operations have completed. • When calibration data measurements are done • When data storage has completed
Warning beeper	Sounds a beep tone to prompt the user to use caution. • When an instrument error occurs (An error message appears at the same time.) • When a limit test fails

The warning beeper sounds slightly longer than the operation complete beeper.

Setting the Operation Complete Beeper

Step 1. Press System.

Step 2. Press **Misc Setup**.

Step 3. Press **Beeper**.

Step 4. Press **Beep Complete** to switch the operation complete beeper on/off.

Pressing **Test Beep Complete** allows you to hear and check the beep tone of the operation complete beeper.

Setting the Warning Beeper

Step 1. Press System.

Step 2. Press **Misc Setup**.

Step 3. Press **Beeper**.

Step 4. Press **Beep Warning** to switch the warning beeper on/off.

Pressing **Test Beep Warning** allows you to hear and check the beep tone of the warning beeper.

Turning off the LCD Screen Backlight

You can switch off the backlight (illumination) of the LCD screen of the E5070B/E5071B. This extends the life of the backlight when using it continuously over a long period.

Turning off the LCD Screen Backlight

Step 1. Press System.

Step 2. Press **Backlight** to switch the backlight on/off.

Switching off the backlight causes indications on the LCD screen to be almost invisible.

The backlight that has been switched off can be turned on again by pressing Preset. When the LCD backlight is off, Preset works as a key for switching the backlight back on.

Checking the product information

Checking the serial number

The revision number of the firmware installed in the E5070B/E5071B can be checked using the following procedure.

Checking the serial number

Step 1. Press System .

Step 2. Press **Service Functions**.

Step 3. Press **Enable Options**.

The serial number is displayed in the softkey menu bar.

Checking the Firmware Revision

The revision number of the firmware installed in the E5070B/E5071B can be checked using the following procedure.

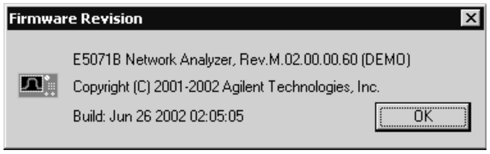
Checking the Firmware Revision

Step 1. Press System .

Step 2. Press **Firmware Revision**.

The Firmware Revision dialog box (Figure 12-22) appears.

Figure 12-22 **Firmware Revision Dialog Box**



Step 3. Press **OK** to close the dialog box.

System Recovery

By executing system recovery, you can return the system of the E5070B/E5071B (the Windows operating system and the firmware) to the factory state (at the time of purchase[*1]).

Notes on executing system recovery

Executing system recovery causes the following:

❑ In addition to the Windows operating system and the firmware, the following settings of the E5070B/E5071B are returned to the factory state.

- Network setting
- GPIB setting
- Printer setting

❑ The driver for the supported printer installed after purchase is deleted.

❑ You need to execute initial registration again.

Files you created using the save function (files in the D drive) are not affected, but we recommend backing them up before executing system recovery for precautionary purposes. For more information on backup, refer to “Making Backup Files” on page 418.

*1. If the hard disk failed and has been replaced after purchase, the state when the replacement was performed is recovered.

Procedure to execute system recovery

NOTE You need the keyboard for this operation.

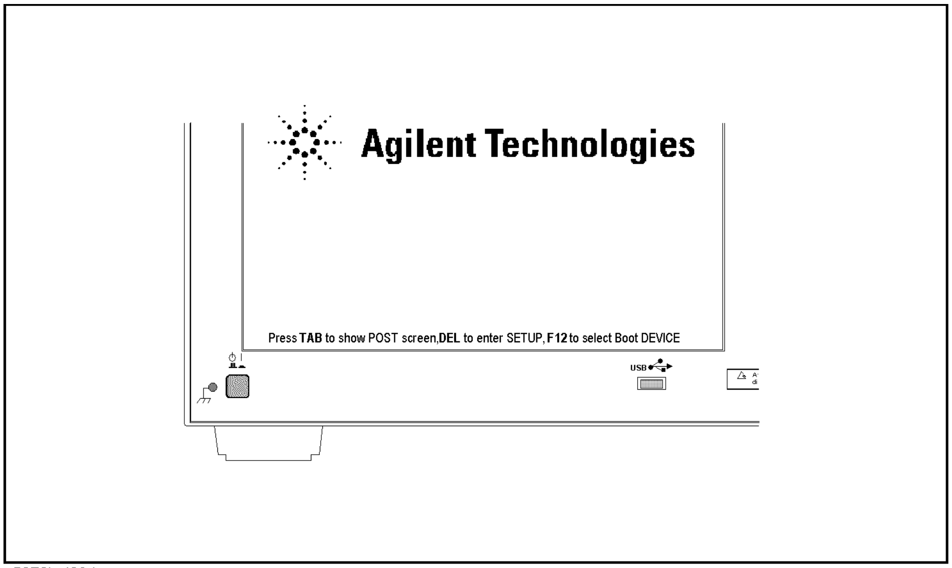
Step 1. Shut down the E5070B/E5071B.

Step 2. Connect the keyboard to the E5070B/E5071B.

Step 3. Insert the disk for the system recovery into the floppy disk drive of the E5070B/E5071B.

Step 4. Press the standby switch of the E5070B/E5071B to turn it on.

Step 5. When the screen as shown in the figure below appears, press and hold F12 of the keyboard until this screen disappears.



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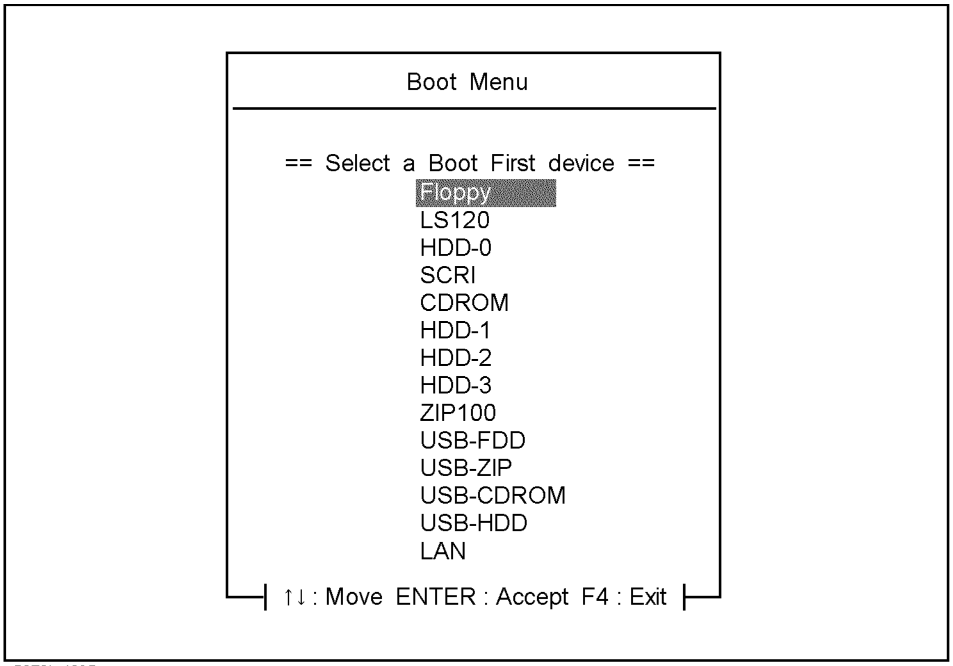
NOTE After several seconds, the next screen appears automatically even if you do not press any key, so do not miss it.

If the above message does not appear, the instrument is at fault; contact your local Agilent customer center listed at the end of this manual or distributor.

Step 6. The following screen appears. Check that Floppy is selected (highlighted) (if Floppy is not selected, select it with [↑] of the keyboard), and press [Enter] of the keyboard.



e5070buj035

Step 7. The message as shown below appears. Press [1] of the keyboard. If you want to cancel the system recovery, press [2] here.

```
Agilent Technologies System Utilities
Recovery & Backup Options (for the E5070/71B)

Choose One of the following:
_________________________________________________________________

   1. Recover Factory Backup Image
   2. Exit
_________________________________________________________________

Enter a Choice: _
```

NOTE If the above message does not appear, the instrument or the disk for the system recovery is at fault; contact your local Agilent customer center listed at the end of this manual or distributor.

Step 8. The message as shown below appears. Press C of the keyboard. If you want to cancel the system recovery, press E here.

```
You chose to Restore your system by installing the original factory
installed OS and system software.

WARNING: Press C to Continue only if you are sure that you want
to proceed.  The C: Drive will be completely overwritten with no
chance of recovering any data.  Use Option 1 to recover the system
from a serious malfunction caused by corrupted or inadvertently
deleted files on the system's primary C: partition.

Press C to Continue or E to Exit: _
```

Step 9. The message as shown below appears. Press C of the keyboard to start the system recovery. If you want to cancel the system recovery, press E here.

```
CAUTION! Interrupting this process may leave the system in an
         unstable state.  Allow the software to complete the
         backup and recovery process.  This may take up to 20
         minutes depending on the system configuration.

Press C to Continue or E to Exit: _
```

CAUTION **Never turn off the power during the system recovery because doing so may cause serious damage to the E5070B/E5071B.**

Step 10. The system recovery will be complete in about 5 minutes. When the system recovery is complete, the message as shown below appears. Press Ctrl, Alt, and Delete of the keyboard at the same time to restart.

```
Remove the disk and Press CLT+ALT+DEL to restart your
system.
```

NOTE If the above message does not appear, the instrument is at fault; contact your local Agilent customer center listed at the end of this manual or distributor.

Step 11. After restart, the screen for initial registration appears. Execute initial registration. For information on the execution procedure, refer to *Installation/Quick Start Guide*.

Step 12. For the E5070B/E5071B equipped with the Option 016 touch screen, execute the calibration of the touch screen. For information on the execution procedure, refer to “Calibration of the Touch Screen” on page 322.

Calibration of the Touch Screen

When you have executed system recovery on the E5070B/E5071B equipped with an Option 016 touch screen, you have to calibrate the touch screen. Follow the procedure described below to calibrate the touch screen.

Step 1. Press System.

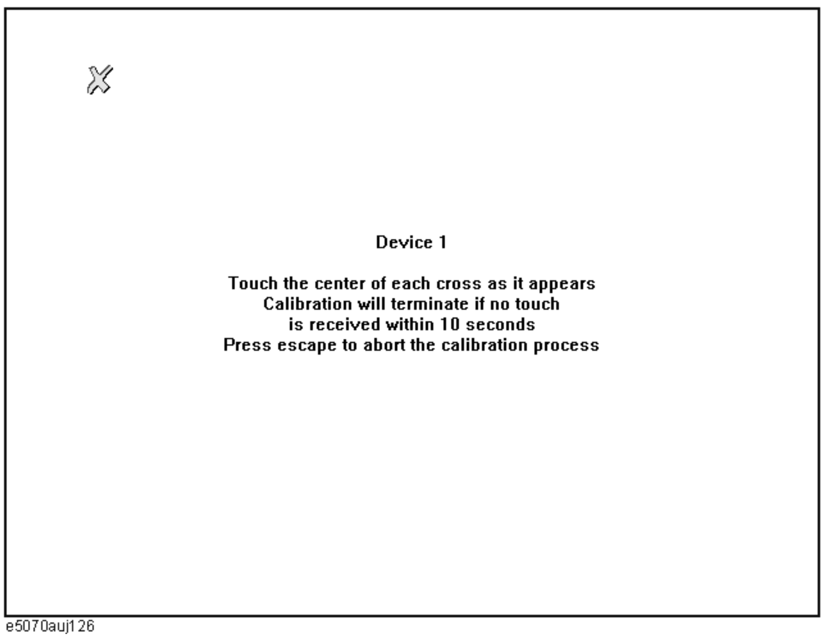
Step 2. Press **Service Menu**.

Step 3. Press **Test Menu**.

Step 4. Press **Adjust Touch Screen**.

The touch screen calibration screen (Figure 12-23) appears.

Figure 12-23 **Touch Panel Calibration Screen**



Step 5. Touch the x mark on the upper left with your finger. The mark x appears also on the lower left, upper right, and lower right. Touch the x marks in that order with your finger.

Touching the four locations described above with your finger automatically concludes the touch screen calibration.

NOTE With no operation on the touch screen calibration screen for a preset time, it automatically closes and the previous measurement screen reappears.

13 Controlling E5091A

This chapter describes how to control the E5091A multiport test set.

Connecting E5070B/E5071B and E5091A

Required devices

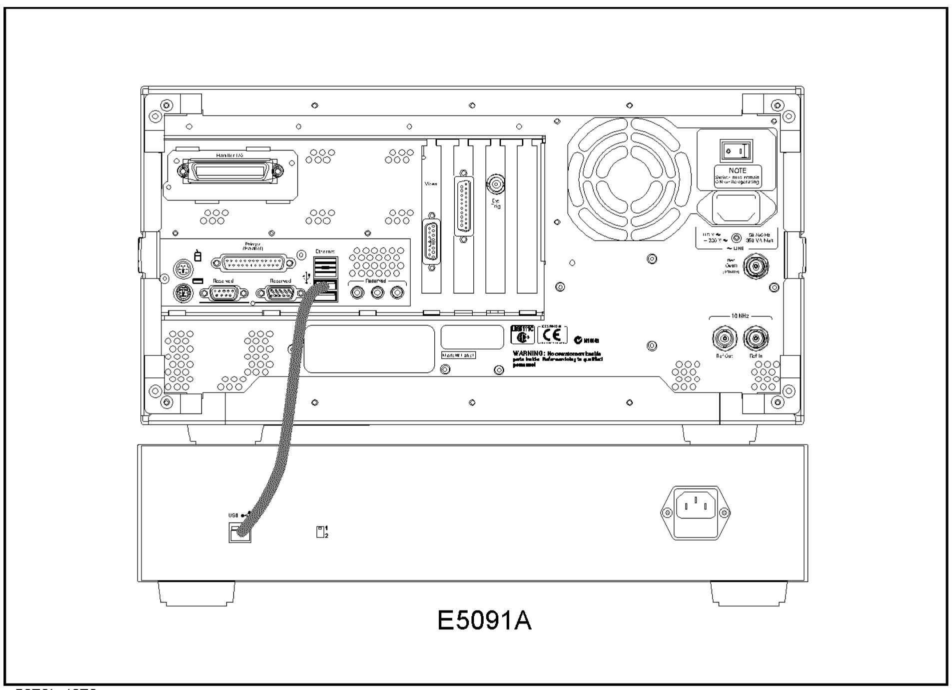
The required devices to connect between the E5070B/E5071B and the E5091A are listed below.

- E5070B/E5071B
- E5091A
- N-type to N-type cable (attached to the E5091A, Agilent part number: 8120-4782)
- USB cable (attached to the E5091A, Agilent part number: 8121-0770)

Connecting E5070B/E5071B and E5091A

As shown in Figure 13-1, connect the USB cable between the rear panel of the E5070B/E5071B and that of the E5091A.

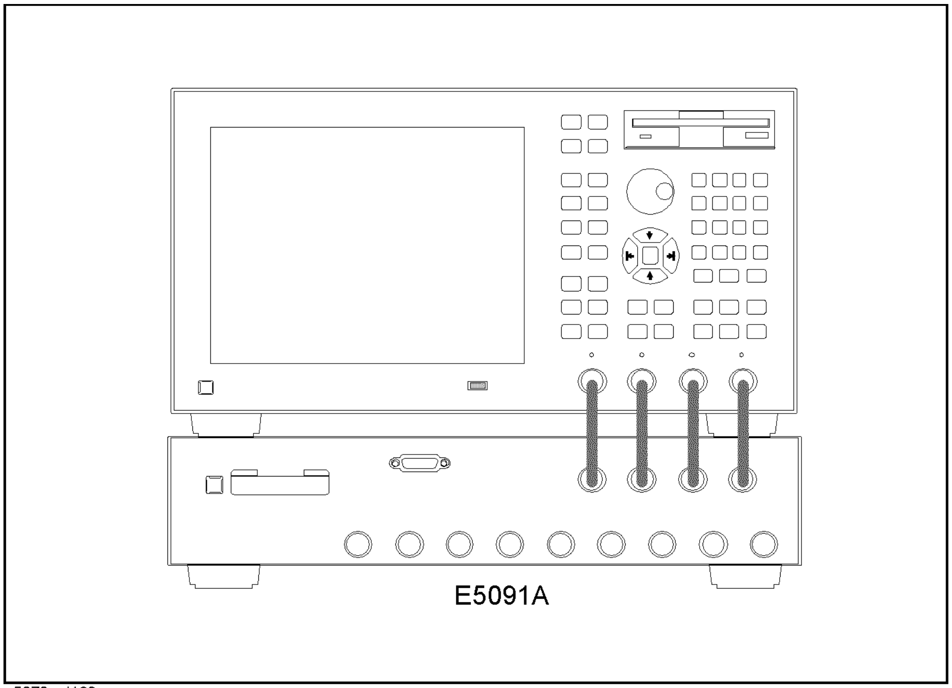
Figure 13-1 **Connection between the E5070B/E5071B and the E5091A (rear view)**



NOTE Don't switch on/off devices connected using USB ports (both front and rear panels) and connect/disconnect devices to the USB ports, while the E5070B/E5071B measures with the E5091A.

As shown in Figure 13-2, connect the N-type cable between the front panel of the E5070B/E5071B and that of the E5091A. Make the connection so that the numbers of the test ports of the E5070B/E5071B and those of the interconnection ports of the E5091A match.

Figure 13-2 Connection between E5070B/E5071B and E5091A (front view)



e5070auj189

Powering on

After connecting the E5070B/E5071B and the E5091A, follow these steps to power them on.

Step 1. Turn on the E5070B/E5071B and the E5091A.

Step 2. Immediately after power-on, all the port connection indicator LEDs of the E5091A go on. Then, after the E5070B/E5071B detects the E5091A, 4 LEDs that indicate the connected test ports stay on. As the initial setting of the E5070B/E5071B, the port connection indicators, A, T1, R1+, and R1–, stay on.

NOTE If the E5070B/E5071B is not powered on or if the E5070B/E5071B and the E5091A are not connected with the USB cable, all the LEDs stay on.

Setting E5091A

This section describes the setting of the E5091A. Table 13-1 shows the flow of the setting.

Table 13-1 **Setting flow for E5091A**

Item	Description
"Selecting ID for E5091A" on page 326	Select the ID of the E5091A you want to set.
"Assigning test ports" on page 327	Assign between the test ports of the E5070B/E5071B and those of the E5091A.
"Displaying the E5091A property" on page 327	Display the E5091A property to check the port setting.
"Setting control line" on page 328	Make the setting of the control line to control the DUT.
"Enabling control of E5091A" on page 329	Enables the functions of the E5091A.

Selecting ID for E5091A

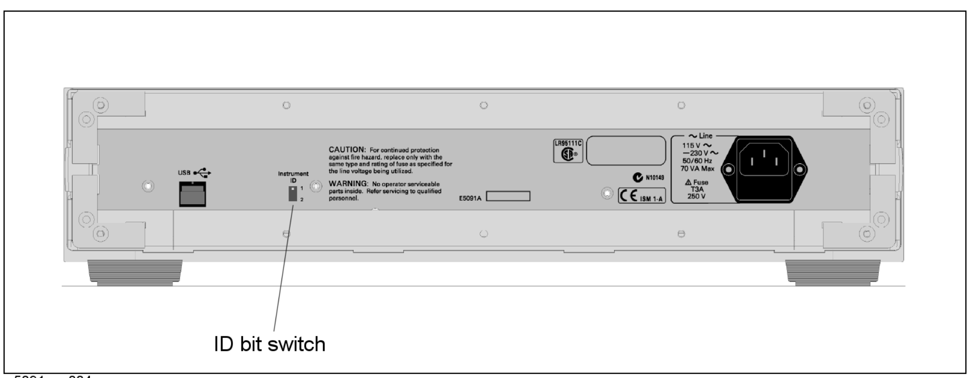
Set the set target ID to the ID of the connected E5091A.

Step 1. Press System - **E5091A Setup** to display the E5091A setup menu.

Step 2. Press **Select ID** and then select the ID of the E5091A. The ID is set with the bit switch on the rear panel of the E5091A. (Figure 13-3)

NOTE Change the ID bit switch setting when the E5070B/E5071B is turned off.

Figure 13-3 **ID bit switch of E5091A**



e5091aoe004

Assigning test ports

Before calibration and measurement, you need to assign the test ports of the E5091A. You can set the connection ports for each channel and perform measurement switching the connection for each channel.

Operational procedure

Step 1. Press System - **E5091A Setup** to display the E5091A setup menu.

Step 2. Press Channel Next or Channel Prev to activate a channel for which you want to set the connection ports.

Step 3. Use the corresponding softkey to assign between the test ports of the E5091A and the interconnection ports.

Softkey	Function
Port1	Selects a test port of the E5091A to which you want to connect port 1 of the E5070B/E5071B. You can select the port from **A** or **T1**[*1].
Port2	Selects a test port of the E5091A to which you want to connect port 2 of the E5070B/E5071B. You can select the port from **T1**[*1] or **T2**.
Port3	Selects a test port of the E5091A to which you want to connect port 3 of the E5070B/E5071B. You can select the port from **R1+**, **R2+**, or **R3+**[*2].
Port4	Selects a test port of the E5091A to which you want to connect port 4 of the E5070B/E5071B. You can select the port from **R1-**, **R2-**, or **R3-**[*2].

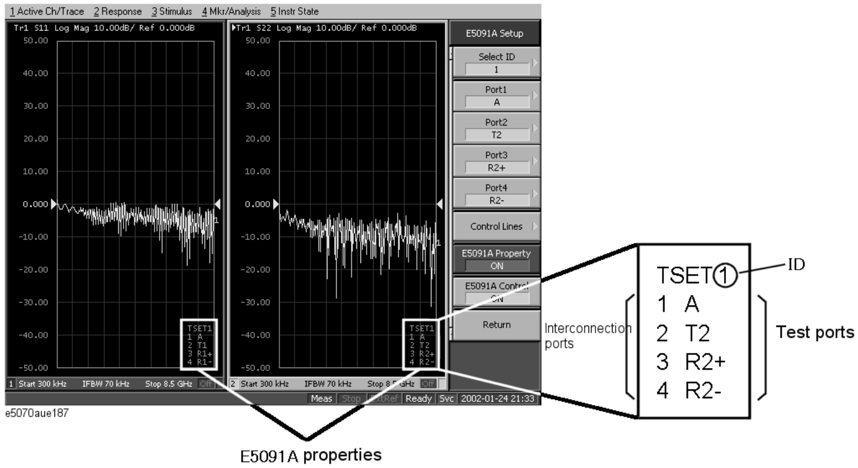
*1. If port T1 has been already assigned to port 2 when you try to assign port T1 to port 1, port T2 is automatically assigned to port 2. If port T1 has been already assigned to port 1 when you try to assign port T1 to port 2, port A is automatically assigned to port 1.
*2. When the E5091A Option 007 is connected, the connection is made to R2+ if **R3+** has been set; the connection is made R2- to if **R3-** has been set.

Step 4. Execute Step. 2 through Step. 3 for all channels for which you want to perform sweep.

Displaying the E5091A property

By displaying the E5091A property shown in Figure 13-4, you can obtain the assignment information of the test ports for each channel. It is useful when you need to check the test port assignment, for example, when you perform calibration.

Figure 13-4 **E5091A property**



Operational procedure

Step 1. Press System - **E5091A Setup** to display the E5091A setup menu.

Step 2. Press **Select ID** and then select the ID whose E5091A property you want to display. The ID is set with the bit switch on the rear panel of the E5091A. (Figure 13-3)

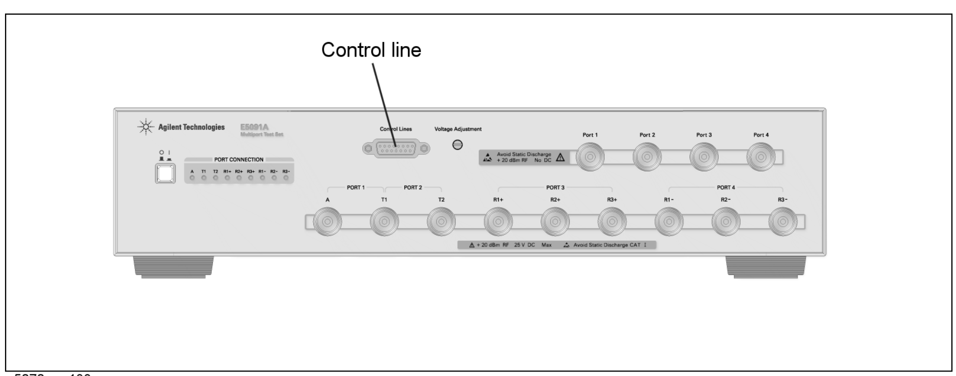
Step 3. Press **E5091A Property** to enable it (**ON**) to display the E5091 property.

NOTE The enable (**ON**)/disable (**OFF**) setting of the E5091A property display is executed for all channels.

Setting control line

The E5070B/E5071B can control the output from the control line (Figure 13-5) of the E5091A and control the DUT (for example, switching the frequency band of the front end module). The procedure is shown below. For the specifications of the DUT control line, refer to *E5091A Users & Service Guide*.

Figure 13-5 **Control line**



Operational procedure

Step 1. Press [System] - **E5091A Setup** to display the E5091A setup menu.

Step 2. Press [Channel Next] or [Channel Prev] to activate a channel for which you want to set the control line.

Step 3. Press **Select ID** and then select the ID of the E5091A. The ID is set with the bit switch on the real panel of the E5091A. (Figure 13-3 on page 326)

Step 4. Press **Control Lines** to the setting menu of the DUT control line.

Step 5. Use the corresponding softkey to set the control line of the E5091A.

Softkey	Function
Line 1, **Line 2**, **Line 3**, **Line 4**, **Line 5**, **Line 6**, **Line 7**, **Line 8**	Set **High**/**Low** of each line of the control line.

Step 6. Execute Step. 3 through Step. 5 for all channels for which you want to perform sweep.

Enabling control of E5091A

If you enable the control of the E5091A, switching the measurement path and the output function of the control line of the E5091A during measurement become available.

NOTE The E5070B/E5071B needs about 3 ms to control the E5091A when you enable the control of the E5091A. Notice that, if the E5091A is not connected to the E5070B/E5071B, the E5070B/E5071B does not need any additional time to control the E5091A regardless of this setting.

When you disable the control of the E5091A, the E5070B/E5071B does not need any additional time to control the E5091A regardless of connecting the E5091A to the E5070B/E5071B.

Operational procedure

Step 1. Press [System] - **E5091A Setup** to display the E5091A setup menu.

Step 2. Press **E5091A Control** to enable (**ON**) the control of the E5091A.

NOTE The enable (**ON**)/disable (**OFF**) setting of the control function of the E5091A is executed for all channels.

Calibration

Follow these steps to perform calibration with the E5091A connected:

Step 1. Press Channel Next or Channel Prev to set the channel for which you want to perform calibration to the active channel.

Step 2. Follow "Displaying the E5091A property" on page 327 to display the E5091A property.

Step 3. According to Chapter 4, "Calibration," on page 81, perform calibration. Check the connected test ports shown in the calibration property as the port names of the E5070B/E5071B on the calibration menu, connect the calibration standard to the corresponding test ports of the E5091A, and perform calibration.

Performing Measurement

Trigger state and switching the setting of the E5091A

The following table shows how the setting in the E5091A is switched from when the trigger state is the stop state. For more information on the trigger state, refer to *E5070B/E5071BProgrammers Guide*.

Trigger state	Switching the setting the E5091A
Stop	The setting is not switched.
Trigger wait	The setting of the internal switch and the output of the control line are switched according to the setting of the channel swept first. The connection of the test ports and the output of the control line are switched according to the setting of the channel swept first.
Measurement	Measurement is performed following the procedure below. Execute a sweep for the first channel. ↓ Set the connection of the test ports and the output of control line according to the setting of the channel swept second. ↓ Execute a sweep for the second channel. ↓ ⋮ ↓ Set the connection of the test ports and the output of control line according to the setting of the channel swept last. ↓ Execute a sweep for the last channel.
Stop or trigger wait	The setting is not switched for the stop state; it is switched for the trigger wait state.

Operation

Perform operation, referring to Chapter 5, “Making Measurements,” on page 167.

Connecting two E5091As

Give attention to the following items when you make measurement with two E5091As.

- Set their ID to different values. The instrument don't work correctly if they are same.
- Connect calibration standards and DUT with after confirming the connection and the port assignment of the E5071As.

14 Measurement Examples

This chapter introduces examples of actual device measurements using the Agilent E5070B/E5071B.

Measuring the SAW Bandpass Filter Using the Segment Sweep

This section illustrates how to use the segment sweep function to evaluate a SAW bandpass filter with a center frequency of 947.5 MHz.

Evaluation Steps

Here, the DUT is evaluated by following the steps described in Table 14-1.

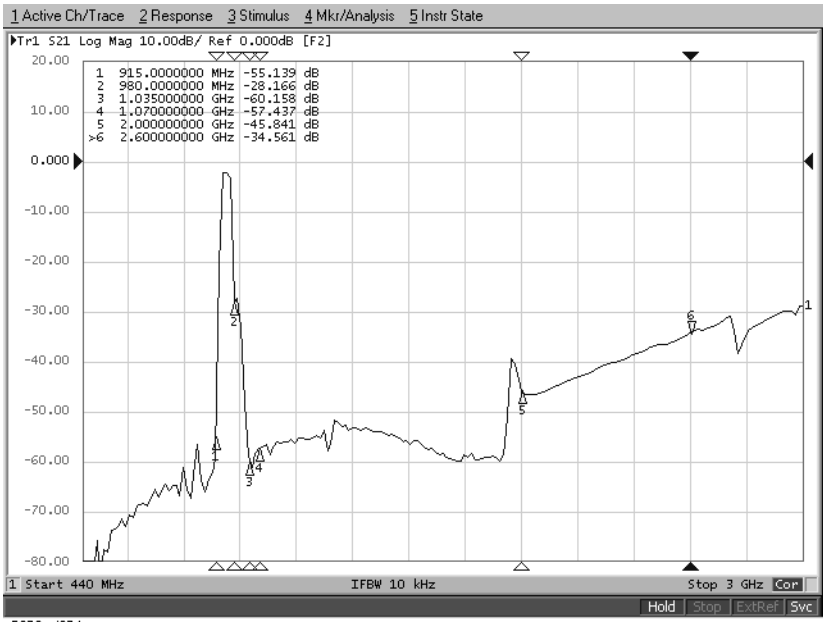
Table 14-1 Evaluating the DUT Using the Segment Sweep

Step	Description
"1. Determine the Segment Sweep Conditions" on page 335	The segment sweep conditions are determined considering the characteristics of the DUT.
"2. Create a Segment Sweep Table" on page 336	The segment sweep conditions are entered in the E5070B/E5071B.
"3. Select the Segment Sweep as the Sweep Type" on page 338	The segment sweep is selected as the sweep type.
"4. Execute the Calibration" on page 338	A 2-port ECal is performed between the test ports connecting the DUT.
"5. Connect the DUT" on page 339	The DUT is connected.
"6. Execute the Measurement" on page 339	A trigger is applied to perform the measurement.
"7. Define the Setup for Display" on page 339	A choice is made between frequency base and order base as the method of displaying segments.

1. Determine the Segment Sweep Conditions

Figure 14-1 shows the result of evaluating the transmission characteristics of the SAW bandpass filter in the range of 440 MHz to 3 GHz by using the linear sweep.

Figure 14-1 Transmission Characteristics of a SAW Bandpass Filter (440 MHz to 3 GHz, linear sweep)



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The measurement conditions are determined for each frequency range. Here, the segment sweep is performed following the sweep conditions shown in Table 14-2.

Table 14-2 Determining the Sweep Conditions (Using markers shown in Figure 14-1).

Frequency Range		Measurement Conditions	
Start	**Stop**	**Number of Points**	**IF Bandwidth**
440 MHz	915 MHz (Marker 1)	47	70 kHz
915 MHz (Marker 1)	980 MHz (Marker 2)	130	100 kHz
980 MHz (Marker 2)	1.035 GHz (Marker 3)	55	70 kHz
1.07 GHz (Marker 4)	2 GHz (Marker 5)	93	70 kHz
2.6 GHz (Marker 6)	3 GHz	41	70 kHz

2. Create a Segment Sweep Table

Follow the steps below to make entries in the segment sweep table.

Step 1. Display the segment table.

Setup Description	Key Operation
Presetting	Preset - **OK**
Displaying the segment table	Sweep Setup - **Edit Segment Table**

Step 2. Display the IF bandwidth setting column on the segment table.

Setup Description	Key Operation
Moving the focus to the softkey menu	Focus
Display of the IF bandwidth setting column: ON	**List IFBW** (Turn it **ON**.)

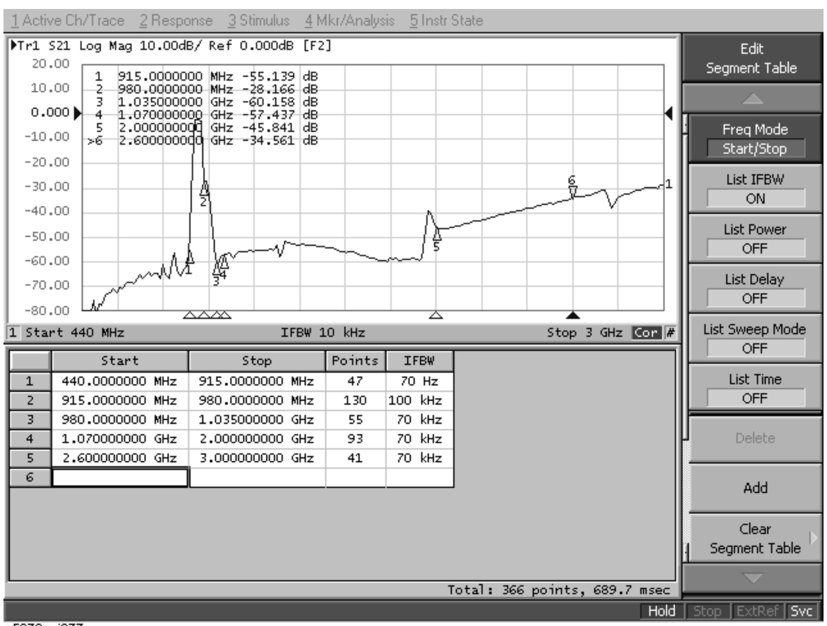
NOTE When setup items (power level, delay time, sweep mode, and sweep time in this case) are not displayed in the segment table, the setting for the channel in use applies to all segments.

Step 3. Enter the setup data into the segment table.

Setup Description	Key Operation
Moving the focus to the segment table	Focus
Segment 1	
Start frequency: 440 MHz	4 4 0 M/μ
Stop frequency: 915 MHz	9 1 5 M/μ
Number of points: 47	4 7 x1
IF bandwidth: 70 kHz	7 0 k/m
Segment 2	
Start frequency: 915 MHz	9 1 5 M/μ
Stop frequency: 980 MHz	9 8 0 M/μ
Number of points: 130	1 3 0 x1
IF bandwidth: 100 kHz	1 0 0 k/m
Segment 3	
Start frequency: 980 MHz	9 8 0 M/μ
Stop frequency: 1.035 GHz	1 . 0 3 5 G/n

Setup Description	Key Operation
Number of points: 55	[5] [5] [x1]
IF bandwidth: 70 kHz	[7] [0] [k/m]
Segment 4	
Start frequency: 1.07 GHz	[1] [.] [0] [7] [G/n]
Stop frequency: 2 GHz	[2] [G/n]
Number of points: 93	[9] [3] [x1]
IF bandwidth: 70 kHz	[7] [0] [k/m]
Segment 5	
Start frequency: 2.6 GHz	[2] [.] [6] [G/n]
Stop frequency: 3 GHz	[3] [G/n]
Number of points: 41	[4] [1] [x1]
IF bandwidth: 70 kHz	[7] [0] [k/m]

Figure 14-2 **Completed Segment Table**



	Start	Stop	Points	IFBW
1	440.0000000 MHz	915.0000000 MHz	47	70 Hz
2	915.0000000 MHz	980.0000000 MHz	130	100 kHz
3	980.0000000 MHz	1.035000000 GHz	55	70 kHz
4	1.070000000 GHz	2.000000000 GHz	93	70 kHz
5	2.600000000 GHz	3.000000000 GHz	41	70 kHz
6				

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3. Select the Segment Sweep as the Sweep Type

The segment sweep is selected as the sweep type.

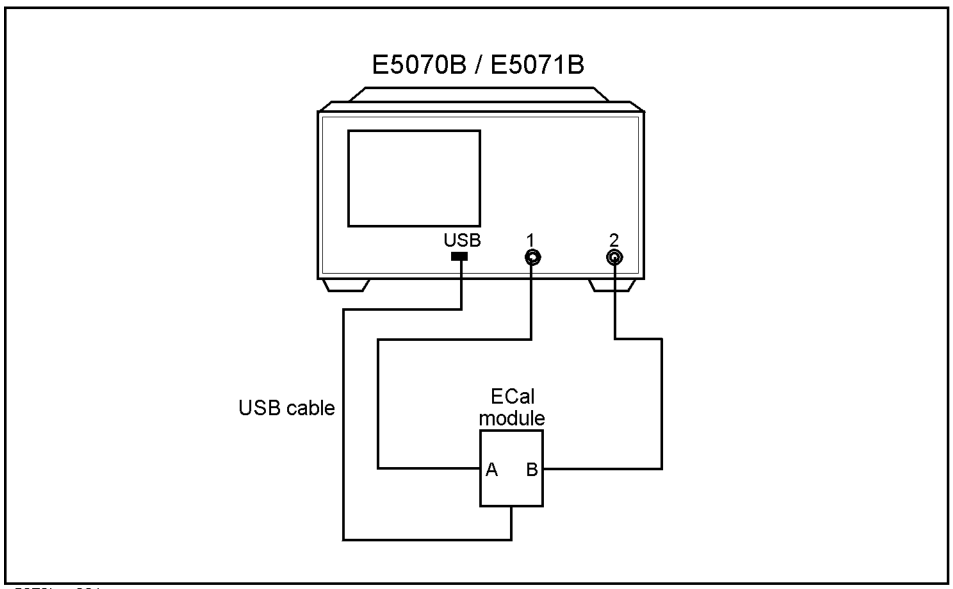
Setup Description	Key Operation
Sweep type: Segment sweep	Sweep Setup - **Sweep Type** - **Segment**

4. Execute the Calibration

In this step, a 2-port ECal is executed on the two ports to be used.

Step 1. Connect the ECal module across test ports 1 and 2.

Figure 14-3 **Connecting the ECal Module**



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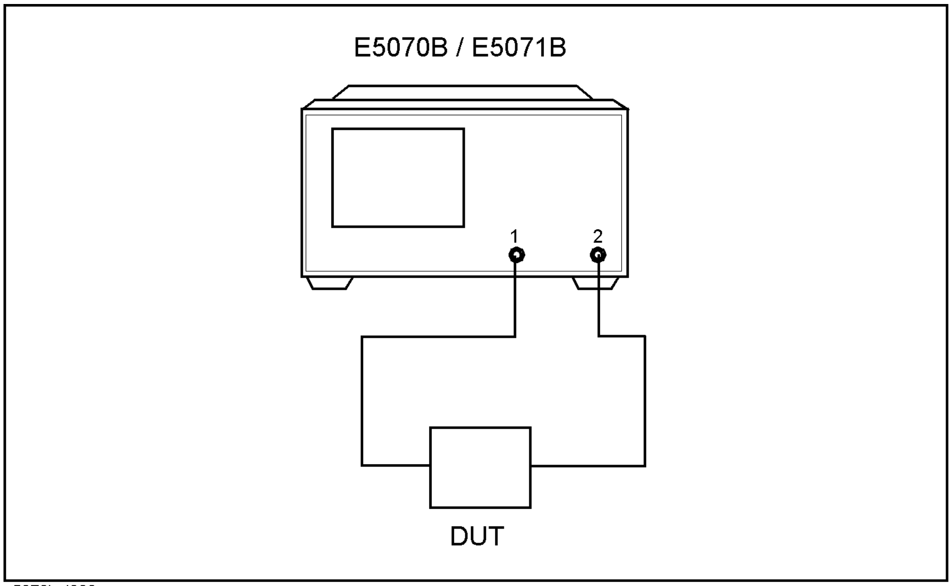
Step 2. Execute the 2-port ECal.

Setup Description	Key Operation
Executing a 2-port ECal between test ports 1 and 2	Cal - **ECal** - **2 Port ECal** - **1-2**

5. Connect the DUT

The DUT is connected across test ports 1 and 2.

Figure 14-4 **Connecting the DUT**



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6. Execute the Measurement

A trigger is applied to perform the measurement.

Setup Description	Key Operation
Trigger mode: Single	Trigger - **Single** (Or **Continuous**)

7. Define the Setup for Display

A choice is made between frequency base and order base as the segment display mode.

Setup Description	Key Operation
Segment display: Frequency base or order base	Sweep Setup - **Segment Display** - **Frequency Base** | **Order Base**

14. Measurement Examples

Figure 14-5 **Segment Display: Frequency Base**

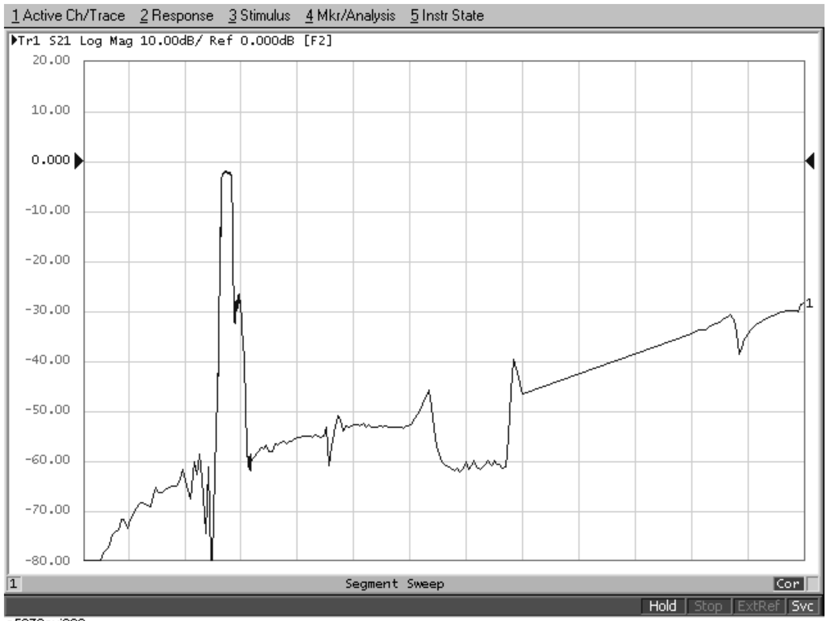

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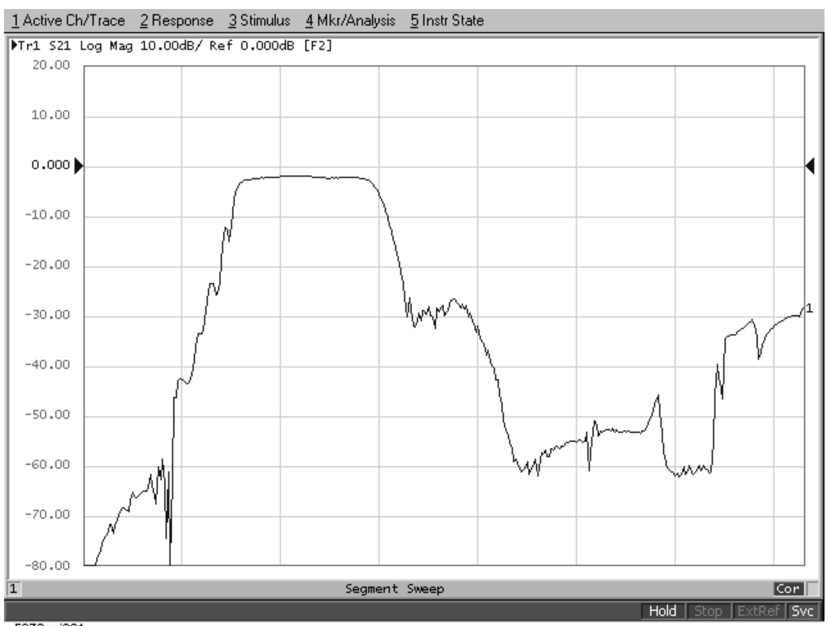
Figure 14-6 **Segment Display: Order Base**



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Evaluating a Duplexer

This section illustrates how to evaluate a duplexer (Tx center frequency: 1.88 GHz, Rx center frequency: 1.96 GHz).

Evaluation Steps

Here, the DUT is evaluated by following the steps described in Table 14-3.

Table 14-3 Evaluating the DUT Using the Segment Sweep

Step	Description
"1. Determine the Segment Sweep Conditions" on page 341	Segment sweep conditions are determined by considering the characteristics of the DUT.
"2. Create a Segment Sweep Table" on page 342	The segment sweep conditions are entered in the E5070B/E5071B.
"3. Select the Segment Sweep as the Sweep Type" on page 343	The segment sweep is selected as the sweep type.
"4. Execute the Calibration" on page 343	A full 3-port calibration is executed by using the 2-port ECal module.
"5. Connect the DUT" on page 345	The DUT is connected.
"6. Define the Setup for Display" on page 346	The number of traces to be displayed, split display, and measurement parameters are specified.
"7. Execute the Measurement" on page 346	A trigger is applied to execute the measurement.
"8. Define the Setup for the Segment Display and Scale" on page 346	The setup for segment display and for the scale are defined.
"9. Analyze the Parameters" on page 347	The evaluation parameters for the duplexer are determined.
"10. Define the Setup for a Limit Table" on page 349	The setup for the limit table is defined.
"11. Execute the Limit Test" on page 350	The limit test is executed.

1. Determine the Segment Sweep Conditions

A segment sweep is performed following the sweep conditions shown in Table 14-4.

Table 14-4 Sweep Conditions

Start	Stop	Number of Points
1.73 GHz	1.83 GHz	50
1.83 GHz	2.03 GHz	400
2.03 GHz	2.13 GHz	50
3.65 GHz	4.03 GHz	38
5.5 GHz	6.02 GHz	52

2. Create a Segment Sweep Table

Entries are made into the segment sweep table following the steps described below.

Step 1. Display the segment table.

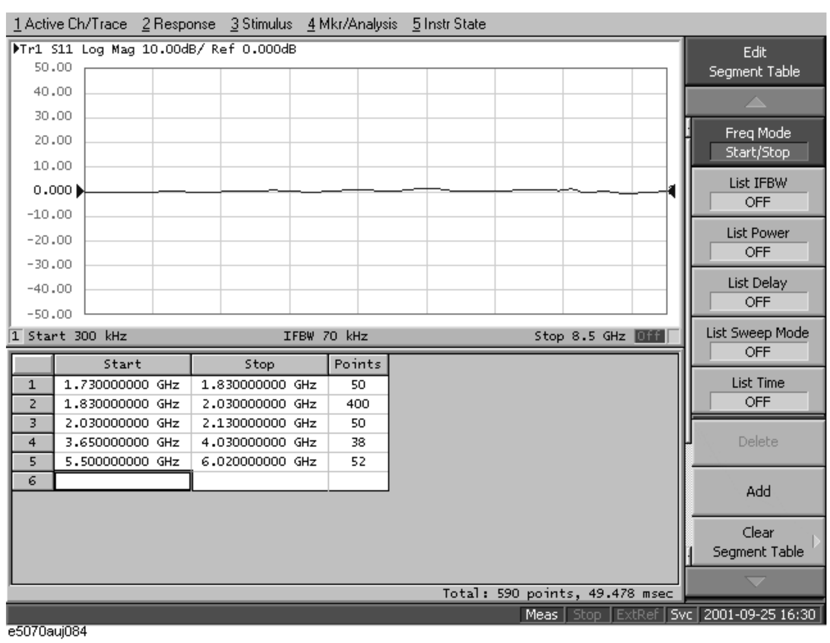
Setup Description	Key Operation
Presetting	Preset - **OK**
Displaying the segment table	Sweep Setup - **Edit Segment Table**

Step 2. Enter the setup data into the segment table (Figure 14-7).

NOTE

In this step, the IF Bandwidth, power level, delay time, and sweep time are not entered segment by segment. By turning off the display of those parameters on the segment table, you can use, in each segment without making a change, the IF Bandwidth (preset value: 70 kHz) of the channel specified by using Avg - **IF Bandwidth**; Power level (preset value: 0 dBm) of the channel specified by using Sweep Setup - **Power**; Sweep delay time (preset value: 0 second) of the channel specified by using Sweep Setup - **Sweep Delay**; Sweep mode (preset value: Stepped mode) of the channel specified by using Sweep Setup - **Sweep Mode**; and Sweep time (preset value: Automatic) of the channel specified by using Sweep Setup - **Sweep Time**.

Figure 14-7 **Completed Segment Table**



3. Select the Segment Sweep as the Sweep Type

The segment sweep is selected as the sweep type.

Setup Description	Key Operation
Sweep type: Segment sweep	Focus (Moves the focus to the softkey menu) - **Return** - **Sweep Type** - **Segment** (or Sweep Setup - **Sweep Type** - **Segment**)

4. Execute the Calibration

In this step, a 2-port ECal module and 3-/4-port module contained in the E5070B/E5071B are used to execute the calibration on the three ports to be used in the measurement.

Step 1. First, connect the USB port of the 2-port ECal module and the USB port of the E5070B/E5071B with a USB cable. The connection may be made while the unit is powered.

Step 2. Load and execute the 3-/4-port ECal programs.

Setup Description	Key Operation
Opening the VBA Project Open dialog box	Macro Setup - **Load Project**
Loading “ECalAssistant.VBA”	Select “D:\Agilent\ECalAssistant.VBA” and press the **Open** button.
Executing the program	Macro Run

Step 3. The EcalAssistant (Start) dialog box appears (Figure 14-8).

Figure 14-8 **EcalAssistant (Start) Dialog Box**

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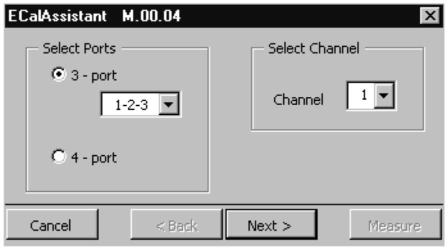
Step 4. Pressing the **Next** button to display the EcalAssistant (Port/Channel Selection) dialog box (Figure 14-9).

14. Measurement Examples

Figure 14-9 **EcalAssistant (Port/Channel Selection) Dialog Box**



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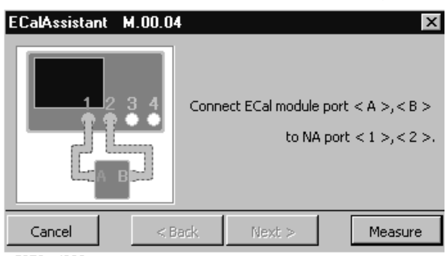
Step 5. Following the instructions in the dialog box, select the type of ECal, test ports, and a channel.

Setup Description	Key Operation
Select Ports	
ECal type: Full 3-port calibration	**3 Port**
Test ports to be used for ECal: 1, 2, and 3	**1, 2, 3**
Select Channel	
Channel on which ECal is to be executed: Channel 1	**Channel**: **1**

Step 6. Press the **Next** button. The EcalAssistant (Connection) dialog box (Figure 14-10) will appear.

Figure 14-10 **EcalAssistant (Connection) Dialog Box**



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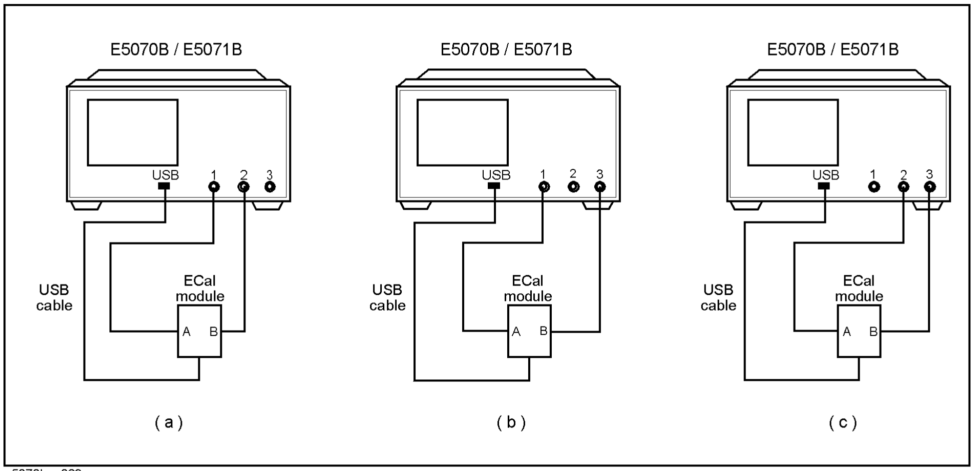
Step 7. Connect the ECal module to the test ports according to the instruction in the dialog box and then press **Measure**.

Setup Description	Key Operation
Executing calibration between ports 1 and 2	(After making the connections shown in Figure 14-11 (a)), press **Measure** - **Next**.
Executing calibration between ports 1 and 3	(After making the connections shown in Figure 14-11 (b)), press **Measure** - **Next**.
Executing calibration between ports 2 and 3	(After making the connections shown in Figure 14-11 (c)), press **Measure** - **Next**.

Figure 14-11 **Connecting the ECal Module**



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Step 8. The EcalAssistant (Complete) dialog box (Figure 14-12) will appear. Press the **Done** button to terminate the calibration.

Figure 14-12 **ECalAssistant (Complete) Dialog Box**

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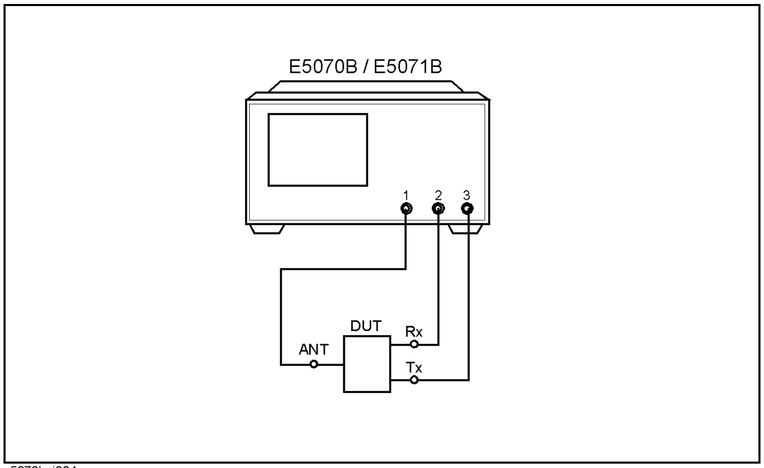
5. Connect the DUT

The DUT is connected to test ports 1, 2, and 3.

Figure 14-13 **Connecting the DUT**



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6. Define the Setup for Display

The setup for display is defined.

Setup Description	Key Operation
Number of traces to be displayed: 5	Display - **Number of Traces** - **5**
Trace placement: Trisected	**Allocate Traces** - ×3
Measurement Parameter	
Trace 1: S_{13}	Meas - **S13**
Trace 2: S_{21}	Trace Next - Meas - **S21**
Trace 3: S_{23}	Trace Next - Meas - **S23**
Trace 4: S_{33}	Trace Next - Meas - **S33**
Trace 5: S_{11}	Trace Next - Meas - **S11**

7. Execute the Measurement

A trigger is applied to execute the measurement.

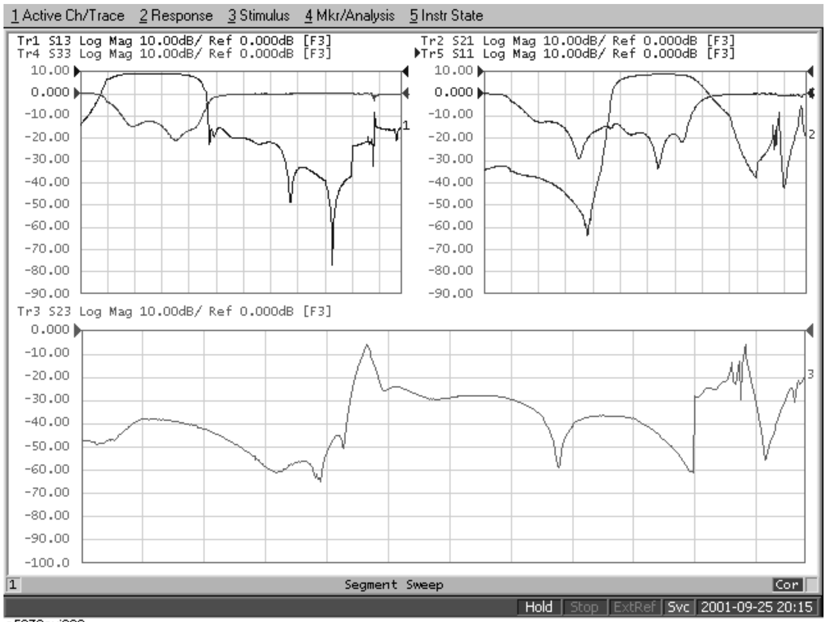
Setup Description	Key Operation
Trigger mode: Single (or continuous)	Trigger - **Single** (or **Continuous**)

8. Define the Setup for the Segment Display and Scale

The setup for the scale is defined.

Setup Description	Key Operation
Segment display: Order base	Sweep Setup - **Segment Display** - **Order Base**
Reference Line Position	
Trace 1: 10	Trace Next - Scale - **Reference Position** - 1 0 x1
Trace 2: 10	Trace Next - **Reference Position** - 1 0 x1
Trace 3: 10	Trace Next - **Reference Position** - 1 0 x1
Trace 4: 9	Trace Next - **Reference Position** - 9 x1
Trace 5: 9	Trace Next - **Reference Position** - 9 x1

Figure 14-14 Measurement Result (Segment Display: Order Base)



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9. Analyze the Parameters

The parameters for the duplexer are determined.

Step 1. Determine the insertion loss and 3 dB bandwidth for Tx.

Setup Description	Key Operation
Marker coupling: OFF	Marker Fctn - **Couple** (Turn it **OFF**)
Activating Trace 1	Trace Next
Marker 1: ON	Marker
Search/Tracking: ON	Marker Search - **Tracking** (Turn it **ON**)
Moving the marker to the trace maximum	**Max**
Bandwidth search: ON	**Bandwidth** (Turn it **ON**.)

In the example shown in Figure 14-15, the insertion loss (**loss**) is 1.243 dB and the 3 dB bandwidth (**BW**) is 85.53 MHz.

Step 2. Determine the insertion loss and 3 dB bandwidth for the Rx.

Setup Description	Key Operation
Activating Trace 2	Trace Next
Marker 1: ON	Marker
Search/Tracking: ON	Marker Search - **Tracking** (Turn it **ON**.)

Setup Description	Key Operation
Moving Marker 1 to the trace maximum	**Max**
Bandwidth search: ON	**Bandwidth** (Turn it **ON**)

In the example shown in Figure 14-15, the insertion loss (**loss**) is 1.627 dB and the 3 dB bandwidth (**BW**) is 71.04 MHz.

Step 3. Determine the isolation between Tx and Rx.

Setup Description	Key Operation
Activating Trace 3	Trace Next
Marker 1: ON	Marker
Search/Tracking: ON	Marker Search - **Tracking** (Turn it **ON**)
Moving Marker 1 to the peak near 1.92 GHz	**Peak** - **Search Left** or **Search Right** (Press as many times as necessary.)

In the example shown in Figure 14-15, the isolation (response value of marker 1) is 6.612 dB.

Step 4. Determine the return loss of Tx.

Setup Description	Key Operation
Activating Trace 4	Trace Next
Marker 1: ON	Marker
Search/Tracking: ON	Marker Search - **Tracking** (Turn it **ON**)
Moving Marker 1 to the peak in the pass band	**Peak** - **Search Left** or **Search Right** (Press as many times as necessary.)*1

*1. If you cannot move the marker to the desired peak, use **Peak Excursion** to change the peak deviation and then execute the search again. (Example: **Peak Excursion** - 0 . 1 x1).

In the example shown in Figure 14-15, the return loss (response value of Marker 1) is 12.65 dB.

Step 5. Determine the return loss of Rx.

Setup Description	Key Operation
Activating Trace 5	Trace Next
Marker 1: ON	Marker
Search/Tracking: ON	Marker Search - **Tracking** (Turn it **ON**)

Setup Description	Key Operation
Moving Marker 1 to the peak in the pass band	**Peak** - **Search Left**|**Search Right** (Press as many times as necessary.)*1

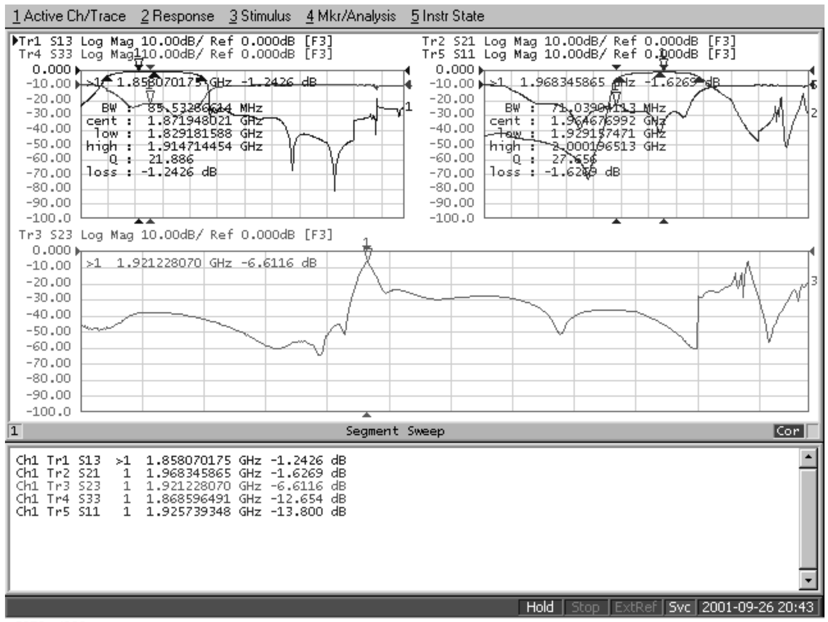
*1. If you cannot move the marker to the desired peak, use **Peak Excursion** to change the peak deviation and then execute the search again. (Example: **Peak Excursion** - [0] [.] [1] [x1]).

In the example shown in Figure 14-15, the return loss (response value of Marker 1) is 13.80 dB.

Step 6. Turn on the marker table display.

Setup Description	Key Operation
Marker table display: ON	[Marker Fctn] - **Marker Table** (Turn it **ON**)

Figure 14-15 **Analyzing Duplexer Parameters**



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10. Define the Setup for a Limit Table

Follow the steps below to make entries into the limit table.

Step 1. Display the limit table for Trace 1 (S_{13}).

Setup Description	Key Operation
Activating Trace 1	[Trace Next]
Displaying a limit table	[System] - **Limit Test** - **Edit Limit Line**

Step 2. Enter the setup data into the limit table for trace 1 (Figure 14-16).

Figure 14-16 **Completed Limit Table for Trace 1**

	Type	Begin Stimulus	End Stimulus	Begin Response	End Response
1	MAX	1.730000000 GHz	1.940000000 GHz	0 dB	0 dB
2	MIN	1.850000000 GHz	1.910000000 GHz	-4 dB	-4 dB
3	MAX	1.930000000 GHz	1.990000000 GHz	-40 dB	-40 dB
4	MAX	1.990000000 GHz	2.130000000 GHz	-40 dB	-40 dB
5	MAX	2.130000000 GHz	6.020000000 GHz	-25 dB	-25 dB
6					

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Step 3. Display the limit table for Trace 2 (S_{21}).

Setup Description	Key Operation
Activating Trace 2	Trace Next

Step 4. Enter the setup data into the limit table for trace 2 (Figure 14-17).

Figure 14-17 **Completed Limit Table for Trace 2**

	Type	Begin Stimulus	End Stimulus	Begin Response	End Response
1	MAX	1.730000000 GHz	1.850000000 GHz	-40 dB	-40 dB
2	MAX	1.850000000 GHz	1.910000000 GHz	-45 dB	-45 dB
3	MAX	1.910000000 GHz	6.020000000 GHz	0 dB	0 dB
4	MIN	1.930000000 GHz	1.990000000 GHz	-5 dB	-5 dB
5					

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11. Execute the Limit Test

The limit test is executed.

Step 1. Turn on the limit line and limit test for Trace 1.

Setup Description	Key Operation
Activating Trace 1	Trace Prev
Limit Line: ON	System - **Limit Test** - **Limit Line** (Turn it **ON**)
Limit Test: ON	**Limit Test** (Turn it **ON**)

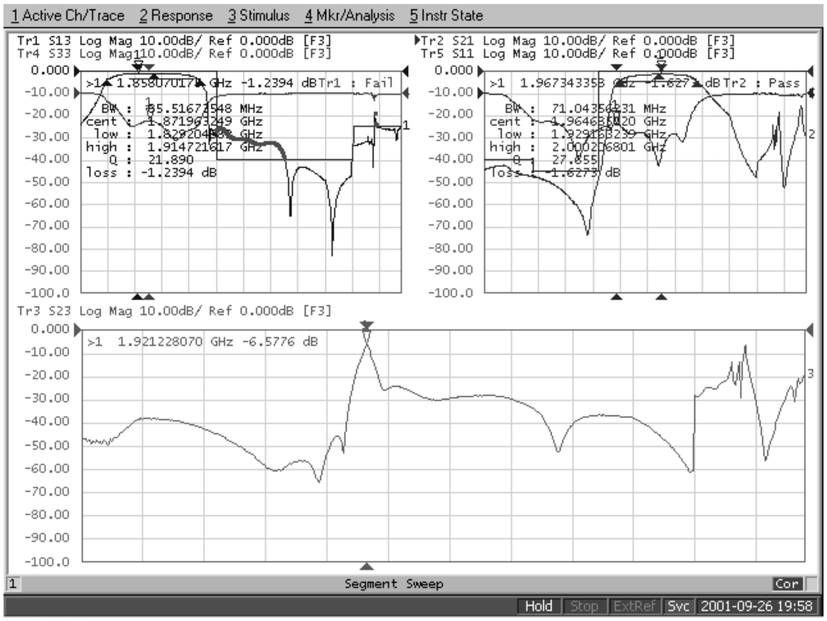
Step 2. Turn on the limit line and limit test for Trace 2.

Setup Description	Key Operation
Activating Trace 2	Trace Next
Limit Line: ON	**Limit Line** (Turn it **ON**)
Limit Test: ON	**Limit Test** (Turn it **ON**)

Step 3. Apply a trigger to execute the measurement.

Setup Description	Key Operation
Trigger Mode: Single	Trigger - **Single** (or **Continuous**)

Figure 14-18 **Limit Test Results**



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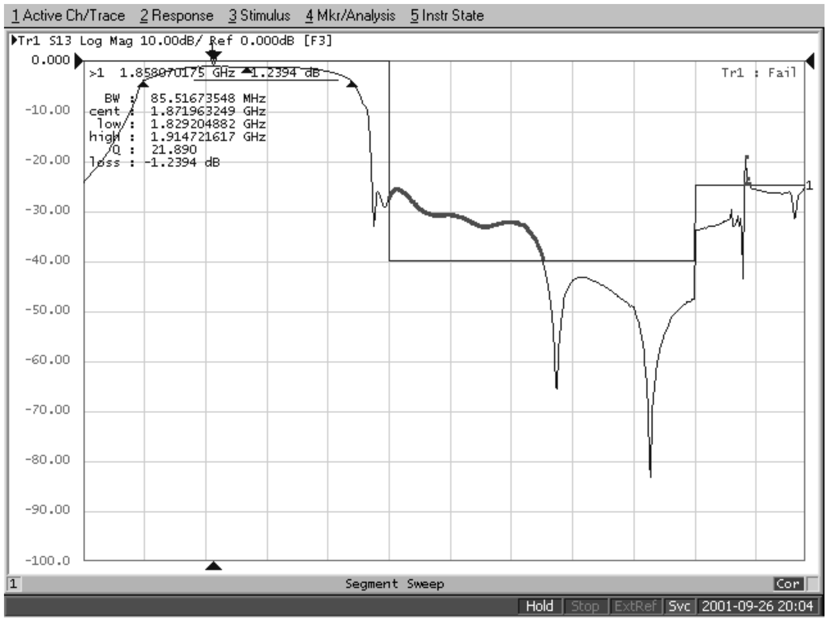
Step 4. Maximize the screen display of Trace 1 to examine its details.

Setup Description	Key Operation
Activating Trace 1	Trace Prev
Maximizing the display of Trace 1	Trace Max

Figure 14-19 Enlarged Display of Trace 1



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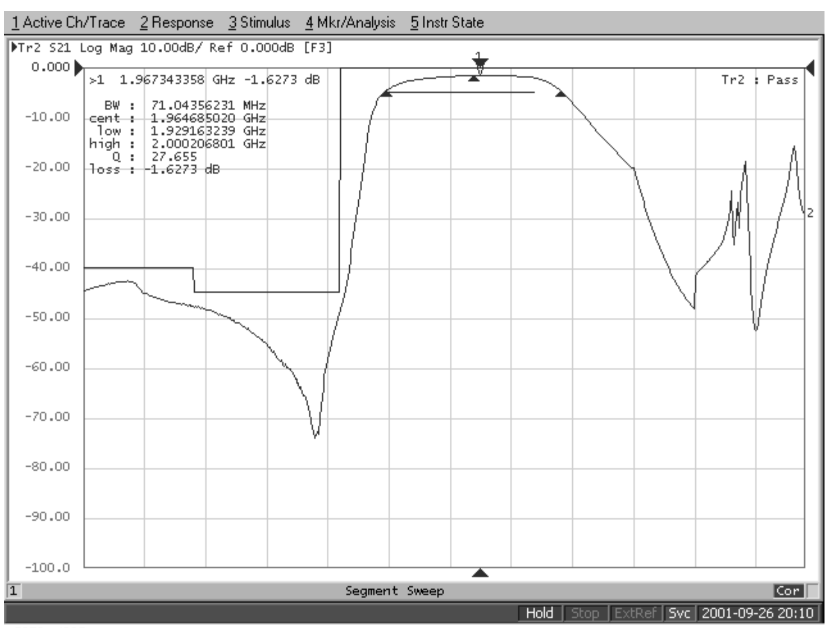
Step 5. Maximize the screen display of Trace 2 to examine its details.

Setup Description	Key Operation
Activating Trace 2	Trace Prev (The display of Trace 2 is maximized.)

Figure 14-20 Enlarged Display of Trace 2



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Measuring the Deviation from a Linear Phase

This section illustrates how to determine the deviation from a linear phase in the pass band of a 1.09 GHz bandpass filter.

Evaluation Steps

Here, the DUT is evaluated by following the steps described in Table 14-5.

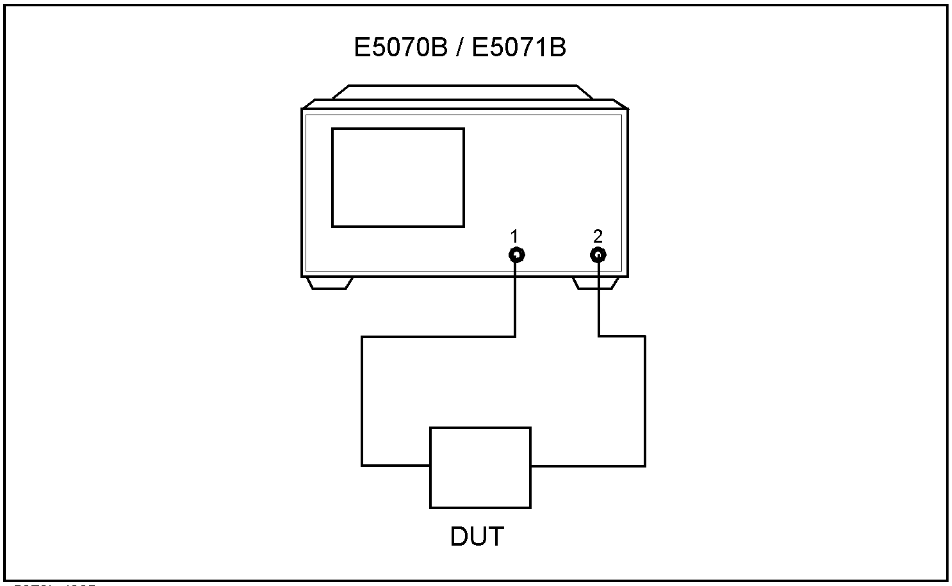
Table 14-5 Evaluating the Deviation from a Linear Phase

Step	Description
"1. Connect the DUT" on page 353	The DUT is connected.
"2. Define the Measurement Conditions" on page 354	The measurement conditions are defined.
"3. Execute the Calibration" on page 354	The calibration is executed.
"4. Connect the DUT and Execute the Auto Scale" on page 354	The DUT is connected again to execute the auto scale function.
"5. Specify the Electrical Delay" on page 355	The electrical delay is specified.
"6. Measure the Deviation from a Linear Phase" on page 356	The statistics data function (peak-to-peak) is used to determine the deviation from a linear phase.

1. Connect the DUT

Connect the DUT as shown in Figure 14-21.

Figure 14-21 Connecting the DUT



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2. Define the Measurement Conditions

The measurement conditions are defined by following the steps described below.

Setup Description	Key Operation
Presetting	Preset - **OK**
Center frequency: 1.09 GHz	Center 1 . 0 9 G/n
Frequency span: 20 MHz	Span 2 0 M/μ
Measurement parameter: S_{21}	Meas - S21
Data format: Expand Phase	Format - **Expand Phase**
Executing the Auto Scale	Scale - **Auto Scale**

3. Execute the Calibration

The THRU response calibration is executed.

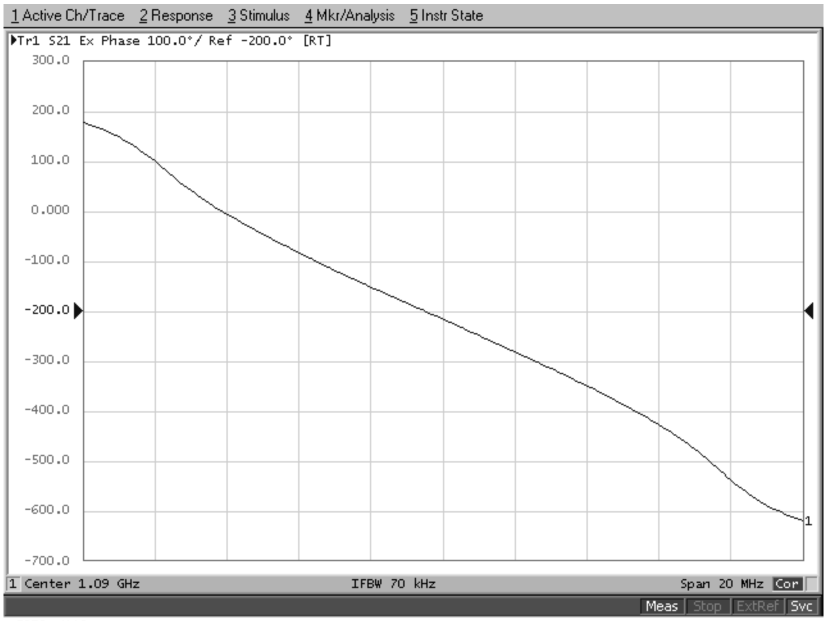
Setup Description	Key Operation
Executing the THRU response	(A THRU standard is connected instead of a DUT) Cal - **Calibrate** - **Response (Thru)** - **Thru** - **Done**

4. Connect the DUT and Execute the Auto Scale

The DUT is connected again as shown in Figure 14-21 to execute the auto scale.

Setup Description	Key Operation
Executing the auto scale	Scale - **Auto Scale**

Figure 14-22 **Phase Characteristics of the DUT**



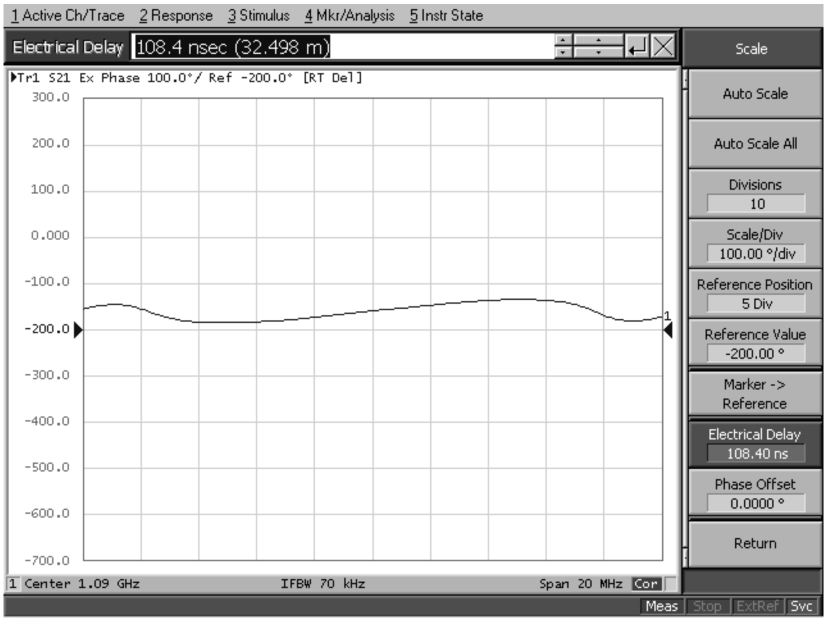
e5070auj113

5. Specify the Electrical Delay

The electrical delay is entered to flatten the phase trace.

Setup Description	Key Operation
Entering the electrical delay	Scale - **Electrical Delay** - ⇧ ⇩ ◯ (Flattening a trace)

Figure 14-23 **Entering the Electrical Delay**



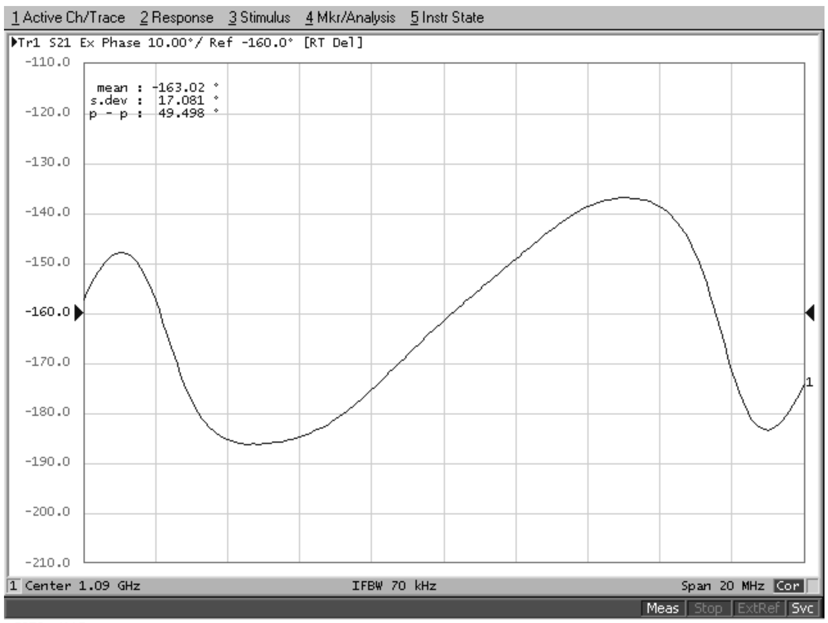
e5070auj114

6. Measure the Deviation from a Linear Phase

The statistics data is used to read the deviation from a linear phase (peak-to-peak) (Figure 14-24).

Setup Description	Key Operation
Executing the auto scale	Scale - **Auto Scale**
Displaying the statistics data	Marker Fctn - **Statistics** (Turn it **ON**.)

Figure 14-24 Measuring the Deviation from a Linear Phase

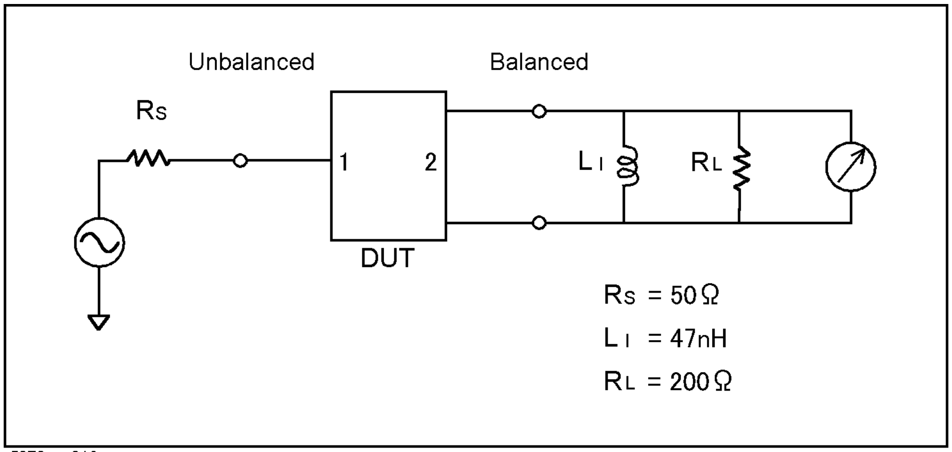


e5070auj115

Measuring an Unbalanced and Balanced Bandpass Filter

This section introduces an example of actually evaluating the unbalanced and balanced SAW bandpass filter with a center frequency of 942.5 MHz. Figure 14-25 shows the measurement circuit in a condition for evaluating the DUT.

Figure 14-25 Measurement Circuit



e5070aue016

Evaluation Steps

Here, the DUT is evaluated by following the steps described in Table 14-6.

Table 14-6 Evaluating the Deviation from a Linear Phase

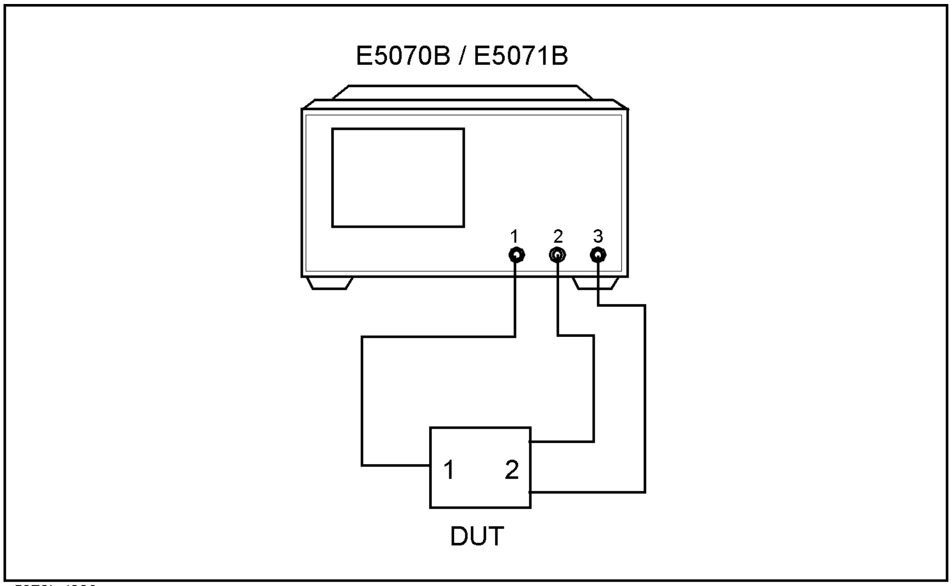
Step	Description
"1. Connecting the DUT" on page 358	The DUT is connected.
"2. Setting the Measuring Conditions" on page 359	The measurement conditions are defined.
"3. Performing a Calibration" on page 360	The full 3 port calibration is executed.
"4. Setting a Balance Conversion Topology" on page 361	The balance conversion topology is specified.
"5. Selecting Measurement Parameters" on page 361	The mixed-mode S-parameters are selected.
"6. Extending the Calibration Plane (removing the cause of error)" on page 363	The calibration reference plane is extended.
"7. Setting the Port Reference Impedances" on page 363	The port reference impedances are specified.
"8. Adding a Matching Circuit" on page 365	A matching circuit is added.

1. Connecting the DUT

Connect the DUT to the E5070B/E5071B using the three test ports on the instrument

(Figure 14-26).

Figure 14-26 Connecting the DUT



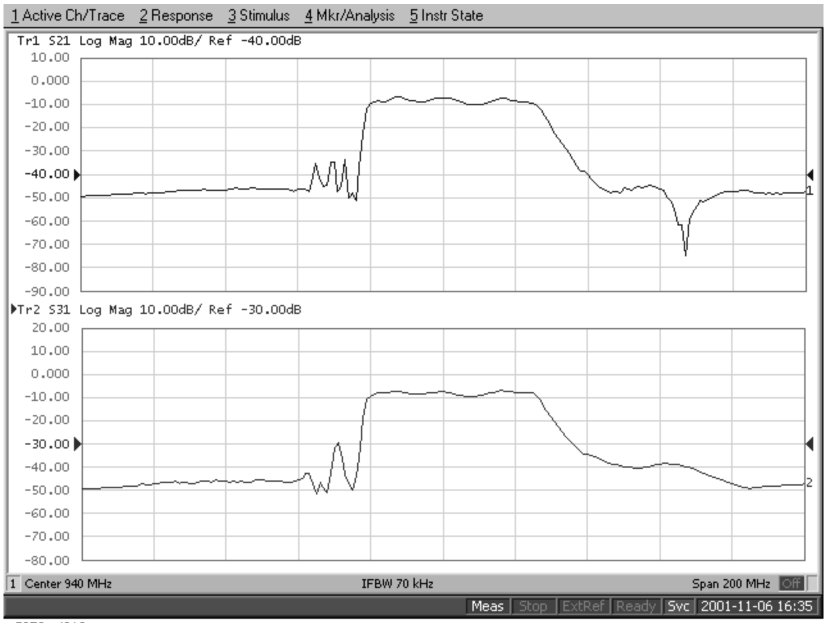
e5070buj026

2. Setting the Measuring Conditions

Follow the procedure below to set the measurement conditions. The measurement parameters for balanced measurements should be set after unbalanced-balanced conversion. Here, set the measurement parameters for observing the characteristics achieved during unbalanced measurements.

Setting Description	Keystroke
Preset for setting	Preset - **OK**
Center frequency: 940 MHz	Center 9 4 0 M/μ
Frequency span: 200 MHz	Span 2 0 0 M/μ
Number of traces: 2	Display - **Num of Traces - 2**
Trace-1 measurement parameter: S_{21}	Meas - **S21**
Trace-2 measurement parameter: S_{31}	Trace Next Meas - **S31**
Allocate a trace to upper and lower displays.	Display - **Allocate Traces** - ×2
Auto-scale all traces.	Scale - **Auto Scale All**

Figure 14-27 **Results of Unbalanced Measurements**



e5070auj018

3. Performing a Calibration

Perform a full three-port calibration for the three ports to be used.

Step 1. Set the type and conditions of the calibration.

Setting Description	Keystroke
Calibration kit to use: 85033D	Cal - **Cal Kit** - **85033D**
Type of calibration: Full three-port calibration	**Calibrate** - **3-Port Cal**
Test ports to calibrate: 1, 2, 3	**Select Ports** - **1-2-3** (check only)

Step 2. Perform a reflection calibration.

Setting Description	Keystroke
Select reflection calibration.	**Reflection**
Perform Port 1 calibration.	(With the OPEN connected) **Port 1 OPEN**
	(With the SHORT connected) **Port 1 SHORT**
	(With the LOAD connected) **Port 1 LOAD**
Perform Port 2 calibration.	(With the OPEN connected) **Port 2 OPEN**
	(With the SHORT connected) **Port 2 SHORT**
	(With the LOAD connected) **Port 2 LOAD**
Perform Port 3 calibration.	(With the OPEN connected) **Port 3 OPEN**
	(With the SHORT connected) **Port 3 SHORT**
	(With the LOAD connected) **Port 3 LOAD**

Step 3. Perform a transmission calibration.

Setting Description	Keystroke
Select transmission calibration.	**Return** - **Reflection**
Perform a Port 1-to-Port 2 calibration.	(With thru connection) **Port 1-2 Thru**
Perform a Port 1-to-Port 3 calibration.	(With thru connection) **Port 1-3 Thru**
Perform a Port 2-to-Port 3 calibration.	(With thru connection) **Port 2-3 Thru**

Step 4. Finish the calibration.

Setting Description	Keystroke
Complete the calibration and then calculate and store calibration coefficients.	**Return** - **Done** (This causes **Correction** to turn **ON**.)
Calibration property display: ON	**Return** - **Return** - **Property** (Turns it **ON**.)

4. Setting a Balance Conversion Topology

Follow the procedure below to set the balanced conversion topology.

Table 14-7

Setting Description	Keystroke
Set port 1 on the DUT to unbalanced and port 2 on the DUT to balanced.	Analysis - **Fixture Simulator - Topology - Device - SE-Bal** (check only)
Set the connecting destination of port 1 on the DUT (unbalanced) to test port 1 of the analyzer.	**Port 1 (se) - 1** (check only)
Set the connecting destination of port 2 on the DUT (balanced) to test ports 2 and 3 of the analyzer.	**Port 2 (bal) - 2-3**(check only)

5. Selecting Measurement Parameters

Step 1. Display four traces.

Setting Description	Keystroke
Number of traces: 4	Display - **Number of Traces - 4**
Trace allocation: 4-part split	**Allocate Traces -** ×4

Step 2. Set the measurement parameter (mixed mode S-parameter) and data format for trace 1.

Setting Description	Keystroke
Fixture simulator: ON	Analysis - **Fixture Simulator - Fixture Simulator** (Turns it **ON**.)
Unbalanced-balanced conversion of trace 1: ON	**BalUn** (Turns it **ON**.)
Measurement parameter: S_{ds21}	Meas - **Sds21**

Step 3. Set the measurement parameter (mixed mode S-parameter) and data format for trace 2.

Setting Description	Keystroke
Unbalanced-balanced conversion of trace 2: ON	Trace Next - Analysis - **Fixture Simulator - BalUn** (Turns it **ON**.)
Measurement parameter: S_{cs21}	Meas - **Scs21**

14. Measurement Examples

Step 4. Set the measurement parameter (mixed mode S-parameter) and data format for trace 3.

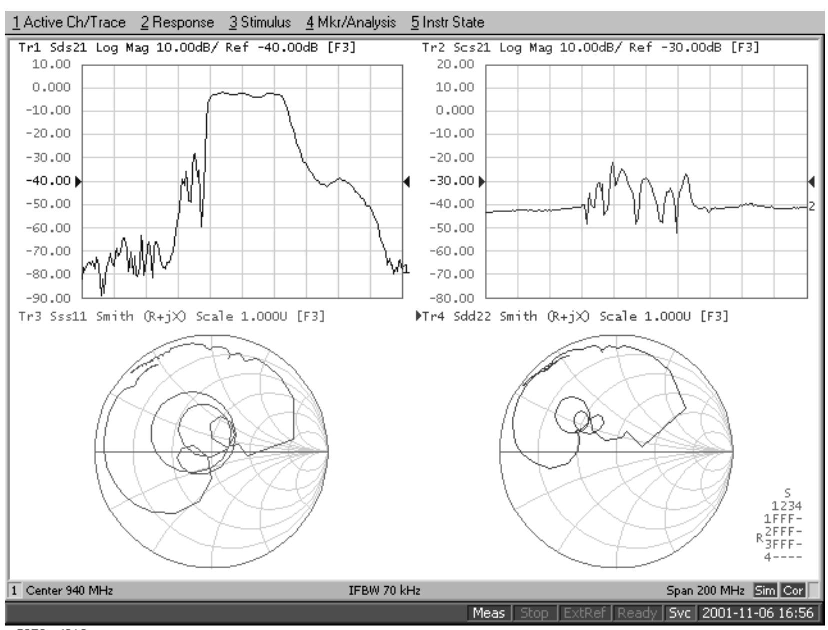
Setting Description	Keystroke
Unbalanced-balanced conversion of trace 3: ON	Trace Next - Analysis - **Fixture Simulator** - **BalUn** (Turns it **ON**.)
Measurement parameter: S_{ss11}	Meas - **Sss11**
Data format: Smith chart (marker display: R+jX)	Format - **Smith** - **R + jX**

Step 5. Set the measurement parameter (mixed mode S-parameter) and data format for trace 4.

Setting Description	Keystroke
Unbalanced-balanced conversion of trace 4: ON	Trace Next - Analysis - **Fixture Simulator** - **BalUn** (Turns it **ON**.)
Measurement parameter: S_{dd22}	Meas - **Sdd22**
Data format: Smith chart (marker display: R+jX)	Format - **Smith** - **R + jX**

Figure 14-28 shows the setting results for each parameter.

Figure 14-28 Measurement Results After Unbalanced-Balanced Conversion



e5070auj019

6. Extending the Calibration Plane (removing the cause of error)

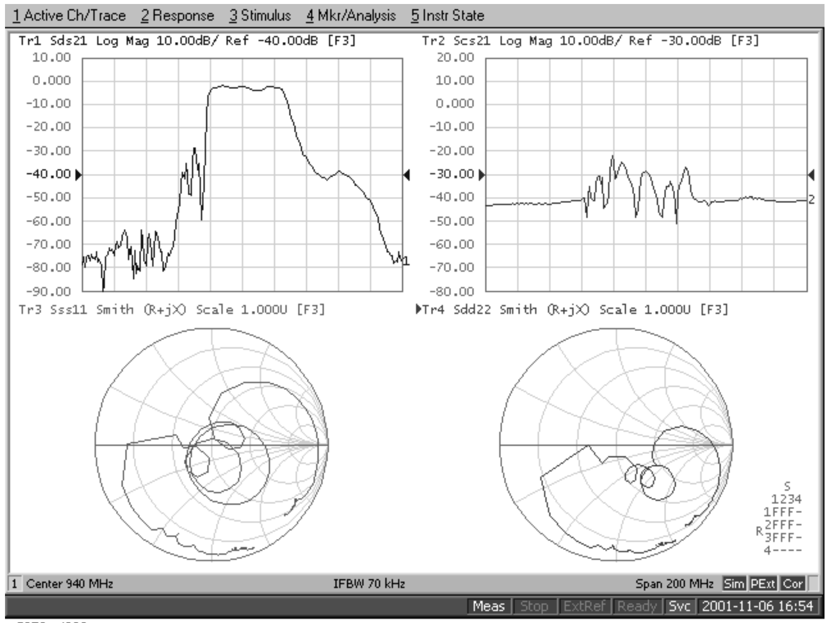
In this section you will use the port extension function to remove an electrical delay caused by cables or fixtures located between the calibration reference plane and the DUT to be evaluated. If you can provide a two-port Touchstone data file representing the characteristics of the network to be removed, the network removal function allows you to remove the network and extend the calibration reference plane.

Follow the procedure below to set port extension for each test port.

Setting Description	Keystroke
Port extension of test port 1: 260 ps	[Cal] - **Port Extensions** - **Extension Port 1** - [.] [2] [6] [G/n]
Port extension of test port 2: 260 ps	**Extension Port 2** - [.] [2] [6] [G/n]
Port extension of test port 3: 260 ps	**Extension Port 3** - [.] [2] [6] [G/n]
Port extension: ON	**Extensions** (Turns it **ON**.)

Figure 14-29 shows the results of extension of the calibration reference plane.

Figure 14-29 **Results of Extending the Calibration Reference Plane**



e5070auj020

7. Setting the Port Reference Impedances

With the reference impedances of two test ports in unbalanced measurements set to Z_0, conversion of those ports into balanced ports causes the impedance of the balanced ports' common mode to be automatically set to $Z_{0/2}$ and the impedance of their differential mode to be automatically set to $2Z_0$.

Step 1. Set the port reference impedance of port 1 on the DUT (unbalanced) to 50 Ω.

Setting Description	Keystroke
Reference impedance of test port 1: 50 Ω	[Analysis] - **Fixture Simulator** - **Port Z conversion** - **Port 1 Z0** - [5] [0] [x1]

Step 2. In order to set the impedance of the differential mode of port 2 on the DUT (balanced) to 200 Ω, set the impedances of two unbalanced ports before conversion each to 100 Ω.

Setting Description	Keystroke
Reference impedance of test port 2: 100 Ω	**Port 2 Z0** - [1] [0] [0] [x1]
Reference impedance of test port 3: 100 Ω	**Port 3 Z0** - [1] [0] [0] [x1]

NOTE Always set the reference impedances of the two test ports before balanced conversion to the same value.

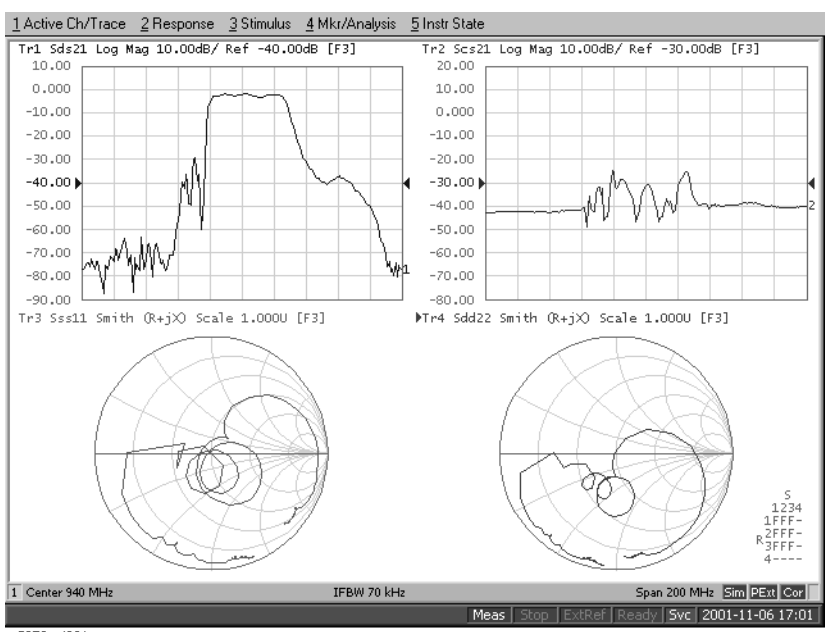
Step 3. Turn on the port reference impedance conversion function.

Setting Description	Keystroke
Port reference impedance conversion: ON	**Port Z Conversion** (Turns it **ON**.)

The reference impedance of the command mode of port 2 on the DUT is set to 50 Ω. The impedance of the differential mode of that port may be set and modified independent of setting the two port reference impedances before balanced conversion. For more information, see “Converting reference impedance of balanced port” on page 214.

Figure 14-30 shows the results of port reference impedance conversion.

Figure 14-30 **Results of Port Reference Impedance Conversion**



e5070auj021

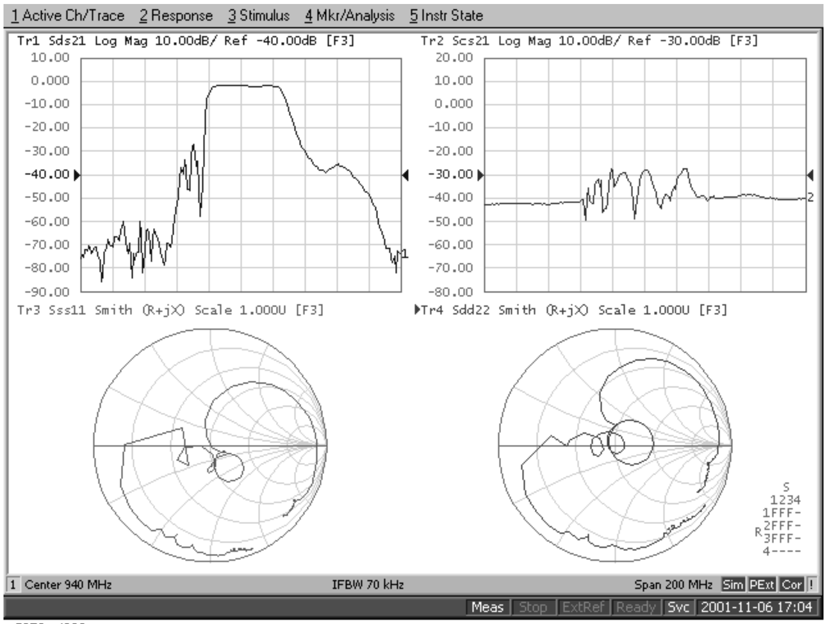
8. Adding a Matching Circuit

Add an inductance of 47 nH in parallel to port 2 on the DUT (balanced). It is also possible to add a matching circuit to the port before unbalanced-balanced conversion. For more information, see “Determining the Characteristics that Result from Adding a Matching Circuit to a Differential Port” on page 216.

Setting Description	Keystroke
Selecting a matching circuit: Shunt L - Shunt C	**Return** (or Analysis - **Fixture Simulator**) - **Diff. Matching** - **Select Circuit** - **Shunt L-Shunt C**
Inductance: 47 nH	**L** - 4 7 G/n
C=0, G=0, R=0	(checks that **C**, **G**, and **R** have been set to **0**.)
Differential matching circuit function: ON	**Diff. Matching** (Turns it **ON**.)

Figure 14-31 shows the results of adding a matching circuit.

Figure 14-31 **Results of Adding a Matching Circuit (47 nH)**



e5070auj022

14. Measurement Examples

Measuring parameters with cable

This section introduces an example of how to detect the location of a mismatch that occurs in a cable using the time domain function.

Overview of evaluation procedure

In this example, a DUT is evaluated according to the procedure shown in Table 14-8.

Table 14-8 Evaluation procedure for deviation from linear phase

Procedure	Description
"1. Setting the measurement conditions" on page 366	Set the measurement conditions.
"2. Executing calibration" on page 366	Execute calibration.
"3. Connecting the DUT" on page 367	Connect the DUT.
"4. Auto scale" on page 367	Execute auto scale.
"5. Setting the time domain function" on page 368	Set the time domain function.

1. Setting the measurement conditions

Follow these steps to set the measurement conditions:

Description of setting	Key stroke
Presetting	Preset - **OK**
Stop frequency: 3 GHz	Start 3 G/n
Number of points: 201	Sweep Setup - **Points** - 2 0 1 x1
Specifying the low pass mode sweep condition	Analysis - **Transform** - **Set Freq Low Pass**
Measurement parameter: S11	Meas - **S11**

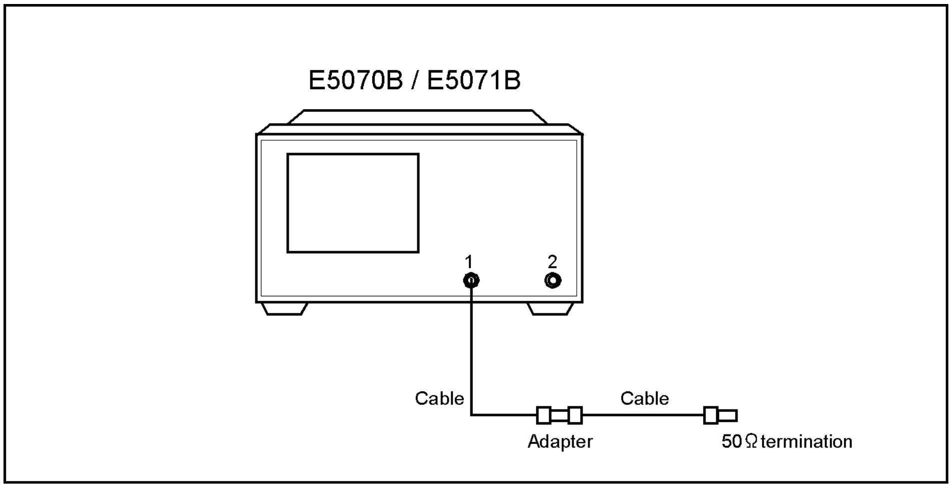
2. Executing calibration

According to "1-Port Calibration (Reflection Test)" on page 98, execute full 1-port calibration on port 1.

3. Connecting the DUT

Connect the DUT as shown in Figure 14-32.

Figure 14-32 **Connecting the DUT**



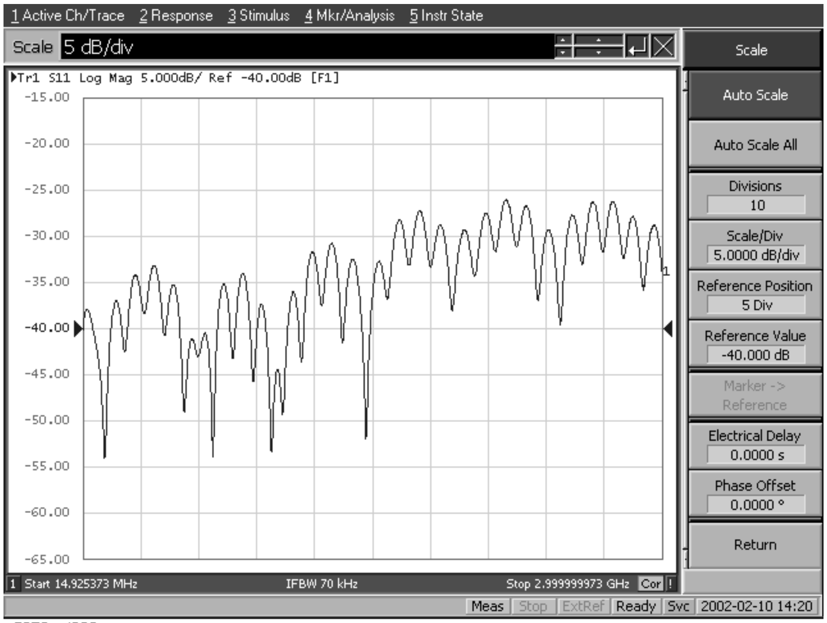
e5070bue027

4. Auto scale

Execute auto scale.

Description of setting	Key stroke
Executing auto scale	Scale - **Auto Scale**

Figure 14-33 **Response in frequency domain**



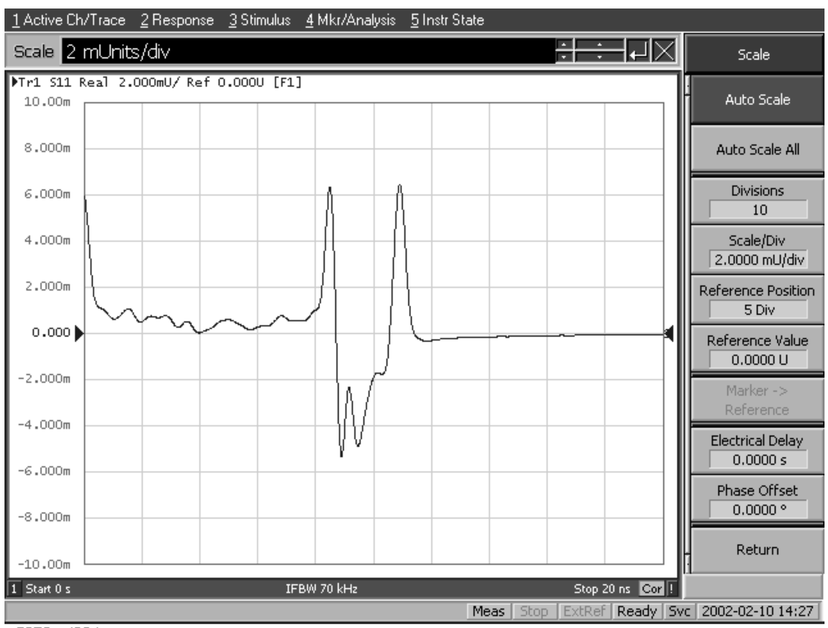
e5070auj203

5. Setting the time domain function

Set the conversion function to display the response in time domain. If you enable this setting, the response in time domain is displayed as shown in Figure 14-34. A peak indicating a small mismatch appears at the location of the connector.

Description of setting	Key stroke
Data format: real	Format - **Real**
Setting the transformation type to low pass impulse	Analysis - **Transform - Lowpass Imp.**
Setting the window type to maximum.	**Window - Maximum**
Setting the display range to from 0 s to 10 ns	**Start** - 0 x1
	Stop - 2 0 G/n
Enabling the transformation function	**Transform** (set to **ON**)
Executing auto scale	Scale - **Auto Scale**

Figure 14-34 Response in time domain

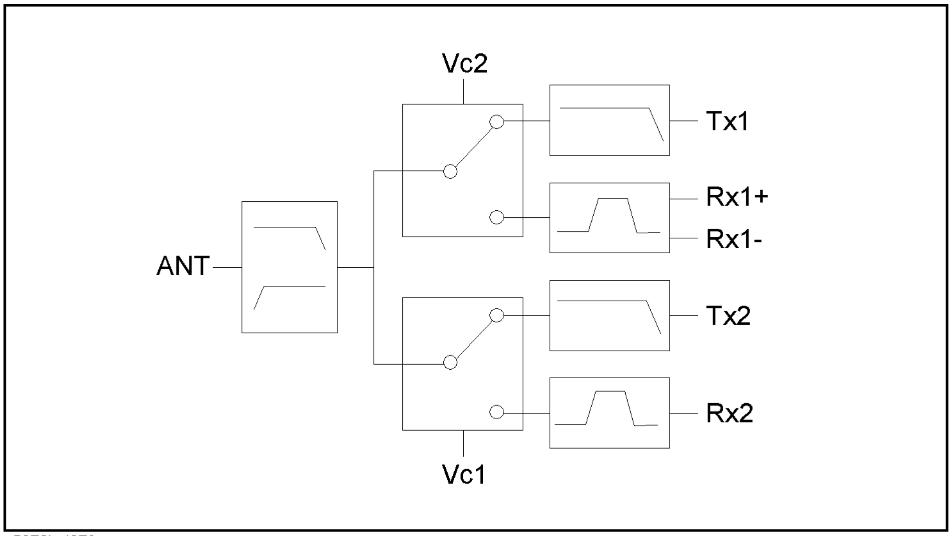


e5070auj204

Evaluating transmission characteristics of a front end module

This example shows how to measure the transmission characteristics of a 6-port front end module shown in Figure 14-35 using the E5070B/E5071B and the E5091A.

Figure 14-35 **Front end module**



e5070buj073

Overview of evaluation procedure

In this example, a DUT is evaluated according to the procedure shown in Table 14-9.

Table 14-9 **Evaluation procedure for 6-port front end module**

Procedure	Description
"1. Determining measurement conditions" on page 370	Determine the measurement conditions such as the sweep conditions and measurement ports.
"2. Setting channel window allocation" on page 370	Set the allocation of the channel windows on the screen.
"3. Setting the test ports" on page 370	Determine the test port assignment for each channel.
"4. Setting control line" on page 371	Set the E5091A's control line.
"5. Setting sweep conditions" on page 371	Set the sweep range and the number of points.
"6. Setting balance conversion topology" on page 371	Set the balance port and unbalance port assignment.
"7. Selecting measurement parameter" on page 372	Set the measurement parameter.
"8. Executing calibration" on page 372	Perform calibration using 4-port ECal.
"9. Connecting DUT" on page 374	Connect the DUT.
"10. Executing measurement" on page 374	Execute the measurement and perform the auto scale.

1. Determining measurement conditions

In this example, perform measurement under the measurement conditions in Table 14-9.

Table 14-10 Sweep conditions

Channel	Start frequency	Stop frequency	NOP	Test port assignment	Control line	Meas. parameter	Calibration	
							Type	Port
1	400 MHz	1.4 GHz	201	Port 1 - Port A Port 2 - Port T1 Port 3 - Port R1+ Port 4 - Port R1-	Line 1: Low Line 2: High	S12	Full 2-Port	1,2
2	880 MHz	1 GHz	101		Line 1: Low Line 2: Low	Sds21	Full 3-Port	1,3,4
3	1.34 GHz	2.34 GHz	201	Port 1 - Port A Port 2 - Port T2 Port 3 - Port R2+ Port 4 - Port R1-	Line 1: High Line 2: Low	S12	Full 2-Port	1,2
4	1.665 GHz	2.015 GHz	101		Line 1: Low Line 2: Low	S31	Full 2-Port	1,3

2. Setting channel window allocation

Make the setting to split the screen into 2 lines and 2 columns to assign channel windows after preset.

Description of setting	Key stroke
Executing preset	Preset - **OK**
Allocating channel windows	Display - **Allocate Channels** - ×4

3. Setting the test ports

Step 1. Display the E5091A setup menu and display the E5091A property.

Description of setting	Key stroke
Displaying the E5091A setup menu	System - **E5091A Setup**
Displaying the E5091A property	**E5091A Property**

Step 2. Select the test ports assigned to ports 1 to 4 for channel 1.

Description of setting	Key stroke
Select the ID of the E5091A	**Select ID - 1**
Assign test port A to port 1.	**Port1 - A**
Assign test port T1 to port 2.	**Port2 - T1**
Assign test port R1+ to port 3.	**Port3 - R1+**
Assign test port R1- to port 4.	**Port4 - R1-**

Step 3. Assign test ports for channels 2, 3, and 4. Press the Channel Next key to switch the active channel and then make the setting in the same way as Step 2.

Step 4. Enable the control of the E5091A.

Description of setting	Key stroke
Enable the control of the E5091A.	**E5091A Control** (Set it to **ON**.)

4. Setting control line

Step 1. Set the bits of the control line for channel 1.

Description of setting	Key stroke
Set channel 1 to the active channel.	Channel Next
Line 1: Low	**Control Line** (check only)
Line 2: High	**Control Line** - **Line 1** (Set it to **High**.)

Step 2. Set the control line for channels 2, 3, and 4 also according to the same procedure as in Step 1.

5. Setting sweep conditions

Step 1. Set the sweep conditions for channel 1.

Description of setting	Key stroke
Set channel 1 to the active channel.	Channel Next
Start frequency: 400 MHz	Start 4 0 0 M/μ
Stop frequency: 1.4 GHz	Stop 1 . 4 G/n
Number of points: 201	Sweep Setup - **Point** - 2 0 1 x1

Step 2. Set the sweep conditions for channels 2, 3, and 4 also according to the same procedure as in Step 1.

6. Setting balance conversion topology

For channel 2, set the balance conversion topology in order to perform measurement including the balanced port.

Description of setting	Key stroke
Set channel 2 to the active channel.	Channel Next (Press it until channel 2 is activated.)
Set DUT port 1 to unbalance and DUT port 2 to balance.	Analysis - **Fixture Simulator** - **Topology** - **Device** - **SE-Bal**

14. Measurement Examples

Description of setting	Key stroke
Set the destination to which DUT port 1 (unbalance) is connected to test port 1 of the analyzer.	**Port 1 (se)** - **1**
Set the destination to which DUT port 2 (balance) is connected to test ports 3 and 4 of the analyzer.	**Port 2 (bal)** - **3-4**
Unbalance-balance conversion for trace 1: ON	**BalUn** (Set it to **ON**.)
Fixture simulator: ON	**Fixture Simulator** (Set it to **ON**.)

7. Selecting measurement parameter

Set the measurement parameter for channel 1.

Step 1. Select the measurement parameter for trace 1 of channel 1.

Description of setting	Key stroke
Set channel 1 to the active channel.	[Channel Next] (Press it until channel 1 is activated.)
Measurement parameter for trace 1: S12	[Meas] - **S12**

NOTE The subscript of the measurement parameter means the test port of the E5070B/E5071B. Check the test port assignment and select the measurement parameter.

Step 2. Set the measurement parameter for channels 2, 3, and 4 according to the same procedure as in Step 1.

8. Executing calibration

Step 1. Display the Ecal menu.

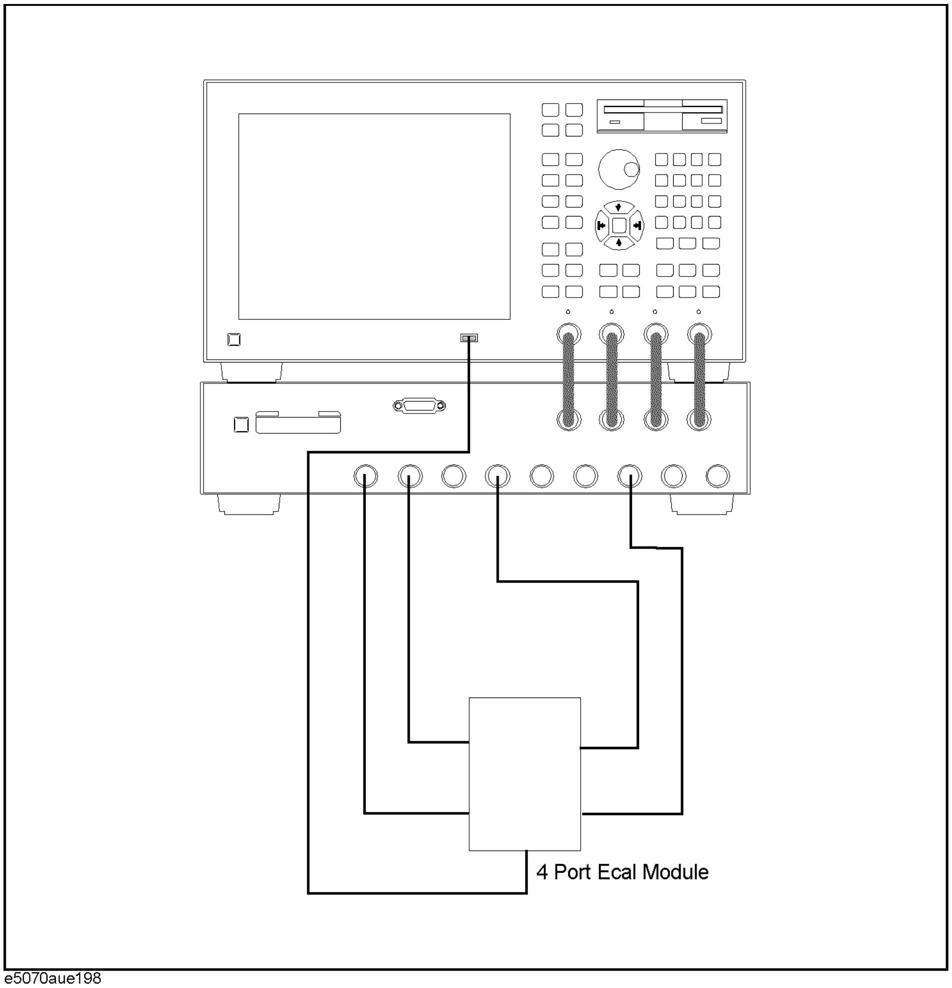
Description of setting	Key stroke
Display the ECal menu.	[Cal] - **ECal**

Step 2. Set channel 1 to the active channel.

Description of setting	Key stroke
Switch the active channel.	[Channel Next]

Step 3. Check the test ports assigned to ports 1 to 4 in the E5091A property and connect the 4-port ECal module to those ports.

Figure 14-36 **Connecting the 4-port ECal**



Step 4. Execute the calibration.

Description of setting	Key stroke
Select the full 2-port calibration.	**2-Port ECal**
Select the port and execute the calibration.	**1-2**

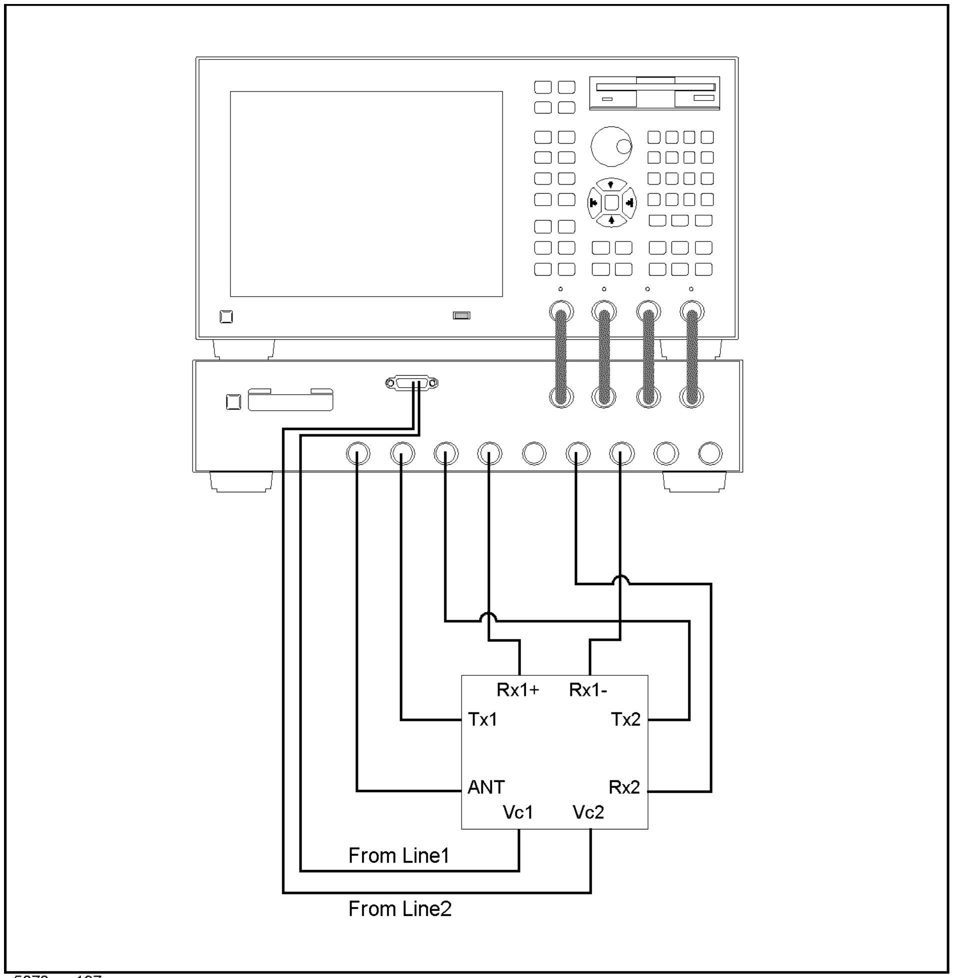
Step 5. Perform the calibration for channels 2, 3, and 4 according to the same procedure as in Step 2 to Step 4.

NOTE Because the test port assignment setting for channels 1 and 2 and that for channels 3 and 4 are the same, you need not to change the connection of ECal.

9. Connecting DUT

Connect the DUT as shown in Figure 14-37.

Figure 14-37 Connecting 6-port front end module



e5070aue197

10. Executing measurement

Step 1. Display the trigger menu.

Description of setting	Key stroke
Display the trigger menu.	Trigger

Step 2. Set the trigger source to “manual.”

Description of setting	Key stroke
Set the trigger source to “manual.”	**Trigger Source - Manual**

Step 3. Set the trigger mode for channel 1 to "continuous."

Description of setting	Key stroke
Set channel 1 to the active channel.	Channel Next
Set the trigger mode to "continuous."	**Continuous**

Step 4. Set the trigger mode for channels 2, 3, and 4 to "continuous" according to the same procedure as in Step 3.

Step 5. Execute the measurement.

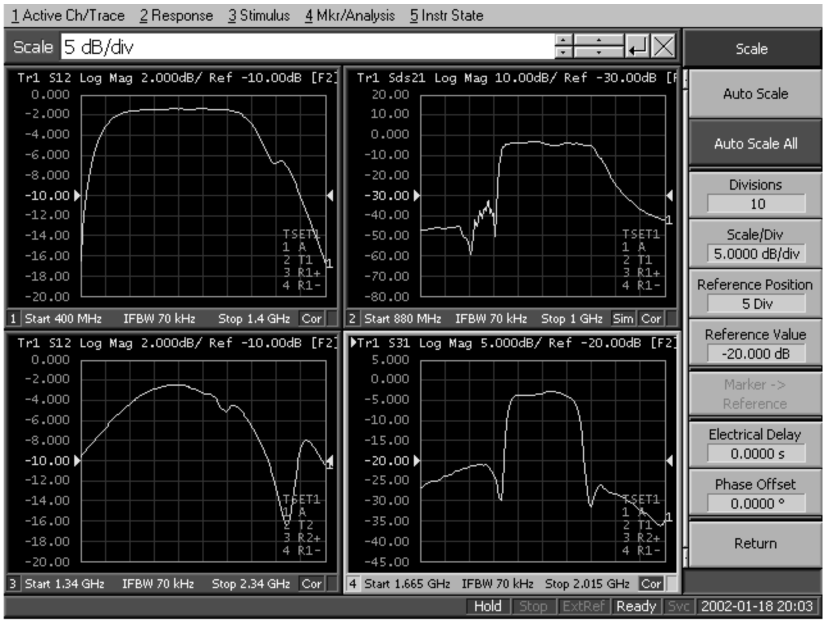
Description of setting	Key stroke
Generate a trigger event.	**Trigger**

Step 6. Repeat the following procedure to execute the auto scale for all the channels.

Description of setting	Key stroke
Set the active channel.	Channel Next
Execute the auto scale.	Scale - **Auto Scale**

Step 7. After all the procedures are complete, the screen as shown in Figure 14-38 appears.

Figure 14-38 **Example of measuring a front end module**



e5070auj201

Executing Power Calibration

This section shows an example to execute power calibration using the E4418B power meter and the E4412A power sensor.

Overview of execution procedure

In this example, power calibration is executed according to the procedure shown in Table 14-11.

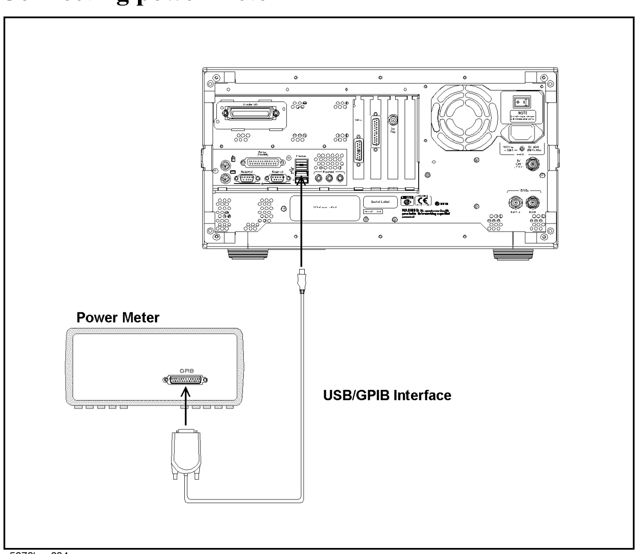
Table 14-11 **Execution procedure of power calibration**

Procedure	Description
"1. Connecting power meter" on page 376	Connect the power meter to the E5070B/E5071B.
"2. Setting address of power meter" on page 377	Configure the power meter's GPIB address with the E5070B/E5071B.
"3. Setting stimulus condition" on page 377	Set the conditions such as the power level and frequency.
"4. Executing zero adjustment and calibration of power sensor" on page 377	Execute the zero adjustment and calibration of the power sensor.
"5. Setting calibration data measurement conditions" on page 377	Select the port, select the power sensor, and set the number of measurements at one point.
"6. Connecting power sensor" on page 378	Connect the power sensor.
"7. Measuring calibration data" on page 378	Execute the measurement of calibration data.

1. Connecting power meter

Connect the E4418A (GPIB address: 14) to the E5070B/E5071B as shown in Figure 14-39.

Figure 14-39 **Connecting power meter**



e5070bue004

2. Setting address of power meter

Follow these steps to configure the power meter's GPIB address.

Description of setting	Key stroke
GPIB address of the power meter: 14	[System] - **Misc Setup** - **GPIB Setup** - **Power Meter Address** - [1] [4] [x1]

3. Setting stimulus condition

Follow these steps to configure the stimulus conditions:

Description of setting	Key stroke
Presetting	[Preset] - **OK**
Sweep type: Power	[Sweep Setup] - **Sweep Type** - **Power Sweep**
Fixed frequency: 1 GHz	[Sweep Setup] - **Power** - **CW Freq** - [1] [G/n]
Power range: -40 dBm to -8 dBm	[Sweep Setup] - **Power** - **Power Ranges** - **-40 to -8**
Start value: -40 dBm	[Start] [+/-] [4] [0] [x1]
Stop value: -10 dBm	[Stop] [+/-] [1] [0] [x1]
Number of points: 61	[Sweep Setup] - **Points** - [6] [1] [x1]

4. Executing zero adjustment and calibration of power sensor

Execute the zero adjustment and calibration of the power sensor according to *E4418B Power Meter User's Guide*.

5. Setting calibration data measurement conditions

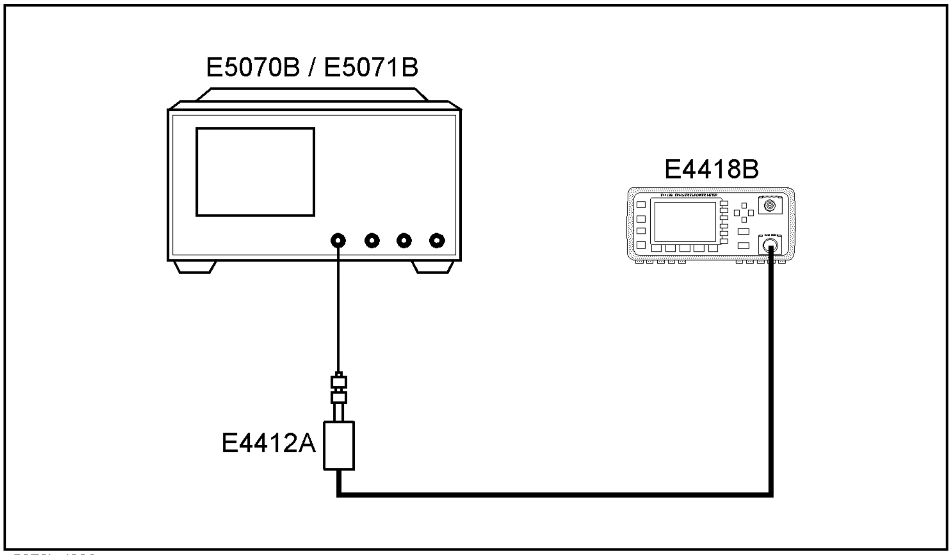
Follow these steps to set the calibration data measurement conditions:

Description of setting	Key stroke
Selecting the test port: 1	[Cal] - **Power Calibration** - **Select Port** - **1**
Selection of the power sensor: A	[Cal] - **Power Calibration** - **Use Sensor [A]**
Number of measurements at one measurement point: 4	[Cal] - **Power Calibration** - **Num of Readings** - [4] [x1]

6. Connecting power sensor

Connect the power sensor as shown in Figure 14-40.

Figure 14-40 **Connecting power sensor**



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7. Measuring calibration data

Follow these steps to measure the calibration data:

Description of setting	Key stroke
Measuring the calibration data	Cal - **Power Calibration** - **Take Cal Sweep**

15 Specifications and Supplemental Information

This chapter provides specifications and supplemental information for the Agilent E5070B/E5071B Network Analyzer.

Definitions

All specifications apply over a 5°C to 40°C range (unless otherwise stated) and 90 minutes after the instrument has been turned on.

Specification (spec.): Warranted performance. Specifications include guardbands to account for the expected statistical performance distribution, measurement uncertainties, and changes in performance due to environmental conditions.

Supplemental information is intended to provide information that is helpful for using the instrument but that is not guaranteed by the product warranty. This information is denoted as either typical or nominal.

Typical (typ.): Expected performance of an average unit that does not include guardbands. It is not guaranteed by the product warranty.

Nominal (nom.): A general, descriptive term that does not imply a level of performance. It is not guaranteed by the product warranty.

Corrected System Performance

The specifications in this section apply for measurements made with the Agilent E5070B/E5071B Network Analyzer under the following conditions:

- No averaging applied to data
- Environmental temperature of 23°C ±5°C, with less than 1°C deviation from the calibration temperature
- Response and isolation calibration not omitted

Table 15-1 System Dynamic Range

Description		Specification	Supplemental Information
System Dynamic Range[*1*2]			
300 kHz to 3 MHz	IF bandwidth = 3 kHz		85 dB
3 MHz to 1.5 GHz		95 dB	98 dB
1.5 GHz to 4 GHz		97 dB	100 dB
4 GHz to 6 GHz		93 dB	95 dB
6 GHz to 7.5 GHz		88 dB	91 dB
7.5 GHz to 8.5 GHz		81 dB	84 dB
300 kHz to 3 MHz	IF bandwidth = 10 Hz		110 dB
3 MHz to 1.5 GHz		120 dB	123 dB
1.5 GHz to 4 GHz		122 dB	125 dB
4 GHz to 6 GHz		118 dB	120 dB
6 GHz to 7.5 GHz		113 dB	116 dB
7.5 GHz to 8.5 GHz		106 dB	109 dB

*1. The test port dynamic range is calculated as the difference between the test port rms noise floor and the source maximum output power. The effective dynamic range must take measurement uncertainty and interfering signals into account.

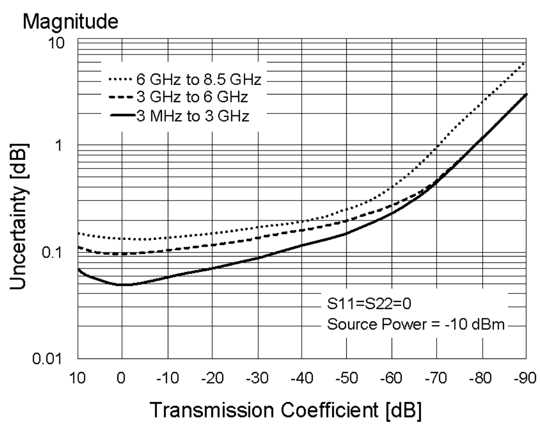
*2. May be limited to 90 dB at particular frequencies below 350MHz or above 4.25GHz due to spurious receiver residuals.

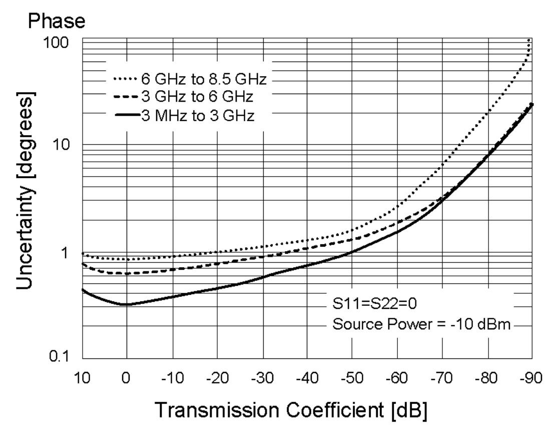
15. Specifications and Supplemental Information

Table 15-2 Corrected System Performance With Type-N Device Connectors, 85032F Calibration Kit

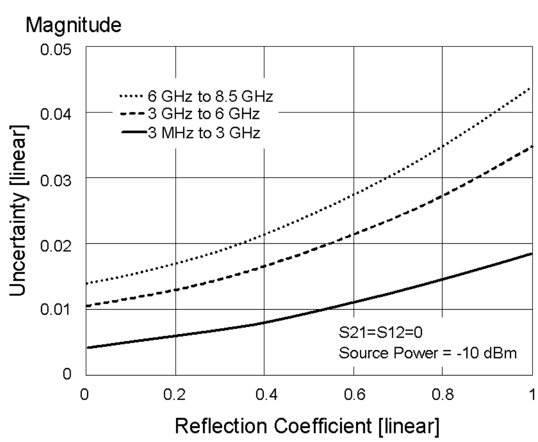
Network analyzer: E5070B/E5071B, Calibration kit: 85032F (Type-N, 50 Ω), Calibration: full 2-port			
IF bandwidth = 10 Hz, No averaging applied to data, Environmental temperature = 23°C±5°C with <1°C deviation from calibration temperature, Isolation calibration not omitted			
Description	**Specification (dB)**		
	3 MHz to 3 GHz	**3 GHz to 6 GHz**	**6 GHz to 8.5 GHz**
Directivity	49	40	38
Source Match	41	36	35
Load Match	49	40	37
Reflection Tracking	±0.011	±0.032	±0.054
Transmission Tracking	±0.016	±0.062	±0.088

Transmission Uncertainty (Specification)





Reflection Uncertainty (Specification)



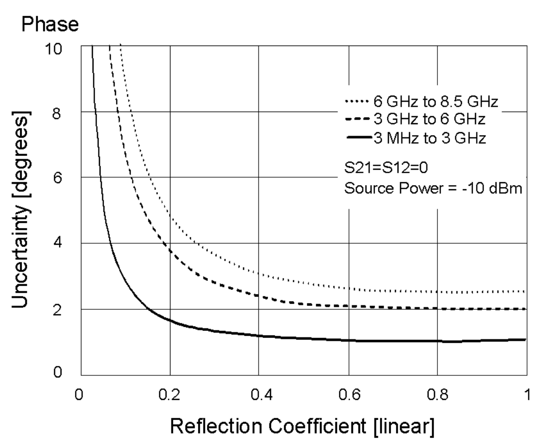


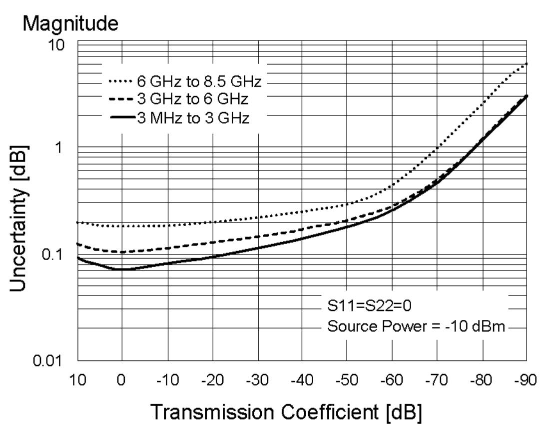
Table 15-3 Corrected System Performance With Type-N Device Connectors, 85092C Electronic Calibration Module

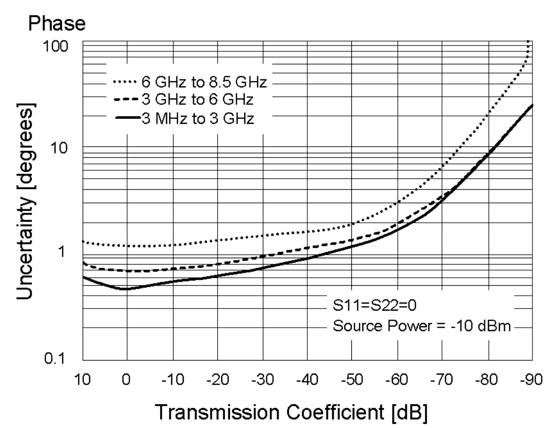
Network analyzer: E5070B/E5071B, Calibration module: 85092C (Type-N, 50 Ω) electronic calibration (ECal) module, Calibration: full 2-port

IF bandwidth = 10 Hz, No averaging applied to data, Environmental temperature = 23°C±5°C with <1°C deviation from calibration temperature, Isolation calibration not omitted

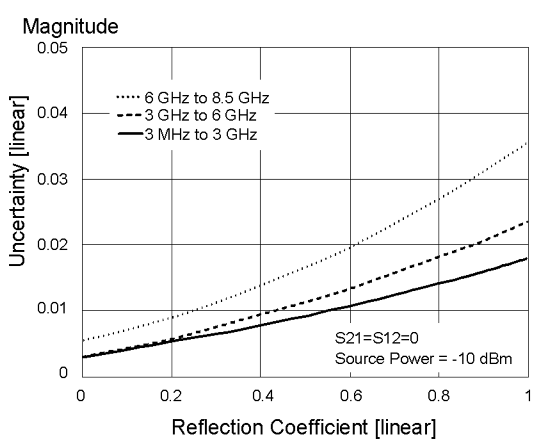
Description	**Specification (dB)**		
	3 MHz to 3 GHz	**3 GHz to 6 GHz**	**6 GHz to 8.5 GHz**
Directivity	52	52	47
Source Match	45	41	36
Load Match	47	44	39
Reflection Tracking	±0.040	±0.060	±0.070
Transmission Tracking	±0.039	±0.069	±0.136

Transmission Uncertainty (Specification)





Reflection Uncertainty (Specification)



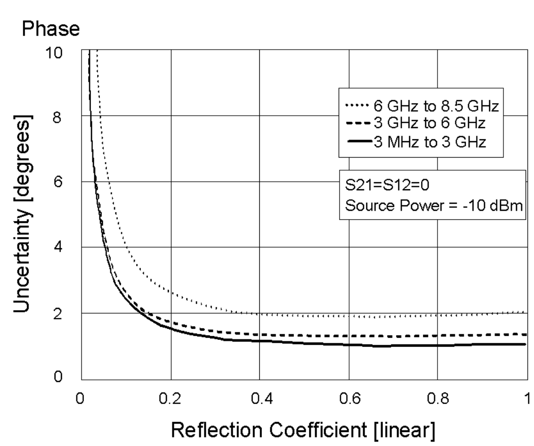
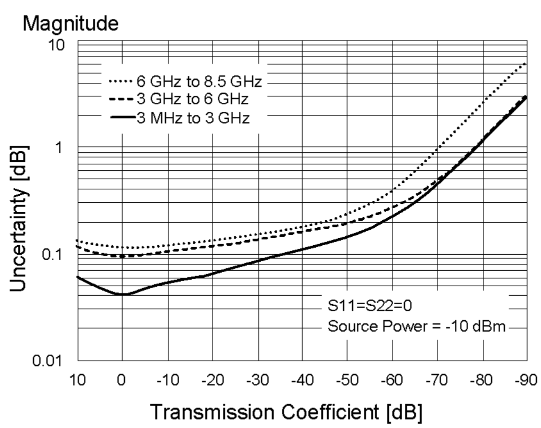
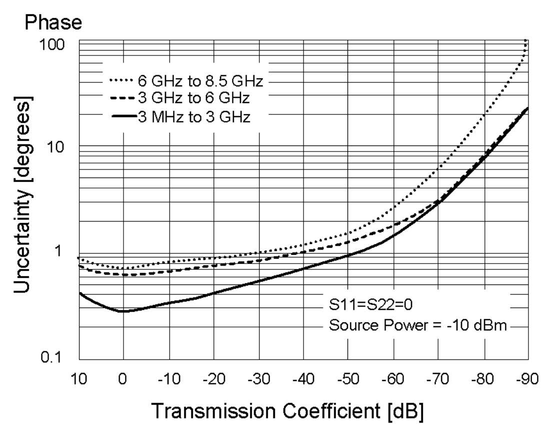


Table 15-4 Corrected System Performance With 3.5 mm Device Connector Type, 85033E Calibration Kit

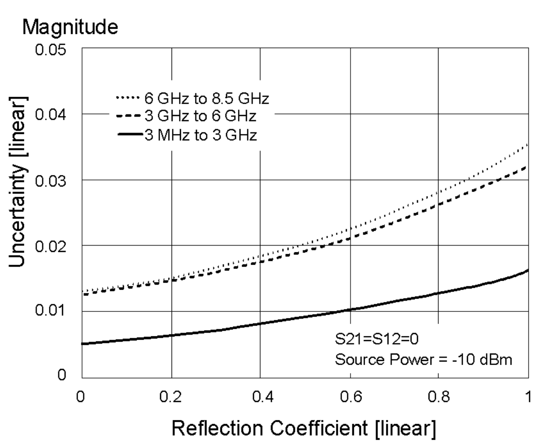
Network analyzer: E5070B/E5071B, Calibration kit: 85033E (3.5 mm, 50 Ω), Calibration: full 2-port			
IF bandwidth = 10 Hz, No averaging applied to data, Environmental temperature = 23°C±5°C with <1°C deviation from calibration temperature, Isolation calibration not omitted			
Description	**Specification (dB)**		
	3 MHz to 3 GHz	**3 GHz to 6 GHz**	**6 GHz to 8.5 GHz**
Directivity	46	38	38
Source Match	43	37	36
Load Match	46	38	38
Reflection Tracking	±0.006	±0.009	±0.010
Transmission Tracking	±0.016	±0.065	±0.079

Transmission Uncertainty (Specification)





Reflection Uncertainty (Specification)



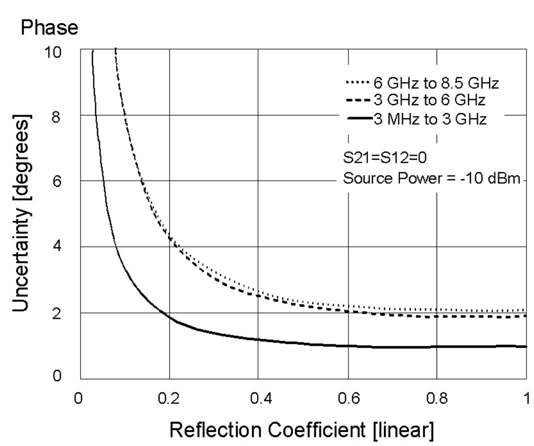
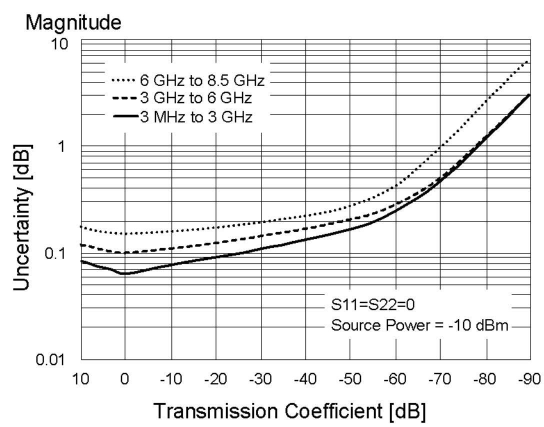
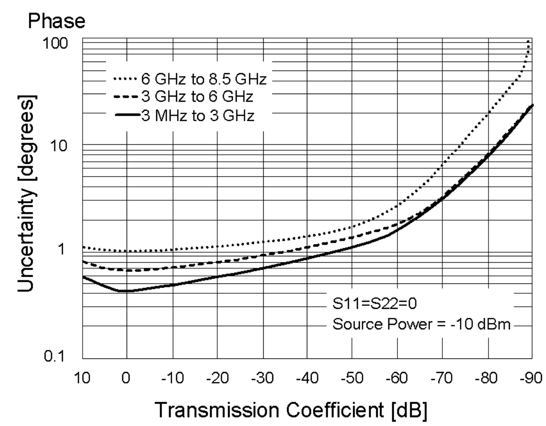


Table 15-5 Corrected System Performance With 3.5 mm Device Connector Type, 85093C Electronic Calibration Module

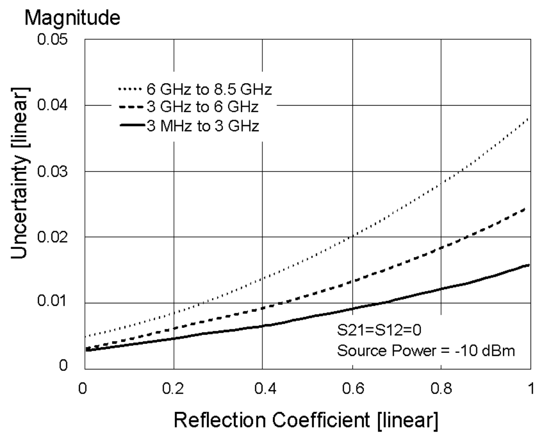
Network analyzer: E5070B/E5071B, Calibration module: 85093C (3.5 mm, 50 Ω) electronic calibration (ECal) module, Calibration: full 2-port			
IF bandwidth = 10 Hz, No averaging applied to data, Environmental temperature = 23°C±5°C with <1°C deviation from calibration temperature, Isolation calibration not omitted			
Description	**Specification (dB)**		
	3 MHz to 3 GHz	**3 GHz to 6 GHz**	**6 GHz to 8.5 GHz**
Directivity	52	51	47
Source Match	44	39	34
Load Match	47	44	40
Reflection Tracking	±0.030	±0.050	±0.070
Transmission Tracking	±0.039	±0.069	±0.117

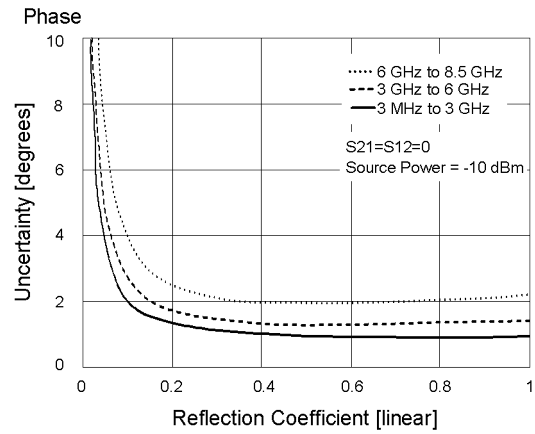
Transmission Uncertainty (Specification)





Reflection Uncertainty (Specification)





Uncorrected System Performance

Table 15-6 **Uncorrected System Performance (Correction: Off, System Correction: On)**

Description	Specification		
	3 MHz to 3 GHz	3 GHz to 6 GHz	6 GHz to 8.5 GHz
Directivity	25 dB	20 dB	15 dB
Source Match	25 dB	20 dB	15 dB
Load Match	17 dB	12 dB	10 dB
Transmission Tracking	± 1.0 dB	± 1.0 dB	± 1.0 dB
Reflection Tracking	± 1.0 dB	± 1.0 dB	± 1.0 dB

Test Port Output (Source)

Table 15-7 Test Port Output Frequency

Description	Specification	Supplemental Information
Range E5070B E5071B	 300 kHz to 3 GHz 300 kHz to 8.5 GHz	
Resolution	1 Hz	
Source Stability Standard Option 1E5		 ±5 ppm (5°C to 40°C, typical) ±0.05 ppm (23°C±5°C, typical) ±0.5 ppm/year (typical)
CW Accuracy Standard Option 1E5	 ±5 ppm, 23°C±5°C ±1 ppm, 23°C±5°C	

Table 15-8 Test Port Output Power[*1]

Description	Specification	Supplemental Information
Level Accuracy (at 23°C±5°C) 300 kHz to 10 MHz 10 MHz to 8.5 GHz Level Accuracy (high temperature mode: ON) 300 kHz to 8.5 GHz Level Accuracy (swept mode) 300 kHz to 4.25 GHz 4.25 GHz to 8.5 GHz	 ±0.650 dB (at 0 dBm, 50 MHz absolute) ±1.0 dB (at 0 dBm, relative to 50 MHz reference)	 ±1.0 dB (at 0 dBm, relative to 50 MHz reference) ±0.8 dB (at 0 dBm, 50 MHz absolute) ±1.5 dB (at 0 dBm, relative to 50 MHz reference) ±2.5 dB (at 0 dBm, relative to 50 MHz reference) ±3.5 dB (at 0 dBm, relative to 50 MHz reference)
Level Linearity (23°C±5°C) 10 MHz to 4.25 GHz 4.25 GHz to 6 GHz 6 GHz to 8.5 GHz Level Linearity (high temperature mode: ON) 300 kHz to 4.25 GHz 4.25 GHz to 6 GHz 6 GHz to 8.5 GHz	 ±0.75 dB (at –15 dBm to 10 dBm) ±0.75 dB (at –15 dBm to 8 dBm) ±0.75 dB (at –15 dBm to 6 dBm)	 ±1.5 dB (at –15 dBm to 10 dBm) ±2.0 dB (at –15 dBm to 8 dBm) ±2.0 dB (at –15 dBm to 6 dBm)

Table 15-8 Test Port Output Power[*1]

Description	Specification	Supplemental Information
Level Linearity (swept mode) 300 kHz to 4.25 GHz 4.25 GHz to 6 GHz 6 GHz to 8.5 GHz		 ±1.5 dB (at −15 dBm to 10 dBm) ±3 dB (at −15 dBm to 8 dBm) ±3 dB (at −15 dBm to 6 dBm)
Range Standard 300 kHz to 4.25 GHz 4.25 GHz to 6 GHz 6 GHz to 8.5 GHz Extended Power Range (with option 214, 314, 414) 300 kHz to 4.25 GHz 4.25 GHz to 6 GHz 6 GHz to 8.5 GHz	 −15 dBm to 10 dBm −15 dBm to 8 dBm −15 dBm to 6 dBm	 −50 dBm to 10 dBm −50 dBm to 8 dBm −50 dBm to 6 dBm (non-harmonics spurious may limit power range)
Sweep Range (without extended power range) 300 kHz to 4.25 GHz 4.25 GHz to 6 GHz 6 GHz to 8.5 GHz	 −15 dBm to 10 dBm −15 dBm to 8 dBm −15 dBm to 6 dBm	 −20 dBm to 10 dBm −20 dBm to 8 dBm −20 dBm to 6 dBm
Level Resolution	0.05 dB	

*1. Source output performance on port 1 only. Other port output performance is typical.

Table 15-9 Test Port Output Signal Purity

Description	Specification	Supplemental Information
Harmonics (2nd or 3rd) 10 MHz to 2 GHz 2 GHz to 3 GHz 3 GHz to 8.5 GHz		 < −25 dBc (at 5 dBm, typical) < −15 dBc (at 5 dBm, typical) < −10 dBc (at 5 dBm, typical)
Non-Harmonic Spurious 10 MHz to 3 GHz 3 GHz to 8.5 GHz		 < −25 dBc (at 5 dBm, typical) < −10 dBc (at 5 dBm, typical)

Test Port Input

Table 15-10 Test Port Input Levels

Description	Specification	Supplemental Information
Maximum Test Port Input Level		
300 kHz to 4.25 GHz 4.25 GHz to 6 GHz 6 GHz to 8.5 GHz	+10 dBm +8 dBm +6 dBm	
Damage Level		
300 kHz to 8.5 GHz		+20 dBm, ±25 VDC, typical
Crosstalk[*1]		
3 MHz to 3 GHz 3 GHz to 6 GHz 6 GHz to 7.5 GHz 7.5 GHz to 8.5 GHz	−120 dB −110 dB −100 dB −90 dB	

*1. Response calibration not omitted.

Table 15-11 Test Port Input (Trace Noise)

Description	Specification	Supplemental Information
Trace Noise[*1] Magnitude		
300 kHz to 3 MHz (source power level = +10 dBm)		5 mdB rms (typical) 8 mdB rms (high temperature mode: ON, typical)
3 MHz to 4.25 GHz (source power level = +10 dBm)	1 mdB rms (23°C±5°C)	4 mdB rms (high temperature mode: ON, typical)
4.25 GHz to 6 GHz (source power level = +8 dBm)	3 mdB rms (23°C±5°C)	6 mdB rms (high temperature mode: ON, typical)
6 GHz to 7.5 GHz (source power level = +6 dBm)	3 mdB rms (23°C±5°C)	6 mdB rms (high temperature mode: ON, typical)
7.5 GHz to 8.5 GHz (source power level = +6 dBm)	5 mdB rms (23°C±5°C)	8 mdB rms (high temperature mode: ON, typical)
Trace Noise[*1] Phase		
300 kHz to 3 MHz (source power level = +10 dBm)		0.035 ° rms (23°C±5°C, typical) 0.05 ° rms (high temperature mode: ON, typical)
3 MHz to 4.25 GHz (source power level = +10 dBm)		0.007 ° rms (23°C±5°C, typical) 0.02 ° rms (high temperature mode: ON, typical)
4.25 GHz to 6 GHz (source power level = +8 dBm)		0.021 ° rms (23°C±5°C, typical) 0.035 ° rms (high temperature mode: ON, typical)
6 GHz to 7.5 GHz (source power level = +6 dBm)		0.021 ° rms (23°C±5°C, typical) 0.035 ° rms (high temperature mode: ON, typical)
7.5 GHz to 8.5 GHz (source power level = +6 dBm)		0.035 ° rms (23°C±5°C, typical) 0.05 ° rms (high temperature mode: ON, typical)

*1. Trace noise is defined as a ratio measurement of a through, at IFBW = 3 kHz.

Table 15-12 Test Port Input (Stability)

Description	Specification	Supplemental Information
Stability Magnitude[*1]		
3 MHz to 3 GHz		0.005 dB/°C (at 23 °C±5°C, typical)
3 GHz to 6 GHz		0.01 dB/°C (at 23 °C±5°C, typical)
6 GHz to 8.5 GHz		0.04 dB/°C (at 23 °C±5°C, typical)
Stability Phase[*1]		
3 MHz to 3 GHz		0.1 °/°C (at 23 °C±5°C, typical)
3 GHz to 6 GHz		0.2 °/°C (at 23 °C±5°C, typical)
6 GHz to 8.5 GHz		0.8 °/°C (at 23 °C±5°C, typical)

*1. Stability is defined as a ratio measurement at the test port.

Table 15-13 Test Port Input (Dynamic Accuracy)

Accuracy of the test port input power reading is relative to –10 dBm reference input power level.

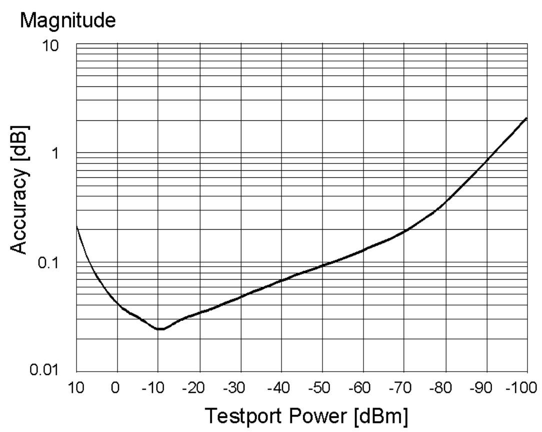
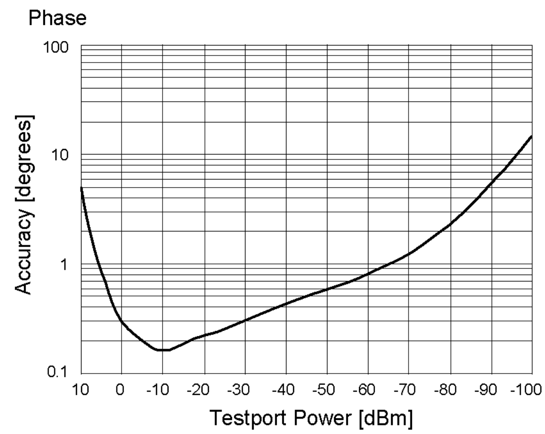
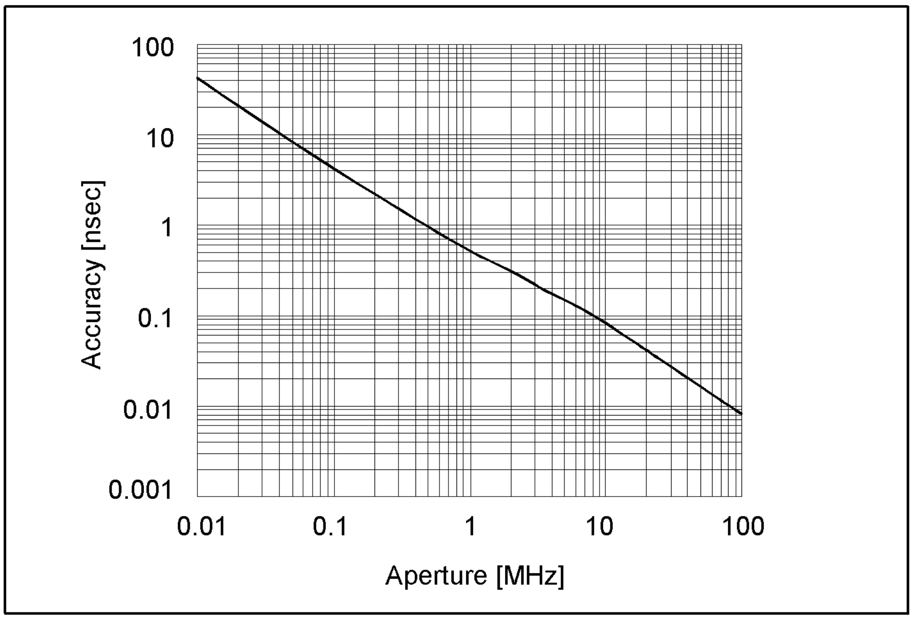
Specification	Supplemental Information
	

Table 15-14 Test Port Input (Group Delay)*1

Description	Specification	Supplemental Information
Aperture (selectable)	(frequency span)/(number of points – 1)	
Maximum Aperture	25% of frequency span	
Minimum Delay		Limited to measuring no more than 180° of phase change within the minimum aperture.
Accuracy		See graph below, typical

The following graph shows group delay accuracy with type-N full 2-port calibration and a 10 Hz IF bandwidth. Insertion loss is assumed to be < 2 dB.



In general, the following formula can be used to determine the accuracy, in seconds, of specific group delay measurement:

$$\pm \text{Phase Accuracy (deg)} / [360 \times \text{Aperture (Hz)}]$$

*1. Group delay is computed by measuring the phase change within a specified step (determined by the frequency span and the number of points per sweep).

General Information

Table 15-15 System Bandwidths

Description	Supplemental Information
IF Bandwidth Settings	
Range	10 Hz to 100 kHz Nominal settings are: 10, 15, 20, 30, 40, 50, 70, 100, 150, 200, 300, 400, 500, 700, 1k, 1.5k, 2k, 3k, 4k, 5k, 7k, 10k, 15k, 20k, 30k, 40k, 50k, 70k, 100kHz

Table 15-16 Front Panel Information

Description	Supplemental Information
RF Connectors	
Type	Type-N, female, 50 Ω (nominal)
Display	
Size	10.4 in TFT color LCD
Resolution	VGA (640 × 480)

Table 15-17 Rear Panel Information

Description	Supplemental Information
External Trigger Connector	
Type	BNC, female
Input level	LOW threshold voltage: 0.5 V HIGH threshold voltage: 2.1 V Input level range: 0 to + 5 V
Pulse width	≥ 2 μsec, typical
Polarity	Negative (downward) only
External Reference Signal Input Connector	
Type	BNC, female
Input Frequency	10 MHz ± 10 ppm, typical
Input Level	0 dBm ± 3 dB, typical
Internal Reference Signal Output Connector	
Type	BNC, female
Output Frequency	10 MHz ± 10 ppm, typical
Signal Type	Sine Wave, typical
Output Level	0 dBm ± 3 dB into 50 Ω, typical
Output Impedance	50 Ω, nominal
VGA Video Output	15-pin mini D-Sub; female; drives VGA compatible monitors
GPIB	24-pin D-Sub (Type D-24), female; compatible with IEEE-488
Parallel Port	36-pin D-Sub (Type 1284-C), female; provides connection to printers
USB Port	
	Universal Serial Bus jack, Type A configuration (4 contacts inline, contact 1 on left); female; provides connection to printer, ECal module, USB/GPIB interface or multiport test set
Contact 1	Vcc: 4.75 to 5.25 VDC, 500 mA, maximum
Contact 2	–Data
Contact 3	+Data
Contact 4	Ground
LAN	10/100BaseT Ethernet, 8-pin configuration; auto selects between the two data rates
Handler I/O Port	36-pin centronics, female; provides connection to handler system

Table 15-17 Rear Panel Information

Description	Supplemental Information
Line Power[*1]	
Frequency	47 Hz to 63 Hz
Voltage	90 to 132 VAC, or 198 to 264 VAC (automatically switched)
VA Max	350 VA max.

*1. A third-wire ground is required.

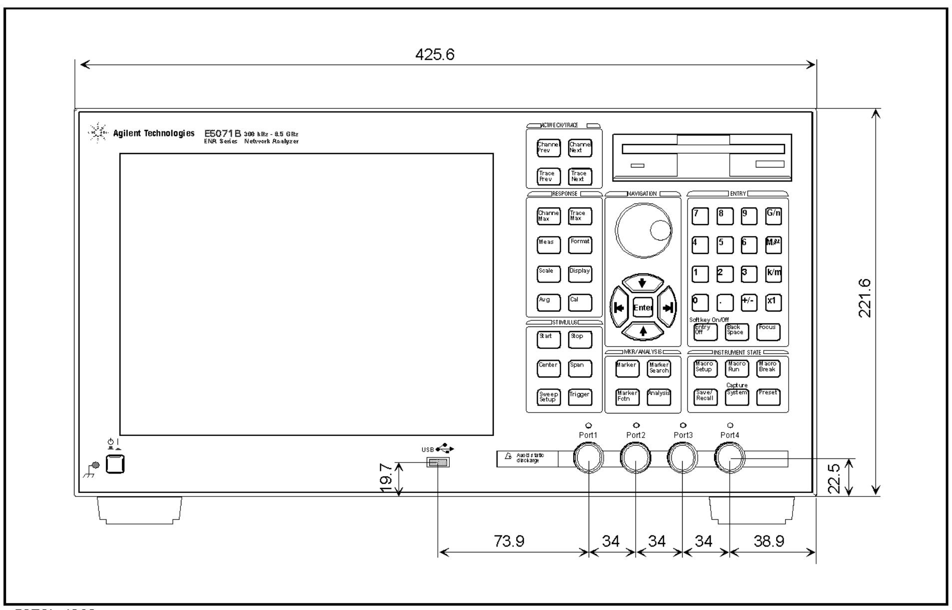
Table 15-18 EMC and Safety

Description	Supplemental Information
EMC	
CE ISM 1-A	European Council Directive 89/336/EEC, 93/68/EEC IEC 61326-1:1997 +A1:1998 / EN 61326-1:1997 +A1:1998 CISPR 11:1997 +A1:1999 / EN 55011:1998 +A1:1999 Group 1, Class A IEC 61000-4-2:1995 / EN 61000-4-2:1995 +A1:1998 4 kV CD / 8 kV AD IEC 61000-4-3:1995 / EN 61000-4-3:1996 +A1:1998 3 V/m, 80-1000 MHz, 80% AM IEC 61000-4-4:1995 / EN 61000-4-4:1995 1 kV power / 0.5 kV Signal IEC 61000-4-5:1995 / EN 61000-4-5:1995 0.5 kV Normal / 1 kV Common IEC 61000-4-6:1996 / EN 61000-4-6:1996 3 V, 0.15-80 MHz, 80% AM IEC 61000-4-11:1994 / EN 61000-4-11:1994 100% 1cycle Note: The performance criterion B is adopted for ESD immunity test, and criterion A for other immunity tests. Temporary deviation from test limit due to accidental measurement of test signal is considered normal performance.
ICES/NMB-001	This ISM device complies with Canadian ICES-001. Cet appareil ISM est conforme à la norme NMB-001 du Canada.
N10149	AS/NZS 2064.1/2 Group 1, Class A
Safety	
CE ISM 1-A	European Council Directive 73/23/EEC IEC 61010-1:1990+A1+A2 / EN 61010-1:1993+A2 INSTALLATION CATEGORY II, POLLUTION DEGREE 2 INDOOR USE IEC60825-1:1994 CLASS 1 LED PRODUCT
LR95111C	CAN/CSA C22.2 No. 1010.1-92

Table 15-19 Analyzer Environment and Dimensions

Description	Supplemental Information
Operating Environment	
Temperature	+5 °C to +40 °C
Error-Corrected Temperature Range	23 °C ± 5 °C with < 1°C deviation from calibration temperature
Humidity	20% to 80% at wet bulb temperature < +29 °C (non-condensing)
Altitude	0 to 2,000 m (0 to 6,561 feet)
Vibration	0.5 G maximum, 5 Hz to 500 Hz
Non-Operating Storage Environment	
Temperature	−10 °C to +60 °C
Humidity	20% to 90% at wet bulb temperature < +40 °C (non-condensing)
Altitude	0 to 4,572 m (0 to 15,000 feet)
Vibration	0.5 G maximum, 5 Hz to 500 Hz
Dimensions	See Figure 15-1 through Figure 15-5.
Weight (Net)	17.5 kg (Option 213/214, nominal) 19.5 kg (Option 413/414, nominal)

Figure 15-1 Dimensions (front view, E5071B with Option 413, in millimeters, nominal)



e5070buj060

Figure 15-2 Dimensions (front view, E5071B with Option 313, in millimeters, nominal)

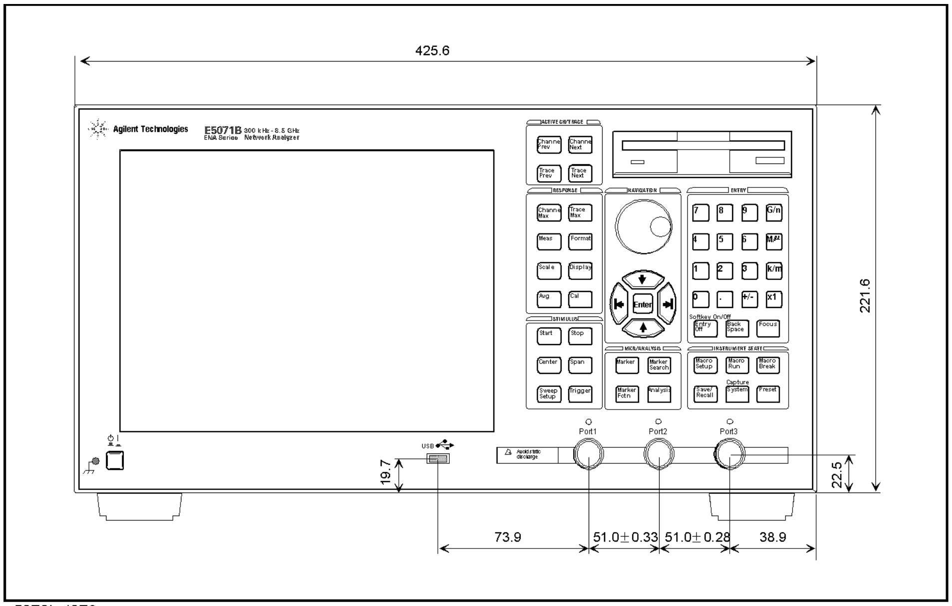


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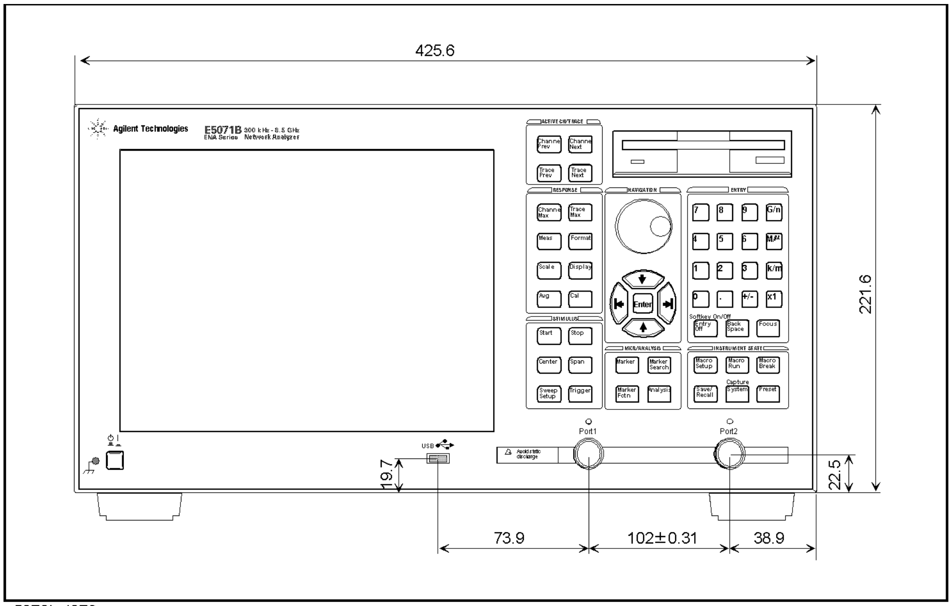
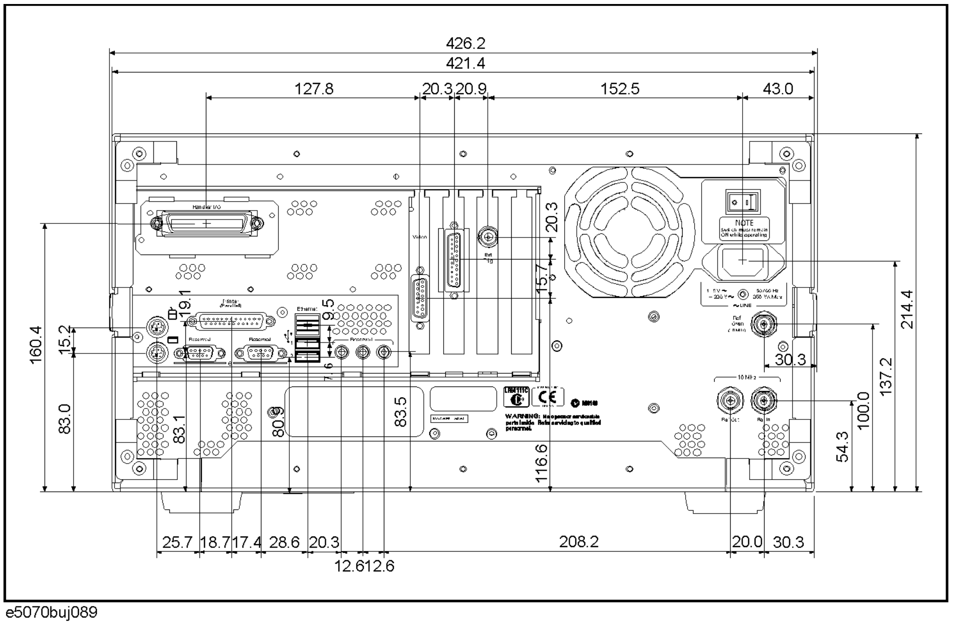
Figure 15-3 Dimensions (front view, E5071B with Option 213, in millimeters, nominal)



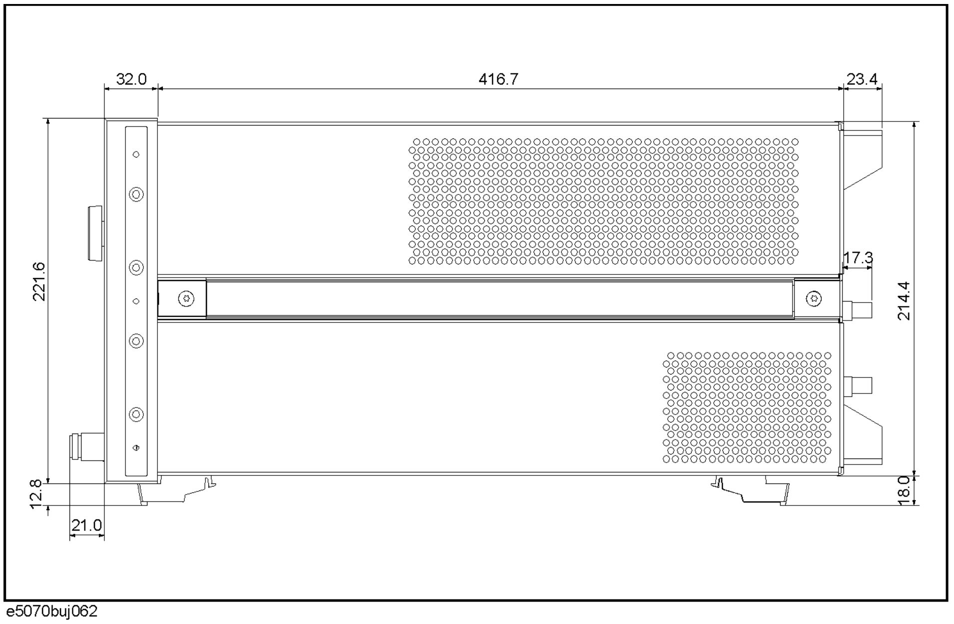
e5070buj079

Figure 15-4 **Dimensions (rear view, with Option 1E5, in millimeters, nominal)**



e5070buj089

Figure 15-5 **Dimensions (side view, in millimeters, nominal)**



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Measurement Throughput Summary

Table 15-20 Typical Cycle Time for Measurement Completion*1*2 (ms)

	Number of Points			
	51	**201**	**401**	**1601**
Start 1 GHz, Stop 1.2 GHz, 100 kHz IF bandwidth				
Uncorrected	4	5	7	18
2-port cal	5	8	13	42
Start 300 kHz, Stop 3 GHz, 100 kHz IF bandwidth				
Uncorrected	11	12	13	23
2-port cal	20	23	25	46
Start 300 kHz, Stop 8.5 GHz, 100 kHz IF bandwidth				
Uncorrected	19	24	24	24
2-port cal	37	46	48	50

*1. Typical performance.
*2. Sweep mode: Fast swept. Analyzer display turned off with :DISP:ENAB OFF. Number of traces = 1. System error correction: OFF.

Table 15-21 Typical Cycle Time for Measurement Completion*1*2 (ms)

	Number of Points			
	51	**201**	**401**	**1601**
Start 1 GHz, Stop 1.2 GHz, 100 kHz IF bandwidth				
Uncorrected	4	6	8	22
2-port cal	5	10	16	56
Start 300 kHz, Stop 3 GHz, 100 kHz IF bandwidth				
Uncorrected	11	12	13	23
2-port cal	20	24	25	55
Start 300 kHz, Stop 8.5 GHz, 100 kHz IF bandwidth				
Uncorrected	20	24	24	26
2-port cal	37	46	47	57

*1. Typical performance.
*2. Sweep mode: Fast swept. Analyzer display turned off with :DISP:ENAB OFF. Number of traces = 1. System error correction: ON.

Table 15-22 Typical Cycle Time for Measurement Completion[*1*2] (ms)

	Number of Points			
	51	**201**	**401**	**1601**
Start 1 GHz, Stop 1.2 GHz, 100 kHz IF bandwidth				
Uncorrected	7	17	29	90
2-port cal	12	32	55	178
Start 300 kHz, Stop 3 GHz, 100 kHz IF bandwidth				
Uncorrected	14	27	43	130
2-port cal	26	50	84	258
Start 300 kHz, Stop 8.5 GHz, 100 kHz IF bandwidth				
Uncorrected	16	30	49	146
2-port cal	30	57	96	291

*1. Typical performance.
*2. Sweep mode: Std Stepped. Analyzer display turned off with :DISP:ENAB OFF. Number of traces = 1. System error correction: ON

Table 15-23 Cycle Time (ms)[*1*2] vs. Number of Points

Number of Points	Sweep mode: Fast Swept System error correction: OFF	Sweep mode: Fast Swept System error correction: ON	Sweep mode: Std Stepped System error correction: ON
3	4	4	4
11	4	4	4
51	4	4	7
101	4	5	11
201	5	6	17
401	8	8	29
801	11	13	52
1601	18	23	90

*1. Typical performance.
*2. Start 1 GHz, Stop 1.2 GHz, 100 kHz IF bandwidth, Error correction: OFF, Display update: OFF, Number of traces = 1.

Table 15-24 Data Transfer Time[*1] (ms)

	Number of Points			
	51	**201**	**401**	**1601**
SCPI over GPIB[*2]				
64-bit floating point	5	16	29	109
ASCII	21	79	156	617
SCPI over 100 Mbps LAN (Telnet)[*2]				
REAL 64	2	2	3	5
ASCII	34	128	254	995
SCPI over 100 Mbps LAN (SICL-LAN)[*2]				
REAL 64	4	4	5	8
ASCII	6	14	26	95
COM[*3]				
Variant type	1	1	1	1

*1. Typical performance.
*2. Measured using a VEE 6.0 program running on a 733 MHz Pentium III HP Kayak, Transferred complex S_{11} data, using :CALC{1-16}:DATA:SDAT?.
*3. Measured using an E5070B/E5071B VBA macro running inside the analyzer. Transferred complex S_{11} data.

Measurement capabilities

Number of measurement channels	Up to 16 independent measurement channels. A measurement channel is coupled to stimulus response settings including frequency, IF bandwidth, power level, and number of points.
Number of display windows	Each measurement channel has a display window. Up to 16 display windows (channels) can be displayed.
Number of traces	Four display modes (selectable) 16 data traces and 16 memory traces per channel at 4-channel mode 9 data traces and 9 memory traces per channel at 9-channel mode 6 data traces and 6 memory traces per channel at 12-channel mode 4 data traces and 4 memory traces per channel at 16-channel mode
Measurement choices	Opt. 213/214: S_{11}, S_{21}, S_{12}, S_{22} Opt. 313/314: S_{11}, S_{21}, S_{31}, S_{12}, S_{22}, S_{32}, S_{13}, S_{23}, S_{33}, Mixed-mode S-parameters, Balance parameters, CMRR Opt. 413/414: S_{11}, S_{21}, S_{31}, S_{41}, S_{12}, S_{22}, S_{32}, S_{42}, S_{13}, S_{23}, S_{33}, S_{43}, S_{14}, S_{24}, S_{34}, S_{44}, Mixed mode S-parameters, Balance parameters, CMRR
Measurement parameter conversion	Available to convert S-parameters into reflection impedance, transmission impedance, reflection admittance, transmission admittance, and 1/S.
Data formats	Log magnitude, linear magnitude, phase, extended phase, positive phase, group delay, SWR, real, imaginary, Smith chart, polar.
Data markers	10 independent markers per trace. Reference marker available for delta marker operation. Smith chart format includes 5 marker formats: linear magnitude/phase, log magnitude/phase, real/imaginary, R + jX, and G + jB. Polar chart format includes 3 marker formats: linear magnitude/phase, log magnitude/phase, and real/imaginary.
Marker functions	
Marker search	Max value, Min value, peak, peak left, peak right, target, target left, target right, bandwidth parameters with user-defined bandwidth values.
Marker-to functions	Set start, stop, center to active marker stimulus value; set reference to active marker response value; set electrical delay to group delay at active marker.
Search range	User definable.
Tracking	Performs marker search continuously or on demand.
Time domain functions	
Transformation	Selectable transformation type from bandpass, lowpass impulse, lowpass step. Selectable window from maximum, normal and minimum.
Gated functions	Selectable gated filter type from bandpass, notch. Selectable gate shape from maximum, normal and wide.

Source control

Measured number of points per sweep	User definable from 2 to 1601.
Sweep mode	Normal stepped, normal swept, fast stepped and fast swept.
Sweep type	Linear sweep, segment sweep, log sweep and power sweep.
Segment sweep	Define independent sweep segments. Set number of points, test port power levels, IF bandwidth, delay time, sweep time and sweep mode independently for each segment.
Sweep trigger	Set to continuous, hold, or single, sweep with internal, external, manual, or bus trigger.
Power	Set source power from -15 dBm (-50 dBm for option 214/314/414) to 10 dBm. The power slope function and the power calibration function compensate source power level error.

Trace functions

Display data	Display current measurement data, memory data, or current measurement and memory data simultaneously.
Trace math	Vector addition, subtraction, multiplication or division of measured complex values and memory data.
Title	Add custom title to each channel window. Titles are printed on hardcopies of displayed measurements.
Autoscale	Automatically selects scale resolution and reference value to vertically center the trace.
Electrical delay	Offset measured phase or group delay by a defined amount of electrical delay, in seconds.
Phase Offset	Offset measured phase or group delay by a defined amount in degrees.
Statistics	Calculates and displays mean, standard deviation and peak-to-peak deviation of the data trace.

Data accuracy enhancement

Measurement calibration	Measurement calibration significantly reduces measurement uncertainty due to errors caused by system directivity, source and load match, tracking and crosstalk. Full 2-port, 3-port, or 4-port calibration removes all the systematic errors for the related test ports to obtain the most accurate measurements.
Calibration types available	
Response	Simultaneous magnitude and phase correction of frequency response errors for either reflection or transmission measurements.
Response and isolation	Compensates for frequency response and crosstalk errors of transmission measurements.
One-port calibration	Available on test port 1, port 2, port 3, or port 4 to correct for directivity, frequency response and source match errors.
Full 2-port/3-port/4-port calibration **TRL calibration**	Compensates for directivity, source match, reflection tracking, load match, transmission tracking and crosstalk. Crosstalk calibration can be omitted.
Interpolated error correction	With any type of accuracy enhancement applied, interpolated mode recalculates the error coefficients when the test frequencies are changed. The number of points can be increased or decreased and the start/stop frequencies can be changed.
Velocity factor	Enter the velocity factor to calculate the equivalent physical length.
Reference port extension	Redefine the measurement plane from the plane where the calibration was done.

Storage

Internal hard disk drive	Store and recall instrument states, calibration data, and trace data on 3 GB, minimum, internal hard drive. Trace data can be saved in CSV (comma separated value) format. All files are MS-DOS® -compatible. Instrument states include control settings, limit lines, segment sweep tables, and memory trace data.
File sharing	Internal hard disk drive (D:) can be accessed from an external Windows® PC through LAN. And The hard disk drive of an external Windows® PC can be accessed from the analyzer through LAN.
Disk drive	Instrument states, calibration data, and trace data can be stored on an internal 3.5 inch 1.4MB floppy disk in MS-DOS® -compatible format.
Screen hardcopy	Printouts of instrument display are directly produced on a printer. The analyzer provides USB and parallel interfaces.

System capabilities

Familiar graphical user interface	The ENA Series analyzer employs a graphical user interface based on the Windows® operating system. There are three ways to operate the instrument manually: you can use a hardkey interface, a touch screen interface (Opt. 016), or a mouse interface.
Limit lines	Define the test limit lines that appear on the display for pass/fail testing. Defined limits may be any combination of horizontal/sloping lines and discrete data points.
Fixture Simulator	
Balanced-unbalanced conversion	Convert data from single-ended measurement to balanced measurement parameters (mixed-mode S-parameters), balance parameter or CMRR by using internal software.
Network De-embedding	De-embed an arbitrary circuit defined by a two-port Touchstone data file for each test port. This function eliminates error factors between the calibration plane and DUT and expands the calibration plane for each test port. This function can be used with the port extension function.
4-port Network Embedding/De-embedding	Embed or de-embed an arbitrary circuit defined by a four-port Touchstone data file.
Port reference impedance conversion	Convert S-parameters measured in 50 Ω reference impedance to data in other reference impedance levels by using internal software. This conversion can be performed for both single-ended (unbalanced) measurement ports and converted balanced measurement ports.
Matching circuit	Add one of the predefined matching circuits or a circuit defined by a two-port Touchstone data file to each single-ended test port or converted balanced (differential) test port by using internal software.

Automation

Methods	
Internal analyzer execution	Applications can be developed in a built-in VBA® (Visual Basic for Applications) language. Applications can be executed from within the analyzer via COM (component object model) or using SCPI.
Controlling via GPIB	The GPIB interface operates to IEEE 488.2 and SCPI protocols. The analyzer can be controlled by a GPIB external controller. The analyzer can control external devices using a USB/GPIB interface.
LAN	
Standard conformity	10 Base-T or 100 Base-TX (automatically switched), Ethertwist, RJ45 connector
Protocol	TCP/IP
Function	Telnet, SICL-LAN

16 Measurement Accessories

This chapter introduces the accessories that can be used with the Agilent E5070B/E5071B for various measurements.

Test Port Cables

The following cables are used to connect the DUT and the network analyzer.

N6314A 50 Ω N Type RF Cable (300 kHz ~ 9 GHz)

An RF cable 610 mm in length with male N type connectors on both ends.

N6315A 50 Ω N Type RF Cable (300 kHz ~ 9 GHz)

An RF cable 610 mm in length with a male and a female N type connector on each end.

Calibration Kits

Calibration kits are used to improve the accuracy of the analyzer in various measurements.

Two types of calibration kit – the coaxial mechanical calibration kit and coaxial electronic calibration kit – are available. Each kit comes with N type connectors or 3.5 mm (SMA) connectors.

The electronic type reduces the time required for calibration, mis-connections, and wear on connectors since it requires fewer changes of connection than the mechanical type.

Specifications for calibration kits and the availability of particular calibration kits are subject to change without prior notice. Contact the nearest Agilent Technology sales office or the supplier of your analyzer for more information before placing an order.

For Devices with N Type Connectors

Coaxial Mechanical Calibration Kits

85032F Mechanical Calibration Kit N Type 50 Ω (30 kHz ~ 9 GHz)

The 85032F kit includes the following items.

Agilent Cat. No.	Description
85032-60017	50 Ω N type (m), terminated
85032-60018	50 Ω N type (f), terminated
85032-60013	50 Ω N type (m), open
85032-60014	50 Ω N type (f), open
85032-60016	50 Ω N type (m), short
85032-60015	50 Ω N type (f), short

Also, the following options are available for the 85032F.

Option	Agilent Cat. No.	Description
Option 100	85032-60021	With a 50 Ω N type (f)-(f) adaptor.
Option 200	85032-60019	With a 50 Ω N type (m)-(m) adaptor.
Option 300	85032-60020	With a N type (m)-(f) adaptor.
Option 500	85054-60001	With two 50 Ω N type (f) to 7 mm adaptors.
	85054-60009	With two 50 Ω N type (m) to 7 mm adaptors.

85054D Economy Mechanical Calibration Kit N Type (45 MHz ~ 18 GHz)

The 85054D includes the followings.

Agilent Cat. No.	Description
85054-60025	N type (m), short
85054-60026	N type (f), short
85054-60027	N type (m), open
85054-60028	N type (f), open
85054-60031	N type (f) to 7 mm adaptor
85054-60032	N type (m) to 7 mm adaptor
85054-60037	N type (f)-(f) adaptor
85054-60038	N type (m)-(m) adaptor
85054-60046	N type (m), terminated
85054-60047	N type (f), terminated

85036B Mechanical Calibration Kit N Type 75 Ω (dc ~ 3 GHz)

The 85036B kit includes the following items.

Agilent Cat. No.	Description
00909-60019	75 Ω N type (m), broadband load
00909-60020	75 Ω N type (f), broadband load
85036-60012	75 Ω N type (m), short
85036-60011	75 Ω N type (f), short
85032-60007	75 Ω N type (m), open
85032-20001	75 Ω N type (f), open body
85036-60019	75 Ω N type (f), open center conductor extender
85036-60013	75 Ω N type (m)-(m) adaptor
85036-60014	75 Ω N type (f)-(f) adaptor
85036-60015	75 Ω N type (m)-(f) adaptor

85036E Mechanical Calibration Kit N Type 75 Ω (dc ~ 3 GHz)

The 85036E kit includes the following items.

Agilent Cat. No.	Description
00909-60019	75 Ω N type (m), broadband load
85036-60016	75 Ω N type (m), combination open/short

Coaxial Electronic Calibration Kits

85092C RF Two-Port ECal Module (300 kHz ~ 9 GHz)

Option	Description
Option M0F	Module with 50 Ω N type (m)/N type (f) connectors
Option 00M	Module with 50 Ω N type (m)/N type (m) connectors
Option 00F	Module with 50 Ω N type (f)/N type (f) connectors

N4431A RF Four-Port ECal Module (300 kHz ~ 9 GHz)

Option	Description
Option 020	Module with four 50 Ω N type (f) connectors

For Devices with 3.5 mm (SMA) Connectors

Coaxial Mechanical Calibration Kits

85033E Mechanical Calibration Kit 3.5 mm 50 Ω (30 kHz ~ 9 GHz)

The 85033E kit includes the following items.

Agilent Cat. No.	Description
85033-60016	3.5 mm (m), terminated
85033-60017	3.5 mm (f), terminated
85033-60018	3.5 mm (m), open
85033-60019	3.5 mm (f), open
85033-60020	3.5 mm (m), short
85033-60021	3.5 mm (f), short
8710-1761	Torque wrench

Also, the following options are available for the 85033E.

Option	Agilent Cat. No.	Description
Option 100	85027-60005	With a 3.5 mm (f)-(f) adaptor.
Option 200	85027-60007	With a 3.5 mm (m)-(m) adaptor.
Option 300	85027-60006	With a 3.5 mm (m)-(f) adaptor.
Option 400	1250-1744	With a 3.5 mm (f) to N type 50Ω (m) adaptor.
	1250-1743	With a 3.5 mm (m) to N type 50Ω (m) adaptor.
	1250-1745	With a 3.5 mm (f) to N type 50Ω (f) adaptor.
	1250-1750	With a 3.5 mm (m) to N type 50Ω (f) adaptor.
Option 500	1250-1746	With two 3.5 mm (m) to 7 mm adaptors.
	1250-1747	With two 3.5 mm (f) to 7 mm adaptors.

85052C Mechanical Calibration Kit 3.5 mm (45 MHz ~ 26.5 GHz)

The 85052C kit includes the following items.

Agilent Cat. No.	Description
00902-60003	3.5 mm (m), terminated
00902-60004	3.5 mm (f), terminated
85052-60006	3.5 mm (m), short
85052-60007	3.5 mm (f), short
85052-60008	3.5 mm (m), open
85052-60009	3.5 mm (f), open
85052-60032	3.5 mm (f)-(f) adaptor
85052-60033	3.5 mm (m)-(m) adaptor
85052-60034	3.5 mm (f)-(m) adaptor
85052-60035	3.5 mm high-precision short airline
85052-60036	3.5 mm high-precision long airline

85052D Economy Mechanical Calibration Kit 3.5 mm (45 MHz to 26.5 GHz)

The 85052D kit includes the following items.

Agilent Cat. No.	Description
00902-60003	3.5 mm (m), terminated
00902-60004	3.5 mm (f), terminated
85052-60006	3.5 mm (m), short
85052-60007	3.5 mm (f), short
85052-60008	3.5 mm (m), open
85052-60009	3.5 mm (f), open
85052-60012	3.5 mm (f)-(f) adaptor
85052-60013	3.5 mm (f)-(m) adaptor
85052-60014	3.5 mm (m)-(m) adaptor

Coaxial Electronic Calibration Kits

85093C RF Two-Port ECal Module (300 kHz ~ 9 GHz)

Option	Description
Option M0F	Module with 3.5 mm (m)/3.5 mm (f) connectors
Option 00M	Module with 3.5 mm (m)/3.5 mm (m) connectors
Option 00F	Module with 3.5 mm (f)/3.5 mm (f) connectors

N4431A RF Four-Port ECal Module (300 kHz ~ 9 GHz)

Option	Description
Option 010	Module with four 3.5 mm (f) connectors

Adaptors

11853A 50 Ω N Type Accessory Kit

The 11853A kit includes the following items.

Agilent Cat. No.	Description
1250-1472	N type (f)-(f) adaptor kit (two adaptors)
1250-1475	N type (m)-(m) adaptor kit (two adaptors)
11511A	N type (f), short
11512A	N type (m), short

11878A N type to 3.5 mm Adaptor Kit

The 11878A kit includes the following items.

Agilent Cat. No.	Description
1250-1744	3.5 mm (f) to N type 50Ω (m) adaptor
1250-1743	3.5 mm (m) to N type 50Ω (m) adaptor
1250-1745	3.5 mm (f) to N type 50Ω (f) adaptor
1250-1750	3.5 mm (m) to N type 50Ω (f) adaptor

11854A 50 Ω BNC Accessory Kit

The 11854A kit includes the following items.

Agilent Cat. No.	Description
1250-0929	BNC (m), short
1250-1473	BNC (m) to N type (m) adaptor kit (two adaptors)
1250-1474	BNC (f) to N type (f) adaptor kit (two adaptors)
1250-1476	BNC (f) to N type (m) adaptor kit (two adaptors)
1250-1477	BNC (m) to N type (f) adaptor kit (two adaptors)

11852B Minimum-loss pad

Option	Description
Option 004	N type connectors, 50Ω (m) to 75Ω (f)

System Accessories

System Racks and Cases

Option	Agilent Cat. No.	Description
Option 1CN	5063-9229	Handle kit (two handles)
Option 1CM	5063-9216	Rack mount kit (without handles)
Option 1CP	5063-9223	Rack mount/handle kit (for customers already supplied with handles)
	E3663AC	Rack mount rail kit (with a rack mount kit and a handle kit)
	9211-2658	Transit case

GP-IB Cables

The following GPIB cables can be used to connect the analyzer with an external device such as a computer.

10833A GPIB cable	1.0 m (3.3 ft)
10833B GPIB cable	2.0 m (6.6 ft)
10833C GPIB cable	3.0 m (9.9 ft)
10833D GPIB cable	0.5 m (1.6 ft)

82357A USB/GPIB Interface

The 82357A can be used to connect the E5070B/E5071B with an external device controlled by the E5070B/E5071B.

17 Information on Maintenance

This chapter explains the measures you should take to maintain the Agilent E5070B/E5071B.

Backing Up the Data

Be sure to back up regularly your important data (including program) files in this instrument to a CD-R or other backup medium. Agilent Technologies shall not be liable for any data damages caused by troubles of this instrument.

Making Backup Files

Making backup files on a floppy disk

You can make backup files on a floppy disk using the copy function. See "Organizing Files and Folders" on page 257 for making a copy.

Making backup files on the hard disk of an external PC

You can make backup files on the hard disk of an external PC using following methods.

- You can access to drive D: of the E5070B/E5071B from an external PC via LAN, and copy your important data files on the drive D: to the external PC. See "Accessing Hard Disk of E5070B/E5071B from External PC" on page 311 for details.
- You can transfer your important data files on the drive D: of the E5070B/E5071B to the external PC using :MMEM:TRAN command via GPIB. See *Programmer's Guide* for details.

NOTE Do not modify any files and folders in drives other than drive A: and drive D:. Doing so will cause malfunctions.

Cleaning this Instrument

This section describes how to clean the instrument.

WARNING **To protect yourself from electrical shock, be sure to unplug the power cable from the outlet before cleaning the instrument.**

Never clean the internal components of the instrument.

Cleaning an LCD

Use one of the following methods to clean the display surface regularly.

- For normal cleaning, rub the surface gently with a dry, soft cloth.
- When stains are difficult to remove, gently wipe the surface with cloth damped with a small amount of ethanol or isopropyl alcohol.
  You can clean the standard type LCD (no touch screen function) with a cloth dipped in water and then wrung tightly.

NOTE Do not use chemicals other than ethanol and isopropyl alcohol to wet the cleaning cloth.

To clean a touch screen type LCD (Option 016), do not wet the cloth with water.

Maintenance of Test Ports and Other Connectors/Ports

Test ports on the front panel of the E5070B/E5071B are fitted with N Type connectors (f). Stains or other damage to these connectors would significantly affect the accuracy in measurements in the RF range. Always pay attention to the following precautions.

- Always keep the connectors free from stains and dust.
- Do not touch the contact surface on the connectors.
- Do not plug damaged or scratched connectors into the test ports.
- Use compressed air for cleaning connectors. Do not use abrasives under any circumstance.

The above precautions must also be observed in maintaining connectors and ports other than these test ports.

Cleaning a Display Other than an LCD

To remove stains on parts other than the LCD, test ports, and other connectors/ports of the instrument, wipe them gently with a soft cloth that is dry or wetted with a small amount of water and wrung tightly.

Replacement of Parts with Limited Service Life

This instrument incorporates parts with limited service life as shown in Table 17-1. Using the recommended replacement time shown in Table 17-1 as a guide, request the Company's Service Center to replace these parts. However, a part may need to be replaced at an earlier time than that listed in the table, depending on such conditions as location, frequency of use, and where it is stored.

NOTE Each service life and recommended replacement time listed below is for reference only and does not imply a guarantee of the part's service life.

Table 17-1 Parts with Limited Service Life

Part Name	Service Life (Parts supplier reference value)	Recommended replacement time
Hard Disk Drive*1	5 years or 20,000 operating hours, whichever comes earlier	3 years
Floppy disk drive*2	5 years or 30,000 operating hours, whichever comes earlier	4 years
Main fan*2	50,000 operating hours	5 years
CPU fan*2	50,000 operating hours	5 years
Power supply*2	50,000 operating hours (Depends on the service life of the power supply cooling fun)	5 years
LCD screen backlight*3	50,000 operating hours	5 years
Touch screen (function)	One million times (dotting life)	5 years

*1. Exchanging hard disk drives causes the contents written after shipment from the factory (LAN setup, etc.)to be initialized to the state at the time of shipment. The programs and data stored in Drive D (user directory) are erased.

*2. The service life may be significantly shorter when used in a dusty and dirty environment.

*3. When the unit is used for automatic measurements in a production line and the on-screen information is not required, the life of the LCD backlight can be saved by turning it off. As for the method of turning the backlight off, refer to "Turning off the LCD Screen Backlight" on page 316.

Cautions Applicable to Requesting Repair, Replacement, Regular Calibration, etc.

Backing Up Data in the Hard Disk

The user is requested to back up the stored programs and data into external media by using the instrument's storing function before requesting the Company's Service Center to repair the instrument or replace hard disks.

See "Making Backup Files" on page 418 for how to make backup files.

Please take note that the Company will not be held liable to any extent for potential erasure or change of stored programs or data due to the repair or replacement of hard disks performed by the Company. When a hard disk itself fails, the programs and data stored in it cannot be recovered.

Devices to be Sent Back for Repair or Regular Calibration

If it is necessary to send the unit to the Service Center of Agilent Technologies for repair or regular calibration, please follow the instructions below.

Equipment to be Sent

When requesting repair or regular calibration of the unit by our Service Center, send only the E5070B/E5071B main unit without any installed option you may have ordered. Unless specifically instructed, it is not necessary to send accessories and calibration kits.

Packing

Use the original package and shock absorbers, or equivalent antistatic packing materials, when sending the unit.

Shipping Address

For the location of the nearest Agilent Technologies Service Center, contact the Customer Contact listed at the end of this brochure.

Recommended Calibration Period

The recommended calibration period for this instrument is one year. The user is recommended to request the Company's Service Center to perform regular calibration every year.

A Manual Changes

This appendix contains the information required to adapt this manual to versions or configurations of the E5070B/E5071B manufactured earlier than the current printing date of this manual. The information in this manual applies directly to E5070B/E5071B units having the serial number printed on the title page of this manual.

Manual Changes

To adapt this manual to your E5070B/E5071B, 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
3.0x	Change 1

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.

Figure A-1 **Example of Serial Number Plate**

e5070auj034

Change 1

The firmware revision 3.0x does not support the following functions. Please delete the descriptions about these functions in this manual

❏ User Characterized ECal

❏ Confidence check on calibration coefficients using ECal

❏ 4-port network embedding/de-embedding (Fixture simulator)

❏ Simplified full 3/4 port calibration

❏ Loading and executing program in batch process

B Troubleshooting

This Chapter describes the steps to take in troubleshooting when your Agilent E5070B/E5071B appears to be operating improperly. Explanations are also given for the error warning messages displayed on the screen.

Troubleshooting

This section describes the steps you should take when you believe the Agilent E5070B/E5071B is operating improperly. The results of these simple investigative procedures may help you avoid the down-time and inconvenience of repair service. The troubleshooting instructions are divided into three categories:

❑ "Troubleshooting during Startup" on page 426
❑ "Troubleshooting during Operation" on page 426
❑ "Troubleshooting for External Devices" on page 429

Troubleshooting during Startup

The System Does Not Start Up.

- Turning on (|) the standby switch does not start up the system.

  ➢ Confirm that the power cable is properly plugged in.

  ➢ Confirm that the line switch on the rear panel is turned on (◯). For the information on the line switch on the rear panel, see "7. Line Switch (Always ON)" on page 47.

When taking all the above measures does not result in normal operation, there is a possibility of a failure. Unplug the power cable immediately, and contact Agilent Technology's Customer Contact listed at the end of this guide or the company from which you bought the device.

The system starts up, but the normal measurement screen does not appear.

- The system starts up, but it automatically shuts down immediately.
- The system starts up, but it enters the service mode (The instrument status bar in the lower right part of the screen displays **SVC** in red).
- The measurement screen appears after startup, but the date and time displayed on the instrument status bar in the lower right part of the screen differ greatly from the previous settings.
- The measurement screen appears after startup, but the power-on test is failed, with Error Message 241 appearing against a red background in the instrument message/warning area in the lower left part of the screen.

  ➢ Execute the system recovery. For information on the execution procedure, see "System Recovery" on page 318.

There is a possibility of a failure. Contact Agilent Technology's Customer Contact listed at the end of this guide or the company from which you bought the device.

Troubleshooting during Operation

The Sweep Action Stops during Measurement or Is Not Executed.

- The sweep action stops during measurement or is not executed, but the front keys and softkeys are operational.

There is a possibility of a failure. Contact Agilent Technology’s Customer Contact listed at the end of this guide or the company from which you bought the device.

The Error Message “Port N receiver overload” (N denotes a port number) is Displayed.

- During the measurement of an amplifier, Error Messages 221 through 224 “Port N receiver overload” (N denotes a port number) on page 435 are displayed.
  This error occurs when the input to a test port exceeds the maximum input level in the measurement of an amplifier. The measurement value obtained in such a case is not correct. In the worst case, a failure (damage to the receiver) may occur.

  ➢ Change the measurement condition so that the input to the test port does not exceed the maximum input level.

  When this message is displayed with nothing connected to the test port, there is a possibility of a failure of the instrument. Contact Agilent Technology’s Customer Contact listed at the end of this guide or the company from which you bought the device.

A Clearly Abnormal Measurement Value

- The measurement value is not reproducible, or clearly abnormal.

  ➢ Confirm that the DUT, connection cables, and other parts are connected correctly.

  ➢ Confirm that the connectors and cables used to connect the DUT are free from damage and poor contact.

  ➢ Confirm that the calibration has been executed correctly. If you have not acquired a correct error correction factor, you cannot obtain a correct measurement value.

  ➢ Confirm that the calibration kit was selected correctly.

  ➢ Confirm that the calibration kit is defined correctly.

  ➢ Confirm that if the stimulus signal output is turned on.

When taking all these measures does not result in a correct measurement value, there is a possibility of a failure. Contact Agilent Technology’s Customer Contact listed at the end of this guide or the company from which you bought the device.

The System Cannot be Operated Manually (Front Panel Keys, Keyboard, Touch Screen and Mouse)

- The keyboard or mouse becomes inoperable.

  ➢ Confirm that the keyboard or mouse is connected correctly. When it is connected correctly, turn off the power once, and restart the system.

- The front panel key or keyboard becomes inoperable.

  ➢ Using the mouse, turn **System** – **Key Lock** – **Front Panel & Keyboard Lock** OFF.

- The touch screen becomes inoperable.

  ➢ Using the front panel keys, turn **System** – **Key Lock** – **Touch Screen & Mouse Lock** OFF.

  ➢ Execute the calibration of the touch screen. For information on the execution procedure, see “Calibration of the Touch Screen” on page 322.

- The mouse becomes inoperable.

  ➢ Using the front panel keys, turn **System** – **Key Lock** – **Touch Screen & Mouse Lock** OFF.

- All of the front panel keys, keyboard, and mouse become inoperable.

  ➢ Confirm that the keyboard or mouse is connected correctly. When it is connected correctly, turn off the power once, and restart the system.

- The keyboard and mouse have been connected after power-on.

  ➢ Turn off the power once, and restart the system.

When taking all these measures does not recover operability, there is a possibility of a failure. Contact Agilent Technology's Customer Contact listed at the end of this guide or the company from which you bought the device.

The Screen Freezes and All Operations Become Impossible.

- The measurement in progress or screen update is stalled and all of the front panel keys, keyboard, mouse, and touch screen (Option 016) are inoperable.

  ➢ Press the standby switch to turn off the power once, and restart the system.

When a similar symptom reappears, there is a possibility of a failure. Contact Agilent Technology's Customer Contact listed at the end of this guide or the company from which you bought the device.

The System Freezes while in Operation.

- The system freezes while in operation.

  ➢ Press the standby switch to turn off the power once, and restart the system.

The Rear Cooling Fan Does Not Operate.

There is a possibility of a failure. Contact Agilent Technology's Customer Contact listed at the end of this guide or the company from which you bought the device.

You Cannot Save a File in a Floppy Disk.

- You cannot save a file in a floppy disk.

  ➢ Confirm that the floppy disk is initialized. If not, initialize it.

  ➢ Confirm that the floppy disk is inserted correctly. Insert a floppy disk until the eject button pops up fully.

  ➢ Confirm that the floppy disk is not write-protected. If it is, unprotect the disk.

  ➢ Confirm that the floppy disk has free space. If it does not, delete unnecessary files or use a new floppy disk.

When taking all these measures does not make it possible to save a file, there is a possibility of a failure. Contact Agilent Technology's Customer Contact listed at the end of this guide or the company from which you bought the device.

You Cannot Read a File from a Floppy Disk.

- You cannot read a file from a floppy disk.

  ➢ Confirm that the floppy disk is inserted correctly. Insert the floppy disk until the eject button pops up fully.

  ➢ A stored file may be damaged by a magnetic field. Confirm that the file can be read on a PC.

When taking all these measures does not make it possible to read the file, there is a possibility of a failure. Contact Agilent Technology’s Customer Contact listed at the end of this guide or the company from which you bought the device.

An Error or Warning Message Appears.

When an error or warning message is displayed on the instrument message/warning area in the lower part of the screen, refer to Error Messages on page 430 and Warning Messages on page 441.

Troubleshooting for External Devices

Cannot Output to a Printer

- Cannot output a measurement screen or data to a printer.
- Attempting to output to a printer causes Error Messages 120 and 121 on page 437 to appear.

  ➢ Confirm that the power to the printer is on and that the line cable is connected correctly.

  ➢ Confirm that the connector cable of the printer is connected correctly.

  ➢ Confirm that the printer is online.

  ➢ Confirm that the printer has not run out of paper.

  ➢ Confirm that the printer has not run out of ink.

When taking all these measures does not result in printer output, there is a possibility of a failure. Contact Agilent Technology’s Customer Contact listed at the end of this guide or the company from which you bought the device.

Does Not Respond to an External Controller/Fails to Function Normally

- A GPIB device does not respond to the external controller, or fails to function normally.

  ➢ Confirm that the GPIB address is defined correctly.

  ➢ Confirm that the GPIB cable is connected.

  ➢ Confirm that another instrument connected by the GPIB cable has the same GPIB address.

  ➢ Confirm that the GPIB cable connection forms a loop.

When taking all these measures does not result in correct operation of the GPIB devices, there is a possibility of a failure. Contact Agilent Technology’s Customer Contact listed at the end of this guide or the company from which you bought the device.

Error Messages

An error message is displayed against a red background in the instrument message/warning area in the lower left part of the screen. Pushing a front panel key or executing :DISP:CCL command clears the error message. Errors caused by the operation of a front panel key simply appear on the display. They are not stored in the error queue with some exceptions.

An error with a positive error number is one uniquely defined for this instrument. On the other hand, an error with a negative error number is basically one defined for common GPIB devices in IEEE488.2

A

20 **Additional standard needed**

The GPIB command that turns ON the calibration function has been sent before all of the data measurements needed to calculate the calibration factor have been completed. For instance, the "SENS:CORR:COLL:SAVE" command is sent to calculate calibration coefficients and turn on error correction for 1-Port Calibration when open and short calibration are completed but load calibration is not completed. Be sure to measure all necessary calibration data before sending commands. This error is not generated by front key operations.

B

-168 **Block data not allowed**

An block-data element has been received at a position where this instrument does not accept one.

C

240 **Calibration data lost**

This error occurs when a file containing the system calibration data is not found or in a damaged state at time of the startup of this instrument, indicating a failure of this instrument. Contact an Agilent Technology sales office or the company from which you bought the instrument.

22 **Calibration method not selected**

This error occurs when the command for validating the calibration, SENS:CORR:COLL:SAVE, is executed before the command for selecting a calibration type, SENS:CORR:COLL:METH:xxxx, is executed. This error is not generated by front key operations.

-148 **Character data not allowed**

A character data element (not violating the standard) has been received at a position where this instrument does not accept one. Double quotes (") are omitted where it is necessary to place a parameter in double quotes ("), for example.

-100 **Command error**

A comprehensive syntax error has occurred showing that this instrument cannot detect a more detailed error. This code simply shows that a command error defined in 11.5.1.1.4, IEEE488.2 has occurred.

60 **Continuous switching may damage source attenuator**

This error occurs when different source attenuator (power range) settings are present during measurement on two or more channels. Performing such measurement for a long time is not recommended because of the possibility of the source attenuator being damaged. The measurement value is normal. This error occurs only on models with the extended power output (Option 214, 314, and 414).

D

-222 **Data out of range**

A data element (not violating the standard) outside the range defined by this instrument has been received. This error occurs when an integer-based command for which the parameter can be rounded exceeds the range of -65536 to +65536 or when a real-number-based command for which the parameter can be rounded exceeds the range of -9.9e37 to +9.9e37, for example.

This error occurs also when a numeric value other than a specified one is entered into a command in which the "port number" and "CalKit number" are specified as parameters and hence the parameters are not rounded. Such commands are, for example, CALC:FSIM:BAL:TOP:BBAL:PPOR, SENS:CORR:COLL:ACQ:OPEN, SENS:CORR:COLL:ECAL:SOLT3, SENS:CORR:COLL:CKIT:ORD:LOAD, etc.

-104 **Data type error**

The parser has recognized a data element that must not exist. Block data has been sent instead of numeric value data or character string data that had been expected, for example.

E

32 **Ecal module not in appropriate RF path**

This error occurs when an ECal command, SENS:CORR:COLL:ECAL:SOLTn, is executed with the port on the ECal module not connected correctly to the instrument.

-200 **Execution error**

An error associated with execution has been generated for which this instrument cannot specify the error message. This code shows that an error associated with execution defined in 11.5.1.1.5, IEEE488.2 has occurred. This error occurs also when a calibration measurement is aborted.

-123 **Exponent too large**

The absolute value of the exponent exceeds 32,000 (see 7.7.2.4.1, IEEE488.2).

-178 **Expression data not allowed**

An expression-data element has been received at a position where this instrument does not accept one.

-170 **Expression error**

When the expression data is put to syntactic analysis, an error not corresponding to one of Error Numbers -171 through -179 occurs.

F

31 **Failed to configure ECal module**

This error occurs when the control of the ECal module fails at time of executing an ECal command, SENS:CORR:COLL:ECAL:SOLTn. The failure results from the failure to connect the ECal module to the USB port, failure of the ECal module, etc.

102 **Failed to copy file**

This error occurs when copying a file (MMEM:COPY command) fails.

104 **Failed to create directory**

This error occurs when creating a directory (MMEM:MDIR command) fails.

103 **Failed to delete file**

This error occurs when deleting a file (MMEM:DEL command) fails.

100 **Failed to read file**

This error occurs when a 2-port touchstone file (CALC:FSIM:SEND:PMC:PORT:USER:FIL command), the formatted data array (MMEM:LOAD:FDAT command) and limit table (MMEM:STOR:LIM command) for the active trace on the active channel, segment sweep table (MMEM:LOAD:SEGM command) for the active channel, a VBA project file (MMEM:LOAD:PROG command), etc. cannot be read normally.

101 **Failed to write file**

This error occurs when the formatted data array (MMEM:STOR:FDATcommand) and limit table (MMEM:STOR:LIM command) for the active trace on the active channel, segment sweep table (MMEM:STOR:SEGM command) for the active channel, display image (MMEM:STOR:IMAG command) for the LCD screen, a VBA project file (MMEM:STOR:PROG command), etc. cannot be written normally.

-257 **File name error**

A file name error. This message appears when an error exists in the file name and hence a command is not executed correctly. This error occurs when you try to copy to an unsuitable file name, for example.

-256 **File name not found**

The file name specified is not found and hence the command is not executed correctly. This error occurs when you try to read a file that does not exist in a disk or a disk is not correctly inserted into the drive to read or write a file, for example.

107 **File transfer failed**

This error occurs when writing data into or reading data from a file (MMEM:TRAN command) fails.

G

-105 **GET not allowed**

A group execution trigger (GET) has been received in the program message (see 7.7, IEEE488.2).

H

-114 **Header suffix out of range**

The unit of the header is outside the range. The header is invalid in the unit for numeric parameters following a SCPI command.

I

-224 **Illegal parameter value**

The parameter value is not suitable. This error occurs when the CALC:PAR:DEF command is used to specify an S-parameter that does not exist in the model (S44 in the case of a 2-port model), for example.

-282 **Illegal program name**

This error occurs when a nonexistent VBA program name is specified by the PROG:SEL:NAME command.

-213 **Init ignored**

Because another measurement is in progress, the request for initiating a measurement (“INIT” command) is ignored.

-161 **Invalid block data**

Block data has been expected, but the block data that appears is invalid for some reason (see 7.7.6.2, IEEE488.2). The END message is received before the length of block data has been filled, for example.

-101 **Invalid character**

An invalid character exists in the program message character string.

-141 **Invalid character data**

An invalid character is found in the character data element, or the parameter received is not valid.

-121 **Invalid character in number**

A character that is invalid for the data type subject to syntactic analysis has been received. For example, a letter is found in a decimal numeric value or a numeric character “9” in octal data.

-171 **Invalid expression**

The expression-data element is invalid (see 7.7.7.2, IEEE488.2). Parentheses are not paired, or illegal characters are used, for example.

-103 **Invalid separator**

The parser (a syntactic analysis program) had been expecting a delimiter, but a character that is not a delimiter has been sent.

-151 **Invalid string data**

Character string data has been expected, but the character string data that appears is invalid for some reason (see 7.7.5.2, IEEE488.2). The END message is received before the ending quotation mark character appears, for example.

-131 **Invalid suffix**

The suffix does not comply with the syntax defined in 7.7.3.2, IEEE488.2. Or it does not suit 4294A.

L

53 **Log sweep requires 2 octave minimum span**

The span of sweep range is not satisfied the requirement for logarithmic sweep. The sweep type is automatically changed to linear sweep when this error occurs.

For example, this error occurs when, with the start and stop frequency are set 1 MHz and 2 MHz respectively, the sweep type is changed to logarithmic sweep.

Set the stop frequency to more than four times as many as the start frequency. And then select logarithmic sweep.

M

-109 **Missing parameter**

The number of parameters is less than that required for the command, or the parameter has not been entered. For example, the command SENS{1-6}:SWE:POIN requires one more parameter.

Therefore, when a message "SENS1:SWE:POIN" is sent to a correct program message "SENS1:SWE:POIN 201" this instrument receives the former message as an invalid one because all parameters have not been entered. Enter command parameters correctly.

N

70 **No GPIB system controller**

The GPIB system controller is not configured correctly.

If the USB/GPIB interface is not connected or the USB/GPIB interface is not configured correctly when measuring power calibration data, this error occurs.

Check the connection and configuration of the USB/GPIB interface.

-120 **Numeric data error**

An error resulting from the numeric value data (including numeric value data having no decimal point representation) has occurred. A numeric value error other than Errors -121 through -129 has occurred.

-128 **Numeric data not allowed**

An numeric-value-data element (not violating the standard) has been received at a position where this instrument does not accept one.

O

200 **Option not installed**

The command received has been ignored because of the mismatch between the contents of an option for this instrument and the command.

For example, this error occurs when the source attenuator (power range) is set at a value other than zero (SOUR:POW:ATT command) in a model not having the extended power output option.

This error is not generated by front key operations.

-225 **Out of memory**

Insufficient memory is available in this instrument to perform the required operation.

P

-220 **Parameter error**

When a parameter-related error other than Errors -221 through -229 occurs, that error is displayed.

-108 **Parameter not allowed**

The number of parameters exceeds that required for the command.

For instance, when a program message ":SENS1:SWE:TYPE LIN, SEGM" is sent instead of a correct program message with a command ":SENS1:SWE:TYPE LIN" which requires a parameter, the instrument receives the message as the number of parameters is invalid. See the command reference to confirm the required number of parameters.

41 **Peak not found**

This error occurs when, after specifying a peak and executing the CALC:MARK:FUNC:EXEC and CALC:FUNC:EXEC commands, the specified peak is not found in the marker search analysis.

220 **Phase lock loop unlocked**

This error occurs when the PLL circuit of this instrument becomes unlocked while the measurement is in progress. The measurement value is not correct. This error may occur when an external reference out of specification is connected to this instrument. Should an error occur with an external reference not connected, this instrument is faulty. Contact an Agilent Technology sales office or the company from which you bought the instrument.

221 **Port 1 receiver overload**

The input to Test Port 1 exceeds the maximum input level. The measurement value is not correct. When a DUT is an amplifier or the like, this error may occur, damaging the receiver in the worst case. Should this error occur with a passive part used as the DUT or with nothing connected to the test port, this instrument is faulty. Contact an Agilent Technology sales office or the company from which you bought the instrument.

If this error occurs, the stimulus signal output is automatically turned to off.

222 **Port 2 receiver overload**

The input to Test Port 2 exceeds the maximum input level. The measurement value is not correct. When a DUT is an amplifier or the like, this error may occur, damaging the receiver in the worst case. Should this error occur with a passive part used as the DUT or with nothing connected to the test port, this instrument is faulty. Contact an Agilent Technology sales office or the company from which you bought the instrument.

If this error occurs, the stimulus signal output is automatically turned to off.

223 **Port 3 receiver overload (for Options 313, 314, 413, and 414 only)**

The input to Test Port 3 exceeds the maximum input level. The measurement value is not correct. When a DUT is an amplifier or the like, this error may occur, damaging the receiver in the worst case. Should this error occur with a passive part used as the DUT or with nothing connected to the test port, this instrument is faulty. Contact an Agilent Technology sales office or the company from which you bought the instrument.

If this error occurs, the stimulus signal output is automatically turned to off.

224 **Port 4 receiver overload (For Options 413 and 414 only)**

The input to Test Port 4 exceeds the maximum input level. The measurement value is not correct. When a DUT is an amplifier or the like, this error may occur, damaging the receiver in the worst case. Should this error occur with a passive part used as the DUT or with nothing connected to the test port, this instrument is faulty. Contact an Agilent Technology sales office or the company from which you bought the instrument.

If this error occurs, the stimulus signal output is automatically turned to off.

73 **Power meter not settled**

The measurement value of the power meter is not stable.

If the measurement value of the power meter does not become stable within about 10 seconds during measuring power calibration data, this error occurs.

If no response from the power meter is obtained during measuring power calibration data, for example, when the power meter is powered off during measuring power calibration data, this error occurs.

Check that the power sensor is connected correctly.

241 **Power on test failed**

This error occurs when the power-on test fails, indicating a failure of this instrument. Contact an Agilent Technology sales office or the company from which you bought the instrument.

61 **Power unleveled**

The out power level exceeds available range.

For example, if the level after correction exceeds the power level that can be outputted when correcting the power level with the power calibration and power slope feature, this error occurs.

Check that the power level is set correctly, the power calibration has been performed correctly and the correction value of the power slope is set correctly.

120 **Printer error**

This error occurs when the previous printing is still in progress or the printer fails (offline, short of paper, etc.) at time of outputting the display image on the LCD screen to the printer (HCOP:IMM command).

121 **Print failed**

This error occurs when printing fails for reasons other than Error 120, Printer error.

-284 **Program currently running**

This error occurs when the PROG:SEL:STAT RUN command is executed with the VBA program in the Run state.

-112 **Program mnemonic too long**

The length of the header exceeds 12 characters (see 7.6.1.4.1, IEEE488.2).

-286 **Program runtime error**

An error occurring when VBA is executed.

Q

-430 **Query DEADLOCKED**

The state that generates a “DEADLOCKED” Query error (see 6.3.1.7, IEEE488.2). This error occurs when both input and output buffers have become full, preventing the instrument from continuing processing, for example.

-400 **Query error**

A comprehensive query error has occurred showing that this instrument cannot detect a more detailed error. This code simply shows that a query error defined in 11.5.1.1.7 and 6.3, IEEE488.2 has occurred.

-410 **Query INTERRUPTED**

The state that generates a “INTERRUPTED” Query error (see 6.3.2.3, IEEE488.1). This error occurs when data bytes (DAB) or GET are received before the transmission of the response after a query has not been completed, for example.

-420 **Query UNTERMINATED**

The state that generates an “UNTERMINATED” Query error (see 6.3.2, IEEE488.2). This error occurs when this instrument is designated as the talker and an incomplete program message is received, for example.

-440 **Query UNTERMINATED after indefinite response**

After a query asking for an indefinite response has been run, another query is received in the same program message (See 6.5.7.5.7, IEEE488.2).

R

105 **Recall failed**

This error occurs when reading an instrument status file (State01.sta, etc.) (MMEM:LOAD:STAT command) fails.

S

106 **Save failed**

This error occurs when writing an instrument status file (State01.sta, etc.) (MMEM:STOR:STAT command) fails.

50 **Specified channel hidden**

This error occurs when an attempt is made to activate a channel not on display using the DISP:WIND:ACT command. This error is not generated by front key operations.

21 **Specified ports overlapped**

This error occurs when a port number is duplicated in a command requiring two or more port numbers as parameters. Such commands are, for example, CALC:FSIM:BAL:TOP:SSB:PPOR 1,2,3,3. Specify port setup correctly to avoid duplication of ports. This error is not generated by front key operations.

-150 **String data error**

When a character-string-data element is put to syntactic analysis, an error not corresponding to one of Error Numbers -151 through -159 occurs.

-158 **String data not allowed**

A character-string-data element has been received at a position where this instrument does not accept one.

-138 **Suffix not allowed**

A suffix is attached to a numeric value element to which a suffix is not allowed to be attached.

-134 **Suffix too long**

The unit is too long.

The unit is expressed in 12 or more characters (see 7.7.3.4, IEEE488.2).

55 **Sweep mode changed to stepped sweep**

You cannot change the sweep mode to the swept mode.

If you attempt to change the sweep mode to the swept mode/fast swept mode when the sweep type is the power sweep, the power slope feature is enabled (on and the correction coefficient is other than 0), or the power calibration is on, this error occurs.

-102 **Syntax error**

A command or data type that is not recognized exists.

-310 **System error**

One of the errors designated as “system errors” in this instrument has occurred.

T

40 **Target value not found**

This error occurs when the target is not found during the marker search analysis after specifying the target and executing the CALC:MARK:FUNC:EXEC and CALC:FUNC:EXEC commands. This error occurs also when the bandwidth is not found after executing the bandwidth marker command, CALC:MARK:BWID:DATA?

-124 **Too many digits**

The number of digits of the argument of the decimal numeric-value-data element exceeds 255 with the preceding 0 removed (see 7.7.2.4.1, IEEE488.2).

-223 **Too much data**

The block-, expression-, or character-string-type program data that has been received conforms with the standard. But it exceeds the amount that can be processed under the condition of the memory or conditions specific to memory-related devices. In this instrument, this error occurs when the number of characters exceeds 254 in a character-string parameter.

54 **Transform, Gate not allowed**

This error occurs when number of points is set 2 or sweep type is set logarithmic/segment sweep, the gating or transform function of time domain function is turned on.

Set number of points to more than 3, the sweep type to linear sweep. And then, turn on the gating or transform function of time domain function.

-211 **Trigger ignored**

This instrument receives and detects a trigger command (“TRIG”) or an external trigger signal. But it is ignored due to the timing condition (This instrument is not in the wait-for-trigger state, for example). Change the setup so that a trigger command or an external trigger signal can be sent after the instrument has entered the wait-for- trigger state.

U

-113 **Undefined header**

A command not defined in this instrument, though not illegal in the syntactic structure, has been received. For example, when a message “:DISP:WIND1:TABL:MEM ON” is sent to a correct program message “:DISP:WIND1:TRAC1:MEM ON,” the message sent is received as an undefined command by this instrument. See the command reference and use correct commands.

This error occurs also when a port not existing on this model is specified in a command specifying a port number as an index. Such commands are CALC:FSIM:SEND:DEEM:PORTn:xxxx, CALC:FSIM:SEND:PMC:PORTn:xxxx, CALC:FSIM:SEND:ZCON:PORTn:Z0:R, and SENS:CORR:EXT:PORTn:TIME; they include PORTn as a part.

V

30 **Valid Ecal module not found**

This error occurs when the number of ports of the ECal module connected is less than the necessary number of ports. This error occurs, for example, when a 4-port Cal executing command, SENS:CORR:COLL:ECAL:SOLT4, is executed with a 2-port ECal module connected. This error is not generated by front key operations.

71 **Valid power meter not found**

A valid power meter (refer to Table 4-3 on page 156) is not connected.

If the E5070B/E5071B and the power meter are not connected correctly via the USB/GPIB interface or the GPIB address of the power meter and the power meter GPIB address of the E5070B/E5071B do not match, or if the power meter is not powered on when measuring power calibration data, this error occurs.

Also, if an invalid power meter is connected, this error occurs.

Check the connection, the GPIB address, and the power supply of the power meter.

72 **Valid power sensor not found**

No power sensor is connected to the power meter.

If no power sensor is connected to the specified channel of the power meter when measuring power calibration data, this error occurs.

Check the connection of the power sensor.

Warning Message

A warning message is displayed in the instrument message/Warning area in the lower left part of the display against a gray background. Pushing a front panel key or executing :DISP:CCL command clears the message.

This message simply appears on the display, being not known to a remote environment such as a GPIB. This message is not displayed when another error (against a red background) has already been displayed in the instrument message/Warning area.

The warning messages for this instrument are as follows:

Log sweep requires 2 octave minimum span

If you change the sweep range that does not satisfy the necessary condition of the frequency span (the stop frequency is about 4 times or more of the start frequency) when the sweep type is set to the log sweep, this message is displayed.

If this message is displayed, the sweep type is automatically set to the linear sweep.

For example, if you attempt to change the log type to the log sweep when the start frequency is set to 1 MHz and the stop frequency to 2 MHz, this error occurs.

Set the stop frequency to a value of about 4 times or more the start frequency and then set the low seep.

Peak not found

This warning message is displayed when, with the tracking turned on, the peak specified by the marker search has not been found by the time the sweep is finished (with the tracking executed).

Segment table changed

This warning message is displayed when the setting specified segment by segment in the segment table is automatically changed by a change in the other setting.

For example, this warning message is displayed when, with the power specified segment by segment in the segment table, the power setting for a segment is adjusted by a change in the power range setting.

Target value not found

This warning message is displayed when, with the tracking turned on, the target specified by the marker search has not been found by the time the sweep is finished (with the tracking executed).

This warning message is displayed also when, with the bandwidth marker displayed, the setting for the bandwidth marker is changed at the end of the sweep, or when, with the active marker changed or moved, the bandwidth is not found.

Transform, Gate not allowed

This warning message is displayed when the gating/transform function of time domain function is turned on, number of points is set 2 or sweep type is set logarithmic/segment sweep.

The gating function and transform function are automatically turned off when this warning message is displayed.

Sweep mode changed to stepped sweep

If you set the sweep type to the power sweep, enable the power slope feature (on and the correction coefficient to other than zero), or turn on the power calibration when the sweep mode is set to the swept mode or the fast swept mode, this message is displayed.

If this message is displayed, the sweep mode is automatically changed to the step mode (for the swept mode) or the fast step mode (for the fast swept mode).

C List of Default Values

This appendix gives the default values, settings for Save/Recall of an object, and settings for backing up an object when using the Agilent E5070B/E5071B.

List of Default Values, Save/Recall Settings, and Backup Settings

The table below shows the following settings for the Agilent E5070B/E5071B.

- Factory-shipped settings
- Settings valid when you press Preset **(Or when you execute the :SYST:PRES** command)
- Settings valid when you execute the ***RST** command
- Settings that permit Save/Recall of a setup state

  In the table, states that can be saved/recalled are denoted in the following manner:

  √: Save/Recall can be performed

  Blank: Save/Recall cannot be performed
- Settings that are backed up (set state not affected by turning power ON/OFF)

  In the table, a setting that is automatically backed up is denoted in the following manner:

  √: Backup operation performed

  Blank: Backup operation not performed
- Available means of defining a setting

  In the table, the following symbols are used to denote the method(s) that can be used to define a setting.

  K: Using the front panel key (including the mouse and keyboard)

  C: Using the SCPI command or COM object

NOTE In the table, the ← symbol shows that the setup is the same as that in the box to the left.

Key Operation	Factory-shipped Setting	Default Value: Preset	Default Value: *RST	Save/ Recall	Backup	Available Means of Defining a Setting
Meas	S11	←	←	√		K/C
	Sss11 (When Fixture Simulator is set on, set Topology at SE-Bal, and, BalUn on in Analysis mode)	←	←	√		K/C
	Sdd11 (When Fixture Simulator is set on, set Topology at Bal-Bal, and BalUn on in Analysis mode)	←	←	√		K/C
	Sss11 (When Fixture Simulator is set on, set Topology at SE-SE-Bal, and BalUn on in Analysis mode)	←	←	√		K/C
Format	Log Mag	←	←	√		K/C
Scale						
Divisions	10	←	←	√		K/C
Scale/Div	10.000 dB/div	←	←	√		K/C
Reference Position	5 Div	←	←	√		K/C
Reference Value	0.0000 dB	←	←	√		K/C
Electrical Delay	0.0000 s	←	←	√		K/C
Phase Offset	0.0000 °	←	←	√		K/C
Display						
Allocate Channels	×1	←	←	√		K/C
Number of Traces	1	←	←	√		K/C
Allocate Traces	×1	←	←	√		K/C
Display	Data	←	←	√		K/C
Data Math	OFF	←	←	√		K/C
Title Label	OFF	←	←	√		K/C
Graticule Label	ON	←	←	√		K/C
Invert Color	OFF	←	←	√		K/C
Frequency	ON	←	←	√		K/C
Update	ON	←	←	√		K/C
Avg						
Avg Factor	16	←	←	√		K/C
Averaging	OFF	←	←	√		K/C
SMO Aperture	1.5000%	←	←	√		K/C
Smoothing	OFF	←	←	√		K/C
IF Bandwidth	70 kHz	←	←	√		K/C
Cal						
Correction	OFF	←	←	√		K/C
Calibrate						

Key Operation	Factory-shipped Setting	Default Value Preset	Default Value *RST	Save/ Recall	Backup	Available Means of Defining a Setting
Cal						
Calibrate						
Response (Open)						
Select Port	1	←	←			K/C
Response (Short)						
Select Port	1	←	←			K/C
Response (Thru)						
Select Ports	2-1 (S21)	←	←			K/C
1-Port Cal						
Select Port	1	←	←			K/C
2-Port Cal						
Select Ports	1-2	←	←			K/C
3-Port Cal						
Select Ports	1-2-3	←	←			K/C
ECal						
Isolation	OFF	←	←	√		K/C
Property	OFF	←	←	√		K/C
Cal Kit	85033E	←	←	√		K/C
Modify Cal Kit						
Define STDs	Define STDs	←	←	√		K
Specify CLSs						
Open	Open	←	←	√		K
Port Extensions						
Extension Port1	OFF	←	←	√		K/C
Extension Port2	OFF	←	←	√		K/C
Extension Port3	OFF	←	←	√		K/C
Extension Port4	OFF	←	←	√		K/C
Velocity Factor	1.0000	←	←	√		K/C
Power Calibration						
Select Port	1	←	←			K
Correction	OFF	←	←	√		K/C
Use Sensor	A	←	←			K
Num of Readings	1	←	←	√		K/C
Loss Compen						
Compensation	OFF	←	←	√		K/C
Sensor A Settings						
Ref Cal Factor	100.00%	Non-changing	←	√		K/C
Sensor B Settings						
Ref Cal Factor	100.00%	Non-changing	←	√		K/C
Start	300.00 kHz	←	←	√		K/C

Key Operation	Factory-shipped Setting	Default Value		Save/ Recall	Backup	Available Means of Defining a Setting
		Preset	*RST			
Stop	3.0000 GHz (E5070A) 8.5000 GHz (E5071A)	←	←	√		K/C
Center	1.50015 GHz (E5070A) 4.25015 GHz (E5071A)	←	←	√		K/C
Span	2.9997 GHz (E5070A) 8.4997 GHz (E5071A)	←	←	√		K/C
Sweep Setup						
Power						
Power	0 dBm	←	←	√		K/C
Power Ranges	-20 to 12	←	←	√		K/C
Port Couple	ON	←	←	√		K/C
Port Power						
Port 1 Power	0 dBm	←	←	√		K/C
Port 2 Power	0 dBm	←	←	√		K/C
Port 3 Power	0 dBm	←	←	√		K/C
Port 4 Power	0 dBm	←	←	√		K/C
Slope [xx dB/GHz]	0 dB/GHz	←	←	√		K/C
Slope [ON/OFF]	OFF	←	←	√		K/C
CW Freq	300.00 kHz	←	←	√		K/C
RF Out	ON	←	←	√		K/C
Sweep Time	AUTO	←	←	√		K/C
Sweep Delay	0.0000 s	←	←	√		K/C
Sweep Mode	Std Stepped	←	←	√		K/C
Points	201	←	←	√		K/C
Sweep Type	Linear	←	←	√		K/C
Edit Segment Table						
Freq Mode	Start/Stop	←	←	√		K/C
List IFBW	OFF	←	←	√		K/C
List Power	OFF	←	←	√		K/C
List Delay	OFF	←	←	√		K/C
List Sweep Mode	OFF	←	←	√		K/C
List Time	OFF	←	←	√		K/C
Segment Display	Order Base	←	←	√		K/C
Trigger						
Continuous	Continuous (Ch1) Hold (Ch2 to 9)	←	Hold (all channels)	√		K/C
Trigger Source	Internal	←	←	√		K/C
Marker						
Marker 1	Marker 1 is turned on immediately after the marker softkey menu is displayed.	←	←	√		K/C

Key Operation	Factory-shipped Setting	Default Value		Save/ Recall	Backup	Available Means of Defining a Setting
		Preset	*RST			
Marker						
Ref Marker Mode	OFF	←	←	√		K/C
Marker Search						
Peak						
Peak Excursion	3.0000 dB	←	←	√		K/C
Peak Polarity	Positive	←	←	√		K/C
Target						
Target Value	0.0000 dB (When Target is selected)	←	←	√		K/C
Target Transition	Both (When Target is selected)	←	←	√		K/C
Tracking	OFF	←	←	√		K/C
Search Range						
Search Range	OFF	←	←	√		K/C
Start	0.0000 Hz	←	←	√		K/C
Stop	0.0000 Hz	←	←	√		K/C
Couple	ON	←	←	√		K/C
Bandwidth	OFF	←	←	√		K/C
Bandwidth Value	-3.0000 dB (When one of the marker is on)	←	←	√		K/C
Marker Fctn						
Discrete	OFF	←	←	√		K/C
Couple	ON	←	←	√		K/C
Marker Table	OFF	←	←	√		K/C
Statistics	OFF	←	←	√		K/C
Analysis						
Fixture Simulator						
Fixture Simulator	OFF	←	←	√		K/C
Topology						
Device	SE-BAL	←	←	√		K/C
Port1 (se)	1 (When SE-Bal is selected as the device) (When SE-SE-Bal is selected as the device)	←	←	√		K/C
Port1 (bal)	1-2 (When Bal-Bal is selected as the device)	←	←	√		K/C
Port2 (bal)	2-3 (SE-Bal is selected as the device) 3-4 (Bal-Bal is selected as the device)	←	←	√		K/C

Key Operation	Factory-shipped Setting	Default Value		Save/ Recall	Backup	Available Means of Defining a Setting
		Preset	*RST			
Analysis						
Fixture Simulator						
Topology						
Port2 (se)	2 (When SE-SE-Bal is selected as the device)	←	←	√		K/C
Port3 (bal)	3-4 (When SE-SE-Bal is selected as the device)	←	←	√		K/C
Property	OFF	←	←	√		K/C
BalUn	OFF	←	←	√		K/C
Port Matching						
Port Matching	OFF	←	←	√		K/C
Select Port	1	←	←	√		K/C
Select Circuit	None	←	←	√		K/C
C	0.000e-12 F	←	←	√		K/C
G	0.0000 S	←	←	√		K/C
L	0.000e-9 H	←	←	√		K/C
R	0.0000 Ω	←	←	√		K/C
Port ZConversion						
Port ZConversion	OFF	←	←	√		K/C
Port1 Z0	50.000 Ω	←	←	√		K/C
Port2 Z0	50.000 Ω	←	←	√		K/C
Port3 Z0	50.000 Ω	←	←	√		K/C
Port4 Z0	50.000 Ω	←	←	√		K/C
De-Embedding						
De-Embedding	OFF	←	←	√		K/C
Select Port	1	←	←	√		K/C
Select Type	None	←	←	√		K/C
Diff Matching						
Diff Matching	OFF	←	←	√		K/C
Select Bal Port	2	←	←	√		K/C
Select Circuit	None	←	←	√		K/C
C	0.000e-12 F	←	←	√		K/C
G	0.0000 S	←	←	√		K/C
L	0.000e-9 H	←	←	√		K/C
R	0.0000 Ω	←	←	√		K/C
Diff ZConversion						
Diff ZConversion	OFF	←	←	√		K/C
Port2 (bal)	100.00 Ω	←	←	√		K/C

Key Operation	Factory-shipped Setting	Default Value		Save/ Recall	Backup	Available Means of Defining a Setting
		Preset	*RST			
Analysis						
Fixture Simulator						
Cmn ZConversion						
Cmn Z Conversion	OFF	←	←	√		K/C
Port2 (bal)	25.000 Ω	←	←	√		K/C
Gating						
Gating	OFF	←	←	√		K/C
Start	-10.000ns	←	←	√		K/C
Stop	10.000ns	←	←	√		K/C
Center	0.0000s	←	←	√		K/C
Span	20.000ns	←	←	√		K/C
Type	Bandpass	←	←	√		K/C
Shape	Normal	←	←	√		K/C
Transform						
Transform	OFF	←	←	√		K/C
Start	-10.000ns	←	←	√		K/C
Stop	10.000ns	←	←	√		K/C
Center	0.0000s	←	←	√		K/C
Span	20.000ns	←	←	√		K/C
Type	Bandpass	←	←	√		K/C
Window	Normal	←	←	√		K/C
Impulse Width	229.55ps	←	←	√		K/C
Kaiser Beta	6.0000	←	←	√		K/C
Conversion						
Conversion	OFF	←	←	√		K/C
Function	Z:Reflection	←	←	√		K/C
Limit Test						
Limit Test	OFF	←	←	√		K/C
Limit Line	OFF	←	←	√		K/C
Fail Sign	ON	←	←	√		K/C
Macro Setup						
Echo Window	OFF	←	←	√		K/C
Save/Recall						
Save Type	State&Cal	←	←	√		K/C
Channel/Trace	Disp Only	←	←	√		K/C
System						
Invert Image	ON	←	←	√		K/C
E5091A Setup						
Select ID	1	←	←	√		K

Key Operation	Factory-shipped Setting	Default Value		Save/ Recall	Backup	Available Means of Defining a Setting
		Preset	*RST			
System						
E5091A Setup						
Port 1	A	←	←	√		K/C
Port 2	T1	←	←	√		K/C
Port 3	R1+	←	←	√		K/C
Port 4	R1-	←	←	√		K/C
Control Lines						
Line 1 ... Line 8	LOW	←	←	√		K/C
E5091A Property	OFF	←	←	√		K/C
E5091A Control	OFF	←	←	√		K/C
Misc Setup						
Beeper						
Beep Complete	ON	←	←	√		K/C
Beep Warning	ON	←	←	√		K/C
GPIB Setup						
Talker/Listener Address	17	Non-changing	←		√	K
Power Meter Address	13	Non-changing	←		√	K/C
Network Setup						
Telnet Server	OFF	Non-changing	←		√	K
SICL-LAN Server	OFF	Non-changing	←		√	K
SICL-LAN Address	17	Non-changing	←		√	K
Network Device	ENABLE	Non-changing	←		√	K
Clock Setup						
Show Clock	ON	←	←	√		K/C
Key Lock						
Front Panel & Keyboard Lock	OFF	←	←			K/C
Touch Screen & Mouse Lock	OFF	←	←			K/C
Color Setup						
Normal						
Data Trace 1	Red:5 Green:5 Blue:0	←	←	√		K/C
Data Trace 2	Red:0 Green:5 Blue:5	←	←	√		K/C
Data Trace 3	Red:5 Green:0 Blue:5	←	←	√		K/C
Data Trace 4	Red:0 Green:5 Blue:0	←	←	√		K/C

Key Operation	Factory-shipped Setting	Default Value		Save/ Recall	Backup	Available Means of Defining a Setting
		Preset	*RST			
System						
Misc Setup						
Color Setup						
Normal						
Data Trace 5	Red:5 Green:4 Blue:0	←	←	√		K/C
Data Trace 6	Red:5 Green:3 Blue:3	←	←	√		K/C
Data Trace 7	Red:3 Green:4 Blue:5	←	←	√		K/C
Data Trace 8	Red:5 Green:4 Blue:4	←	←	√		K/C
Data Trace 9	Red:3 Green:4 Blue:3	←	←	√		K/C
Mem Trace 1	Red:3 Green:3 Blue:0	←	←	√		K/C
Mem Trace 2	Red:0 Green:3 Blue:3	←	←	√		K/C
Mem Trace 3	Red:3 Green:0 Blue:3	←	←	√		K/C
Mem Trace 4	Red:0 Green:3 Blue:0	←	←	√		K/C
Mem Trace 5	Red:3 Green:2 Blue:0	←	←	√		K/C
Mem Trace 6	Red:3 Green:1 Blue:1	←	←	√		K/C
Mem Trace 7	Red:1 Green:2 Blue:3	←	←	√		K/C
Mem Trace 8	Red:3 Green:2 Blue:2	←	←	√		K/C
Mem Trace 9	Red:1 Green:2 Blue:1	←	←	√		K/C
Graticule Main	Red:3 Green:3 Blue:3	←	←	√		K/C
Graticule Sub	Red:1 Green:1 Blue:1	←	←	√		K/C
Limit Fail	Red:5 Green:0 Blue:0	←	←	√		K/C
Limit Line	Red:3 Green:0 Blue:0	←	←	√		K/C
Background	Red:0 Green:0 Blue:0	←	←	√		K/C
Channel/Trace Setup	9 Channels 9 Traces	Non-changing	←		√	K
Backlight	ON	←	←			K/C
Service Menu						
System Correction	ON	←	←	√		K/C
Avoid Spurious	ON	←	←	√		K/C
High Temperature	OFF	Non-changing	←	√		K/C

D Softkey Functions

This appendix explains the functions of softkeys and hardkeys supplied on the Agilent E5070B/E5071B.

E5070B/E5071B Menu (Top Menu)

Key Operation	Function
Double-click on each softkey menu title	Displays the top menu of each menu item below. A preset operation will not cancel the menu display.
Measurement	Same as Meas. See “Measurement Menu” on page 493.
Format	Same as Format . See “Format Menu” on page 484.
Scale	Same as Scale. See “Scale Menu” on page 502.
Display	Same as Display. See “Display Menu” on page 480.
Average	Same as Avg. See “Average Menu” on page 467.
Calibration	Same as Cal . See “Calibration Menu” on page 468.
Stimulus	Displays the same softkey for setting up the sweep range that appears when Start , Stop , Center, or Span is pressed. See “Stimulus Menu” on page 503.
Sweep Setup	Same as Sweep Setup. See “Sweep Setup Menu” on page 504.
Trigger	Same as Trigger. See “Trigger Menu” on page 510.
Marker	Same as Marker. See “Marker Menu” on page 487.
Marker Search	Same as Marker Search . See “Marker Search Menu” on page 490.
Marker Function	Same as Marker Fctn. See “Marker Function Menu” on page 489.
Analysis	Same as Analysis . See “Analysis Menu” on page 455.
Macro Setup	Same as Macro Setup. See “Macro Setup Menu” on page 485.
Save/Recall	Same as Save/Recall. See “Save/Recall Menu” on page 500.
System	Same as System . See “System Menu” on page 506.
Preset	Same as Preset. See “Preset Menu” on page 499.

Analysis Menu

Key Operation	Function	SCPI Command
Analysis	Displays softkeys for performing analysis functions.	
Fixture Simulator	Displays softkeys for setting up fixture simulator functions. The fixture simulator is software that uses measurement results to simulate various measurement conditions. The fixture simulator consists of the following six functions: balanced/unbalanced conversion (use **Topology** and **BalUn** to set up), matching circuit (use **Port Matching**), port impedance conversion (use **Port Z Conversion**), network de-embedding (use **De-Embedding**), differential matching circuit (use **Diff. Matching**), and differential impedance conversion (use **Diff. Z Conversion**). To use each of the above functions, each must be enabled at the same time you enable the fixture simulator using the **Fixture Simulator** key below.	
Fixture Simulator*1	Enables or disables the fixture simulator function. When using one or more of the six functions provided with the fixture simulator, the fixture simulator function must be enabled using this key along with all desired functions.	:CALC{1-16}:FSIM:STAT
Topology*1	Displays softkeys for setting the balanced measurement topology (the types of DUT ports and the connecting method to test the ports).	
Device	Displays softkeys for selecting the types of DUT ports in a balanced measurement.	
SE-Bal	Evaluates mixed mode S parameters between a single-end (unbalanced) port and balanced port on the DUT. In the succeeding procedure, the single-end port and the balanced port will be treated as port 1 on the DUT (logical port 1) and port 2 on the DUT (logical port 2), respectively.	:CALC{1-16}:FSIM:BAL:DEV SBAL
Bal-Bal*2	Evaluates mixed mode S parameters between two balanced ports on the DUT. In the succeeding procedure, the two balanced ports will be treated as port 1 on the DUT (logical port 1) and port 2 on the DUT (logical port 2).	:CALC{1-16}:FSIM:BAL:DEV BBAL
SE-SE-Bal*2	Evaluates mixed mode S parameters between two single-end (unbalanced) ports and balanced port on the DUT. In the succeeding procedure, the two single-end ports will be treated as port 1 on the DUT (logical port 1) and port 2 on the DUT (logical port 2), and the balanced port as port 3 on the DUT (logical port 3).	:CALC{1-16}:FSIM:BAL:DEV SSB
Cancel	Returns to the softkey display screen one level higher.	
Port1 (se)	Displays softkeys for selecting the analyzer port (test port) to which (single-end) port 1 on the DUT will be connected. This key will be displayed only when **SE-Bal** or **SE-SE-Bal** in the **Device** menu is selected.	
1	Selects test port 1 on the analyzer for connection with (single-end) port 1 on the DUT.	:CALC{1-16}:FSIM:BAL:TOP:SBAL :CALC{1-16}:FSIM:BAL:TOP:SSB
2	Selects test port 2 on the analyzer for connection with (single-end) port 1 on the DUT.	:CALC{1-16}:FSIM:BAL:TOP:SBAL :CALC{1-16}:FSIM:BAL:TOP:SSB
3	Selects test port 3 on the analyzer for connection with (single-end) port 1 on the DUT.	:CALC{1-16}:FSIM:BAL:TOP:SBAL :CALC{1-16}:FSIM:BAL:TOP:SSB
4*2	Selects test port 4 on the analyzer for connection with (single-end) port 1 on the DUT.	:CALC{1-16}:FSIM:BAL:TOP:SBAL :CALC{1-16}:FSIM:BAL:TOP:SSB
Cancel	Returns to the softkey display screen one level higher.	
Port1 (bal)*2	Displays softkeys for selecting the analyzer ports (test ports) to which (balanced) port 1 on the DUT will be connected. This key will be displayed only when **Bal-Bal** in the **Device** menu is selected.	
1-2	Selects test ports 1 and 2 on the analyzer for connection with (balanced) port 1 on the DUT (ports a and b in Table 7-8 on page 208) respectively.	:CALC{1-16}:FSIM:BAL:TOP:BBAL
1-3	Selects test ports 1 and 3 on the analyzer for connection with (balanced) port 1 on the DUT (ports a and b in Table 7-8 on page 208) respectively.	:CALC{1-16}:FSIM:BAL:TOP:BBAL
1-4	Selects test ports 1 and 4 on the analyzer for connection with (balanced) port 1 on the DUT (ports a and b in Table 7-8 on page 208) respectively.	:CALC{1-16}:FSIM:BAL:TOP:BBAL
2-1	Selects test ports 2 and 1 on the analyzer for connection with (balanced) port 1 on the DUT (ports a and b in Table 7-8 on page 208) respectively.	:CALC{1-16}:FSIM:BAL:TOP:BBAL

Key Operation	Function	SCPI Command
Analysis	(Continued)	
Fixture Simulator		
Topology[*1]		
Port1 (bal)[*2]		
2-3	Selects test ports 2 and 3 on the analyzer for connection with (balanced) port 1 on the DUT (ports a and b in Table 7-8 on page 208) respectively.	:CALC{1-16}:FSIM:BAL:TOP:BBAL
2-4	Selects test ports 2 and 4 on the analyzer for connection with (balanced) port 1 on the DUT (ports a and b in Table 7-8 on page 208) respectively.	:CALC{1-16}:FSIM:BAL:TOP:BBAL
3-1	Selects test ports 3 and 1 on the analyzer for connection with (balanced) port 1 on the DUT (ports a and b in Table 7-8 on page 208) respectively.	:CALC{1-16}:FSIM:BAL:TOP:BBAL
3-2	Selects test ports 3 and 2 on the analyzer for connection with (balanced) port 1 on the DUT (ports a and b in Table 7-8 on page 208) respectively.	:CALC{1-16}:FSIM:BAL:TOP:BBAL
3-4	Selects test ports 3 and 4 on the analyzer for connection with (balanced) port 1 on the DUT (ports a and b in Table 7-8 on page 208) respectively.	:CALC{1-16}:FSIM:BAL:TOP:BBAL
4-1	Selects test ports 4 and 1 on the analyzer for connection with (balanced) port 1 on the DUT (ports a and b in Table 7-8 on page 208) respectively.	:CALC{1-16}:FSIM:BAL:TOP:BBAL
4-2	Selects test ports 4 and 2 on the analyzer for connection with (balanced) port 1 on the DUT (ports a and b in Table 7-8 on page 208) respectively.	:CALC{1-16}:FSIM:BAL:TOP:BBAL
4-3	Selects test ports 4 and 3 on the analyzer for connection with (balanced) port 1 on the DUT (ports a and b in Table 7-8 on page 208) respectively.	:CALC{1-16}:FSIM:BAL:TOP:BBAL
Cancel	Returns to the softkey display screen one level higher.	
Port2 (bal)	Displays softkeys for selecting the analyzer ports (test ports) to which (balanced) port 2 on the DUT will be connected. This key will be displayed only when **SE-Bal** or **Bal-Bal** in the **Device** menu is selected.	
1-2	Selects test ports 1 and 2 on the analyzer for connection with (balanced) port 2 on the DUT (ports b and c for **SE-Bal** or ports c and d for **Bal-Bal** in Table 7-8 on page 208) respectively.	:CALC{1-16}:FSIM:BAL:TOP:BBAL :CALC{1-16}:FSIM:BAL:TOP:SBAL
1-3	Selects test ports 1 and 3 on the analyzer for connection with (balanced) port 2 on the DUT (ports b and c for **SE-Bal** or ports c and d for **Bal-Bal** in Table 7-8 on page 208) respectively.	:CALC{1-16}:FSIM:BAL:TOP:BBAL :CALC{1-16}:FSIM:BAL:TOP:SBAL
1-4[*2]	Selects test ports 1 and 4 on the analyzer for connection with (balanced) port 2 on the DUT (ports b and c for **SE-Bal** or ports c and d for **Bal-Bal** in Table 7-8 on page 208) respectively.	:CALC{1-16}:FSIM:BAL:TOP:BBAL :CALC{1-16}:FSIM:BAL:TOP:SBAL
2-1	Selects test ports 2 and 1 on the analyzer for connection with (balanced) port 2 on the DUT (ports b and c for **SE-Bal** or ports c and d for **Bal-Bal** in Table 7-8 on page 208) respectively.	:CALC{1-16}:FSIM:BAL:TOP:BBAL :CALC{1-16}:FSIM:BAL:TOP:SBAL
2-3	Selects test ports 2 and 3 on the analyzer for connection with (balanced) port 2 on the DUT (ports b and c for **SE-Bal** or ports c and d for **Bal-Bal** in Table 7-8 on page 208) respectively.	:CALC{1-16}:FSIM:BAL:TOP:BBAL :CALC{1-16}:FSIM:BAL:TOP:SBAL
2-4[*2]	Selects test ports 2 and 4 on the analyzer for connection with (balanced) port 2 on the DUT (ports b and c for **SE-Bal** or ports c and d for **Bal-Bal** in Table 7-8 on page 208) respectively.	:CALC{1-16}:FSIM:BAL:TOP:BBAL :CALC{1-16}:FSIM:BAL:TOP:SBAL
3-1	Selects test ports 3 and 1 on the analyzer for connection with (balanced) port 2 on the DUT (ports b and c for **SE-Bal** or ports c and d for **Bal-Bal** in Table 7-8 on page 208) respectively.	:CALC{1-16}:FSIM:BAL:TOP:BBAL :CALC{1-16}:FSIM:BAL:TOP:SBAL
3-2	Selects test ports 3 and 2 on the analyzer for connection with (balanced) port 2 on the DUT (ports b and c for **SE-Bal** or ports c and d for **Bal-Bal** in Table 7-8 on page 208) respectively.	:CALC{1-16}:FSIM:BAL:TOP:BBAL :CALC{1-16}:FSIM:BAL:TOP:SBAL
3-4[*2]	Selects test ports 3 and 4 on the analyzer for connection with (balanced) port 2 on the DUT (ports b and c for **SE-Bal** or ports c and d for **Bal-Bal** in Table 7-8 on page 208) respectively.	:CALC{1-16}:FSIM:BAL:TOP:BBAL :CALC{1-16}:FSIM:BAL:TOP:SBAL

Key Operation	Function	SCPI Command
Analysis	(Continued)	
Fixture Simulator		
Topology*1		
Port2 (bal)		
4-1*2	Selects test ports 4 and 1 on the analyzer for connection with (balanced) port 2 on the DUT (ports b and c for **SE-Bal** or ports c and d for **Bal-Bal** in Table 7-8 on page 208) respectively.	:CALC{1-16}:FSIM:BAL:TOP:BBAL :CALC{1-16}:FSIM:BAL:TOP:SBAL
4-2*2	Selects test ports 4 and 2 on the analyzer for connection with (balanced) port 2 on the DUT (ports b and c for **SE-Bal** or ports c and d for **Bal-Bal** in Table 7-8 on page 208) respectively.	:CALC{1-16}:FSIM:BAL:TOP:BBAL :CALC{1-16}:FSIM:BAL:TOP:SBAL
4-3*2	Selects test ports 4 and 3 on the analyzer for connection with (balanced) port 2 on the DUT (ports b and c for **SE-Bal** or ports c and d for **Bal-Bal** in Table 7-8 on page 208) respectively.	:CALC{1-16}:FSIM:BAL:TOP:BBAL :CALC{1-16}:FSIM:BAL:TOP:SBAL
Cancel	Returns to the softkey display screen one level higher.	
Port2 (se)*2	Displays softkeys for selecting the analyzer port (test port) to which (single-end) port 2 on the DUT will be connected. This key will be displayed only when **SE-SE-Bal** in the **Device** menu is selected.	
1	Selects test port 1 on the analyzer for connection with (single-end) port 2 on the DUT.	:CALC{1-16}:FSIM:BAL:TOP:SSB
2	Selects test port 2 on the analyzer for connection with (single-end) port 2 on the DUT.	:CALC{1-16}:FSIM:BAL:TOP:SSB
3	Selects test port 3 on the analyzer for connection with (single-end) port 2 on the DUT.	:CALC{1-16}:FSIM:BAL:TOP:SSB
4	Selects test port 4 on the analyzer for connection with (single-end) port 2 on the DUT.	:CALC{1-16}:FSIM:BAL:TOP:SSB
Cancel	Returns to the softkey display screen one level higher.	
Port3 (bal)*2	Displays softkeys for selecting the analyzer ports (test ports) to which (balanced) port 3 on the DUT will be connected. This key will be displayed only when **SE-SE-Bal** in the **Device** menu is selected.	
1-2	Selects test ports 1 and 2 on the analyzer for connection with (balanced) port 3 on the DUT (ports c and d in Table 7-8 on page 208) respectively.	:CALC{1-16}:FSIM:BAL:TOP:SSB
1-3	Selects test ports 1 and 3 on the analyzer for connection with (balanced) port 3 on the DUT (ports c and d in Table 7-8 on page 208) respectively.	:CALC{1-16}:FSIM:BAL:TOP:SSB
1-4	Selects test ports 1 and 4 on the analyzer for connection with (balanced) port 3 on the DUT (ports c and d in Table 7-8 on page 208) respectively.	:CALC{1-16}:FSIM:BAL:TOP:SSB
2-1	Selects test ports 2 and 1 on the analyzer for connection with (balanced) port 3 on the DUT (ports c and d in Table 7-8 on page 208) respectively.	:CALC{1-16}:FSIM:BAL:TOP:SSB
2-3	Selects test ports 2 and 3 on the analyzer for connection with (balanced) port 3 on the DUT (ports c and d in Table 7-8 on page 208) respectively.	:CALC{1-16}:FSIM:BAL:TOP:SSB
2-4	Selects test ports 2 and 4 on the analyzer for connection with (balanced) port 3 on the DUT (ports c and d in Table 7-8 on page 208) respectively.	:CALC{1-16}:FSIM:BAL:TOP:SSB
3-1	Selects test ports 3 and 1 on the analyzer for connection with (balanced) port 3 on the DUT (ports c and d in Table 7-8 on page 208) respectively.	:CALC{1-16}:FSIM:BAL:TOP:SSB
3-2	Selects test ports 3 and 2 on the analyzer for connection with (balanced) port 3 on the DUT (ports c and d in Table 7-8 on page 208) respectively.	:CALC{1-16}:FSIM:BAL:TOP:SSB
3-4	Selects test ports 3 and 4 on the analyzer for connection with (balanced) port 3 on the DUT (ports c and d in Table 7-8 on page 208) respectively.	:CALC{1-16}:FSIM:BAL:TOP:SSB
4-1	Selects test ports 4 and 1 on the analyzer for connection with (balanced) port 3 on the DUT (ports c and d in Table 7-8 on page 208) respectively.	:CALC{1-16}:FSIM:BAL:TOP:SSB
4-2	Selects test ports 4 and 2 on the analyzer for connection with (balanced) port 3 on the DUT (ports c and d in Table 7-8 on page 208) respectively.	:CALC{1-16}:FSIM:BAL:TOP:SSB

Key Operation	Function	SCPI Command
Analysis	(Continued)	
Fixture Simulator		
Topology*1		
Port3 (bal)*2		
4-3	Selects test ports 4 and 3 on the analyzer for connection with (balanced) port 3 on the DUT (ports c and d in Table 7-8 on page 208) respectively.	:CALC{1-16}:FSIM:BAL:TOP:SSB
Cancel	Returns to the softkey display screen one level higher.	
Property	Enables or disables the display of the balanced measurement topology property. When enabled, calibration status information between test ports will be displayed in a matrix format in the lower-right corner of the channel window.	:CALC{1-16}:FSIM:BAL:TOP:PROP:STAT
Return	Returns to the softkey display screen one level higher.	
BalUn*1	Enables or disables the balanced/unbalanced conversion function of active trace. This function uses internal software to convert the results obtained from an unbalanced test port on the E5070B/E5071B into characteristics of a balanced port. The port converted into a balanced port will be characterized by a common mode signal and a differential mode signal. Measurement parameters are expressed as mixed mode S parameters. Use the **Topology** to select the type of DUT port and the connection method to test the ports.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:STAT
Balun OFF All Traces*1	Disables the balanced/unbalanced conversion function of all displayed traces.	None
Balun ON All Traces*1	Enables the balanced/unbalanced conversion function of all displayed traces.	None
Measurement	Same as Meas. See “Measurement Menu” on page 493.	
Port Matching	Displays softkeys for setting up the matching circuit function. Based on the measurement results, the matching circuit function uses internal software to determine characteristics with a matching circuit inserted between the DUT and the test ports.	
Port Matching	Enables or disables the matching circuit function.	:CALC{1-16}:FSIM:SEND:PMC:STAT
Select Port	Displays softkeys for selecting the test port to which a matching circuit is added.	
1	Selects test port 1 for adding a matching circuit.	:CALC{1-16}:FSIM:SEND:PMC:PORT1
2	Selects test port 2 for adding a matching circuit.	:CALC{1-16}:FSIM:SEND:PMC:PORT2
3*1	Selects test port 3 for adding a matching circuit.	:CALC{1-16}:FSIM:SEND:PMC:PORT3
4*2	Selects test port 4 for adding a matching circuit.	:CALC{1-16}:FSIM:SEND:PMC:PORT4
Cancel	Returns to the softkey display screen one level higher.	
Select Circuit	Displays softkeys for selecting the type of matching circuit to be added.	
None	Does not add any matching circuit to the port selected in the **Select Port** menu.	:CALC{1-16}:FSIM:SEND:PMC:PORT{1-4} NONE
SeriesL - ShuntC	Adds a series L - shunt C type matching circuit to the port selected in the **Select Port** menu.	:CALC{1-16}:FSIM:SEND:PMC:PORT{1-4} SLPC
ShuntC - SeriesL	Adds a shunt C - series L type matching circuit to the port selected in the **Select Port** menu.	:CALC{1-16}:FSIM:SEND:PMC:PORT{1-4} PCSL
ShuntL - SeriesC	Adds a shunt L - series C type matching circuit to the port selected in the **Select Port** menu.	:CALC{1-16}:FSIM:SEND:PMC:PORT{1-4} PLSC
SeriesC - ShuntL	Adds a series C - shunt L type matching circuit to the port selected in the **Select Port** menu.	:CALC{1-16}:FSIM:SEND:PMC:PORT{1-4} SCPL

Key Operation	Function	SCPI Command
Analysis	(Continued)	
Fixture Simulator		
Port Matching		
Select Circuit		
ShuntL - ShuntC	Adds a shunt L - shunt C type matching circuit to the port selected in the **Select Port** menu.	:CALC{1-16}:FSIM:SEND:PMC: PORT{1-4} PLPC
User	Adds a user-defined matching circuit to the port selected in the **Select Port** menu. The user-defined matching circuit must be prepared in the 2-port Touchstone data format and loaded onto the E5070B/E5071B from the **User File** menu.	:CALC{1-16}:FSIM:SEND:PMC: PORT{1-4} USER
Cancel	Returns to the softkey display screen one level higher.	
C	Sets the value of C for the matching circuit selected in the **Select Circuit** menu for addition to the port selected in the **Select Port** menu.	:CALC{1-16}:FSIM:SEND:PMC: PORT{1-4}:PAR:C
G	Sets the value of G for the matching circuit selected in the **Select Circuit** menu for addition to the port selected in the **Select Port** menu.	:CALC{1-16}:FSIM:SEND:PMC: PORT{1-4}:PAR:G
L	Sets the value of L for the matching circuit selected in the **Select Circuit** menu for addition to the port selected in the **Select Port** menu.	:CALC{1-16}:FSIM:SEND:PMC: PORT{1-4}:PAR:L
R	Sets the value of R for the matching circuit selected in the **Select Circuit** menu for addition to the port selected in the **Select Port** menu.	:CALC{1-16}:FSIM:SEND:PMC: PORT{1-4}:PAR:R
User File	Opens a dialog box for loading a user-defined 2-port Touchstone data file. The loaded matching circuit can be added to ports by selecting **User** in the **Select Circuit** menu.	:CALC{1-16}:FSIM:SEND:PMC: PORT{1-4}:USER:FIL
Return	Returns to the softkey display screen one level higher.	
Port ZConversion	Displays softkeys for setting up the port impedance conversion function. This function is included in internal software that converts S parameters determined with a 50 Ω reference port impedance to S parameters for arbitrary port impedance.	
Port ZConversion	Enables or disables the port impedance conversion function.	:CALC{1-16}:FSIM:SEND:ZCON: STAT
Port 1 Z0	Sets the reference impedance of port 1.	:CALC{1-16}:FSIM:SEND:ZCON: PORT1:Z0
Port 2 Z0	Sets the reference impedance of port 2.	:CALC{1-16}:FSIM:SEND:ZCON: PORT2:Z0
Port 3 Z0[*1]	Sets the reference impedance of port 3.	:CALC{1-16}:FSIM:SEND:ZCON: PORT3:Z0
Port 4 Z0[*2]	Sets the reference impedance of port 4.	:CALC{1-16}:FSIM:SEND:ZCON: PORT4:Z0
Return	Returns to the softkey display screen one level higher.	
De-Embedding	Displays softkeys for setting up the network de-embedding function. Network de-embedding is a function used to eliminate any user-defined network (with a reference impedance of 50 Ω) supplied in a 2-port Touchstone data file, from desired test ports to extend the calibration plane.	
De-Embedding	Enables or disables the network de-embedding function.	:CALC{1-16}:FSIM:SEND:DEEM:STA T
Select Port	Displays softkeys for selecting test ports for which network de-embedding will be performed.	
1	Selects test port 1 for performing network de-embedding.	:CALC{1-16}:FSIM:SEND:DEEM: PORT1
2	Selects test port 2 for performing network de-embedding.	:CALC{1-16}:FSIM:SEND:DEEM: PORT2
3[*1]	Selects test port 3 for performing network de-embedding.	:CALC{1-16}:FSIM:SEND:DEEM: PORT3
4[*2]	Selects test port 4 for performing network de-embedding.	:CALC{1-16}:FSIM:SEND:DEEM: PORT4
Cancel	Returns to the softkey display screen one level higher.	

Key Operation	Function	SCPI Command
Analysis	(Continued)	
Fixture Simulator		
De-Embedding		
Select Type	Displays softkeys for selecting the type of network de-embedding to be performed on the test port selected in the **Select Port** menu.	
None	Does not allow network de-embedding on the test port selected in the **Select Port** menu.	:CALC{1-16}:FSIM:SEND:DEEM:PORT{1-4} NONE
User	De-embeds a user-defined network from the test port selected in the **Select Port** menu. The user-defined network should be prepared in the 2-port Touchstone data format and loaded onto the E5070B/E5071B from the **User File** menu.	:CALC{1-16}:FSIM:SEND:DEEM:PORT{1-4} USER
Cancel	Returns to the softkey display screen one level higher.	
User File	Opens a dialog box for reading a 2-port Touchstone data file prepared by the user. Selecting **User** in the **Select Type** menu will de-embed the loaded network.	:CALC{1-16}:FSIM:SEND:DEEM:PORT{1-4}:USER:FIL
Return	Returns to the softkey display screen one level higher.	
Diff Matching[*1]	Displays softkeys for setting up the differential matching circuit function. This function uses internal software to convert the characteristics of a balanced port to those with an inserted differential matching circuit.	
Diff. Matching	Enables or disables the differential matching circuit function.	:CALC{1-16}:FSIM:BAL:DMC:STAT
Select Bal Port	Displays softkeys for selecting a balanced port to which a differential matching circuit will be added.	
1[*2]	Selects port 1 on the DUT for adding a differential matching circuit.	:CALC{1-16}:FSIM:BAL:DMC:BPOR1
2	Selects port 2 on the DUT for adding a differential matching circuit.	:CALC{1-16}:FSIM:BAL:DMC:BPOR{1-2}
3[*2]	Selects port 3 on the DUT for adding a differential matching circuit.	:CALC{1-16}:FSIM:BAL:DMC:BPOR1
Cancel	Returns to the softkey display screen one level higher.	
Select Circuit	Displays softkeys for selecting the type of differential matching circuit.	
None	Does not allow a differential matching circuit to be added to the balanced port selected in the **Select Bal Port** menu.	:CALC{1-16}:FSIM:BAL:DMC:BPOR{1-2} NONE
ShuntL - ShuntC	Adds a shunt L - shunt C type differential matching circuit to the port selected in the **Select Bal Port** menu.	:CALC{1-16}:FSIM:BAL:DMC:BPOR{1-2} PLPC
User	Adds a user-defined differential matching circuit to the port selected in the **Select Bal Port** menu. The user-defined differential matching circuit should be provided in the 2-port Touchstone data format and loaded onto the E5070B/E5071B from the **User File** menu.	:CALC{1-16}:FSIM:BAL:DMC:BPOR{1-2} USER
Cancel	Returns to the softkey display screen one level higher.	
C	Sets the value of C for the shunt L - shunt C differential matching circuit to be added to the balanced port selected in the **Select Bal Port** menu.	:CALC{1-16}:FSIM:BAL:DMC:BPOR{1-2}:PAR:C
G	Sets the value of G for the shunt L - shunt C differential matching circuit to be added to the balanced port selected in the **Select Bal Port** menu.	:CALC{1-16}:FSIM:BAL:DMC:BPOR{1-2}:PAR:G
L	Sets the value of L for the shunt L - shunt C differential matching circuit to be added to the balanced port selected in the **Select Bal Port** menu.	:CALC{1-16}:FSIM:BAL:DMC:BPOR{1-2}:PAR:L
R	Sets the value of R for the shunt L - shunt C differential matching circuit to be added to the balanced port selected in the **Select Bal Port** menu.	:CALC{1-16}:FSIM:BAL:DMC:BPOR{1-2}:PAR:R
User File	Opens a dialog box for reading a 2-port Touchstone data file prepared by the user. Selecting **User** in the **Select Circuit** menu adds the loaded differential matching circuit.	:CALC{1-16}:FSIM:BAL:DMC:BPOR{1-2}:USER:FIL
Return	Returns to the softkey display screen one level higher.	

Key Operation	Function	SCPI Command
Analysis	(Continued)	
Fixture Simulator		
Diff ZConversion[*1]	Displays softkeys for setting up the differential impedance conversion function. When the reference impedance of two unbalanced ports is expressed as Z_0, an automatic conversion sets the differential mode reference impedance of the converted balanced port to $2Z_0$ and the common mode reference impedance to $Z_0/2$. Differential impedance conversion is a function that further converts $2Z_0$ into another reference impedance.	
Diff ZConversion	Enables or disables the differential impedance conversion function.	:CALC{1-16}:FSIM:BAL:DZC:STAT
Port1 (bal)[*2]	Sets the differential reference impedance of balanced port 1.	:CALC{1-16}:FSIM:BAL:DZC:BPOR1:Z0
Port2 (bal)	Sets the differential reference impedance of balanced port 2.	:CALC{1-16}:FSIM:BAL:DZC:BPOR{1-2}:Z0
Port3 (bal)[*2]	Sets the differential reference impedance of balanced port 3.	:CALC{1-16}:FSIM:BAL:DZC:BPOR1:Z0
Return	Returns to the softkey display screen one level higher.	
Return	Returns to the softkey display screen one level higher.	
Cmn ZConversion[*1]	Displays softkeys for setting up the common impedance conversion function. When the reference impedance of two unbalanced ports is expressed as Z_0, an automatic conversion sets the differential mode reference impedance of the converted balanced port to $2Z_0$ and the common mode reference impedance to $Z_0/2$. Common impedance conversion is a function that further converts $Z_0/2$ into another reference impedance.	
Cmn ZConversion	Enables or disables the common impedance conversion function.	:CALC{1-16}:FSIM:BAL:CZC:STAT
Port1 (bal)[*2]	Sets the common reference impedance of balanced port 1.	:CALC{1-16}:FSIM:BAL:CZC:BPOR1:Z0
Port2 (bal)	Sets the common reference impedance of balanced port 2.	:CALC{1-16}:FSIM:BAL:CZC:BPOR{1-2}:Z0
Port3 (bal)[*2]	Sets the common reference impedance of balanced port 3.	:CALC{1-16}:FSIM:BAL:CZC:BPOR1:Z0
Return	Returns to the softkey display screen one level higher.	
De-Embedding S4P	Displays the softkey to make the setting of the 4-port network embedding/de-embedding feature. The 4-port network embedding/de-embedding feature is the feature to embed or de-embed your desired network that you have defined in a 4-port touchstone data file.	
De-Embedding S4P	Toggles ON/OFF the 4-port network embedding/de-embedding feature.	:CALC{1-16}:FSIM:EMB:STAT
Topology	Displays the softkey to assign a topology (the connection method between the analyzer and the DUT).	
Select Topology	Displays the softkey to select the type of the topology (see Figure 7-6).	
A	Selects topology A (connecting the 2 ports of the analyzer and the DUT).	:CALC{1-16}:FSIM:EMB:TYPE A
B[*1]	Selects topology B (connecting the 2 ports of the analyzer and the DUT).	:CALC{1-16}:FSIM:EMB:TYPE B
C[*2]	Selects topology C (connecting the 2 ports of the analyzer and the DUT).	:CALC{1-16}:FSIM:EMB:TYPE C
Cancel	Returns to the softkey display screen one level higher.	
Ports	Displays the softkey to select a port of the analyzer (test port) that you want to connect to the DUT. (When you select **A** on the **Select Topology** menu.)	
1-2	Sets the ports of the analyzer connected to ports a and b in Figure 7-6 to test ports 1 and 2, respectively.	:CALC{1-16}:FSIM:EMB:TOP:A:PORT 1,2
1-3[*1]	Sets the ports of the analyzer connected to ports a and b in Figure 7-6 to test ports 1 and 3, respectively.	:CALC{1-16}:FSIM:EMB:TOP:A:PORT 1,3
1-4[*2]	Sets the ports of the analyzer connected to ports a and b in Figure 7-6 to test ports 1 and 4, respectively.	:CALC{1-16}:FSIM:EMB:TOP:A:PORT 1,4
2-1	Sets the ports of the analyzer connected to ports a and b in Figure 7-6 to test ports 2 and 1, respectively.	:CALC{1-16}:FSIM:EMB:TOP:A:PORT 2,1

Key Operation	Function	SCPI Command
Analysis Fixture Simulator De-Embedding S4P Topology Ports	(Continued)	
2-3*1	Sets the ports of the analyzer connected to ports a and b in Figure 7-6 to test ports 2 and 3, respectively.	:CALC{1-16}:FSIM:EMB:TOP:A:PORT 2,3
2-4*2	Sets the ports of the analyzer connected to ports a and b in Figure 7-6 to test ports 2 and 4, respectively.	:CALC{1-16}:FSIM:EMB:TOP:A:PORT 2,4
3-1*1	Sets the ports of the analyzer connected to ports a and b in Figure 7-6 to test ports 3 and 1, respectively.	:CALC{1-16}:FSIM:EMB:TOP:A:PORT 3,1
3-2*1	Sets the ports of the analyzer connected to ports a and b in Figure 7-6 to test ports 3 and 2, respectively.	:CALC{1-16}:FSIM:EMB:TOP:A:PORT 3,2
3-4*2	Sets the ports of the analyzer connected to ports a and b in Figure 7-6 to test ports 3 and 4, respectively.	:CALC{1-16}:FSIM:EMB:TOP:A:PORT 3,4
4-1*2	Sets the ports of the analyzer connected to ports a and b in Figure 7-6 to test ports 4 and 1, respectively.	:CALC{1-16}:FSIM:EMB:TOP:A:PORT 4,1
4-2*2	Sets the ports of the analyzer connected to ports a and b in Figure 7-6 to test ports 4 and 2, respectively.	:CALC{1-16}:FSIM:EMB:TOP:A:PORT 4,2
4-3*2	Sets the ports of the analyzer connected to ports a and b in Figure 7-6 to test ports 4 and 3, respectively.	:CALC{1-16}:FSIM:EMB:TOP:A:PORT 4,3
Cancel	Returns to the softkey display screen one level higher.	
Ports*1	Displays the softkey to select a port of the analyzer (test port) that you want to connect to the DUT. (When you select **B** on the **Select Topology** menu.)	
1-2-3	Sets the ports of the analyzer connected to ports a, b, and c in Figure 7-6 to test ports 1, 2, and 3, respectively.	:CALC{1-16}:FSIM:EMB:TOP:B:PORT 1,2,3
1-2-4*2	Sets the ports of the analyzer connected to ports a, b, and c in Figure 7-6 to test ports 1, 2, and 4, respectively.	:CALC{1-16}:FSIM:EMB:TOP:B:PORT 1,2,4
1-3-2	Sets the ports of the analyzer connected to ports a, b, and c in Figure 7-6 to test ports 1, 3, and 2, respectively.	:CALC{1-16}:FSIM:EMB:TOP:B:PORT 1,3,2
1-3-4*2	Sets the ports of the analyzer connected to ports a, b, and c in Figure 7-6 to test ports 1, 3, and 4, respectively.	:CALC{1-16}:FSIM:EMB:TOP:B:PORT 1,3,4
1-4-2*2	Sets the ports of the analyzer connected to ports a, b, and c in Figure 7-6 to test ports 1, 4, and 2, respectively.	:CALC{1-16}:FSIM:EMB:TOP:B:PORT 1,4,2
1-4-3*2	Sets the ports of the analyzer connected to ports a, b, and c in Figure 7-6 to test ports 1, 4, and 3, respectively.	:CALC{1-16}:FSIM:EMB:TOP:B:PORT 1,4,3
2-1-3	Sets the ports of the analyzer connected to ports a, b, and c in Figure 7-6 to test ports 2, 1, and 3, respectively.	:CALC{1-16}:FSIM:EMB:TOP:B:PORT 2,1,3
2-1-4*2	Sets the ports of the analyzer connected to ports a, b, and c in Figure 7-6 to test ports 2, 1, and 4, respectively.	:CALC{1-16}:FSIM:EMB:TOP:B:PORT 2,1,4
2-3-1	Sets the ports of the analyzer connected to ports a, b, and c in Figure 7-6 to test ports 2, 3, and 1, respectively.	:CALC{1-16}:FSIM:EMB:TOP:B:PORT 2,3,1
2-3-4*2	Sets the ports of the analyzer connected to ports a, b, and c in Figure 7-6 to test ports 2, 3, and 4, respectively.	:CALC{1-16}:FSIM:EMB:TOP:B:PORT 2,3,4
2-4-1*2	Sets the ports of the analyzer connected to ports a, b, and c in Figure 7-6 to test ports 2, 4, and 1, respectively.	:CALC{1-16}:FSIM:EMB:TOP:B:PORT 2,4,1
2-4-3*2	Sets the ports of the analyzer connected to ports a, b, and c in Figure 7-6 to test ports 2, 4, and 3, respectively.	:CALC{1-16}:FSIM:EMB:TOP:B:PORT 2,4,3
3-1-2	Sets the ports of the analyzer connected to ports a, b, and c in Figure 7-6 to test ports 3, 1, and 2, respectively.	:CALC{1-16}:FSIM:EMB:TOP:B:PORT 3,1,2

Key Operation	Function	SCPI Command
Analysis	(Continued)	
Fixture Simulator		
De-Embedding S4P		
Topology		
Ports*1		
3-1-4*2	Sets the ports of the analyzer connected to ports a, b, and c in Figure 7-6 to test ports 3, 1, and 4, respectively.	:CALC{1-16}:FSIM:EMB:TOP:B:PORT 3,1,4
3-2-1	Sets the ports of the analyzer connected to ports a, b, and c in Figure 7-6 to test ports 3, 2, and 1, respectively.	:CALC{1-16}:FSIM:EMB:TOP:B:PORT 3,2,1
3-2-4*2	Sets the ports of the analyzer connected to ports a, b, and c in Figure 7-6 to test ports 3, 2, and 4, respectively.	:CALC{1-16}:FSIM:EMB:TOP:B:PORT 3,2,4
3-4-1*2	Sets the ports of the analyzer connected to ports a, b, and c in Figure 7-6 to test ports 3, 4, and 1, respectively.	:CALC{1-16}:FSIM:EMB:TOP:B:PORT 3,4,1
3-4-2*2	Sets the ports of the analyzer connected to ports a, b, and c in Figure 7-6 to test ports 3, 4, and 2, respectively.	:CALC{1-16}:FSIM:EMB:TOP:B:PORT 3,4,2
4-1-2*2	Sets the ports of the analyzer connected to ports a, b, and c in Figure 7-6 to test ports 4, 1, and 2, respectively.	:CALC{1-16}:FSIM:EMB:TOP:B:PORT 4,1,2
4-1-3*2	Sets the ports of the analyzer connected to ports a, b, and c in Figure 7-6 to test ports 4, 1, and 3, respectively.	:CALC{1-16}:FSIM:EMB:TOP:B:PORT 4,1,3
4-2-1*2	Sets the ports of the analyzer connected to ports a, b, and c in Figure 7-6 to test ports 4, 2, and 1, respectively.	:CALC{1-16}:FSIM:EMB:TOP:B:PORT 4,2,1
4-2-3*2	Sets the ports of the analyzer connected to ports a, b, and c in Figure 7-6 to test ports 4, 2, and 3, respectively.	:CALC{1-16}:FSIM:EMB:TOP:B:PORT 4,2,3
4-3-1*2	Sets the ports of the analyzer connected to ports a, b, and c in Figure 7-6 to test ports 4, 3, and 1, respectively.	:CALC{1-16}:FSIM:EMB:TOP:B:PORT 4,3,1
4-3-2*2	Sets the ports of the analyzer connected to ports a, b, and c in Figure 7-6 to test ports 4, 3, and 2, respectively.	:CALC{1-16}:FSIM:EMB:TOP:B:PORT 4,3,2
Cancel	Returns to the softkey display screen one level higher.	
Ports*2	Displays the softkey to select a port of the analyzer (test port) that you want to connect to the DUT. (When you select **C** on the **Select Topology** menu.)	
1-2-3-4	Sets the ports of the analyzer connected to ports a, b, c and d in Figure 7-6 to test ports 1, 2, 3, and 4, respectively.	:CALC{1-16}:FSIM:EMB:TOP:C:PORT 1,2,3,4
1-2-4-3	Sets the ports of the analyzer connected to ports a, b, c and d in Figure 7-6 to test ports 1, 2, 4, and 3, respectively.	:CALC{1-16}:FSIM:EMB:TOP:C:PORT 1,2,4,3
1-3-2-4	Sets the ports of the analyzer connected to ports a, b, c and d in Figure 7-6 to test ports 1, 3, 2, and 4, respectively.	:CALC{1-16}:FSIM:EMB:TOP:C:PORT 1,3,2,4
1-3-4-2	Sets the ports of the analyzer connected to ports a, b, c and d in Figure 7-6 to test ports 1, 3, 4, and 2, respectively.	:CALC{1-16}:FSIM:EMB:TOP:C:PORT 1,3,4,2
1-4-2-3	Sets the ports of the analyzer connected to ports a, b, c and d in Figure 7-6 to test ports 1, 4, 2, and 3, respectively.	:CALC{1-16}:FSIM:EMB:TOP:C:PORT 1,4,2,3
1-4-3-2	Sets the ports of the analyzer connected to ports a, b, c and d in Figure 7-6 to test ports 1, 4, 3, and 2, respectively.	:CALC{1-16}:FSIM:EMB:TOP:C:PORT 1,4,3,2
2-1-3-4	Sets the ports of the analyzer connected to ports a, b, c and d in Figure 7-6 to test ports 2, 1, 3, and 4, respectively.	:CALC{1-16}:FSIM:EMB:TOP:C:PORT 2,1,3,4
2-1-4-3	Sets the ports of the analyzer connected to ports a, b, c and d in Figure 7-6 to test ports 2, 1, 4, and 3, respectively.	:CALC{1-16}:FSIM:EMB:TOP:C:PORT 2,1,4,3
2-3-1-4	Sets the ports of the analyzer connected to ports a, b, c and d in Figure 7-6 to test ports 2, 3, 1, and 4, respectively.	:CALC{1-16}:FSIM:EMB:TOP:C:PORT 2,3,1,4
2-3-4-1	Sets the ports of the analyzer connected to ports a, b, c and d in Figure 7-6 to test ports 2, 3, 4, and 1, respectively.	:CALC{1-16}:FSIM:EMB:TOP:C:PORT 2,3,4,1

Key Operation	Function	SCPI Command
Analysis	(Continued)	
Fixture Simulator		
De-Embedding S4P		
Topology		
Ports[*2]		
2-4-1-3	Sets the ports of the analyzer connected to ports a, b, c and d in Figure 7-6 to test ports 2, 4, 1, and 3, respectively.	:CALC{1-16}:FSIM:EMB:TOP:C:PORT 2,4,1,3
2-4-3-1	Sets the ports of the analyzer connected to ports a, b, c and d in Figure 7-6 to test ports 2, 4, 3, and 1, respectively.	:CALC{1-16}:FSIM:EMB:TOP:C:PORT 2,4,3,1
3-1-2-4	Sets the ports of the analyzer connected to ports a, b, c and d in Figure 7-6 to test ports 3, 1, 2, and 4, respectively.	:CALC{1-16}:FSIM:EMB:TOP:C:PORT 3,1,2,4
3-1-4-2	Sets the ports of the analyzer connected to ports a, b, c and d in Figure 7-6 to test ports 3, 1, 4, and 2, respectively.	:CALC{1-16}:FSIM:EMB:TOP:C:PORT 3,1,4,2
3-2-1-4	Sets the ports of the analyzer connected to ports a, b, c and d in Figure 7-6 to test ports 3, 2, 1, and 4, respectively.	:CALC{1-16}:FSIM:EMB:TOP:C:PORT 3,2,1,4
3-2-4-1	Sets the ports of the analyzer connected to ports a, b, c and d in Figure 7-6 to test ports 3, 2, 4, and 1, respectively.	:CALC{1-16}:FSIM:EMB:TOP:C:PORT 3,2,4,1
3-4-1-2	Sets the ports of the analyzer connected to ports a, b, c and d in Figure 7-6 to test ports 3, 4, 1, and 2, respectively.	:CALC{1-16}:FSIM:EMB:TOP:C:PORT 3,4,1,2
3-4-2-1	Sets the ports of the analyzer connected to ports a, b, c and d in Figure 7-6 to test ports 3, 4, 2, and 1, respectively.	:CALC{1-16}:FSIM:EMB:TOP:C:PORT 3,4,2,1
4-1-2-3	Sets the ports of the analyzer connected to ports a, b, c and d in Figure 7-6 to test ports 4, 1, 2, and 3, respectively.	:CALC{1-16}:FSIM:EMB:TOP:C:PORT 4,1,2,3
4-1-3-2	Sets the ports of the analyzer connected to ports a, b, c and d in Figure 7-6 to test ports 4, 1, 3, and 2, respectively.	:CALC{1-16}:FSIM:EMB:TOP:C:PORT 4,1,3,2
4-2-1-3	Sets the ports of the analyzer connected to ports a, b, c and d in Figure 7-6 to test ports 4, 2, 1, and 3, respectively.	:CALC{1-16}:FSIM:EMB:TOP:C:PORT 4,2,1,3
4-2-3-1	Sets the ports of the analyzer connected to ports a, b, c and d in Figure 7-6 to test ports 4, 2, 3, and 1, respectively.	:CALC{1-16}:FSIM:EMB:TOP:C:PORT 4,2,3,1
4-3-1-2	Sets the ports of the analyzer connected to ports a, b, c and d in Figure 7-6 to test ports 4, 3, 1, and 2, respectively.	:CALC{1-16}:FSIM:EMB:TOP:C:PORT 4,3,1,2
4-3-2-1	Sets the ports of the analyzer connected to ports a, b, c and d in Figure 7-6 to test ports 4, 3, 2, and 1, respectively.	:CALC{1-16}:FSIM:EMB:TOP:C:PORT 4,3,2,1
Cancel	Returns to the softkey display screen one level higher.	
Type (nwk1)	Displays the softkey to select the processing (embedding/de-embedding) of the network 1 (nwk1).	
None	Select disabled (not embedded nor de-embedded).	:CALC{1-16}:FSIM:EMB:NETW1:TYPE NONE
Embed	Select embedding.	:CALC{1-16}:FSIM:EMB:NETW1:TYPE EMB
De-Embed	Select de-embedding.	:CALC{1-16}:FSIM:EMB:NETW1:TYPE DEEM
Cancel	Returns to the softkey display screen one level higher.	
User File (nwk1)	Opens the dialog box to read in a 4 port touchstone data file that the user prepared for the network 1. You can embed/de-embed the network read in here.	:CALC{1-16}:FSIM:EMB:NETW1:FIL
Type (nwk2)	Displays the softkey to select the processing (embedding/de-embedding) of the network 2 (nwk2).	
None	Select disabled (not embedded nor de-embedded).	:CALC{1-16}:FSIM:EMB:NETW2:TYPE NONE
Embed	Select embedding.	:CALC{1-16}:FSIM:EMB:NETW2:TYPE EMB

Key Operation	Function	SCPI Command
Analysis	(Continued)	
Fixture Simulator		
De-Embedding S4P		
Topology		
Type (nwk2)		
De-Embed	Select de-embedding.	:CALC{1-16}:FSIM:EMB:NETW2:TYPE DEEM
Cancel	Returns to the softkey display screen in one level upper.	
User File (nwk2)	Opens the dialog box to read in a 4 port touchstone data file that the user prepared for the network 2. You can embed/de-embed the network read in here.	:CALC{1-16}:FSIM:EMB:NETW2:FIL
Return	Returns to the softkey display screen one level higher.	
Return	Returns to the softkey display screen one level higher.	
Return	Returns to the softkey display screen one level higher.	
Gating	Displays softkeys for setting up the gating function of the time domain function.	
Gating	Enables or disables the gating function.	:CALC{1-16}:FILT:TIME:STAT
Start	Sets the start value of the gate.	:CALC{1-16}:FILT:TIME:STAR
Stop	Sets the stop value of the gate.	:CALC{1-16}:FILT:TIME:STOP
Center	Sets the center value of the gate.	:CALC{1-16}:FILT:TIME:CENT
Span	Sets the span value of the gate.	:CALC{1-16}:FILT:TIME:SPAN
Type	Sets a type of the gate (bandpass/notch).	:CALC{1-16}:FILT:TIME:SPAN
Shape	Displays softkeys for selecting a shape of the gate.	
Maximum	Selects the maximum shape.	:CALC{1-16}:FILT:TIME:SHAP MAX
Wide	Selects the wide shape.	:CALC{1-16}:FILT:TIME:SHAP WIDE
Normal	Selects the normal shape.	:CALC{1-16}:FILT:TIME:SHAP NORM
Minimum	Selects the minimum shape.	:CALC{1-16}:FILT:TIME:SHAP MIN
Cancel	Returns to the softkey display screen one level higher.	
Return	Returns to the softkey display screen one level higher.	
Transform	Displays softkeys for setting up the transform function of the time domain function.	
Transform	Enables or disables the transform function.	:CALC{1-16}:TRAN:TIME:STAT
Start	Sets the start value.	:CALC{1-16}:TRAN:TIME:STAR
Stop	Sets the stop value.	:CALC{1-16}:TRAN:TIME:STOP
Center	Sets the center value.	:CALC{1-16}:TRAN:TIME:CENT
Span	Sets the span value.	:CALC{1-16}:TRAN:TIME:SPAN
Set Freq Low Pass	Changes the frequency range to match with the low-pass type transformation.	:CALC{1-16}:TRAN:TIME:LPFR
Type	Displays softkeys for selecting a type of the transform.	
Bandpass	Selects the bandpass mode.	:CALC{1-16}:TRAN:TIME BPAS
Lowpass Step	Selects the lowpass step mode.	:CALC{1-16}:TRAN:TIME LPAS :CALC{1-16}:TRAN:TIME:STIM STEP
Lowpass Imp	Selects the lowpass impulse mode.	:CALC{1-16}:TRAN:TIME LPAS :CALC{1-16}:TRAN:TIME:STIM STEP
Cancel	Returns to the softkey display screen one level higher.	

Key Operation	Function	SCPI Command
Analysis	(Continued)	
Transform		
Window	Displays softkeys for selecting a type of the window.	
Maximum	Selects the maximum type.	:CALC{1-16}:TRAN:TIME KBES 13
Normal	Selects the normal type.	:CALC{1-16}:TRAN:TIME KBES 6
Minimum	Selects the minimum type.	:CALC{1-16}:TRAN:TIME KBES 0
User	Displays softkeys for setting up the user window shape.	
Impulse Width	Sets the impulse width value.	:CALC{1-16}:TRAN:TIME IMP:WIDT
Rise Time	Sets the rise time of the step signal.	:CALC{1-16}:TRAN:TIME STEP:RTIM
Kaiser Beta	Sets the β value of Kaiser Bessel window.	:CALC{1-16}:TRAN:TIME KBES
Return	Returns to the softkey display screen one level higher.	
Return	Returns to the softkey display screen one level higher.	
Conversion	Displays softkeys for setting up the conversion function.	
Conversion	Enables or disables the conversion function.	:CALC{1-16}:CONV
Function	Displays softkeys for selecting a converted parameter.	
Z:Reflection	Selects the equivalent impedance in reflection measurement.	:CALC{1-16}:CONV:FUNC ZREF
Z:Transmission	Selects the equivalent impedance in transmission measurement.	:CALC{1-16}:CONV:FUNC ZTR
Y:Reflection	Selects the equivalent admittance in reflection measurement.	:CALC{1-16}:CONV:FUNC YREF
Y:Transmission	Selects the equivalent admittance in transmission measurement.	:CALC{1-16}:CONV:FUNC YTR
1/S	Selects the inverse S-parameter.	:CALC{1-16}:CONV:FUNC INV
Cancel	Returns to the softkey display screen one level higher.	
Return	Returns to the softkey display screen one level higher.	
Limit Test	Displays softkeys for setting up the limit test function.	
Limit Test	Enables or disables the limit test function.	:CALC{1-16}:LIM
Limit Line	Enables or disables the limit line display.	:CALC{1-16}:LIM:DISP
Edit Limit Line	Displays softkeys for editing the limit line.	
Delete	Deletes the line at the cursor from the limit table.	:CALC{1-16}:LIM:DATA
Add	Adds a new segment to the limit table under the line on which the cursor is located.	:CALC{1-16}:LIM:DATA
Clear Limit Table	Displays softkeys for clearing the contents of the limit table.	:CALC{1-16}:LIM:DATA
OK	Deletes all segments in the limit table.	:CALC{1-16}:LIM:DATA
Cancel	Returns to the softkey display screen one level higher.	
Export to CSV File	Exports (saves the data in formats used by other software) the limit table to a CSV (comma-separated value) file.	:MMEM:STOR:LIM
Import from CSV File	Imports (loads the data from files in different formats) a CSV (comma-separated value) file to the limit table.	:MMEM:LOAD:LIM
Return	Returns to the softkey display screen one level higher.	
Fail Sign	Turns on/off the display of the limit test fail sign.	:DISP:FSIG
Return	Returns to the softkey display screen one level higher.	
Return	Returns to the "E5070B/E5071B Menu (Top Menu)" on page 454.	

*1. Only with Options 313, 314, 413, and 414.
*2. Only with Options 413 and 414.

Average Menu

Key Operation	Function	SCPI Command
Avg	Displays softkeys for setting averaging options.	
Averaging Restart	Resets the counter and restarts from “1”.	:SENS{1-16}:AVER:CLE
Avg Factor	Sets the averaging factor. The averaging factor must be defined as an integer from 1 to 999.	:SENS{1-16}:AVER:COUN
Averaging	Enables or disables averaging execution	:SENS{1-16}:AVER
Smo Aperture	Sets the smoothing aperture using a percentage against the sweep span	:CALC{1-16}:SMO:APER
Smoothing	Enables or disables the smoothing function. When enabled, the letters “Smo” will appear in the trace status area.	:CALC{1-16}:SMO:STAT
IF Bandwidth	Sets the IF bandwidth. For more about the effective range of the IF bandwidth, refer to “Specifications and Reference Data”. If an input value is out of the range, it will automatically be modified to the closest value in the effective range. A narrow IF bandwidth slows down the sweep speed, but improves the S/N ratio.	:SENS{1-16}:BAND or :SENS{1-16}:BWID
Return	Returns to the “E5070B/E5071B Menu (Top Menu)” on page 454.	

Calibration Menu

Key Operation					Function	SCPI Command
Cal					Displays softkeys for setting and executing calibrations.	
	Correction				Enables or disables error correction.	:SENS{1-16}:CORR:STAT
	Calibrate				Displays softkeys for selecting calibration options.	
		Response (Open)			Displays softkeys for selecting options for response calibration using the OPEN standard.	
			Select Port		Displays softkeys for selecting a test port.	
				1	Selects test port 1.	:SENS{1-16}:CORR:COLL:METH:OPEN 1
				2	Selects test port 2.	:SENS{1-16}:CORR:COLL:METH:OPEN 2
				3[*1]	Selects test port 3.	:SENS{1-16}:CORR:COLL:METH:OPEN 3
				4[*2]	Selects test port 4.	:SENS{1-16}:CORR:COLL:METH:OPEN 4
				Cancel	Returns to the softkey display screen one level higher.	
			Open		Executes a response calibration using the OPEN standard on the test port selected in the **Select Port** menu. This calibration is effective for eliminating response tracking errors.	:SENS{1-16}:CORR:COLL:OPEN
			Load (Optional)		Executes an isolation calibration using the LOAD standard on the test port selected in the **Select Port** menu. This calibration is effective for eliminating directivity errors.	:SENS{1-16}:CORR:COLL:LOAD
			Done		Terminates a calibration process and calculates the calibration coefficients.	:SENS{1-16}:CORR:COLL:SAVE
			Cancel		Displays softkeys for canceling a calibration.	
				OK	Cancels the calibration in progress.	None
				Cancel	Returns to the softkey display screen one level higher.	
			Return		Returns to the softkey display screen one level higher.	
		Response (Short)			Displays softkeys for selecting options for a response calibration using the SHORT standard.	
			Select Port		Displays softkeys for selecting a test port.	
				1	Selects test port 1.	:SENS{1-16}:CORR:COLL:METH:SHOR 1
				2	Selects test port 2.	:SENS{1-16}:CORR:COLL:METH:SHOR 2
				3[*1]	Selects test port 3.	:SENS{1-16}:CORR:COLL:METH:SHOR 3
				4[*2]	Selects test port 4.	:SENS{1-16}:CORR:COLL:METH:SHOR 4
				Cancel	Returns to the softkey display screen one level higher.	
			Short		Executes a SHORT calibration on the test port selected in the **Select Port** menu. This calibration is effective for eliminating reflection tracking errors.	:SENS{1-16}:CORR:COLL:SHOR
			Load (Optional)		Executes an isolation calibration using the LOAD standard on the test port selected in the **Select Port** menu. This calibration is effective for eliminating directivity errors.	:SENS{1-16}:CORR:COLL:LOAD
			Done		Terminates a calibration process and calculates the calibration coefficients.	:SENS{1-16}:CORR:COLL:SAVE
			Cancel		Displays softkeys for canceling a calibration.	
				OK	Cancels the calibration in progress.	None
				Cancel	Returns to the softkey display screen one level higher.	
			Return		Returns to the softkey display screen one level higher.	

Key Operation	Function	SCPI Command
Cal	(Continued)	
Calibrate		
Response (Thru)	Displays softkeys for selecting options for response calibrations using the THRU standard.	
Select Ports	Displays softkeys for selecting test ports.	
2-1 (S21)	Selects the transmission test (measurement of S_{21}) for test port 1→2.	:SENS{1-16}:CORR:COLL:METH:THRU 2,1
3-1 (S31)*1	Selects the transmission test (measurement of S_{31}) for test port 1→3.	:SENS{1-16}:CORR:COLL:METH:THRU 3,1
4-1 (S41)*2	Selects the transmission test (measurement of S_{41}) for test port 1→4.	:SENS{1-16}:CORR:COLL:METH:THRU 4,1
1-2 (S12)	Selects the transmission test (measurement of S_{12}) for test port 2→1.	:SENS{1-16}:CORR:COLL:METH:THRU 1,2
3-2 (S32)*1	Selects the transmission test (measurement of S_{32}) for test port 2→3.	:SENS{1-16}:CORR:COLL:METH:THRU 3,2
4-2 (S42)*2	Selects the transmission test (measurement of S_{42}) for test port 2→4.	:SENS{1-16}:CORR:COLL:METH:THRU 4,2
1-3 (S13)*1	Selects the transmission test (measurement of S_{13}) for test port 3→1.	:SENS{1-16}:CORR:COLL:METH:THRU 1,3
2-3 (S23)*1	Selects the transmission test (measurement of S_{23}) for test port 3→2.	:SENS{1-16}:CORR:COLL:METH:THRU 2,3
4-3 (S43)*2	Selects the transmission test (measurement of S_{43}) for test port 3→4.	:SENS{1-16}:CORR:COLL:METH:THRU 4,3
1-4 (S14)*2	Selects the transmission test (measurement of S_{14}) for test port 4→1.	:SENS{1-16}:CORR:COLL:METH:THRU 1,4
2-4 (S24)*2	Selects the transmission test (measurement of S_{24}) for test port 4→2.	:SENS{1-16}:CORR:COLL:METH:THRU 2,4
3-4 (S34)*2	Selects the transmission test (measurement of S_{34}) for test port 4→3.	:SENS{1-16}:CORR:COLL:METH:THRU 3,4
Cancel	Returns to the softkey display screen one level higher.	
Thru	Executes a THRU response calibration on the test ports selected in the **Select Ports** menu. This calibration is effective for eliminating transmission tracking errors.	:SENS{1-16}:CORR:COLL:THRU
Isolation (Optional)	Executes an isolation calibration on the test ports selected in the **Select Ports** menu. This calibration is effective for eliminating isolation errors.	:SENS{1-16}:CORR:COLL:ISOL
Done	Terminates a calibration process and calculates the calibration coefficients.	:SENS{1-16}:CORR:COLL:SAVE
Cancel	Displays softkeys for canceling a calibration.	
OK	Cancels the calibration in progress.	None
Cancel	Returns to the softkey display screen one level higher.	
Return	Returns to the softkey display screen one level higher.	
1-Port Cal	Displays softkeys for executing 1-port calibrations.	
Select Port	Displays softkeys for selecting a test port.	
1	Selects test port 1.	:SENS{1-16}:CORR:COLL:METH:SOLT1 1
2	Selects test port 2.	:SENS{1-16}:CORR:COLL:METH:SOLT1 2
3*1	Selects test port 3.	:SENS{1-16}:CORR:COLL:METH:SOLT1 3
4*2	Selects test port 4.	:SENS{1-16}:CORR:COLL:METH:SOLT1 4

Key Operation	Function	SCPI Command
Cal	(Continued)	
Calibrate		
1-Port Cal		
Select Port		
Cancel	Returns to the softkey display screen one level higher.	
Open	Executes an OPEN calibration on the test port selected in the **Select Port** menu.	:SENS{1-16}:CORR:COLL:OPEN
Short	Executes a SHORT calibration on the test port selected in the **Select Port** menu.	:SENS{1-16}:CORR:COLL:SHOR
Load	Executes a LOAD calibration on the test port selected in the **Select Port** menu.	:SENS{1-16}:CORR:COLL:LOAD
Done	Terminates a calibration process and calculates the calibration coefficients.	:SENS{1-16}:CORR:COLL:SAVE
Cancel	Displays softkeys for canceling a calibration.	
OK	Cancels the calibration in progress.	None
Cancel	Returns to the softkey display screen one level higher.	
Return	Returns to the softkey display screen one level higher.	
2-Port Cal	Displays softkeys for executing a full 2-port calibration.	
Select Ports*1	Displays softkeys for selecting test ports.	
1-2	Selects test ports 1 and 2.	:SENS{1-16}:CORR:COLL:METH:SOLT2 1,2
1-3	Selects test ports 1 and 3.	:SENS{1-16}:CORR:COLL:METH:SOLT2 1,3
1-4*2	Selects test ports 1 and 4.	:SENS{1-16}:CORR:COLL:METH:SOLT2 1,4
2-3	Selects test ports 2 and 3.	:SENS{1-16}:CORR:COLL:METH:SOLT2 2,3
2-4*2	Selects test ports 2 and 4.	:SENS{1-16}:CORR:COLL:METH:SOLT2 2,4
3-4*2	Selects test ports 3 and 4.	:SENS{1-16}:CORR:COLL:METH:SOLT2 3,4
Cancel	Returns to the softkey display screen one level higher.	
Reflection	Displays softkeys for executing reflection calibrations. Symbols x and y refer to the two test ports selected in the **Select Ports** menu (x and y are always 1 and 2, respectively, for models with Option 213 or 214).	
Port x Open	Executes an OPEN reflection calibration on test port x.	:SENS{1-16}:CORR:COLL:OPEN x
Port x Short	Executes a SHORT reflection calibration on test port x.	:SENS{1-16}:CORR:COLL:SHOR x
Port x Load	Executes a LOAD reflection calibration on test port x.	:SENS{1-16}:CORR:COLL:LOAD x
Port y Open	Executes an OPEN reflection calibration on test port y.	:SENS{1-16}:CORR:COLL:OPEN y
Port y Short	Executes a SHORT reflection calibration on test port y.	:SENS{1-16}:CORR:COLL:SHOR y
Port y Load	Executes a LOAD reflection calibration on test port y.	:SENS{1-16}:CORR:COLL:LOAD y
Return	Returns to the softkey display screen one level higher.	
Transmission	Displays softkeys for executing transmission calibrations. Symbols x and y refer to the two test ports selected in the **Select Ports** menu (x and y are always 1 and 2, respectively, for models with Option 213 or 214).	
Port x-y Thru	Executes a THRU calibration on test ports x and y.	:SENS{1-16}:CORR:COLL:THRU x,y :SENS{1-16}:CORR:COLL:THRU y,x
Return	Returns to the softkey display screen one level higher.	
Isolation (Optional)	Displays softkeys for executing isolation calibrations. Symbols x and y refer to the two test ports selected in the **Select Ports** menu (x and y are always 1 and 2, respectively, for models with Option 213 or 214).	
Port x-y Isol	Executes an isolation calibration on test ports x and y.	:SENS{1-16}:CORR:COLL:ISOL x,y :SENS{1-16}:CORR:COLL:ISOL y,x
Return	Returns to the softkey display screen one level higher.	

Key Operation	Function	SCPI Command
Cal	(Continued)	
Calibrate		
2-Port Cal		
Done	Terminates a calibration process and calculates the calibration coefficients.	:SENS{1-16}:CORR:COLL:SAVE
Cancel	Displays softkeys for canceling a calibration.	
OK	Cancels the calibration in progress.	None
Cancel	Returns to the softkey display screen one level higher.	
Return	Returns to the softkey display screen one level higher.	
3-Port Cal[*1]	Displays softkeys for executing full 3-port calibrations.	
Select Ports[*2]	Displays softkeys for selecting test ports.	
1-2-3	Selects test ports 1, 2, and 3.	:SENS{1-16}:CORR:COLL:METH:SOLT3 1,2,3
1-2-4	Selects test ports 1, 2, and 4.	:SENS{1-16}:CORR:COLL:METH:SOLT3 1,2,4
1-3-4	Selects test ports 1, 3, and 4.	:SENS{1-16}:CORR:COLL:METH:SOLT3 1,3,4
2-3-4	Selects test ports 2, 3, and 4.	:SENS{1-16}:CORR:COLL:METH:SOLT3 2,3,4
Cancel	Returns to the softkey display screen one level higher.	
Reflection	Displays softkeys for executing reflection calibrations. Symbols x, y, and z refer to the three test ports selected in the **Select Ports** menu (x, y, and z are always 1, 2, and 3, respectively, for models with Option 313 or 314).	
Port x Open	Executes an OPEN reflection calibration on test port x.	:SENS{1-16}:CORR:COLL:OPEN x
Port x Short	Executes a SHORT reflection calibration on test port x.	:SENS{1-16}:CORR:COLL:SHOR x
Port x Load	Executes a LOAD reflection calibration on test port x.	:SENS{1-16}:CORR:COLL:LOAD x
Port y Open	Executes an OPEN reflection calibration on test port y.	:SENS{1-16}:CORR:COLL:OPEN y
Port y Short	Executes a SHORT reflection calibration on test port y.	:SENS{1-16}:CORR:COLL:SHOR y
Port y Load	Executes a LOAD reflection calibration on test port y.	:SENS{1-16}:CORR:COLL:LOAD y
Port z Open	Executes an OPEN reflection calibration on test port z.	:SENS{1-16}:CORR:COLL:OPEN z
Port z Short	Executes a SHORT reflection calibration on test port z.	:SENS{1-16}:CORR:COLL:SHOR z
Port z Load	Executes a LOAD reflection calibration on test port z.	:SENS{1-16}:CORR:COLL:LOAD z
Return	Returns to the softkey display screen one level higher.	
Transmission	Displays softkeys for executing transmission calibrations. Symbols x, y, and z refer to the three test ports selected in the **Select Ports** menu (x, y, and z are always 1, 2, and 3, respectively, for models with Option 313 or 314).	
Port x-y Thru	Executes a THRU calibration on test ports x and y.	:SENS{1-16}:CORR:COLL:THRU x,y :SENS{1-16}:CORR:COLL:THRU y,x
Port x-z Thru	Executes a THRU calibration on test ports x and z.	:SENS{1-16}:CORR:COLL:THRU x,z :SENS{1-16}:CORR:COLL:THRU z,x
Port y-z Thru	Executes a THRU calibration on test ports y and z.	:SENS{1-16}:CORR:COLL:THRU y,z :SENS{1-16}:CORR:COLL:THRU z,y
Return	Returns to the softkey display screen one level higher.	
Isolation (Optional)	Displays softkeys for executing isolation calibrations. Symbols x, y, and z refer to the three test ports selected in the **Select Ports** menu (x, y, and z are always 1, 2, and 3, respectively, for models with Option 313 or 314).	
Port x-y Isol	Executes an isolation test on test ports x and y.	:SENS{1-16}:CORR:COLL:ISOL x,y :SENS{1-16}:CORR:COLL:ISOL y,x
Port x-z Isol	Executes an isolation test on test ports x and z.	:SENS{1-16}:CORR:COLL:ISOL x,z :SENS{1-16}:CORR:COLL:ISOL z,x
Port y-z Isol	Executes an isolation test on test ports y and z.	:SENS{1-16}:CORR:COLL:ISOL y,z :SENS{1-16}:CORR:COLL:ISOL z,y
Return	Returns to the softkey display screen one level higher.	

Key Operation	Function	SCPI Command
Cal	(Continued)	
Calibrate		
3-Port Cal*1		
Done	Terminates a calibration process and calculates the calibration coefficients.	:SENS{1-16}:CORR:COLL:SAVE
Cancel	Displays softkeys for canceling a calibration.	
OK	Cancels the calibration in progress.	None
Cancel	Returns to the softkey display screen one level higher.	
Return	Returns to the softkey display screen one level higher.	
4-Port Cal*2	Displays softkeys for executing full 4-port calibrations.	
Reflection	Displays softkeys for executing reflection calibrations.	
Port 1 Open	Executes an OPEN calibration on test port 1.	:SENS{1-16}:CORR:COLL:OPEN 1
Port 1 Short	Executes a SHORT calibration on test port 1.	:SENS{1-16}:CORR:COLL:SHOR 1
Port 1 Load	Executes a LOAD calibration on test port 1.	:SENS{1-16}:CORR:COLL:LOAD 1
Port 2 Open	Executes an OPEN calibration on test port 2.	:SENS{1-16}:CORR:COLL:OPEN 2
Port 2 Short	Executes a SHORT calibration on test port 2.	:SENS{1-16}:CORR:COLL:SHOR 2
Port 2 Load	Executes a LOAD calibration on test port 2.	:SENS{1-16}:CORR:COLL:LOAD 2
Port 3 Open	Executes an OPEN calibration on test port 3.	:SENS{1-16}:CORR:COLL:OPEN 3
Port 3 Short	Executes a SHORT calibration on test port 3.	:SENS{1-16}:CORR:COLL:SHOR 3
Port 3 Load	Executes a LOAD calibration on test port 3.	:SENS{1-16}:CORR:COLL:LOAD 3
Port 4 Open	Executes an OPEN calibration on test port 4.	:SENS{1-16}:CORR:COLL:OPEN 4
Port 4 Short	Executes a SHORT calibration on test port 4.	:SENS{1-16}:CORR:COLL:SHOR 4
Port 4 Load	Executes a LOAD calibration on test port 4.	:SENS{1-16}:CORR:COLL:LOAD 4
Return	Returns to the softkey display screen one level higher.	
Transmission	Displays softkeys for executing transmission calibrations.	
Port 1-2 Thru	Executes a THRU calibration between test ports 1 and 2.	:SENS{1-16}:CORR:COLL:THRU 1,2 :SENS{1-16}:CORR:COLL:THRU 2,1
Port 1-3 Thru	Executes a THRU calibration between test ports 1 and 3.	:SENS{1-16}:CORR:COLL:THRU 1,3 :SENS{1-16}:CORR:COLL:THRU 3,1
Port 1-4 Thru	Executes a THRU calibration between test ports 1 and 4.	:SENS{1-16}:CORR:COLL:THRU 1,4 :SENS{1-16}:CORR:COLL:THRU 4,1
Port 2-3 Thru	Executes a THRU calibration between test ports 2 and 3.	:SENS{1-16}:CORR:COLL:THRU 2,3 :SENS{1-16}:CORR:COLL:THRU 3,2
Port 2-4 Thru	Executes a THRU calibration between test ports 2 and 4.	:SENS{1-16}:CORR:COLL:THRU 2,4 :SENS{1-16}:CORR:COLL:THRU 4,2
Port 3-4 Thru	Executes a THRU calibration between test ports 3 and 4.	:SENS{1-16}:CORR:COLL:THRU 3,4 :SENS{1-16}:CORR:COLL:THRU 4,3
Return	Returns to the softkey display screen one level higher.	
Isolation (Optional)	Displays softkeys for executing isolation calibrations.	
Port 1-2 Isol	Executes an isolation calibration on test ports 1 and 2.	:SENS{1-16}:CORR:COLL:ISOL 1,2 :SENS{1-16}:CORR:COLL:ISOL 2,1
Port 1-3 Isol	Executes an isolation calibration on test ports 1 and 3.	:SENS{1-16}:CORR:COLL:ISOL 1,3 :SENS{1-16}:CORR:COLL:ISOL 3,1
Port 1-4 Isol	Executes an isolation calibration on test ports 1 and 4.	:SENS{1-16}:CORR:COLL:ISOL 1,4 :SENS{1-16}:CORR:COLL:ISOL 4,1
Port 2-3 Isol	Executes an isolation calibration on test ports 2 and 3.	:SENS{1-16}:CORR:COLL:ISOL 2,3 :SENS{1-16}:CORR:COLL:ISOL 3,2

Key Operation	Function	SCPI Command
Cal	(Continued)	
Calibrate		
4-Port Cal*2		
Isolation (Optional)		
Port 2-4 Isol	Executes an isolation calibration on test ports 2 and 4.	:SENS{1-16}:CORR:COLL:ISOL 2,4 :SENS{1-16}:CORR:COLL:ISOL 4,2
Port 3-4 Isol	Executes an isolation calibration on test ports 3 and 4.	:SENS{1-16}:CORR:COLL:ISOL 3,4 :SENS{1-16}:CORR:COLL:ISOL 4,3
Return	Returns to the softkey display screen one level higher.	
Done	Terminates a calibration process and calculates the calibration coefficients.	:SENS{1-16}:CORR:COLL:SAVE
Cancel	Displays softkeys for canceling a calibration.	
OK	Cancels the calibration in progress.	None
Cancel	Returns to the softkey display screen one level higher.	
Return	Returns to the softkey display screen one level higher.	
Return	Returns to the softkey display screen one level higher.	
ECal	Displays softkeys for executing ECal (Electronic Calibrations).	:CALC{1-16}:SEL:FORM GDEL
1-Port ECal	Displays softkeys for executing 1-port ECal	
Port 1	Executes a 1-port ECal on test port 1.	:SENS{1-16}:CORR:COLL:ECAL:SOLT1 1
Port 2	Executes a 1-port ECal on test port 2.	:SENS{1-16}:CORR:COLL:ECAL:SOLT1 2
Port 3*1	Executes a 1-port ECal on test port 3.	:SENS{1-16}:CORR:COLL:ECAL:SOLT1 3
Port 4*2	Executes a 1-port ECal on test port 4.	:SENS{1-16}:CORR:COLL:ECAL:SOLT1 4
Return	Returns to the softkey display screen one level higher.	
2-Port ECal	Options 213 and 214: Execute a 2-port ECal. Options 313, 314, 413, and 414: Display softkeys for executing a 2-port ECal.	
Port 1-2*1	Executes a 2-port ECal on test ports 1 and 2.	:SENS{1-16}:CORR:COLL:ECAL:SOLT2 1,2
Port 1-3*1	Executes a 2-port ECal on test ports 1 and 3.	:SENS{1-16}:CORR:COLL:ECAL:SOLT2 1,3
Port 1-4*2	Executes a 2-port ECal on test ports 1 and 4.	:SENS{1-16}:CORR:COLL:ECAL:SOLT2 1,4
Port 2-3*1	Executes a 2-port ECal on test ports 2 and 3.	:SENS{1-16}:CORR:COLL:ECAL:SOLT2 2,3
Port 2-4*2	Executes a 2-port ECal on test ports 2 and 4.	:SENS{1-16}:CORR:COLL:ECAL:SOLT2 2,4
Port 3-4*2	Executes a 2-port ECal on test ports 3 and 4.	:SENS{1-16}:CORR:COLL:ECAL:SOLT2 3,4
Return*1	Returns to the softkey display screen one level higher.	
3-Port ECal	Options 313 and 314: Execute a 3-port ECal. Options 413 and 414: Display softkeys for executing a 3-port ECal.	
Port 1-2-3*2	Executes a 3-port ECal on test ports 1, 2, and 3.	:SENS{1-16}:CORR:COLL:ECAL:SOLT3 1,2,3
Port 1-2-4*2	Executes a 3-port ECal on test ports 1, 2, and 4.	:SENS{1-16}:CORR:COLL:ECAL:SOLT3 1,2,4
Port 1-3-4*2	Executes a 3-port ECal on test ports 1, 3, and 4.	:SENS{1-16}:CORR:COLL:ECAL:SOLT3 1,3,4
Port 2-3-4*2	Executes a 3-port ECal on test ports 2, 3, and 4.	:SENS{1-16}:CORR:COLL:ECAL:SOLT3 2,3,4
Return*2	Returns to the softkey display screen one level higher.	
4-Port ECal*2	Executes a 4-port ECal.	:SENS{1-16}:CORR:COLL:ECAL:SOLT4 1,2,3,4

Key Operation	Function	SCPI Command
Cal	(Continued)	
ECal		
Thru ECal	Display softkeys for executing a THRU ECal.	
2-1 (S21)	Executes a THRU ECal for test port 1→2.	:SENS{1-16}:CORR:COLL:ECAL:THRU 2,1
3-1 (S31)*1	Executes a THRU ECal for test port 1→3.	:SENS{1-16}:CORR:COLL:ECAL:THRU 3,1
4-1 (S41)*2	Executes a THRU ECal for test port 1→4.	:SENS{1-16}:CORR:COLL:ECAL:THRU 4,1
1-2 (S12)	Executes a THRU ECal for test port 2→1.	:SENS{1-16}:CORR:COLL:ECAL:THRU 1,2
3-2 (S32)*1	Executes a THRU ECal for test port 2→3.	:SENS{1-16}:CORR:COLL:ECAL:THRU 3,2
4-2 (S42)*2	Executes a THRU ECal for test port 2→4.	:SENS{1-16}:CORR:COLL:ECAL:THRU 4,2
1-3 (S13)*1	Executes a THRU ECal for test port 3→1.	:SENS{1-16}:CORR:COLL:ECAL:THRU 1,3
2-3 (S23)*1	Executes a THRU ECal for test port 3→2.	:SENS{1-16}:CORR:COLL:ECAL:THRU 2,3
4-3 (S43)*2	Executes a THRU ECal for test port 3→4.	:SENS{1-16}:CORR:COLL:ECAL:THRU 4,3
1-4 (S14)*2	Executes a THRU ECal for test port 4→1.	:SENS{1-16}:CORR:COLL:ECAL:THRU 1,4
2-4 (S24)*2	Executes a THRU ECal for test port 4→2.	:SENS{1-16}:CORR:COLL:ECAL:THRU 2,4
3-4 (S34)*2	Executes a THRU ECal for test port 4→3.	:SENS{1-16}:CORR:COLL:ECAL:THRU 3,4
Return	Returns to the softkey display screen one level higher.	
Isolation	Enables or disables isolation calibration.	:SENS{1-16}:CORR:COLL:ECAL:ISOL
Characterization	Display softkeys for selecting the ECal characteristic.	
Factory	Selects the factory-default characteristic.	:SENS{1-16}:CORR:COLL:ECAL:UCH CHAR0
User1	Selects the characteristic stored at location number 1 in the ECal's flash memory.	:SENS{1-16}:CORR:COLL:ECAL:UCH CHAR1
User2	Selects the characteristic stored at location number 2 in the ECal's flash memory.	:SENS{1-16}:CORR:COLL:ECAL:UCH CHAR2
User3	Selects the characteristic stored at location number 3 in the ECal's flash memory.	:SENS{1-16}:CORR:COLL:ECAL:UCH CHAR3
User4	Selects the characteristic stored at location number 4 in the ECal's flash memory.	:SENS{1-16}:CORR:COLL:ECAL:UCH CHAR4
User5	Selects the characteristic stored at location number 5 in the ECal's flash memory.	:SENS{1-16}:CORR:COLL:ECAL:UCH CHAR5
Cancel	Returns to the softkey display screen one level higher.	
Characterization Info	Displays the information of the selected ECal characteristic.	None
Confidence Check	Executes the confidence check of the calibration coefficients.	:SENS{1-16}:CORR:COLL:ECAL:CCH
Return	Returns to the softkey display screen one level higher.	
Property	Enables or disables the display of calibration property. When enabled, calibration status information between test ports will be displayed in a matrix format in the lower-right corner of the channel window.	:SENS{1-16}:CORR:PROP
Cal Kit	Displays softkeys for selecting calibration kits. Up to ten calibration kits may be defined. Calibration kits 85033E, 85033D, 85052D, 85032F, 85032B, and 85036B/E are pre-defined with default settings.	
85033E	Selects calibration kit 85033E.	:SENS{1-16}:CORR:COLL:CKIT 1
85033D	Selects calibration kit 85033D.	:SENS{1-16}:CORR:COLL:CKIT 2
85052D	Selects calibration kit 85052D.	:SENS{1-16}:CORR:COLL:CKIT 3
85032F	Selects calibration kit 85032F.	:SENS{1-16}:CORR:COLL:CKIT 4
85032B	Selects calibration kit 85032B.	:SENS{1-16}:CORR:COLL:CKIT 5

Key Operation	Function	SCPI Command
Cal	(Continued)	
Modify Cal Kit		
User	Selects calibration kit 85036B/E.	:SENS{1-16}:CORR:COLL:CKIT 6
User	Selects a user-defined calibration kit.	:SENS{1-16}:CORR:COLL:CKIT 7
User	Selects a user-defined calibration kit.	:SENS{1-16}:CORR:COLL:CKIT 8
User	Selects a user-defined calibration kit.	:SENS{1-16}:CORR:COLL:CKIT 9
User	Selects a user-defined calibration kit.	:SENS{1-16}:CORR:COLL:CKIT 10
Cancel	Returns to the softkey display screen one level higher.	
Modify Cal Kit	Displays softkeys for changing the definition of the calibration kit selected in the **Cal Kit** menu.	CALC{1-16}:SEL:FORM SCOM
Define STDs	Displays softkeys for defining the standard for a calibration kit. The label **(Std Name)** on each softkey represents the name of each standard. As a default setting, undefined standards are tagged with a **No Name** label. Up to 21 standards may be defined.	
1. (Std Name)	Displays softkeys for changing the definition of **1. (Std Name)**.	
Label	Defines the name of the standard No.1. Once named, the new name will appear as a label for the corresponding softkey, which is represented as **(Std Name)** in this manual.	:SENS{1-16}:CORR:COLL:CKIT:STAN1:LAB
STD Type	Displays softkeys for setting the types of standards. A standard type is a classification of a standard based on its form and construction. There are five standard types: OPEN, SHORT, LOAD, delay/THRU, and arbitrary impedance.	
Open	Selects “OPEN” as the standard type.	:SENS{1-16}:CORR:COLL:CKIT:STAN1:TYPE OPEN
Short	Selects “SHORT” as the standard type.	:SENS{1-16}:CORR:COLL:CKIT:STAN1:TYPE SHOR
Load	Selects “LOAD” as the standard type.	:SENS{1-16}:CORR:COLL:CKIT:STAN1:TYPE LOAD
Delay/ Thru	Selects “delay/THRU” as the standard type.	:SENS{1-16}:CORR:COLL:CKIT:STAN1:TYPE THRU
Arbitrary	Selects “arbitrary impedance” as the standard type.	:SENS{1-16}:CORR:COLL:CKIT:STAN1:TYPE ARBI
None	Does not select any standard type.	:SENS{1-16}:CORR:COLL:CKIT:STAN1:TYPE NONE
Cancel	Returns to the softkey display screen one level higher.	
C0	Sets the value of C0 (F) for the standard. The fringe capacitance (F) of a standard is determined by the following formula: $C = (C0) + (C1 \times F) + (C2 \times F^2) + (C3 \times F^3)$ (F: measurement frequency [Hz])	:SENS{1-16}:CORR:COLL:CKIT:STAN1:C0
C1	Sets the value of C1 (F/Hz) for the standard.	:SENS{1-16}:CORR:COLL:CKIT:STAN1:C1
C2	Sets the value of C2 (F/Hz^2) for the standard.	:SENS{1-16}:CORR:COLL:CKIT:STAN1:C2
C3	Sets the value of C3 (F/Hz^3) for the standard.	:SENS{1-16}:CORR:COLL:CKIT:STAN1:C3
L0	Sets the value of L0 (H) for the standard. The residual inductance (H) of a standard is determined by the following formula: $L = (L0) + (L1 \times F) + (L2 \times F^2) + (L3 \times F^3)$ (F: measurement frequency [Hz])	:SENS{1-16}:CORR:COLL:CKIT:STAN1:L0
L1	Sets the value of L1 (H/Hz) for the standard.	:SENS{1-16}:CORR:COLL:CKIT:STAN1:L1
L2	Sets the value of L2 (H/Hz^2) for the standard.	:SENS{1-16}:CORR:COLL:CKIT:STAN1:L2
L3	Sets the value of L3 (H/Hz^3) for the standard.	:SENS{1-16}:CORR:COLL:CKIT:STAN1:L3

Key Operation	Function	SCPI Command
Cal	(Continued)	
Modify Cal Kit		
Define STDs		
1. (Std Name)		
Offset Delay	Sets the offset delay (sec.) for the standard. The offset delay is a delay caused by the length of the transmission line between the standard to be defined and the actual measurement plane. For the OPEN, SHORT, and LOAD standards, input the one-way transmission time (sec.) from the measurement plane to the standard. For the THRU standard, input the one-way transmission time (sec.) from one measurement plane to the other. The offset delay can be obtained either by measuring it or by dividing the exact physical length of the standard by the velocity factor.	:SENS{1-16}:CORR:COLL:CKIT:STAN1:DEL
Offset Z0	Sets the impedance Z0 between the measurement plane and the standard being defined. Normally, this value is set to the characteristic impedance of the system.	:SENS{1-16}:CORR:COLL:CKIT:STAN1:Z0
Offset Loss	Sets the offset loss for the standard. The offset loss is an energy loss due to skin effect on the length of single coaxial cable. Input the energy loss at 1 GHz using the unit Ω/sec. In most applications, setting the offset loss to “0” should not affect the result. The offset loss of a standard can be determined by measuring the offset delay and the loss at 1 GHz and then substituting them in the following formula: $\mathrm{Loss}(\Omega/s) = \frac{\mathrm{loss(dB)} \times Z_0(\Omega)}{4.3429(\mathrm{dB}) \times \mathrm{delay(s)}}$	:SENS{1-16}:CORR:COLL:CKIT:STAN1:LOSS
Arb. Impedance	Sets the value for the LOAD standard. Use this option to input an arbitrary impedance that is different from the system impedance.	:SENS{1-16}:CORR:COLL:CKIT:STAN1:ARB
Return	Returns to the softkey display screen one level higher.	
2. (Std Name)	Displays softkeys for changing the definition of **2. (Std Name)**. The lower-level softkeys displayed are the same as those for **1. (Std Name)**.	
. .	. .	
21. (Std Name)	Displays softkeys for changing the definition of **21. (Std Name)**. The lower-level softkeys displayed are the same as those for **1. (Std Name)**.	
Return	Returns to the softkey display screen one level higher.	
Specify CLSs	Displays softkeys for setting the classes of standards. A standard class refers to a set of standards that are used in the process of calibration. For each class of OPEN, SHORT, LOAD, and THRU, designate standards to be used from among the 21 standards.	
Open	Displays softkeys for selecting standards for the OPEN standard class.	
Set All	Displays softkeys for selecting standards for the OPEN standard class that applies to all test ports.	
1. (Std Name)	Includes **1. (Std Name)** in the OPEN standard class.	:SENS{1-16}:CORR:COLL:CKIT:ORD:OPEN x,1
2. (Std Name)	Includes **2. (Std Name)** in the OPEN standard class.	:SENS{1-16}:CORR:COLL:CKIT:ORD:OPEN x,2
. .	. .	. .
21. (Std Name)	Includes **21. (Std Name)** in the OPEN standard class.	:SENS{1-16}:CORR:COLL:CKIT:ORD:OPEN x,21
Cancel	Returns to the softkey display screen one level higher.	

Key Operation	Function	SCPI Command
Cal	(Continued)	
Modify Cal Kit		
Specify CLSs		
Open		
Port 1	Displays softkeys for selecting standards for the OPEN standard class that applies only to test port 1. The lower-level softkeys are the same as those for **Set All**.	
Port 2	Displays softkeys for selecting standards for the OPEN standard class that applies only to test port 2. The lower-level softkeys are the same as those for **Set All**.	
Port 3*1	Displays softkeys for selecting standards for the OPEN standard class that applies only to test port 3. The lower-level softkeys are the same as those for **Set All**.	
Port 4*2	Displays softkeys for selecting standards for the OPEN standard class that applies only to test port 4. The lower-level softkeys are the same as those for **Set All**.	
Return	Returns to the softkey display screen one level higher.	
Short	Displays softkeys for selecting standards for the SHORT standard class. The lower-level softkeys displayed are the same as those for **Open**.	:SENS{1-16}:CORR:COLL:CKIT:ORD:SHOR
Load	Displays softkeys for selecting standards for the LOAD standard class. The lower-level softkeys displayed are the same as those for **Open**.	:SENS{1-16}:CORR:COLL:CKIT:ORD:LOAD
Thru	Displays softkeys for selecting standards for the THRU standard class. The lower-level softkeys displayed are the same as those for **Open**.	:SENS{1-16}:CORR:COLL:CKIT:ORD:THRU
Return	Returns to the softkey display screen one level higher.	
Label Kit	Allows the user to label the calibration kit.	:SENS{1-16}:CORR:COLL:CKIT:LAB
Restore Cal Kit	Displays softkeys for initializing the definition of calibration kit.	
OK	Restores the definition of the calibration kit selected by **Cal Kit** to factory default settings.	:SENS{1-16}:CORR:COLL:CKIT:RES
Cancel	Returns to the softkey display screen one level higher.	
Return	Returns to the softkey display screen one level higher.	
Port Extensions	Displays softkeys for extending ports.	
Extensions	Enables or disables the port extension function.	:SENS{1-16}:CORR:EXT
Extension Port 1	Sets the value for test port 1 extension (sec.).	:SENS{1-16}:CORR:EXT:PORT 1
Extension Port 2	Sets the value for test port 2 extension (sec.).	:SENS{1-16}:CORR:EXT:PORT 2
Extension Port 3*1	Sets the value for test port 3 extension (sec.).	:SENS{1-16}:CORR:EXT:PORT 3
Extension Port 4*2	Sets the value for test port 4 extension (sec.).	:SENS{1-16}:CORR:EXT:PORT 4
Return	Returns to the softkey display screen one level higher.	
Velocity Factor	Sets the velocity factor.	:SENS{1-16}:CORR:RVEL:COAX
Power Calibration	Displays the softkey to execute the power calibration.	
Select Port	Displays the softkey to select the test port you want to calibrate.	
1	Selects test port 1.	None
2	Selects test port 2.	None
3	Selects test port 3.	None
4	Selects test port 4.	None
Correction	Toggles on/off the power level error correction.	:SOUR{1-16}:POW:PORT{1-4}:CORR
Take Cal Sweep	Executes the measurement of power calibration data.	:SOUR{1-16}:POW:PORT{1-4}:CORR:COLL
Abort	Aborts the measurement of power calibration data.	None

Key Operation	Function	SCPI Command
Cal	(Continued)	
Power Calibration		
Use Sensor	Selects the channel of the power sensor you want to use for the measurement of power calibration data.	None
Num of Readings	Sets the number of power level measurements per measurement point (averaging factor).	:SOUR{1-16}:POW:PORT{1-4}:CORR:COLL:AVER
Loss Compen	Displays the softkey to set the loss correction.	
Compensation	Toggles on/off the loss correction.	:SOUR{1-16}:POW:PORT{1-4}:CORR:COLL:TABL:LOSS
Delete	Deletes the cursor line on the loss correction table.	:SOUR{1-16}:POW:PORT{1-4}:CORR:COLL:TABL:LOSS:DATA
Add	Inserts a new segment above the cursor line on the loss correction table.	:SOUR{1-16}:POW:PORT{1-4}:CORR:COLL:TABL:LOSS:DATA
Clear Loss Table	Displays the softkey to clear the loss correction table.	
OK	Deletes all segments in the loss correction table.	None
Cancel	Returns to the softkey display in one level upper.	
Export to CSV File	Exports (writes in another software format) the content of the loss correction table as a CSV (comma separated value) format file.	:MMEM:STOR:PLOS{1-4}
Import from CSV File	Imports a saved CSV (comma separated value) format file into the loss correction table.	:MMEM:LOAD:PLOS{1-4}
Return	Returns to the softkey display in one level upper.	
Sensor A Settings	Displays the softkey to set the calibration coefficient for the power sensor connected to channel A.	
Ref Cal Factor	Sets the value of the reference calibration coefficient.	:SOUR:POW:PORT:CORR:COLL:ASEN:RCF
Delete	Deletes the cursor line on the calibration coefficient table.	:SOUR:POW:PORT:CORR:COLL:TABL:ASEN:DATA
Add	Inserts a new segment above the cursor line on the calibration coefficient table.	:SOUR:POW:PORT:CORR:COLL:TABL:ASEN:DATA
Clear Loss Table	Displays the softkey to clear the calibration coefficient table.	
OK	Deletes all segments in the calibration coefficient table.	None
Cancel	Returns to the softkey display in one level upper.	
Export to CSV File	Exports (writes in another software format) the content of the calibration coefficient table as a CSV (comma separated value) format file.	:MMEM:STOR:ASCF
Import from CSV File	Imports a saved CSV (comma separated value) format file into the calibration coefficient table.	:MMEM:LOAD:ASCF
Return	Returns to the softkey display in one level upper.	
Sensor B Settings	Displays the softkey to set the calibration coefficient for the power sensor connected to channel B.	
Ref Cal Factor	Sets the value of the reference calibration coefficient.	:SOUR:POW:PORT:CORR:COLL:BSEN:RCF
Delete	Deletes the cursor line on the calibration coefficient table.	:SOUR:POW:PORT:CORR:COLL:TABL:BSEN:DATA
Add	Inserts a new segment above the cursor line on the calibration coefficient table.	:SOUR:POW:PORT:CORR:COLL:TABL:BSEN:DATA
Clear Loss Table	Displays the softkey to clear the calibration coefficient table.	
OK	Deletes all segments in the calibration coefficient table.	None
Cancel	Returns to the softkey display in one level upper.	
Export to CSV File	Exports (writes in another software format) the content of the calibration coefficient table as a CSV (comma separated value) format file.	:MMEM:STOR:BSCF

Key Operation	Function	SCPI Command
Cal	(Continued)	
Power Calibration		
Sensor B Settings		
Import from CSV File	Imports a saved CSV (comma separated value) format file into the calibration coefficient table.	:MMEM:LOAD:BSCF
Return	Returns to the softkey display in one level upper.	
Return	Returns to the softkey display screen one level higher.	
Return	Returns to the “E5070B/E5071B Menu (Top Menu)” on page 454.	

*1. Only with Options 313, 314, 413, and 414.
*2. Only with Options 413 and 414.

Display Menu

Key Operation	Function	SCPI Command
Display	Displays softkeys for setting up display options.	
Allocate Channels	Displays softkeys for setting the number of channels to be displayed and the channel window arrangement. The execution of measurements does not depend on the display status of each channel (measurements can be performed on channels that are not displayed). The user can set up each channel for measurements (by selecting the sweep mode and the trigger source) from the "Trigger Menu" on page 510.	
× 1	Displays channel 1 using the entire display screen.	:DISP:SPL D1
× 2	Displays channel windows by bisecting the screen horizontally with channel 1 on the left and channel 2 on the right.	:DISP:SPL D12
× 2	Displays channel windows by bisecting the screen vertically, with channel 1 displayed above channel 2.	:DISP:SPL D1_2
× 2	Displays channel windows by splitting the screen vertically (with the left window occupying 2/3 of the screen), with channel 1 on the left and channel 2 on the right.	:DISP:SPL D112
× 2	Displays channel windows by splitting the screen vertically (with the upper window occupying 2/3 of the screen), and channel 1 displayed above channel 2.	:DISP:SPL D1_1_2
× 3	Displays channel windows by trisecting the screen horizontally, with channels 1, 2, and 3 displayed from left to right.	:DISP:SPL D123
× 3	Displays channel windows by trisecting the screen vertically with channels 1, 2, and 3 arranged from top to bottom.	:DISP:SPL D1_2_3
× 3	Displays channel windows by bisecting the screen vertically and then bisecting the upper window horizontally with channels 1, 2, and 3 displayed, respectively, in the upper-left corner, upper-right corner, and bottom.	:DISP:SPL D12_33
× 3	Displays channel windows by bisecting the screen vertically and then bisecting the lower window horizontally with channels 1, 2, and 3 displayed, respectively, in the top, lower-left corner, and lower-right corner.	:DISP:SPL D11_23
× 3	Displays channel windows by bisecting the screen horizontally and then bisecting the left window vertically, with channels 1, 2, and 3 displayed, respectively, in the upper-left corner, lower-left corner, and on the right.	:DISP:SPL D13_23
× 3	Displays channel windows by bisecting the screen horizontally and then bisecting the right window vertically, with channels 1, 2, and 3 displayed, respectively, on the left, in the upper-right corner, and lower-right corner.	:DISP:SPL D12_13
× 4	Displays channel windows by splitting the screen horizontally into four equal parts, with channels 1, 2, 3, and 4 displayed from left to right.	:DISP:SPL D1234
× 4	Displays channel windows by splitting the screen vertically into four equal parts, with channels 1, 2, 3, and 4 displayed from top to bottom.	:DISP:SPL D1_2_3_4
× 4	Displays channel windows by bisecting the screen both vertically and horizontally with channels 1, 2, 3, and 4 in the upper-left, upper-right, lower-left corner, and lower-right corners, respectively.	:DISP:SPL D12_34
× 6	Displays channel windows by trisecting the screen horizontally and then bisecting each window vertically, with channels 1, 2, 3, 4, 5, and 6 displayed.	:DISP:SPL D123_456
× 6	Displays channel windows by bisecting the screen horizontally and trisecting each window vertically, with channels 1, 2, 3, 4, 5, and 6 displayed.	:DISP:SPL D12_34_56
× 8	Displays channel windows by splitting the screen horizontally into four equal parts and then bisecting each window vertically, with channels 1, 2, 3, and 4 displayed in upper windows from left to right, and channels 5, 6, 7, and 8 displayed in lower windows from left to right.	:DISP:SPL D1234_5678

Key Operation	Function	SCPI Command
Display	(Continued)	
Allocate Channels		
×8	Displays channel windows by splitting the screen vertically into four equal parts and then bisecting each window horizontally, with channels 1, 3, 5, and 7 displayed in left windows from top to bottom, and channels 2, 4, 6, and 8 displayed in right windows from top to bottom.	:DISP:SPL D12_34_56_78
×9	Displays channels 1, 2, and 3 from the left of the upper part, channels 4,5, and 6 from the left of the middle part, and channels 7, 8, and 9 from the left of the lower part in the display area divided into 9 as softkey labels.	:DISP:SPL D123_456_789
×12	Displays channels 1, 2, 3, and 4 from the left of the upper part, channels 5, 6, 7, and 8 from the left of the middle part, and channels 9, 10, 11, and 12 from the left of the lower part in the display area divided into 12 as softkey labels.	:DISP:SPL D1234__9ABC
×12	Displays channels 1, 2, and 3 from the left of the 1st line, channels 4, 5, and 6 from the left of the 2nd line, channels 7, 8, and 9 from the left of the 3rd line, and channels 10, 11, and 12 from the left of the 4th line in the display area divided into 12 as softkey labels.	:DISP:SPL D123__ABC
×16	Displays channels 1, 2, 3, and 4 from the left of the 1st line, channels 5, 6, 7, and 8 from the left of the 2nd line, channels 9, 10, 11, and 12 from the left of the 3rd line, and channels 13, 14, 15, and 16 from the left of the 4th line in the display area divided into 16 as softkey labels.	:DISP:SPL D1234_CDEF
Cancel	Returns to the softkey display screen one level higher.	
Number of Traces	Displays softkeys for setting the number of traces.	
1	Sets the number of traces to one for the active channel.	:CALC{1-16}:PAR:COUN 1
2	Sets the number of traces to two for the active channel.	:CALC{1-16}:PAR:COUN 2
3	Sets the number of traces to three for the active channel.	:CALC{1-16}:PAR:COUN 3
4	Sets the number of traces to four for the active channel.	:CALC{1-16}:PAR:COUN 4
5	Sets the number of traces to five for the active channel.	:CALC{1-16}:PAR:COUN 5
6	Sets the number of traces to six for the active channel.	:CALC{1-16}:PAR:COUN 6
7	Sets the number of traces to seven for the active channel.	:CALC{1-16}:PAR:COUN 7
8	Sets the number of traces to eight for the active channel.	:CALC{1-16}:PAR:COUN 8
9	Sets the number of traces to nine for the active channel.	:CALC{1-16}:PAR:COUN 9
Cancel	Returns to the softkey display screen one level higher.	
Allocate Traces	Displays softkeys for setting up the trace display arrangement. Traces are displayed based on the order determined from the graph arrangement currently being used. If the number of traces is less than the number of graphs, nothing will be displayed in the extra area(s). If the number of traces is more than the number of graphs, the remaining traces will be displayed by going back to the first graph, overlapping existing traces.	
×1	Displays channel 1 using the entire channel window.	:DISP:WIND{1-16}:SPL D1
×2	Displays graphs by bisecting the screen horizontally with graph 1 on the left and graph 2 on the right.	:DISP:WIND{1-16}:SPL D1_2
×2	Displays graphs by bisecting the screen vertically, with graph 1 displayed above graph 2.	:DISP:WIND{1-16}:SPL D12
×2	Displays graphs by splitting the screen vertically (with the left window occupying 2/3 of the screen), with graph 1 on the left and graph 2 on the right.	:DISP:WIND{1-16}:SPL D112
×2	Displays graphs by splitting the screen vertically (with the upper window occupying 2/3 of the screen), and graph 1 displayed above graph 2.	:DISP:WIND{1-16}:SPL D1_1_2
×3	Displays graphs by trisecting the screen horizontally, with graphs 1, 2, and 3 displayed from left to right.	:DISP:WIND{1-16}:SPL D123
×3	Displays graphs by trisecting the screen vertically with graphs 1, 2, and 3 arranged from top to bottom.	:DISP:WIND{1-16}:SPL D1_2_3

Key Operation	Function	SCPI Command
Display	(Continued)	
Allocate Traces		
×3	Displays graphs by bisecting the screen vertically and then bisecting the upper window horizontally with graphs 1, 2, and 3 displayed, respectively, in the upper-left corner, upper-right corner, and bottom.	:DISP:WIND{1-16}:SPL D12_33
×3	Displays graphs by bisecting the screen vertically and then bisecting the lower window horizontally with graphs 1, 2, and 3 displayed, respectively, in the top, lower-left corner, and lower-right corner.	:DISP:WIND{1-16}:SPL D11_23
×3	Displays graphs by bisecting the screen horizontally and then bisecting the left window vertically, with graphs 1, 2, and 3 displayed, respectively, in the upper-left corner, lower-left corner, and on the right.	:DISP:WIND{1-16}:SPL D13_23
×3	Displays graphs by bisecting the screen horizontally and then bisecting the right window vertically, with graphs 1, 2, and 3 displayed, respectively, on the left, in the upper-right corner, and lower-right corner.	:DISP:WIND{1-16}:SPL D12_13
×4	Displays graphs by splitting the screen horizontally into four equal parts, with graphs 1, 2, 3, and 4 displayed from left to right.	:DISP:WIND{1-16}:SPL D1234
×4	Displays graphs by splitting the screen vertically into four equal parts, with graphs 1, 2, 3, and 4 displayed from top to bottom.	:DISP:WIND{1-16}:SPL D1_2_3_4
×4	Displays graphs by bisecting the screen both vertically and horizontally with graphs 1, 2, 3, and 4 in the upper-left, upper-right, lower-left corner, and lower-right corners, respectively.	:DISP:WIND{1-16}:SPL D12_34
×6	Displays graphs by trisecting the screen horizontally and then bisecting each window vertically, with graphs 1, 2, 3, 4, 5, and 6 displayed.	:DISP:WIND{1-16}:SPL D123_456
×6	Displays graphs by bisecting the screen horizontally and trisecting each window vertically, with graphs 1, 2, 3, 4, 5, and 6 displayed.	:DISP:WIND{1-16}:SPL D12_34_56
×8	Displays graphs by splitting the screen horizontally into four equal parts and then bisecting each window vertically, with graphs 1, 2, 3, and 4 displayed in upper windows from left to right, and graphs 5, 6, 7, and 8 displayed in lower windows from left to right.	:DISP:WIND{1-16}:SPL D1234_5678
×8	Displays graphs by splitting the screen vertically into four equal parts and then bisecting each window horizontally, with graphs 1, 3, 5, and 7 displayed in left windows from top to bottom, and graphs 2, 4, 6, and 8 displayed in right windows from top to bottom.	:DISP:WIND{1-16}:SPL D12_34_56_78
×9	Displays graphs 1, 2, and 3 from the left of the upper part, graphs 4,5, and 6 from the left of the middle part, and graphs 7,8, and 9 from the left of the lower part in the display area divided into 9 as softkey labels	:DISP:WIND{1-16}:SPL D123_456_789
×12	Displays graphs 1, 2, 3, and 4 from the left of the upper part, graphs 5, 6, 7, and 8 from the left of the middle part, and graphs 9, 10, 11, and 12 from the left of the lower part in the display area divided into 12 as softkey labels.	:DISP:WIND{1-16}:SPL D1234__9ABC
×12	Displays graphs 1, 2, and 3 from the left of the 1st line, graphs 4, 5, and 6 from the left of the 2nd line, graphs 7, 8, and 9 from the left of the 3rd line, and graphs 10, 11, and 12 from the left of the 4th line in the display area divided into 12 as softkey labels.	:DISP:WIND{1-16}:SPL D123__ABC
×16	Displays graphs 1, 2, 3, and 4 from the left of the 1st line, graphs 5, 6, 7, and 8 from the left of the 2nd line, graphs 9, 10, 11, and 12 from the left of the 3rd line, and graphs 13, 14, 15, and 16 from the left of the 4th line in the display area divided into 16 as softkey labels.	:DISP:WIND{1-16}:SPL D1234_CDEF
Return	Returns to the softkey display screen one level higher.	
Display	Displays softkeys for selecting between data trace and memory trace for on-screen display.	
Data	Selects data trace for on-screen display. If the data math option was enabled in the **Data Math** menu, the computation results will also be displayed.	:DISP:WIND{1-16}:TRAC{1-16}:STAT
Mem	Selects memory trace for on-screen display. To store data for a memory trace, go back to the previous menu and press **Data** → **Mem**.	:DISP:WIND{1-16}:TRAC{1-16}:MEM

Key Operation	Function	SCPI Command
Display	(Continued)	
Display		
Data & Mem	Selects both data trace and memory trace for on-screen display. By storing data obtained under certain conditions, it is possible to compare them to new measurement results (data trace) obtained under different conditions. To store data for a memory trace, go back to the previous menu and press **Data** → **Mem**.	:DISP:WIND{1-16}:TRAC{1-16}:MEM :DISP:WIND{1-16}:TRAC{1-16}:STAT
OFF	Turns off both the data trace and memory trace.	:DISP:WIND{1-16}:TRAC{1-16}:MEM :DISP:WIND{1-16}:TRAC{1-16}:STAT
Cancel	Returns to the softkey display screen one level higher.	
Data → Mem	Stores the measured data for the current active trace in memory. Stored data can be displayed using the memory trace option. To enable/disable the memory trace, go to the **Display** menu.	:CALC{1-16}:MATH:MEM
Data Math	Displays softkeys for selecting the types of data processing to be performed.	
OFF	Disables the data processing function. Raw measurement data will be stored as a data trace.	:CALC{1-16}:MATH:FUNC NORM
Data / Mem	Divides the measured data by the memory trace data (normalization) and stores the results as a data trace. This function is used to evaluate the ratio between two traces (e.g., to evaluate gains and attenuations).	:CALC{1-16}:MATH:FUNC DIV
Data * Mem	Multiplies the measured data by the memory trace data and stores the result as a data trace.	:CALC{1-16}:MATH:FUNC MULT
Data – Mem	Subtracts the memory trace data from the measured data (vector operation) and stores the results as a data trace. This function is useful in determining vector errors (e.g., directivity) and storing them for data compensation for future measurements.	:CALC{1-16}:MATH:FUNC SUBT
Data + Mem	Adds the measured data to the memory trace data and stores the result as a data trace.	:CALC{1-16}:MATH:FUNC ADD
Cancel	Returns to the softkey display screen one level higher.	
Edit Title Label	Displays the input bar for editing title labels. Each channel is allowed to have a title label up to 100 characters in length. However, the entire title bar may not be displayed depending on the width of the channel window.	:DISP:WIND{1-16}:TITL:DATA
Title Label	Enables or disables the title label display. Once a title label is assigned, it can be displayed within the title bar at the top of a channel window by enabling the title label display. Title labels are useful for adding extra information to saved data and printouts.	:DISP:WIND{1-16}:TITL
Graticule Label	Enables or disables the graticule label display for the Y-axis in a rectangular display format. Disabling the graticule label display will result in expanded graph areas.	:DISP:WIND{1-16}:LAB
Invert Color	Inverts the display colors for all channel windows. Inverting colors from the normal display will create white backgrounds.	:DISP:IMAG
Frequency	Enables or disables the frequency display on the screen. This function is useful for protecting critical information by making it impossible to obtain frequencies used in measurements just by glancing at the screen.	:DISP:ANN:FREQ:STAT
Update	Enables or disables screen updates. When disabled, the analyzer can save time required for screen updates and thus improve measurement throughput. If it is not necessary to confirm results on the screen, this is an effective way to improve throughput.	:DISP:ENAB
Return	Returns to the "E5070B/E5071B Menu (Top Menu)" on page 454.	

Format Menu

Key Operation	Function	SCPI Command
Format	Displays softkeys for setting up data formats.	
Log Mag	Displays traces in a rectangular display format with log magnitude (dB) on the Y-axis and frequencies on the X-axis (log magnitude format).	:CALC{1-16}:SEL:FORM MLOG
Phase	Displays traces in a rectangular display format with phase (-180° to +180°) on the Y-axis and frequencies on the X-axis (phase format).	:CALC{1-16}:SEL:FORM PHAS
Group Delay	Displays traces in a rectangular display format with group delay (s) on the Y-axis and frequencies on the X-axis (group delay format).	:CALC{1-16}:SEL:FORM GDEL
Smith	Displays softkeys for setting up smith chart.	
Lin / Phase	Displays traces in Smith chart format. The marker response values are linear magnitude and phase (°).	:CALC{1-16}:SEL:FORM SLIN
Log / Phase	Displays traces in Smith chart format. The marker response values are log magnitude (dB) and phase (°).	:CALC{1-16}:SEL:FORM SLOG
Real / Imag	Displays traces in Smith chart format. The marker response values are the real and imaginary parts.	:CALC{1-16}:SEL:FORM SCOM
R + jX	Displays traces in Smith chart format. The marker response values are resistance (Ω) and reactance (Ω).	:CALC{1-16}:SEL:FORM SMIT
G + jB	Displays traces in Smith chart format. The marker response values are conductance (S) and susceptance (S).	:CALC{1-16}:SEL:FORM SMGB
Cancel	Returns to the softkey display screen one level higher.	
Ploar	Displays softkeys for setting up polar format.	
Lin / Phase	Displays traces in polar format. The marker response values are linear magnitude and phase (°).	:CALC{1-16}:SEL:FORM PLIN
Log / Phase	Displays traces in polar format. The marker response values are log magnitude (dB) and phase (°).	:CALC{1-16}:SEL:FORM PLOG
Real / Imag	Displays traces in polar format. The marker response values are the real and imaginary parts.	:CALC{1-16}:SEL:FORM POL
Cancel	Returns to the softkey display screen one level higher.	
Lin Mag	Displays traces in a rectangular display format with linear magnitude on the Y-axis and frequencies on the X-axis (linear magnitude format).	:CALC{1-16}:SEL:FORM MLIN
SWR	Displays traces in a rectangular display format with SWR (standing wave ratio) on the Y-axis and frequencies on the X-axis (SWR format).	:CALC{1-16}:SEL:FORM SWR
Real	Displays traces in a rectangular display format with the real part on the Y-axis and frequencies on the X-axis (real format).	:CALC{1-16}:SEL:FORM REAL
Imaginary	Displays traces in a rectangular display format with the imaginary part on the Y-axis and frequencies on the X-axis (imaginary format).	:CALC{1-16}:SEL:FORM IMAG
Expand Phase	Displays traces in a rectangular display format with expanded phase (°) on the Y-axis and frequencies on the X-axis (expanded phase format).	:CALC{1-16}:SEL:FORM UPH
Positive Phase	Displays traces in a rectangular display format with phase (0° to +360°) on the Y-axis and frequencies on the X-axis (positive phase format).	:CALC{1-16}:SEL:FORM PPH
Return	Returns to the “E5070B/E5071B Menu (Top Menu)” on page 454.	

Macro Setup Menu

Key Operation	Function	SCPI Command
Macro Setup	Displays the macro setup menu.	
VBA Editor	Starts the VBA editor. A keyboard and mouse are necessary to use this editor.	None
New Project	Creates a new VBA project.	None
Load Project	Opens a dialog box for loading a saved VBA project.	:MMEM:LOAD:PROG
Load & Run	Displays programs (VBA projects) stored under D:\VBA as a list of softkeys.	
(program name)	Loads the program whose name is shown in the softkey label and executes it.	None
:	:	
(program name)	Loads the program whose name is shown in the softkey label and executes it.	
Return	Returns to the softkey display screen one level higher.	
Save Project	Opens a dialog box for saving a VBA project.	:MMEM:STOR:PROG
Close Editor	Closes the currently open VBA editor.	None
Select Macro	Displays a list of all macros in the form of softkeys from which they can be executed.	
(macro name)	Executes the macro that corresponds to the softkey.	:PROG:NAME :PROG:STAT
:	:	
(macro name)	Executes the macro that corresponds to the softkey.	
Cancel	Returns to the softkey display screen one level higher.	
Stop	Stops execution of a program after executing the line of code being executed at the time the Stop key is pressed.	:PROG:STAT
Continue	Resumes execution of a program that has been stopped.	:PROG:STAT
Echo Window	Enables or disables the echo window display at the bottom of the screen.	:DISP:TABL :DISP:TABL:TYPE
Clear Echo	Clears text displayed in the echo window.	:DISP:ECHO:CLE
User Menu	Displays user menu softkeys.	
Button 1	Executes the procedure assigned to **Button 1**. Softkey label can be modified using a command.	None
Button 2	Executes the procedure assigned to **Button 2**. Softkey label can be modified using a command.	None
Button 3	Executes the procedure assigned to **Button 3**. Softkey label can be modified using a command.	None
Button 4	Executes the procedure assigned to **Button 4**. Softkey label can be modified using a command.	None
Button 5	Executes the procedure assigned to **Button 5**. Softkey label can be modified using a command.	None
Button 6	Executes the procedure assigned to **Button 6**. Softkey label can be modified using a command.	None
Button 7	Executes the procedure assigned to **Button 7**. Softkey label can be modified using a command.	None
Button 8	Executes the procedure assigned to **Button 8**. Softkey label can be modified using a command.	None
Button 9	Executes the procedure assigned to **Button 9**. Softkey label can be modified using a command.	None

Key Operation	Function	SCPI Command
Macro Setup	(Continued)	
User Menu		
Button 10	Executes the procedure assigned to **Button 10**. Softkey label can be modified using a command.	None
Return	Returns to the softkey display screen one level higher.	
Preset User Menu	Returns the softkey labels of user menu to the initial settings.	None
Return	Returns to the “E5070B/E5071B Menu (Top Menu)” on page 454.	

Marker Menu

Key Operation	Function	SCPI Command
Marker	Activates marker 1 and displays an input dialog box for setting the stimulus value for marker 1. Also displays softkeys for setting and moving each marker.	
Marker 1	Enables marker 1 if it is disabled. Also activates marker 1 and displays an input dialog box for setting the stimulus value.	:CALC{1-16}:MARK1 :CALC{1-16}:MARK1:ACT :CALC{1-16}:MARK1:X
Marker 2	Enables marker 2 if it is disabled. Also activates marker 2 and displays an input dialog box for setting the stimulus value.	:CALC{1-16}:MARK2 :CALC{1-16}:MARK2:ACT :CALC{1-16}:MARK2:X
Marker 3	Enables marker 3 if it is disabled. Also activates marker 3 and displays an input dialog box for setting the stimulus value.	:CALC{1-16}:MARK3 :CALC{1-16}:MARK3:ACT :CALC{1-16}:MARK3:X
Marker 4	Enables marker 4 if it is disabled. Also activates marker 4 and displays an input dialog box for setting the stimulus value.	:CALC{1-16}:MARK4 :CALC{1-16}:MARK4:ACT :CALC{1-16}:MARK4:X
More Markers	Displays softkeys for setting markers 5 to 9.	
Marker 5	Enables marker 5 if it is disabled. Also activates marker 5 and displays an input dialog box for setting the stimulus value.	:CALC{1-16}:MARK5 :CALC{1-16}:MARK5:ACT :CALC{1-16}:MARK5:X
Marker 6	Enables marker 6 if it is disabled. Also activates marker 6 and displays an input dialog box for setting the stimulus value.	:CALC{1-16}:MARK6 :CALC{1-16}:MARK6:ACT :CALC{1-16}:MARK6:X
Marker 7	Enables marker 7 if it is disabled. Also activates marker 7 and displays an input dialog box for setting the stimulus value.	:CALC{1-16}:MARK7 :CALC{1-16}:MARK7:ACT :CALC{1-16}:MARK7:X
Marker 8	Enables marker 8 if it is disabled. Also activates marker 8 and displays an input dialog box for setting the stimulus value.	:CALC{1-16}:MARK8 :CALC{1-16}:MARK8:ACT :CALC{1-16}:MARK8:X
Marker 9	Enables marker 9 if it is disabled. Also activates marker 9 and displays an input dialog box for setting the stimulus value.	:CALC{1-16}:MARK9 :CALC{1-16}:MARK9:ACT :CALC{1-16}:MARK9:X
Return	Returns to the softkey display screen one level higher.	
Ref Marker	Enables the reference marker if it is disabled (the reference marker mode [**Ref Marker Mode**] is enabled at the same time). Also activates the reference marker and displays an input dialog box for setting the stimulus value.	:CALC{1-16}:MARK10 :CALC{1-16}:MARK10:ACT :CALC{1-16}:MARK10:X
Clear Marker Menu	Displays softkeys for turning off each marker.	
All OFF	Turns off all markers on the active trace.	None
Marker 1	Turns off marker 1 on the active trace.	:CALC{1-16}:MARK1
Marker 2	Turns off marker 2 on the active trace.	:CALC{1-16}:MARK2
Marker 3	Turns off marker 3 on the active trace.	:CALC{1-16}:MARK3
Marker 4	Turns off marker 4 on the active trace.	:CALC{1-16}:MARK4
Marker 5	Turns off marker 5 on the active trace.	:CALC{1-16}:MARK5
Marker 6	Turns off marker 6 on the active trace.	:CALC{1-16}:MARK6
Marker 7	Turns off marker 7 on the active trace.	:CALC{1-16}:MARK7
Marker 8	Turns off marker 8 on the active trace.	:CALC{1-16}:MARK8
Marker 9	Turns off marker 9 on the active trace.	:CALC{1-16}:MARK9
Ref Marker	Turns off the reference marker on the active trace.	:CALC{1-16}:MARK10
Return	Returns to the softkey display screen one level higher.	
Marker → Ref Marker	Replaces the stimulus value of the reference marker with that of the active marker. As a result, the reference marker will be placed at the same position as the active marker.	None

Key Operation	Function	SCPI Command
Marker	(Continued)	
Ref Marker Mode	Enables or disables the reference marker mode. When enabled, stimulus values and response values of markers 1 to 9 will be displayed using values relative to the reference marker. When disabled, the reference marker will not appear on the screen.	:CALC{1-16}:MARK{1-10}:REF
Return	Returns to the “E5070B/E5071B Menu (Top Menu)” on page 454.	

Marker Function Menu

Key Operation	Function	SCPI Command
Marker Fctn	Displays softkeys for setting the sweep range using markers and other marker options.	
Marker → Start	Sets the starting frequency to the stimulus value of the active marker on the active trace. Even if the reference marker is enabled and a relative stimulus value is displayed, the absolute value will be used.	:CALC{1-16}:MARK{1-10}:SET STAR
Marker → Stop	Sets the ending frequency to the stimulus value of the active marker on the active trace. Even if the reference marker is enabled and a relative stimulus value is displayed, the absolute value will be used.	:CALC{1-16}:MARK{1-10}:SET STOP
Marker → Center	Sets the center frequency to the stimulus value of the active marker on the active trace. Even if the reference marker is enabled and a relative stimulus value is displayed, the absolute value will be used.	:CALC{1-16}:MARK{1-10}:SET CENT
Marker → Reference	Sets the value of the reference line to the response value of the active marker on the active trace. A softkey having the same function is also provided in “Scale Menu” on page 502.	:CALC{1-16}:MARK{1-10}:SET RLEV
Marker → Delay	Sets the electrical delay to the value of the group delay at the position of the active marker (a value smoothed with the aperture of 20% regardless of the setting of smoothing).	:CALC{1-16}:MARK{1-10}:SET DEL
Discrete	Enables or disables the discrete marker function. When enabled, the marker will be placed at the nearest measurement point from the specified marker stimulus value. When disabled, the marker will be placed at the point corresponding to the specified marker stimulus value (by interpolating gaps between measurement points).	:CALC{1-16}:MARK{1-10}:DISC
Couple	Enables or disables marker coupling. When enabled, marker settings and movements become effective for all traces on a channel. When disabled, marker settings and movements are done independently on each trace.	:CALC{1-16}:MARK{1-10}:COUP
Marker Table	Enables or disables the marker table display. The marker table lists the values of markers for all traces defined on a channel using the bottom third of the screen. If a channel holds too many markers to be displayed in the display area, use the scroll bar on the right to view the entire table.	:DISP:TABL :DISP:TABL:TYPE MARK
Statistics	Enables or disables the display of statistics. When enabled, the following three statistical data items (Mean value, Standard deviation, Peak-to-peak) will be displayed on the screen. For details, see “Determining the Mean, Standard Deviation, and p-p of the Trace” on page 189.	:CALC{1-16}:MST
Return	Returns to the “E5070B/E5071B Menu (Top Menu)” on page 454.	

Marker Search Menu

Key Operation	Function	SCPI Command
Marker Search	Displays softkeys for performing searches using markers.	
Max	Moves the active marker to a position on the trace that represents the maximum response value.	:CALC{1-16}:MARK{1-10}:FUNC:EXEC :CALC{1-16}:MARK{1-10}:FUNC:TYPE MAX
Min	Moves the active marker to a position on the trace that represents the minimum response value.	:CALC{1-16}:MARK{1-10}:FUNC:EXEC :CALC{1-16}:MARK{1-10}:FUNC:TYPE MIN
Peak	Displays softkeys for setting and performing a peak search. A peak refers to a point where the response value is larger (positive peak) or smaller (negative peak) than those of adjacent measurement points on either side in a rectangular display format. A peak search picks up points that satisfy definitions given by **Peak Excursion** and **Peak Polarity** among all the peaks. If the Smith chart format or polar format is used, the main response value, among the two response values, will be used to perform searches (e.g., resistance in the **Smith (R+jX)** format).	
Search Peak	In the rectangular display format, the active marker will move to the peak with maximum response value among the peaks that match the definition if the peak polarity is **Positive** or **Both**, or to the peak with minimum response value if the peak polarity is **Negative**.The search is performed based on conditions defined by **Peak Excursion** and **Peak Polarity**.	:CALC{1-16}:MARK{1-10}:FUNC:EXEC :CALC{1-16}:MARK{1-10}:FUNC:TYPE PEAK
Search Left	In a rectangular display format, moves the active marker to the peak on its left under the given conditions. The search is performed based on conditions defined by **Peak Excursion** and **Peak Polarity**.	:CALC{1-16}:MARK{1-10}:FUNC:EXEC :CALC{1-16}:MARK{1-10}:FUNC:TYPE LPE
Search Right	In a rectangular display format, moves the active marker to the peak on its right under the given conditions. The search is performed based on conditions defined by **Peak Excursion** and **Peak Polarity**.	:CALC{1-16}:MARK{1-10}:FUNC:EXEC :CALC{1-16}:MARK{1-10}:FUNC:TYPE RPE
Peak Excursion	Sets the peak offset (and performs **Search Peak** at the same time). Peak offset is the difference between the response value of a peak and those of adjacent peaks of opposite polarity (the vertical interval between the tip and the base of a slope, one each on the left and right) in a rectangular display format. The smaller of the two will be used. The peak search will detect peaks with an offset larger than the set value.	:CALC{1-16}:MARK{1-10}:FUNC:PEXC
Peak Polarity	Displays softkeys for selecting the polarity of peaks. A peak search will detect peaks having the matching polarity.	
Positive	Selects positive polarity (and performs **Search Peak** at the same time). A positive peak is a point whose measured value is larger than the values of the two adjacent points on its left and right.	:CALC{1-16}:MARK{1-10}:FUNC:PPOL POS
Negative	Selects negative polarity (and performs **Search Peak** at the same time). A negative peak is a point whose measured value is smaller than the values of the two adjacent points on its left and right.	:CALC{1-16}:MARK{1-10}:FUNC:PPOL NEG
Both	Selects both positive and negative polarity (and performs **Search Peak** at the same time).	:CALC{1-16}:MARK{1-10}:FUNC:PPOL BOTH
Cancel	Returns to the softkey display screen one level higher.	
Return	Returns to the softkey display screen one level higher.	

Key Operation	Function	SCPI Command
Marker Search	(Continued)	
Target	Displays softkeys for setting and performing target searches. A target refers to a point on a trace that has a unique response value (target value) in a rectangular display format. A target search picks up points that have matching characteristics defined by **Target Value** and **Target Transition**. If the Smith chart format or polar format is used, the main response value, among the two response values, will be used to perform searches (e.g., resistance in the **Smith (R+jX)** format).	
Search Target	In a rectangular display format, moves the active marker to the nearest target (i.e., the closest stimulus value on the X-axis) that matches the definition (having a unique response value - the target value). The conditions for a target search must be defined using **Target Value** and **Target Transition**.	:CALC{1-16}:MARK{1-10}:FUNC:EXEC :CALC{1-16}:MARK{1-10}:FUNC:TYPE TARG
Search Left	In a rectangular display format, moves the active marker to the target that is nearest on its left and that matches the definition (having a unique response value - the target value). The conditions for a target search must be defined using **Target Value** and **Target Transition**.	:CALC{1-16}:MARK{1-10}:FUNC:EXEC :CALC{1-16}:MARK{1-10}:FUNC:TYPE LTAR
Search Right	In a rectangular display format, moves the active marker to the target that is nearest on its right and that matches the definition (having a unique response value - the target value). The conditions for a target search must be defined using **Target Value** and **Target Transition**.	:CALC{1-16}:MARK{1-10}:FUNC:EXEC :CALC{1-16}:MARK{1-10}:FUNC:TYPE RTAR
Target Value	Sets the target value (desired response value). (Also performs **Search Target** at the same time.) A target search uses the target value to look for a point on a trace.	:CALC{1-16}:MARK{1-10}:FUNC:TARG
Target Transition	Displays softkeys for defining the transition direction.	
Positive	Selects positive transition for a target search (and performs **Search Target** at the same time). Targets with positive transition refer to points whose response value is larger than the value of the adjacent point on its left in a rectangular display format.	:CALC{1-16}:MARK{1-10}:FUNC:TTR POS
Negative	Selects negative transition for a target search (and performs **Search Target** at the same time). Targets with negative transition refer to points whose response value is larger than the value of the adjacent point on its left in a rectangular display format.	:CALC{1-16}:MARK{1-10}:FUNC:TTR NEG
Both	Selects both positive and negative transition for a target search (and performs **Search Target** at the same time).	:CALC{1-16}:MARK{1-10}:FUNC:TTR BOTH
Cancel	Returns to the softkey display screen one level higher.	
Return	Returns to the softkey display screen one level higher.	
Tracking	Enables or disables search tracking. When enabled, the currently selected search operation will be performed each time a sweep is completed. If disabled, you can initiate a search by pressing a key for a particular search.	:CALC{1-16}:MARK{1-10}:FUNC:TRAC
Search Range	Displays softkeys for setting the search range of the maximum, minimum, peak and target search.	
Search Range	Enables or disables partial search feature.	:CALC{1-16}:MARK:FUNC:DOM
Start	Sets start value (lower limit) of the search range.	:CALC{1-16}:MARK:FUNC:DOM:STAR
Stop	Sets stop value (upper limit) of the search range.	:CALC{1-16}:MARK:FUNC:DOM:STOP
Couple	Enables or disables trace coupling within search range.	:CALC{1-16}:MARK:FUNC:DOM:COUP
Return	Returns to the softkey display screen one level higher.	

Key Operation	Function	SCPI Command
Marker Search	(Continued)	
Bandwidth	Enables or disables bandwidth searching. When enabled, bandwidth parameters (Insertion loss, Low cutoff point, High cutoff point, Center frequency, Bandwidth and Q) will be displayed on the screen.If the Smith chart format or polar format is used, the main response value, among the two response values, will be used to perform searches (e.g., resistance in the **Smith (R+jX)** format). For details, see “Determining the Bandwidth of the Trace (Bandwidth Search)” on page 187.	:CALC{1-16}:MARK{1-10}:BWID
Bandwidth Value	Sets the bandwidth. The bandwidth in a bandwidth search is defined by specifying the displacement from the active marker to the cutoff point using the response value (the value assigned to the Y-axis in a rectangular display format).	:CALC{1-16}:MARK{1-10}:BWID:THR
Return	Returns to the “E5070B/E5071B Menu (Top Menu)” on page 454.	

Measurement Menu

Key Operation	Function	SCPI Command
Meas	Displays softkeys for setting measurement parameters. These softkeys will not be displayed unless either the balanced/unbalanced conversion function or the fixture simulator function is turned off (**BalUn OFF** or **Fixture Simulator OFF**) in the “Analysis Menu” on page 455 on the E5070B/E5071B.	
S11	Selects parameter S_{11}.	:CALC{1-16}:PAR{1-16}:DEF S11
S21	Selects parameter S_{21}.	:CALC{1-16}:PAR{1-16}:DEF S21
S31[*1]	Selects parameter S_{31}.	:CALC{1-16}:PAR{1-16}:DEF S31
S41[*2]	Selects parameter S_{41}.	:CALC{1-16}:PAR{1-16}:DEF S41
S12	Selects parameter S_{12}.	:CALC{1-16}:PAR{1-16}:DEF S12
S22	Selects parameter S_{22}.	:CALC{1-16}:PAR{1-16}:DEF S22
S32[*1]	Selects parameter S_{32}.	:CALC{1-16}:PAR{1-16}:DEF S32
S42[*2]	Selects parameter S_{42}.	:CALC{1-16}:PAR{1-16}:DEF S42
S13[*1]	Selects parameter S_{13}.	:CALC{1-16}:PAR{1-16}:DEF S13
S23[*1]	Selects parameter S_{23}.	:CALC{1-16}:PAR{1-16}:DEF S23
S33[*1]	Selects parameter S_{33}.	:CALC{1-16}:PAR{1-16}:DEF S33
S43[*2]	Selects parameter S_{43}.	:CALC{1-16}:PAR{1-16}:DEF S43
S14[*2]	Selects parameter S_{14}.	:CALC{1-16}:PAR{1-16}:DEF S14
S24[*2]	Selects parameter S_{24}.	:CALC{1-16}:PAR{1-16}:DEF S24
S34[*2]	Selects parameter S_{34}.	:CALC{1-16}:PAR{1-16}:DEF S34
S44[*2]	Selects parameter S_{44}.	:CALC{1-16}:PAR{1-16}:DEF S44
Return	Returns to the “E5070B/E5071B Menu (Top Menu)” on page 454.	

*1. Only with Options 313, 314, 413, and 414.
*2. Only with Options 413 and 414.

Measurement Menu (Balance Measurement, SE-Bal)

Key Operation	Function	SCPI Command
Meas	Displays softkeys for setting measurement parameters (**only for models with Option 313, 314, 413, or 414**). To display these softkeys, the balanced/unbalanced conversion topology must be set to unbalanced-balanced (**SE-Bal**), the balanced/unbalanced conversion function must be on (**BalUn ON**), and the fixture simulator function must be on (**Fixture Simulator ON**) in the "Analysis Menu" on page 455.	
Sss11	Selects parameter S_{ss11}. S_{ss11} defines the way an unbalanced signal input to (unbalanced) port 1 on the DUT is reflected as an unbalanced signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:SBAL SSS11
Sds21	Selects parameter S_{ds21}. S_{ds21} defines the way an unbalanced signal input to (unbalanced) port 1 on the DUT is transmitted to (balanced) port 2 on the DUT as a differential signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:SBAL SDS21
Ssd12	Selects parameter S_{sd12}. S_{sd12}defines the way a differential signal input to (balanced) port 2 on the DUT is transmitted to (unbalanced) port 1 on the DUT as an unbalanced signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:SBAL SSD12
Scs21	Selects parameter S_{cs21}. S_{cs21} defines the way an unbalanced signal input to (unbalanced) port 1 on the DUT is transmitted to (balanced) port 2 on the DUT as a common mode signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:SBAL SCS21
Ssc12	Selects parameter S_{sc12}. S_{sc12} defines the way a common mode signal input to (balanced) port 2 on the DUT is transmitted to (unbalanced) port 1 on the DUT as an unbalanced signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:SBAL SSC12
Sdd22	Selects parameter S_{dd22}. S_{dd22} defines the way a differential signal input to (balanced) port 2 on the DUT is reflected as a differential signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:SBAL SDD22
Scd22	Selects parameter S_{cd22}. S_{cd22} defines the way a differential signal input to (balanced) port 2 on the DUT is reflected as a common mode signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:SBAL SCD22
Sdc22	Selects parameter S_{dc22}. S_{dc22} defines the way a common mode signal input to (balanced) port 2 on the DUT is reflected as a differential signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:SBAL SDC22
Scc22	Selects parameter S_{cc22}. S_{cc22} defines the way a common mode signal input to (balanced) port 2 on the DUT is reflected as a common mode signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:SBAL SCC22
Imbalance	Selects parameter Imbalance.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:SBAL IMB
Sds21/Scs21	Selects parameter Sds21/Scs21.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:SBAL CMRR
Ssd12/Ssc12	Selects parameter Ssd12/Ssc12.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:SBAL CMRR2
Return	Returns to the "E5070B/E5071B Menu (Top Menu)" on page 454.	

Measurement Menu (Balanced Measurement, Bal-Bal)

Key Operation	Function	SCPI Command
Meas	Displays softkeys for setting up measurement parameters (**only for models with Option 412 or 414**). To display these softkeys, the balanced/unbalanced conversion topology must be set to balanced-balanced (**Bal-Bal**), the balanced/unbalanced conversion function must be on (**BalUn ON**), and the fixture simulator function must be on (**Fixture Simulator ON**) in the "Analysis Menu" on page 455.	
Sdd11	Selects parameter S_{dd11}. S_{dd11} defines the way a differential signal input to (balanced) port 1 on the DUT is reflected as a differential signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:BBAL SDD11
Sdd21	Selects parameter S_{dd21}. S_{dd21} defines the way a differential signal input to (balanced) port 1 on the DUT is transmitted to (balanced) port 2 on the DUT as a differential signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:BBAL SDD21
Sdd12	Selects parameter S_{dd12}. S_{dd12} defines the way a differential signal input to (balanced) port 2 on the DUT is transmitted to (balanced) port 1 on the DUT as a differential signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:BBAL SDD12
Sdd22	Selects parameter S_{dd22}. S_{dd22} defines the way a differential signal input to (balanced) port 2 on the DUT is reflected as a differential signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:BBAL SDD22
Scd11	Selects parameter S_{cd11}. S_{cd11} defines the way a differential signal input to (balanced) port 1 on the DUT is reflected as a common mode signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:BBAL SCD11
Scd21	Selects parameter S_{cd21}. S_{cd21} defines the way a differential signal input to (balanced) port 1 on the DUT is transmitted to (balanced) port 2 on the DUT as a common mode signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:BBAL SCD21
Scd12	Selects parameter S_{cd12}. S_{cd12} defines the way a differential signal input to (balanced) port 2 on the DUT is transmitted to (balanced) port 1 on the DUT as a common mode signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:BBAL SCD12
Scd22	Selects parameter S_{cd22}. S_{cd22} defines the way a differential signal input to (balanced) port 2 on the DUT is reflected as a common mode signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:BBAL SCD22
Sdc11	Selects parameter S_{dc11}. S_{dc11} defines the way a common mode signal input to (balanced) port 1 on the DUT is reflected as a differential signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:BBAL SDC11
Sdc21	Selects parameter S_{dc21}. S_{dc21} defines the way a common mode signal input to (balanced) port 1 on the DUT is transmitted to (balanced) port 2 on the DUT as a differential signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:BBAL SDC21
Sdc12	Selects parameter S_{dc12}. S_{dc12} defines the way a common mode signal input to (balanced) port 2 on the DUT is transmitted to (balanced) port 1 on the DUT as a differential signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:BBAL SDC12
Sdc22	Selects parameter S_{dc22}. S_{dc22} defines the way a common mode signal input to (balanced) port 2 on the DUT is reflected as a differential signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:BBAL SDC22
Scc11	Selects parameter S_{cc11}. S_{cc11} defines the way a common mode signal input to (balanced) port 1 on the DUT is reflected as a common mode signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:BBAL SCC11
Scc21	Selects parameter S_{cc21}. S_{cc21} defines the way a common mode signal input to (balanced) port 1 on the DUT is transmitted to (balanced) port 2 on the DUT as a common mode signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:BBAL SCC21
Scc12	Selects parameter S_{cc12}. S_{cc12} defines the way a common mode signal input to (balanced) port 2 on the DUT is transmitted to (balanced) port 1 on the DUT as a common mode signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:BBAL SCC12

Key Operation	Function	SCPI Command
Meas	(Continued)	
Scc22	Selects parameter S_{cc22}. S_{cc22} defines the way a common mode signal input to (balanced) port 2 on the DUT is reflected as a common mode signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}: BBAL SCC22
Imbalance1	Selects parameter Imbalance1.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:BBAL IMB1
Imbalance2	Selects parameter Imbalance2.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:BBAL IMB2
Sdd21/Scc21	Selects parameter Sdd21/Scc21.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:BBAL CMRR
Return	Returns to the "E5070B/E5071B Menu (Top Menu)" on page 454.	

Measurement Menu (Balanced Measurement, SE-SE-Bal)

Key Operation	Function	SCPI Command
Meas	Displays softkeys for setting measurement parameters (**only for models with Option 413 or 414**). To display these softkeys, the balanced/unbalanced conversion topology must be set to unbalanced-unbalanced-balanced **SE-SE-Bal**), the balanced/unbalanced conversion function must be on (**BalUn ON**), and the fixture simulator function must be on (**Fixture Simulator ON**) in the “Analysis Menu” on page 455.	
Sss11	Selects parameter S_{ss11}. S_{ss11} defines the way an unbalanced signal input to (unbalanced) port 1 on the DUT is reflected as an unbalanced signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:SSB SSS11
Sss21	Selects parameter S_{ss21}. S_{ss21} defines the way an unbalanced signal input to (unbalanced) port 1 on the DUT is transmitted to (unbalanced) port 2 on the DUT as an unbalanced signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:SSB SSS21
Sss12	Selects parameter S_{ss12}. S_{ss12} defines the way an unbalanced signal input to (unbalanced) port 2 on the DUT is transmitted to (unbalanced) port 1 on the DUT as an unbalanced signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:SSB SSS12
Sss22	Selects parameter S_{ss22}. S_{ss22} defines the way an unbalanced signal input to (unbalanced) port 2 on the DUT is reflected as an unbalanced signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:SSB SSS22
Sds31	Selects parameter S_{ds31}. S_{ds31} defines the way an unbalanced signal input to (unbalanced) port 1 on the DUT is transmitted to (balanced) port 3 on the DUT as a differential signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:SSB SDS31
Sds32	Selects parameter S_{ds32}. S_{ds32} defines the way an unbalanced signal input to (unbalanced) port 2 on the DUT is transmitted to (balanced) port 3 on the DUT as a differential signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:SSB SDS32
Ssd13	Selects parameter S_{sd13}. S_{sd13} defines the way a differential signal input to (balanced) port 3 on the DUT is transmitted to (unbalanced) port 1 on the DUT as an unbalanced signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:SSB SSD13
Ssd23	Selects parameter S_{sd23}. S_{sd23} defines the way a differential signal input to (balanced) port 3 on the DUT is transmitted to (unbalanced) port 2 on the DUT as an unbalanced signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:SSB SSD23
Scs31	Selects parameter S_{cs31}. S_{cs31} defines the way an unbalanced signal input to (unbalanced) port 1 on the DUT is transmitted to (balanced) port 3 on the DUT as a common mode signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:SSB SCS31
Scs32	Selects parameter S_{cs32}. S_{cs32} defines the way an unbalanced signal input to (unbalanced) port 2 on the DUT is transmitted to (balanced) port 3 on the DUT as a common mode signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:SSB SCS32
Ssc13	Selects parameter S_{sc13}. S_{sc13} defines the way a common mode signal input to (balanced) port 3 on the DUT is transmitted to (unbalanced) port 1 on the DUT as an unbalanced signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:SSB SSC13
Ssc23	Selects parameter S_{sc23}. S_{sc23} defines the way a common mode signal input to (balanced) port 3 on the DUT is transmitted to (unbalanced) port 2 on the DUT as an unbalanced signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:SSB SSC23
Sdd33	Selects parameter S_{dd33}. S_{dd33} defines the way a differential signal input to (balanced) port 3 on the DUT is reflected as a differential signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:SSB SDD33
Scd33	Selects parameter S_{cd33}. S_{cd33} defines the way a differential signal input to (balanced) port 3 on the DUT is reflected as a common mode signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:SSB SCD33
Sdc33	Selects parameter S_{dc33}. S_{dc33} defines the way a common mode signal input to (balanced) port 3 on the DUT is reflected as a differential signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:SSB SDC33

Key Operation	Function	SCPI Command
Meas	(Continued)	
Scc33	Selects parameter S_{cc33}. S_{cc33} defines the way a common mode signal input to (balanced) port 3 on the DUT is reflected as a common mode signal.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:SSB SCC33
Imbalance1	Selects parameter Imbalance1.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:SSB IMB1
Imbalance2	Selects parameter Imbalance2.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:SSB IMB2
Sds31/Scs31	Selects parameter Sds31/Scs31.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:SSB CMRR1
Sds32/Scs32	Selects parameter Sds32/Scs32.	:CALC{1-16}:FSIM:BAL:PAR{1-16}:SSB CMRR2
Return	Returns to the “E5070B/E5071B Menu (Top Menu)” on page 454.	

Preset Menu

Key Operation	Function	SCPI Command
Preset	Displays softkeys for restoring the preset conditions.	
OK	Restores the preset conditions.	:SYST:PRES
Cancel	Returns to the “E5070B/E5071B Menu (Top Menu)” on page 454.	

Save/Recall Menu

Key Operation	Function	SCPI Command
Save/Recall	Displays softkeys for saving and recalling data.	
Save State	Displays softkeys for saving settings.	
State01	Saves the current settings on the internal hard disk drive (D:) and names it State01.sta.	:MMEM:STOR "State01.sta"
State02	Saves the current settings on the internal hard disk drive (D:) and names it State02.sta.	:MMEM:STOR "State02.sta"
State03	Saves the current settings on the internal hard disk drive (D:) and names it State03.sta.	:MMEM:STOR "State03.sta"
State04	Saves the current settings on the internal hard disk drive (D:) and names it State04.sta.	:MMEM:STOR "State04.sta"
State05	Saves the current settings on the internal hard disk drive (D:) and names it State05.sta.	:MMEM:STOR "State05.sta"
State06	Saves the current settings on the internal hard disk drive (D:) and names it State06.sta.	:MMEM:STOR "State06.sta"
State07	Saves the current settings on the internal hard disk drive (D:) and names it State07.sta.	:MMEM:STOR "State07.sta"
State08	Saves the current settings on the internal hard disk drive (D:) and names it State08.sta.	:MMEM:STOR "State08.sta"
Autorec	Saves the current settings on the internal hard disk drive (D:) and names it Autorec.sta. This file will be automatically loaded during the startup process and the analyzer settings will be restored.	:MMEM:STOR "Autorec.sta"
File Dialog...	Opens a dialog box for saving settings. This dialog box allows the user to save settings with an arbitrary name. This key is also used to save settings to a floppy disk.	:MMEM:STOR
Return	Returns to the softkey display screen one level higher.	
Recall State	Displays softkeys for recalling settings.	
State01	Recalls from the internal hard disk drive (D:) the settings saved as State01.sta.	:MMEM:LOAD "State01.sta"
State02	Recalls from the internal hard disk drive (D:) the settings saved as State02.sta.	:MMEM:LOAD "State02.sta"
State03	Recalls from the internal hard disk drive (D:) the settings saved as State03.sta.	:MMEM:LOAD "State03.sta"
State04	Recalls from the internal hard disk drive (D:) the settings saved as State04.sta.	:MMEM:LOAD "State04.sta"
State05	Recalls from the internal hard disk drive (D:) the settings saved as State05.sta.	:MMEM:LOAD "State05.sta"
State06	Recalls from the internal hard disk drive (D:) the settings saved as State06.sta.	:MMEM:LOAD "State06.sta"
State07	Recalls from the internal hard disk drive (D:) the settings saved as State07.sta.	:MMEM:LOAD "State07.sta"
State08	Recalls from the internal hard disk drive (D:) the settings saved as State08.sta.	:MMEM:LOAD "State08.sta"
Autorec	Recalls from the internal hard disk drive (D:) the settings saved as Autorec.sta.	:MMEM:LOAD "Autorec.sta"
File Dialog...	Opens a dialog box for recalling settings. This dialog box allows the user to recall settings saved under arbitrary names. This key is also used to recall a file saved on a floppy disk.	:MMEM:LOAD
Return	Returns to the softkey display screen one level higher.	
Save Channel	Displays softkeys for saving settings for each channel into registers A to D (volatile memory).	
State A	Saves the current settings for each channel into registers A.	:MMEM:STOR:CHAN A
State B	Saves the current settings for each channel into registers B.	:MMEM:STOR:CHAN B
State C	Saves the current settings for each channel into registers C.	:MMEM:STOR:CHAN C
State D	Saves the current settings for each channel into registers D.	:MMEM:STOR:CHAN D

Key Operation	Function	SCPI Command
Save/Recall	(Continued)	
Save Channel		
Clear States	Displays softkeys for clearing registers.	
OK	Clears all registers (A - D).	:MMEM:STOR:CHAN:CLE
Cancel	Returns to the softkey display screen one level higher.	
Return	Returns to the softkey display screen one level higher.	
Recall Channel	Displays softkeys for recalling settings for each channel from registers A to D (volatile memory).	
State A	Recalls the current settings for each channel from registers A.	:MMEM:LOAD:CHAN A
State B	Recalls the current settings for each channel from registers B.	:MMEM:LOAD:CHAN B
State C	Recalls the current settings for each channel from registers C.	:MMEM:LOAD:CHAN C
State D	Recalls the current settings for each channel from registers D.	:MMEM:LOAD:CHAN D
Return	Returns to the softkey display screen one level higher.	
Save Type	Displays softkeys for selecting the types of data to be saved.	
State Only	Saves settings only.	:MMEM:STOR:STYP STAT
State & Cal	Saves settings and calibration data.	:MMEM:STOR:STYP CST
State & Trace	Saves settings and trace data.	:MMEM:STOR:STYP DST
All	Saves settings, calibration data, and trace data.	:MMEM:STOR:STYP CDST
Cancel	Returns to the softkey display screen one level higher.	
Channel/Trace	Selects the save target for saving settings from all channels/traces (**All**) or displayed channel/traces only (**Disp Only**).	:MMEM:STOR:STYP SALL
Save Trace Data	Opens a dialog box for saving trace data as a CSV (comma-separated value) file. A CSV file can be opened in spreadsheet software such as Microsoft® Excel®.	:MMEM:STOR:FDAT
Explorer...	Opens Windows Explorer for organizing (cut, copy, paste, delete, rename, format) files and folders. The operation is same as Windows 98 computers. Users can modify files and folders in drive A: (floppy disk drive) and drive D: (user directory). Be sure not to modify any files and folders in drives other than drive A: and drive D:. Doing so will cause malfunctions.	:MMEM:MDIR :MMEM:COPY :MMEM:DEL
Cancel	Returns to the “E5070B/E5071B Menu (Top Menu)” on page 454.	

Scale Menu

Key Operation	Function	SCPI Command
Scale	Displays softkeys for adjusting scales.	
Auto Scale	Automatically adjusts scales for the active trace.	:DISP:WIND{1-16}:TRAC{1-16}:Y:AUTO
Auto Scale All	Automatically adjusts scales for all traces within the active channel.	None
Divisions	Defines the number of divisions on the Y-axis of a rectangular display format. An even number from 4 to 30 must be used. Once set, it is then applied to all traces displayed in any rectangular display format within that channel.	:DISP:WIND{1-16}:TRAC{1-16}:Y:DIV
Scale/Div	In a rectangular format, defines the number of increments per division on the Y-axis. In the Smith chart format or polar format, defines the range (the displacement of the outermost circle). The setting applies to the active trace only.	:DISP:WIND{1-16}:TRAC{1-16}:Y:PDIV
Reference Position	Defines the position of the reference line on a rectangular display format. The position must be defined by using numbers assigned to the Y-axis between 0 (the origin, the X-axis) and the number of divisions (the highest scale). This setting applies only to the active trace. The reference line can also be moved by performing a drag-and-drop operation (pressing the mouse button on the object to be moved and releasing the button after dragging it to the desired position) on one of the reference line pointers (▶ and ◀).	:DISP:WIND{1-16}:TRAC{1-16}:Y:RPOS
Reference Value	Defines the value corresponding to the reference line on a rectangular display format. The setting applies only to the active trace.	:DISP:WIND{1-16}:TRAC{1-16}:Y:RLEV
Marker → Reference	Changes the value of the reference line to the response value of the active marker. The same function is also accessible from the “Marker Function Menu” on page 489.	:CALC{1-16}:MARK{1-10}:SET
Electrical Delay	Sets an electrical delay to the active trace. This function simulates the addition or deletion of a variable length lossless transfer line against the input of a receiver. It can be used to compensate for the electrical length of cables inside the DUT. Although the unit used is seconds, the length (meters) will be displayed in parentheses next to the input box based on the velocity coefficient used at the time.	:CALC{1-16}:CORR:EDEL:TIME
Phase Offset	Sets the values to be added or subtracted in phase measurement (phase offset) (°).	:CALC{1-16}:CORR:OFFS:PHAS
Return	Returns to the “E5070B/E5071B Menu (Top Menu)” on page 454.	

Stimulus Menu

Key Operation		Function	SCPI Command
Start		Sets the lowest frequency for sweeps. Also displays a menu (Stimulus Menu) for defining the sweep range.	:SENS{1-16}:FREQ:STAR
	Start	Sets the starting frequency for sweeps.	:SENS{1-16}:FREQ:STAR
	Stop	Sets the ending frequency for sweeps.	:SENS{1-16}:FREQ:STOP
	Center	Sets the center frequency of the sweep range.	:SENS{1-16}:FREQ:CENT
	Span	Sets the frequency span for sweeps.	:SENS{1-16}:FREQ:SPAN
	Return	Returns to the “E5070B/E5071B Menu (Top Menu)” on page 454.	
Stop		Sets the ending frequency for sweeps. Also displays the Stimulus Menu same as Start.	:SENS{1-16}:FREQ:STOP
Center		Sets the center frequency of the sweep range. Also displays the Stimulus Menu same as Start.	:SENS{1-16}:FREQ:CENT
Span		Sets the frequency span for sweeps. Also displays the Stimulus Menu same as Start.	:SENS{1-16}:FREQ:SPAN

Sweep Setup Menu

Key Operation	Function	SCPI Command
Sweep Setup	Displays softkeys for setting up sweeps.	
Power	Displays the menu to set the stimulus signal output.	
Power	Sets the output power level of the internal signal source of the analyzer.	:SOUR{1-16}:POW
Power Ranges[*1]	Displays softkeys for selecting the power range.	
–20 to 12	Sets the power range to –20 dBm to 12 dBm.	:SOUR{1-16}:POW:ATT 0
–25 to 7	Sets the power range to –25 dBm to 7 dBm.	:SOUR{1-16}:POW:ATT 5
–30 to 2	Sets the power range to –30 dBm to 2 dBm.	:SOUR{1-16}:POW:ATT 10
–35 to –3	Sets the power range to –35 dBm to –3 dBm.	:SOUR{1-16}:POW:ATT 15
–40 to –8	Sets the power range to –40 dBm to –8 dBm.	:SOUR{1-16}:POW:ATT 20
–45 to –13	Sets the power range to –45 dBm to –13 dBm.	:SOUR{1-16}:POW:ATT 25
–50 to –18	Sets the power range to –50 dBm to –18 dBm.	:SOUR{1-16}:POW:ATT 30
–55 to –23	Sets the power range to –55 dBm to –23 dBm.	:SOUR{1-16}:POW:ATT 35
Cancel	Returns to the softkey display screen one level higher.	
Port Couple	Turns on/off the port coupling for the power level.	:SOUR{1-16}:POW:PORT:COUP
Port Power	Displays the softkey to set the power level for each port when the port coupling is off.	
Port 1 Power	Sets the power level of port 1.	:SOUR{1-16}:POW:PORT1
Port 2 Power	Sets the power level of port 2.	:SOUR{1-16}:POW:PORT2
Port 3 Power	Sets the power level of port 3.	:SOUR{1-16}:POW:PORT3
Port 4 Power	Sets the power level of port 4.	:SOUR{1-16}:POW:PORT4
Slope [xx dB/GHz]	Sets the correction coefficient (correction amount of power level per 1 GHz) when the power slope feature is on.	:SOUR{1-16}:POW:SLOP
Slope [ON/OFF]	Turns on/off of the power slope feature.	:SOUR{1-16}:POW:SLOP:STAT
CW Freq	Sets the fixed frequency for the power sweep.	:SENS{1-16}:FREQ
RF Out	Turns on/off of the stimulus signal output.	:OUTP
Return	Returns to the softkey display screen one level higher.	
Sweep Time	Sets the sweep time for each source port. Inputting the value “0” as the sweep time causes the analyzer to go into automatic sweep time mode.	:SENS{1-16}:SWE:TIME :SENS{1-16}:SWE:TIME:AUTO
Sweep Delay	Sets the wait (delay) time before starting a sweep for each source port.	:SENS{1-16}:SWE:DEL
Sweep Mode	Displays softkeys for selecting the sweep mode.	
Std Stepped	Selects the stepped mode.	:SENS{1-16}:SWE:GEN STEP
Std Swept	Selects the swept mode.	:SENS{1-16}:SWE:GEN ANAL
Fast Stepped	Selects the fast stepped mode.	:SENS{1-16}:SWE:GEN FST
Fast Swept	Selects the fast swept mode.	:SENS{1-16}:SWE:GEN FAN
Cancel	Returns to the softkey display screen one level higher.	
Points	Sets the number of points per sweep. The number of points should be from 2 to 1601.	:SENS{1-16}:SWE:POIN
Sweep Type	Displays softkeys for selecting the sweep type.	
Lin Freq	Selects linear frequency sweep.	:SENS{1-16}:SWE:TYPE LIN
Log Freq	Selects logarithmic frequency sweep.	:SENS{1-16}:SWE:TYPE LOG
Segment	Selects segment sweep.	:SENS{1-16}:SWE:TYPE SEG
Power Sweep	Selects power sweep.	:SENS{1-16}:SWE:TYPE LOG
Cancel	Returns to the softkey display screen one level higher.	

Key Operation	Function	SCPI Command
Sweep Setup	(Continued)	
Edit Segment Table	Displays the segment sweep setup table as well as softkeys for editing the segment table.	
Freq Mode	Alternates the setup mode for the sweep range between two methods: one using the starting and ending frequencies (**Start/Stop**), and the other using the center frequency and a frequency span (**Center/Span**).	:SENS{1-16}:SEGM:DATA
List IFBW	Enables or disables the IF bandwidth display in the segment table.	:SENS{1-16}:SEGM:DATA
List Power	Enables or disables the power level display in the segment table.	:SENS{1-16}:SEGM:DATA
List Delay	Enables or disables the segment delay display in the segment table.	:SENS{1-16}:SEGM:DATA
List Sweep Mode	Enables or disables the segment sweep mode display in the segment table.	:SENS{1-16}:SEGM:DATA
List Time	Enables or disables the segment sweep time display in the segment table.	:SENS{1-16}:SEGM:DATA
Delete	Deletes from the segment table the segment upon which the cursor is currently located. If the cursor is not displayed, the segment on the bottom will be deleted.	:SENS{1-16}:SEGM:DATA
Add	Adds a new segment immediately above the segment upon which the cursor is currently located. If the cursor is not displayed, a new segment will be added to the bottom of the table.	:SENS{1-16}:SEGM:DATA
Clear Segment Table	Displays softkeys for clearing elements of the segment table.	
OK	Deletes all segments in the segment table.	None
Cancel	Returns to the softkey display screen one level higher.	
Export to CSV File	Exports (saves data in file formats used by other software) the segment table as a CSV (comma-separated value) file.	:MMEM:STOR:SEGM
Import from CSV File	Imports (loads a file that is written in a format used by other software) a CSV (comma-separated value) file to the segment table of E5070B/E5071B.	:MMEM:LOAD:SEGM
Return	Returns to the softkey display screen one level higher.	
Segment Display	Selects linear frequency (**Freq Base**) or selects the order of measurements (1, 2, ..., N; where N refers to the number of points) (**Order Base**) for drawing the X-axis of a rectangular display format in a segment sweep.	:DISP:WIND{1-16}:X:SPAC LIN :DISP:WIND{1-16}:X:SPAC OBAS
Return	Returns to the “E5070B/E5071B Menu (Top Menu)” on page 454.	

*1. Only with Options 214, 314, and 414.

System Menu

Key Operation				Function	SCPI Command
System				Displays softkeys for performing limit tests and accessing control and management functions on the analyzer.	
	Print			Outputs the current screen to a printer.	:HCOP
	Abort Printing			Aborts printing.	:HCOP:ABOR
	Printer Setup			Opens a dialog box for setting up the printer.	None
	Invert Image			Inverts the colors of the screen display.	:HCOP:IMAG
	Dump Screen Image			Opens a dialog box for saving the screen image in BMP (Windows or OS/2 bitmap) format.	:MMEM:STOR:IMAG
	E5091A Setup			Displays softkeys for setting up the E5091A.	
		Select ID		Displays softkeys for selecting the E5091A's ID.	
			1	Selects 1.	None
			2	Selects 2.	None
			Cancel	Returns to the softkey display screen one level higher.	
		Port 1		Displays softkeys for selecting a test port of the E5091A to which you want to connect port 1.	
			A	Selects A.	:SENS{1-16}:MULT{1-2}:TEST9:PORT1 A
			T1	Selects T1.	:SENS{1-16}:MULT{1-2}:TEST9:PORT1 T1
			Cancel	Returns to the softkey display screen one level higher.	
		Port 2		Displays softkeys for selecting a test port of the E5091A to which you want to connect port 2.	
			T1	Selects T1.	:SENS{1-16}:MULT{1-2}:TEST9:PORT2 T1
			T2	Selects T2.	:SENS{1-16}:MULT{1-2}:TEST9:PORT2 T2
			Cancel	Returns to the softkey display screen one level higher.	
		Port 3		Displays softkeys for selecting a test port of the E5091A to which you want to connect port 3.	
			R1+	Selects R1+.	:SENS{1-16}:MULT{1-2}:TEST9:PORT3 R1
			R2+	Selects R2+.	:SENS{1-16}:MULT{1-2}:TEST9:PORT3 R2
			R3+	Selects R3+.	:SENS{1-16}:MULT{1-2}:TEST9:PORT3 R3
			Cancel	Returns to the softkey display screen one level higher.	
		Port 4		Displays softkeys for selecting a test port of the E5091A to which you want to connect port 4.	
			R1–	Selects R1– .	:SENS{1-16}:MULT{1-2}:TEST9:PORT4 R1
			R2–	Selects R2– .	:SENS{1-16}:MULT{1-2}:TEST9:PORT4 R2
			R3–	Selects R3– .	:SENS{1-16}:MULT{1-2}:TEST9:PORT4 R3
			Cancel	Returns to the softkey display screen one level higher.	
		Control Lines		Displays softkeys for setting up HIGH/LOW of control lines.	
			Line 1	Sets HIGH/LOW of line 1.	:SENS{1-16}:MULT{1-2}:TEST9:OUTP
			Line 2	Sets HIGH/LOW of line 2.	:SENS{1-16}:MULT{1-2}:TEST9:OUTP
			Line 3	Sets HIGH/LOW of line 3.	:SENS{1-16}:MULT{1-2}:TEST9:OUTP
			Line 4	Sets HIGH/LOW of line 4.	:SENS{1-16}:MULT{1-2}:TEST9:OUTP
			Line 5	Sets HIGH/LOW of line 5.	:SENS{1-16}:MULT{1-2}:TEST9:OUTP
			Line 6	Sets HIGH/LOW of line 6.	:SENS{1-16}:MULT{1-2}:TEST9:OUTP
			Line 7	Sets HIGH/LOW of line 7.	:SENS{1-16}:MULT{1-2}:TEST9:OUTP
			Line 8	Sets HIGH/LOW of line 8.	:SENS{1-16}:MULT{1-2}:TEST9:OUTP
			Cancel	Returns to the softkey display screen one level higher.	
		E5091A Property		Enables or disables the display of the E5091A property.	:SENS:MULT{1-2}:DISP

Key Operation	Function	SCPI Command
System	(Continued)	
E5091A Setup		
E5091A Control	Enables or disables control of the E5091A.	:SENS:MULT{1-2}:STAT
Return	Returns to the softkey display screen one level higher.	
Misc Setup	Displays softkeys for setting up the beeper function, GPIB, Network, internal clock, key lock function and color of display image.	
Beeper	Displays softkeys for setting up the beeper function.	
Beep Complete	Enables or disables beeps at the end of processes. When enabled, the user will be notified with a beep when a measurement has completed or settings have been saved.	:SYST:BEEP:COMP:STAT
Test Beep Complete	Tests the beeping sound.	:SYST:BEEP:COMP:IMM
Beep Warning	Enables or disables warning beeps. When enabled, all warning messages will be accompanied by beeps.	:SYST:BEEP:WARN:STAT
Test Beep Warning	Tests the beeping sound for warnings.	:SYST:BEEP:WARN:IMM
Return	Returns to the softkey display screen one level higher.	
GPIB Setup	Displays softkeys for setting up the GPIB.	
Talker/Listener Address	Sets the address for controlling the analyzer from a controller via GPIB.	None
System Controller Configuration	Opens a dialog box for configuring the system controller (USB/GPIB interface).	None
Power Meater Address	Sets an address of a power meter used for the power calibration.	:SYST:COMM:GPIB:PMET:ADDR
Return	Returns to the softkey display screen one level higher.	
Network Setup	Displays softkeys for configuring network settings.	
Telnet Server	Enables or disables the telnet server function.	None
SICL-LAN Server	Enables or disables the SICL-LAN server function.	None
SICL-LAN Address	Sets the address for controlling the analyzer from a controller via SICL-LAN.	None
Network Identification	Opens a dialog box for configuring the analyzer’s identification such as a computer name.	None
Network Configuration	Opens a window for configuring network settings.	None
Return	Returns to the softkey display screen one level higher.	
Clock Setup	Displays softkeys for setting the internal clock.	
Set Date and Time	Opens a dialog box for setting the date and time of the internal clock.	:SYST:DATE :SYST:TIME
Show Clock	Enables or disables the time and date display inside the status bar.	:DISP:CLOC
Return	Returns to the softkey display screen one level higher.	
Key Lock	Displays softkeys for locking the keyboard and the mouse.	
Front Panel & Keyboard Lock	Locks the front panel keys and the keyboard (key operations disabled).	:SYST:KLOC:KBD
Touch Screen & Mouse Lock	Locks the touch screen[*1] and the mouse (mouse operations disabled).	:SYST:KLOC:MOUS
Return	Returns to the softkey display screen one level higher.	

Key Operation	Function	SCPI Command
System	(Continued)	
Misc Setup		
Color Setup	Displays softkeys for setting up the color of display image.	
Normal	Displays softkeys for setting up the color of the normal display.	
Data Trace 1	Displays softkeys for setting up the color of the data trace of Trace 1.	
Red	Displays softkeys for setting up the amount of red in a color.	
0	Sets 0.	:DISP:COL{1-2}:TRAC1:DATA
1	Sets 1.	:DISP:COL{1-2}:TRAC1:DATA
:	:	:
5	Sets 5.	:DISP:COL{1-2}:TRAC1:DATA
Cancel	Returns to the softkey display screen one level higher.	
Green	Displays softkeys for setting up the amount of green in a color. The lower-level softkeys are the same as those for **Red**.	
Blue	Displays softkeys for setting up the amount of blue in a color. The lower-level softkeys are the same as those for **Red**.	
Return	Returns to the softkey display screen one level higher.	
Data Trace 2	Displays softkeys for setting up the color of the data trace of Trace 2. The lower-level softkeys are the same as those for **Data Trace 1**.	:DISP:COL{1-2}:TRAC2:DATA
:	:	:
Data Trace 9	Displays softkeys for setting up the color of the data trace of Trace 9. The lower-level softkeys are the same as those for **Data Trace 1**.	:DISP:COL{1-2}:TRAC9:DATA
Mem Trace 1	Displays softkeys for setting up the color of the memory trace of Trace 1. The lower-level softkeys are the same as those for **Data Trace 1**.	:DISP:COL{1-2}:TRAC1:MEM
:	:	:
Mem Trace 9	Displays softkeys for setting up the color of the memory trace of Trace 9. The lower-level softkeys are the same as those for **Data Trace 1**.	:DISP:COL{1-2}:TRAC9:MEM
Graticule Main	Displays softkeys for setting up the color of the graticule labels and the outer frame of graphs. The lower-level softkeys are the same as those for **Data Trace 1**.	:DISP:COL{1-2}:GRAT1
Graticule Sub	Displays softkeys for setting up the color of the graticule lines in graphs. The lower-level softkeys are the same as those for **Data Trace 1**.	:DISP:COL{1-2}:GRAT2
Limit Fail	Displays softkeys for setting up the color of the fail label of the limit test. The lower-level softkeys are the same as those for **Data Trace 1**.	:DISP:COL{1-2}:LIM1
Limit Line	Displays softkeys for setting up the color of the limit line of the limit test. The lower-level softkeys are the same as those for **Data Trace 1**.	:DISP:COL{1-2}:LIM2
Background	Displays softkeys for setting up the color of the background. The lower-level softkeys are the same as those for **Data Trace 1**.	:DISP:COL{1-2}:BACK
Reset Color	Resets the color to the factory seting state.	:DISP:COL{1-2}:RES
Return	Returns to the softkey display screen one level higher.	
Invert	Displays softkeys for setting up the color of the inverted display. The lower-level softkeys are the same as those for **Nomal**.	
Return	Returns to the softkey display screen one level higher.	

Key Operation	Function	SCPI Command
System	(Continued)	
Misc Setup		
Channel/Trace Setup	Displays softkeys for setting up the maximum numbers of the channels and traces.	
4 Channels 16 Traces	Sets the maximum number of the channels to 4 and the maximum number of the traces to 16.	None
9 Channels 9 Traces	Sets the maximum number of the channels to 9 and the maximum number of the traces to 9.	None
12 Channels 6 Traces	Sets the maximum number of the channels to 12 and the maximum number of the traces to 6.	None
16 Channels 4 Traces	Sets the maximum number of the channels to 16 and the maximum number of the traces to 4.	None
Return	Returns to the softkey display screen one level higher.	
Control Panel...	Opens a control panel window.	None
Return	Returns to the softkey display screen one level higher.	
Backlight	Turns the backlight for the LCD screen on/off.	:SYST:BACK
Firmware Revision	Displays the firmware revision information in a dialog box.	*IDN?
Service Menu	Displays softkeys for maintenance services.	
Test Menu	Displays softkeys for self diagnosis functions.	
Power On Test	Executes an internal test.	None
Display	Executes a display test.	None
Front Panel	Tests the front panel keys (hardkeys).	None
Adjust Touch Screen	Executes calibration of the touch screen.	None
Return	Returns to the softkey display screen one level higher.	
System Correction	Turns ON/OFF error correction, which uses system calibration data. If user calibration using [Cal] is executed properly and the error correction is valid, you can turn off system error correction and reduce measurement time.	:SYST:CORR
Avoid Spurious	Turns ON/OFF the avoid spurious mode.	:SENS{1-16}:SWE:ASP
High Temperature	Turns ON/OFF the high temperature measurement mode. When the high temperature measurement mode is turned on, drift error can be reduced in the ambient temperature range of 28°C to 33°C. If you use the analyzer within the range of 23°C ± 5°C, you must turn off this function.	:SYST:TEMP:HIGH
Enable Options	Displays softkeys for other options.	
Restart Firmware	Restarts the firmware of the analyzer.	
Update Firmware	Use when firmware is updated	
Service Functions	Displays softkeys for performing service functions. This option is not open to average users.	
Return	Returns to the softkey display screen one level higher.	
Return	Returns to the "E5070B/E5071B Menu (Top Menu)" on page 454.	

*1. Only with Options 016.

Trigger Menu

Key Operation	Function	SCPI Command
Trigger	Displays following seven softkeys for setting the trigger. Once the trigger mode is set, measurements are executed according to the trigger mode even when the channel is no longer on display due to reduction of the number of channels to be displayed from the “Display Menu” on page 480.	
Hold	Sets the active channel trigger mode to “hold”. A trigger sent from the trigger source to that channel will not prompt a sweep.	:INIT{1-16}:CONT
Single	Sets the active channel trigger mode to “single”. A trigger sent from the trigger source to that channel prompts a single sweep and then the sweep mode changes to “hold.”	:INIT{1-16}
Continuous	Sets the active channel trigger mode to “continuous”. Each trigger sent from the trigger source to that channel prompts a single sweep.	:INIT{1-16}:CONT
Hold All Channels	Sets all channel trigger modes to “hold”.	None
Continuous Disp Channels	Sets all displayed channel trigger modes to “continuous”. See “Setting channel display (layout of channel windows)” on page 53 for details about displayed channels.	None
Trigger Source	Displays softkeys for selecting the trigger source.	
Internal	Selects the “internal” trigger source of the analyzer. The analyzer will generate a series of trigger signals. A trigger, once generated, is sent to all channels in order no matter how many channels are displayed.	:TRIG:SOUR INT
External	Selects the “external” trigger source. A signal input to the external trigger input terminal (BNC(f) connector) on the rear panel will be used as the trigger source. A trigger, once generated, is sent to all channels in order no matter how many channels are displayed.	:TRIG:SOUR EXT
Manual	Sets the trigger source to “manual”. Pressing the **Trigger** key in the Trigger Menu generates a trigger. A trigger, once generated, is sent to all channels in order no matter how many channels are displayed.	:TRIG:SOUR MAN
Bus	Sets the analyzer trigger source to “bus”. A trigger is generated by sending a trigger command through the GPIB or a LAN. A trigger, once generated, is sent to all channels in order no matter how many channels are displayed.	:TRIG:SOUR BUS
Cancel	Returns to the softkey display screen one level higher.	
Restart	Aborts a sweep.	:ABOR
Trigger	When the trigger source is set to “manual”, generates a trigger.	:TRIG
Return	Returns to the “E5070B/E5071B Menu (Top Menu)” on page 454.	

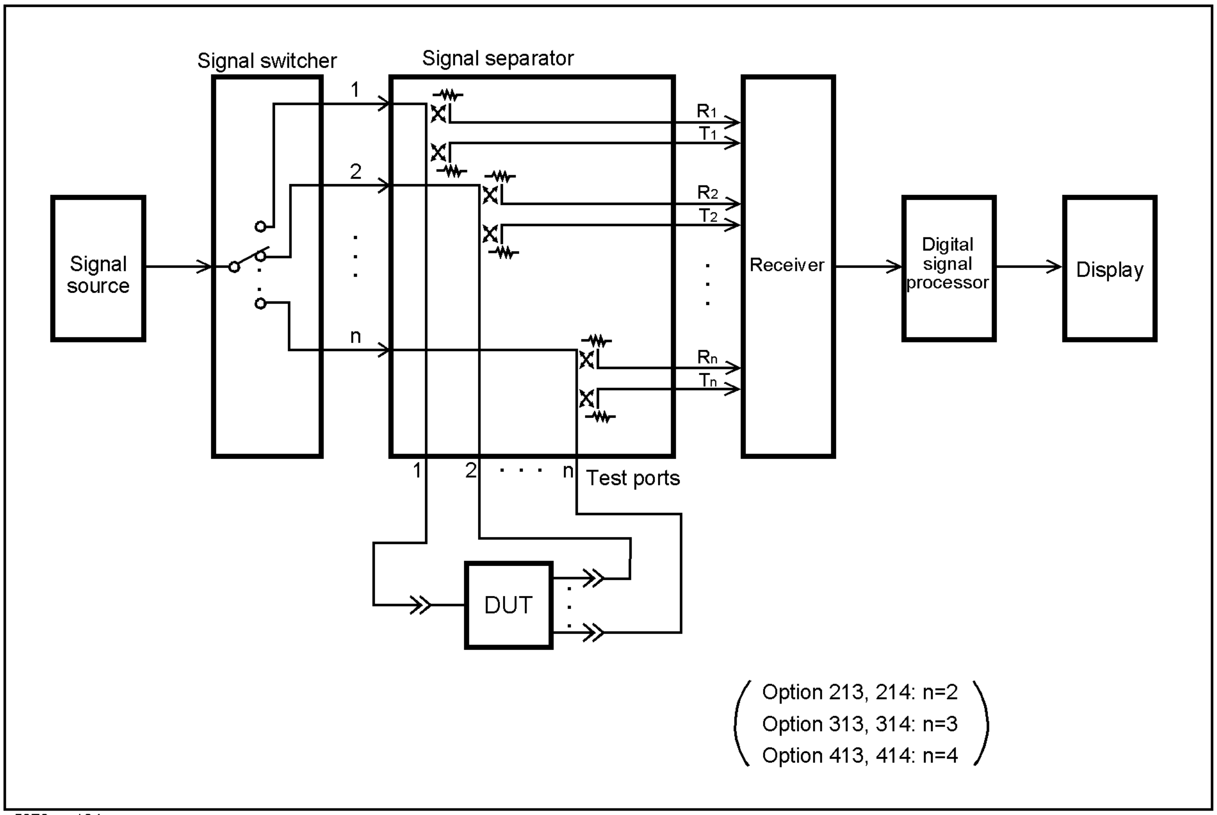
E General Principles of Operation

This chapter explains the general principles of operation for the Agilent E5070B/E5071B.

System Description

A network analyzer supplies a sweep signal to a DUT, measures its transmission and reflection, and displays the results as ratios against the input signal from the signal source. The E5070B/E5071B network analyzer consists of the circuit modules shown in Figure E-1.

Figure E-1 **System Diagram for the E5070B/E5071B Network Analyzer**



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Synthesized Source

The synthesized source generates an RF sweep signal in the following frequency range.

- E5070B: 300 kHz ~ 3 GHz
- E5071B: 300 kHz ~ 8.5 GHz

The signal source is phase-locked to a highly reliable quartz crystal oscillator to maintain a high level of accuracy in its frequency as well as to achieve precise phase measurements. The level of RF output power is controlled within the range of –15 dBm ~ +10 dBm by the internal ALC (automatic leveling control) circuit. The E5070B/E5071B with option 214, 314, or 414 comes with a source-stepping attenuator which allows the user to set the power level in the range of –50 dBm ~ +10 dBm.

Source Switcher

The source switcher is used to switch test ports to which the RF signal is supplied from the source.

Signal Separator

The signal separator consists of directivity couplers that detect input and output signals at the test ports. On a test port to which a signal is output, the output signal and the reflection from the DUT are detected as the reference signal (R) and the test signal (T), respectively. On the other ports, the signal that is transmitted through the DUT is detected as the test signal (T). All signals are then sent to the receiver.

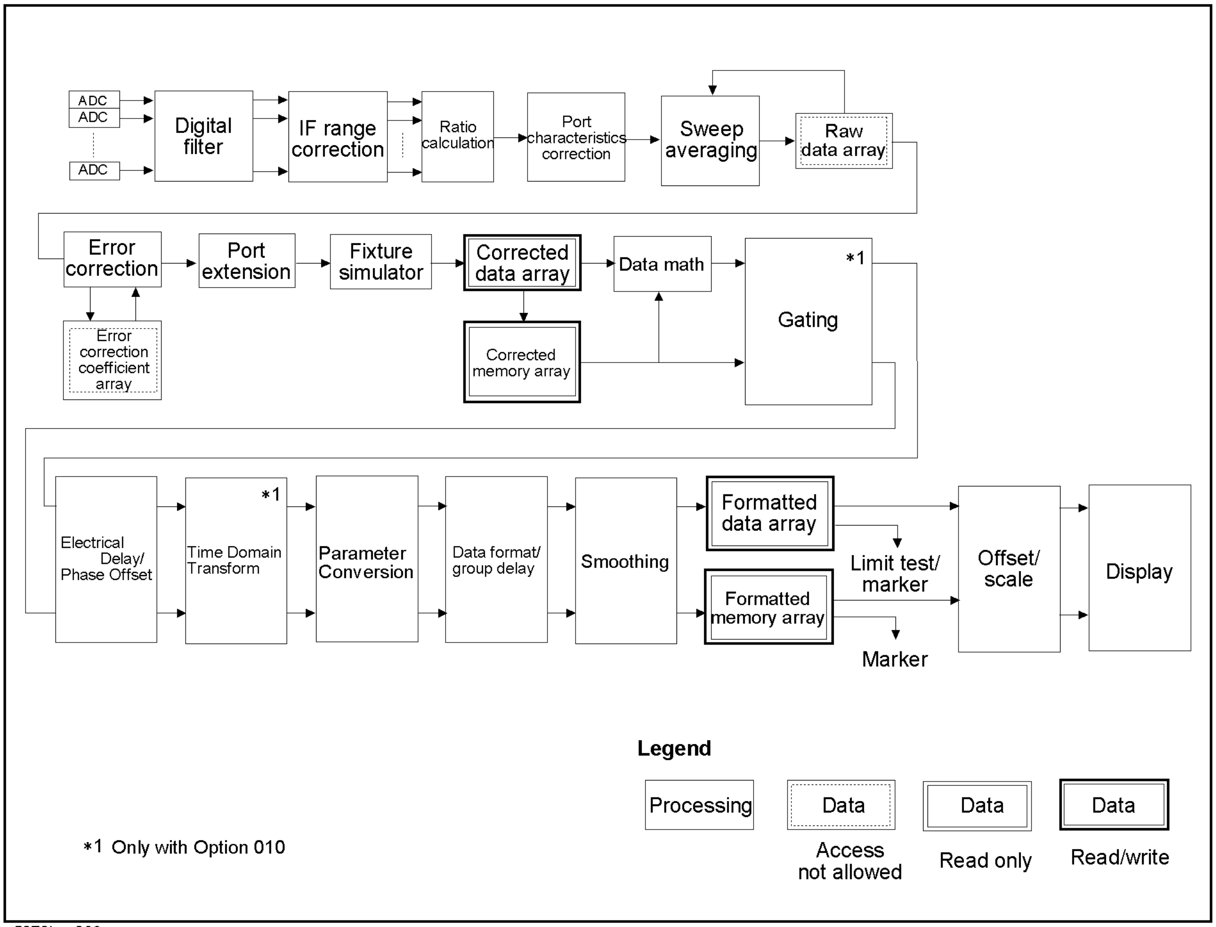
Receiver

Each signal that is sent to the receiver is first converted into an IF signal by a mixer and then converted into a digital signal by an ADC (analog to digital converter). These processes are applied to each signal independently. The digital data is then analyzed by a micro processor and measurement results will be displayed on the screen.

Data Processing

The internal data processing flowchart for the E5070B/E5071B is shown in Figure E-2.

Figure E-2 **Data Processing Flowchart**



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ADC

The ADCs (analog-to-digital converters) convert analog signals fed to the receiver and converted into IF signals (R_1, R_2, ···, R_n and T_1, T_2, ···, T_n) into digital signals. One ADC is available for each signal and the conversion takes place simultaneously.

Digital Filter

The digital filter performs a discrete Fourier transformation (DFT) and picks up IF signals. Each IF signal is then converted into a complex number that has a real part and an imaginary part. The IF bandwidth of the analyzer is equivalent to the bandwidth of the DFT filter. The IF bandwidth can be set in the range of 10 Hz ~ 100 kHz.

IF Range Correction

Input signals that went through ranging at the receiver are reverted (corrected) to previous values before the ranging.

Ratio Calculation

The ratio between two signals is determined by performing divisions on complex numbers.

Port Characteristics Correction

The equivalent source match error, the directivity error, and the tracking error of each test port bridge are corrected.

Sweep Averaging

The average of complex indices is determined based on data obtained from multiple sweep measurements. Sweep averaging is effective in reducing random noise in measurements.

Raw Data Array

The results from all data processing done up to this point are stored in this array as raw data. All prior data processing is performed as each sweep takes place. When the full N-port error correction (N=2 to 4) is enabled, all 4 × N S parameters are stored in the raw data array and used in error correction. The user is not allowed to access (read/write) this raw data array.

Error Correction/Error Correction Coefficient Array

When error correction is enabled, the process eliminates the system errors that are reproducible and stored in the error correction coefficient array (calibration coefficient array). It accommodates everything from the simple vector normalization to the full 12-term error correction. The user is not allowed to access (read/write) this error correction coefficient array.

Port Extension

This process carries out a simulation of adding or eliminating a variable length no-loss transmission path on each test port so that the reference plane of calibration is moved. The port extension is defined by an electrical delay (sec).

Fixture Simulator

A data conversion by the fixture simulator function is executed. The fixture simulator function is a collective term for six different functions: balanced-unbalanced conversion, addition of matching circuits, port reference impedance conversion, network elimination, addition of differential matching circuits, and differential reference impedance conversion.

Corrected Data Array

Unlike the raw data array, this array stores the results obtained after error corrections, port extensions, or the fixture simulator functions are applied. The user is allowed to read/write data from/to the corrected data array.

Corrected Memory Array

By pressing Display - Data → Mem, the contents of the corrected data array will be copied to this array. The user is allowed to read/write data from/to the corrected memory array.

Data Math

Data processing is carried out using the corrected data array and the corrected memory array. Four types of data processing – addition, subtraction, multiplication, and division – are available.

Electrical Delay/Phase Offset

An electrical delay and a phase offset are applied to each trace. By setting an electrical delay, a linear phase that is proportional to the frequency will be added or subtracted. On the other hand, setting a phase offset adds or subtracts a phase that is constant throughout the frequency range. Incidentally, data processing performed from this point on in the flowchart is applied to both the data array and the memory array.

Data Format/Group Delay

Complex data consisting of the real parts and the imaginary parts are converted into scalar data according to the data format of user’s choice. Group delays are also calculated here.

Smoothing

By enabling the smoothing function, each point in a sweep measurement will be replaced by a moving average of several measurement points nearby. The number of points used in calculating a moving average is determined by the smoothing aperture set by the user. The smoothing aperture is defined by a percentage against the sweep span.

Formatted Data Array/Formatted Memory Array

All results from data processing are stored in the formatted data array and the formatted memory array. The marker functions are applied to these arrays. The limit test is applied to the formatted data array. The user is allowed to read/write data from/to these arrays.

Offset/Scale

Each set of data is processed so that traces can be drawn on the screen. Particular scaling depending on the data format is applied using the position of the reference line, the value of the reference line, and the scale/graticule settings.

Display

The results obtained after data processing are displayed on the screen as traces.

F Replacing the 8753ES with the E5070B/E5071B

This chapter describes the information necessary to replace Agilent 8753ES with the Agilent E5070B/E5071B.

Important Functional Differences

This section describes the key differences between the Agilent 8753ES and Agilent E5070B/E5071B.

Channel and Trace Concepts

In the 8753ES, channels 1 and 2 are independent from each other and have auxiliary channels, channels 3 and 4, respectively. Channels 3 and 4 can be displayed as additions to channels 1 and 2, respectively. This allows up to four channels to be displayed for up to four traces on the screen simultaneously. Channels 1 and 3 and channels 2 and 4 are always coupled, while channels 1 and 2 are independent from each other. This enables you to specify different sweep conditions on each of channels 1 and 2. The E5070B/E5071B has four/nine/twelve/sixteen independent channels, each of which allows sweep conditions to be defined different from those on other channels. On the screen you can open up to sixteen windows, each of which allows up to sixteen traces to be defined.

Measurement Parameters

In the 8753ES, S-parameters as well as measurement parameters such as A, B, R, A/R, B/R, and A/B are supported to enable you to measure values such as the absolute value of the power input to a port. The E5070B/E5071B, however, allows only S-parameters to be measured.

Test Port Output Ranges

The 8753ES comes standard with test sets for two ports, while the E5070B/E5071B comes optionally with test sets for two ports (Options 213 and 214), three ports (Options 313 and 314), and four ports (Options 413 and 414). Furthermore, the 8753ES comes optionally with a 75 Ω test set (Option 075), while the E5070B/E5071B does not.

For more about the measurement frequency ranges of the 8753ES and E5070B/E5071B, see Table F-1.

Table F-1 Measurement Frequency Ranges

Function	8753ES	E5070B/E5071B
Measurement frequency range	30 kHz to 3 GHz (std.) 30 kHz to 6 GHz (Option 006)	300 kHz to 3 GHz (E5070B) 300 kHz to 8.5 GHz (E5071B)

For more about the output power levels and output power ranges of the 8753ES and E5070B/E5071B, see Table F-2.

Table F-2 Test Port Output Power Levels

Function	8753ES	E5070B/E5071B
Output power levels	−85 dBm to 10 dBm (std.) −85 dBm to 8 dBm (Options 014 and 075)	−15 dBm to 0 dBm (Options 213, 313, and 413) −50 dBm to 0 dBm (Options 214, 314, and 414)
Output power ranges	−15 dBm to 10 dBm (std.) or −15 dBm to 8 dBm (Options 014 and 075), −25 dBm to 0 dBm, −35 dBm to −10 dBm, −45 dBm to −20 dBm, −55 dBm to −30 dBm, −65 dBm to −40 dBm, −75 dBm to −50 dBm, −85 dBm to −60 dBm	−15 dBm to 0 dBm only (Options 213, 313, and 413) −15 dBm to 10 dBm, −20 dBm to 5 dBm, −25 dBm to 0 dBm, −30 dBm to −5 dBm, −35 dBm to −10 dBm, −40 dBm to −15 dBm, −45 dBm to −20 dBm, −50 dBm to −25 dBm (Options 214, 314, and 414)

Sweep Function

The list (segment) sweep function enables you to perform measurements corresponding to two or more sweep conditions in one sweep operation and is supported both on the 8753ES and E5070B/E5071B. While the 8753ES allows only up to 30 segments per table to be defined, the E5070B/E5071B allows up to 201 segments to be defined. Furthermore, while two or more commands are needed to create a table using GPIB (SCPI) commands on the 8753ES, only one command does the same function on the E5070B/E5071B.

The 8753ES supports an IF bandwidth up to 6 kHz, but the E5070B/E5071Bsupports an IF bandwidth up to 100 kHz, enabling faster sweep operations than with the 8753ES.

While the 8753ES supports automatically selecting the output power range, the E5070B/E5071B supports only manual selection.

On the 8753ES, which supports frequency offset sweeps, frequency conversion devices such as mixers can be measured. The E5070B/E5071B, however, does not support this function.

Calibration

The types of calibration kits supported by the 8753ES and E5070B/E5071B are shown in Table F-3.

Table F-3 Supported Calibration Kits

Type of calibration kit	8753ES	E5070B/E5071B
7 mm	85031B	N/A
3.5 mm	85033C/D/E	85033D/E, 85032D
N type	50 Ω: 85032B/E/F 75 Ω: 85036B/E	50 Ω: 85032B/F 75 Ω: 85036B/E
2.4 mm	85056/D	N/A
TRL 3.5 mm	85052C	N/A
Others	User-defined calibration kit	User-defined calibration kit

The 8753ES allows only one type of user-defined calibration kit to be saved in the internal memory. Up to 15 classes can be set up when defining calibration kits, including 12 classes (isolation included) to be used for full 2-port calibration and three calibration classes (THRU, reflect, and line/match for TRL*/LRM* calibration. A maximum of seven standards can be defined for each calibration class.
In contrast, the E5070B/E5071B allows ten types of user-defined calibration kits to be saved in the internal memory, which include the five calibration kits registrated beforehand. When setting up calibration classes, OPEN, SHORT, and LOAD can be set up on each port and THRU between ports. Only one standard is allowed for each calibration class.

ECal

Both the 8753ES and E5070B/E5071B support ECal measurement. However, each supports slightly different functions. The 8753ES supports enhanced response calibration, 1-port calibration for S11 and S22, and full 2-port calibration. Although the E5070B/E5071B does not support enhanced response calibration, it does support full 3-port calibration (Options 313, 314, 413, 414) and full 4-port calibration (Options 413, 414), making multi-port calibration possible.

While the 8753ES allows the manual measurement for the THRU standard, the E5070B/E5071B does not. Furthermore, the 8753ES allows a frequency array or module information to be read, but these functions are not supported on the E5070B/E5071B.

Trigger System

The trigger system detects the signal for starting a measurement (trigger) and controls decisions on whether to measure or not measure.

On the 8753ES, the trigger state is available for the pair of a main channel and an auxiliary channel (two pairs: channels 1 and 3 and channels 2 and 4). For each pair, three states are available: Hold, Waiting for Trigger, and Measurement. When a trigger event occurs, one pair of channels in the Waiting for Trigger state are put into a sweep operation. If the other pair is also Waiting for Trigger, then the next trigger event puts it into sweep operation as well. When the sweep condition coupling channels is turned on, the Hold, Waiting for Trigger, and Measurement states are common to all channels. In this case, when a trigger event occurs in the Waiting for Trigger state, all channels are put into sweep operation. For example, when you set channel 1 and 2 to uncouple and sweep each channel, you need to set each channel to Hold state and make trigger events to each channel.

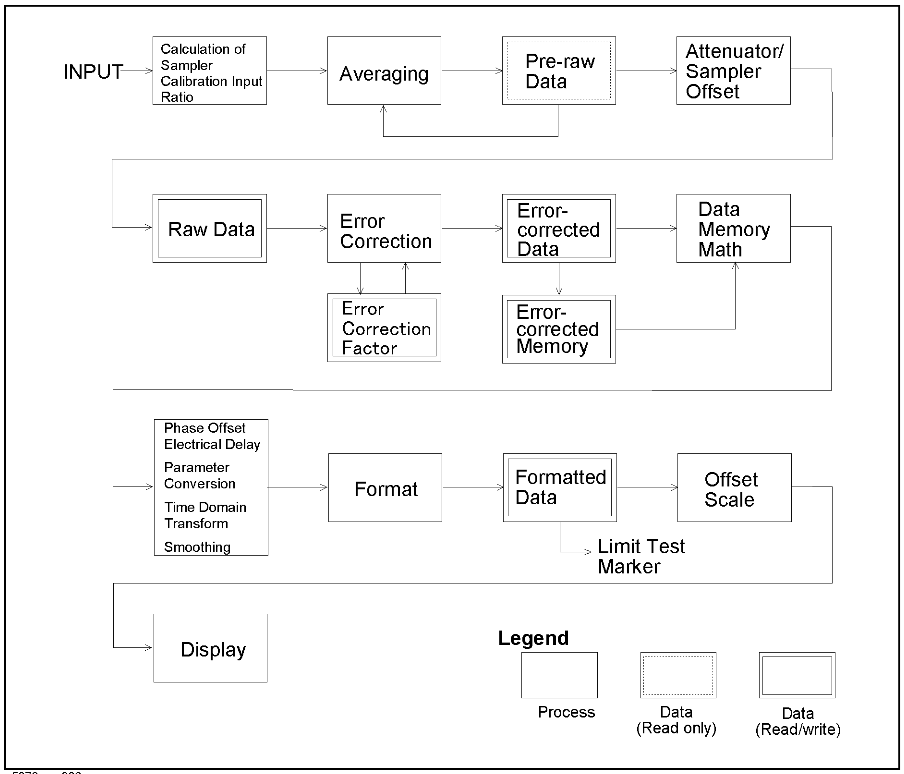
On the E5070B/E5071B, the trigger system involves states of the entire system and those of each of the channels. Since a trigger event is common to all channels, three system-wide states exist: Hold, Waiting for Trigger, and Measurement. On the other hand, two states exist for each channel: Idle and Startup. For a channel in an Idle state, measurement is not performed at all, while for a channel in Startup state, measurements are started in sequence after an event occurs. When all channels are in an Idle state, the E5070B/E5071B is in Hold state when viewed as an entire system. If even one Startup state channel exists, the E5070B/E5071B enters the Waiting for Trigger or Measurement state. Upon a transition from the Waiting for Trigger to the Measurement state, measurement is performed on channels put into Startup state starting with the channel with the smallest channel number.

While the 8753ES allows either High or Low input signals from the external trigger line to be selected, the E5070B/E5071B allows only Low input signals to be selected.

Data Flow

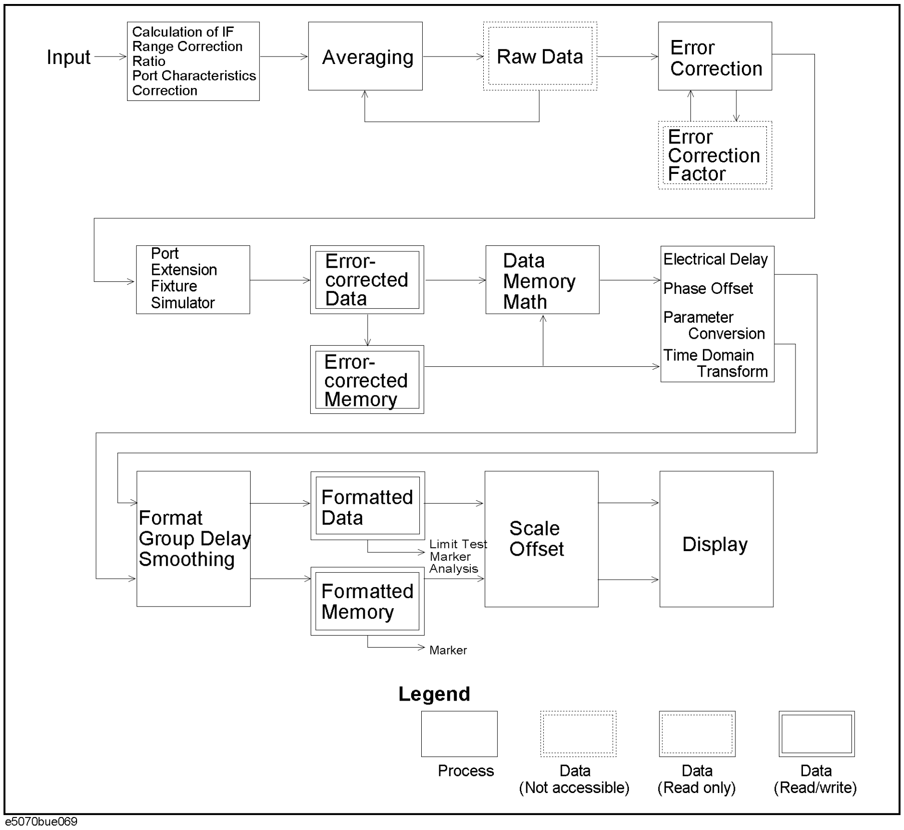
The data flow in the 8753ES is shown in Figure F-1 while the flow in the E5070B/E5071B is shown in Figure F-2. As described in “Reading/Writing Data” on page 523, the types of data you can read/write using the 8753ES differ from those you can read/write using the E5070B/E5071B.

Figure F-1 **8753ES Data Flow**



e5070ame002

Figure F-2 **E5070B/E5071B Data Flow**



Reading/Writing Data

Types of data that can be handled by the 8753ES and E5070B/E5071B are listed in Table 3-4.

Table F-4 **Reading/Writing Data**

Function	8753ES	E5070B/E5071B
Data transfer format	Intra-device binary IEEE 32-bit floating point IEEE 64-bit floating point ASCII PC-DOS 32-bit floating point	IEEE 64-bit floating point ASCII
Reading/Writing data	Raw data array Calibration coefficient array (before interpolation) Corrected data array Formatted memory array Memory trace Calibration kit array data Power meter calibration coefficient array (before interpolation)	Formatted data array Formatted memory array Corrected data array Corrected memory array Power meter calibration coefficient array (after interpolation)
Reading data	Pre-raw data (in Take4 mode) Calibration coefficient array (after interpolation) Power meter calibration coefficient array (after interpolation) Entry area display All lists in list format	

Screen Display and Marker Functions

The 8753ES allows up to four channels to be displayed on the screen. Up to five markers can be displayed on each channel. Also, one of the displayed markers can be designated as the reference marker. Each channel also supports a fixed marker that can be established at a fixed position.

In contrast, the E5070B/E5071B enables you to have all sixteen channels displayed by opening up nine separate windows on the screen. Sixteen traces can be displayed for each channel, and up to nine markers can be displayed for each trace. In addition to the markers displayed, you can also designate one marker as the reference marker. The E5070B/E5071B, however, does not support fixed markers.

The 8753ES supports the Maximum, Minimum, Target value, and Bandwidth marker functions. The E5070B/E5071B supports all these in addition to a Peak Search function. Using this function, you can determine whether or not to search for a positive or negative peak. In addition, the 8753ES has an additional function to search for the maximum or minimum bandwidth. While the 8753ES allows a target value or search tracking to be established only on the active marker, the E5070B/E5071B allows a target value or search tracking to be established on all markers.

Math Operation Functions on Traces

On the 8753ES, each channel is provided with a memory trace. For this reason, math operations between the data trace and memory trace are supported: “Data / Memory” and “Data – Memory”. On the E5070B/E5071B, however, “Data × Memory” and “Data + Memory” are supported along with the division and subtraction operations described above.
The trace displays supported on the 8753ES are: “Data trace only”, “Memory trace only”, “Both memory trace and data trace”, and “Data math only”. The E5070B/E5071B supports these functions in addition to “Both data math and memory trace”.

Device Test Functions

The 8753ES supports the limit test, ripple test, and bandwidth test, while the E5070B/E5071B supports only the limit test. For the limit test on the 8753ES, a limit test table is provided for each channel with up to 18 segments are allowed in each table. In contrast, the E5070B/E5071B allows a limit test table to be defined for each trace and up to 100 segments to be defined per table.

Among the items read from the test results, the 8753ES supports a pass/fail for each channel, segment, and point, plus maximum/minimum values for each segment. In contrast, the E5070B/E5071B supports only a pass/fail of the active trace on each channel.

Analytical Functions

Although the 8753ES does not support the fixture simulator function, the E5070B/E5071B does. The fixture simulator supported by the E5070B/E5071B include the balanced-unbalanced transformation function for analyzing balanced devices, and the matching circuit function.

Save/Recall

For storing data, the 8753ES is provided with an internal register, internal disk drive (floppy disk), and external disk drive (connected through the GPIB). In contrast, the E5070B/E5071B provides an internal hard disk drive, and an internal disk drive (floppy disk). While the 8753ES can save or recall the device setup, screen color settings, and test sequences, the E5070B/E5071B is able to save or recall the instrument setup, segment sweep table, and limit line table as well as VBA projects. The 8753ES saves display data in JPEG format while the E5070B/E5071B supports the Windows® Bitmap (BMP) and Portable Network Graphics (PNG) format.

Test Sequence Program

Although the 8753ES supports the test sequence program, the E5070B/E5071B provides an environment for developing VBA programs for automatic measurement.

Outputting to a Printer/Plotter

The 8753ES enables you to establish the print area covering an entire sheet or just a 1/4 sheet, and to define traces, the reference line, and colors of warning messages. In contrast, the E5070B/E5071B supports only full-sheet output, and an on/off setting for highlighting the entire screen in connection with color setup.

The 8753ES supports parallel ports, serial ports, and GPIB as printer ports, although the E5070B/E5071Bsupports only parallel- and USB-connected printers.

GPIB Interface

While the 8753ES uses pass control to pass the controller information to an external PC or instrument, the E5070B/E5071B does not support this function.

LAN Interface

Although the 8753ES does not support a LAN interface, support for LANs is standard on the E5070B/E5071B.

Other Functions

The 8753ES is provided with Take4 mode, mixer measurement function, and harmonics measurement function (Option 002), but the E5070B/E5071B is not provided with these functions.

Comparing Functions

Table F-5 Functions of the 8753ES vs. the E5070B/E5071B

Function				8753ES	E5070B/E5071B
Measurement	Reset			Can be executed by using the front panel and the GPIB command.	Can be executed by using the front panel, the GPIB command, and telnet.
	Channel	Number of channels		4 channels	4/9/12/16 channels
		Coupling between channels		Channels 3 and 4 are auxiliary channels for channels 1 and 2 and subject to the same sweep conditions, etc. applicable to channels 1 and 2. Couple/Uncouple between channels 1 and 2 can be set up.	Channels are independent of each other.
	Trace			A trace for each channel	Each channel can accommodate up to 4/9/12/16 traces.
	Measurement parameter			S-parameters, A, B, R, A/R, B/R, A/B, and analog bus	S-parameters, Mixed-mode S-parameters
	S-parameter conversion			Impedance (reflection and transmission), admittance (reflection and transmission), and 1/S	←
	Display format (Data format)			log magnitude, linear magnitude, phase, group delay, Smith chart, polar format, SWR, real, imaginary	log magnitude, linear magnitude, phase, expanded phase, positive phase, group delay, Smith chart, polar format, SWR, real, imaginary
	Test port output	Number of ports		2 ports	2 ports (Opts. 213/214) 3 ports (Opts. 313/314) 4 ports (Opts. 413/414)
		Frequency		30 kHz to 3 GHz (Std.) 30 kHz to 6 GHz (Opt. 006)	300 kHz to 3 GHz (E5070B) 300 kHz to 8.5 GHz (E5071B)
		Power level		-85 to +10 dBm (Std.) -85 to +8 dBm (Opts. 014/075)	-15 to 10 dBm (Opts. 213, 313, 413) -50 to 10 dBm (Opts. 214, 314, 414)
		Characteristic Impedance		50 Ω(Std.) 75 Ω(Opt. 075)	50 Ω
		Coupled/Uncoupled power levels		You can define Couple/Uncouple between channels and between ports.	Traces are coupled on the same channel, not between channels.
		Power slope function		Available	←
		Turning the output On/Off		Allowed	←
		Power range	Items to be set up	Per port and per channel	Per channel (Opts. 214/314/414) If the above options are not installed, the default range is -15 to 10 dBm.
			Automatic setting	On/Off setting capability	Manual setting
			Setting range	Range setting with 10 dBm resolution is definable from between -15 and +10 dBm down to between -85 and -60 dBm.	Range setting with 5 dBm resolution is definable from between -15 and 10 dBm down to between -50 and -25 dBm

Table F-5 Functions of the 8753ES vs. the E5070B/E5071B

Function				8753ES	E5070B/E5071B
Measurement (cont'd.)	Sweep conditions	Number of points (except for the list frequency sweep operation)		3, 11, 21, 26, 51, 101, 201, 401, 801, 1601	Arbitrary value from 2 to 1601
		Sweep type		linear sweep, log sweep, list sweep, power sweep, and CW time sweep	linear sweep, log sweep, segment sweep, and power sweep
		List frequency sweep	Number of list tables	One for channels 1 and 3 and one for channels 2 and 4, two in total	One for each channel (16 in total)
			Number of segments per table	Up to 30	Up to 201
			Creation of a table using GPIB(SCPI) command	Creating a table using more than one command	Creating a table using a single command
			Number of points	1 to 1601 points per segment Up to 1601 points in total	2 to 1601 points per segment Up to 1601 points in total
			Stepped/swept mode	stepped mode and swept mod. Selectable only when list frequency sweep is performed	stepped mode, swept mode, fast stepped mode, and fast swept mode. Selectable also when list frequency sweep is not performed.
			Sweep of designated segments.	Allowed	Not allowed (Always sweeps all segments.)
		Sweep time		Automatic, Manual (definable from the shortest time to 24 hours)	Automatic, Manual (range of definable sweep depends on sweep condition)
		IF bandwidth		10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 KHz, 3 kHz, 3.7 kHz, 6 kHz	10 Hz, 15 Hz, 20 Hz, 30 Hz, 40 Hz, 50 Hz, 70 Hz, 100 Hz, 150 Hz, 200 Hz, 300 Hz, 400 Hz, 500 Hz, 700 Hz, 1 kHz, 1.5 kHz, 2 kHz, 3 kHz, 4 kHz, 5 KHz, 7 KHz, 10 KHz, 15 KHz, 20 KHz, 30 KHz, 40 KHz, 50 KHz, 70 KHz, 100 kHz
		Averaging		Can be set from 1 to 999.	Can be set from 1 to 999.
	Smoothing			The smoothing aperture can be set from 0.05% to 20%.	The smoothing aperture can be set from 0.05% to 25%.
	Electrical delay	Transmission line		Compatible with coaxial cables and waveguides	Compatible with coaxial cables only
		Value		Any value from 0 to 10 seconds	Any value from -10 to +10 seconds
	Phase offset			Any value from -360° to +360°.	Any value from -360° to 360°.
	Setting sweep conditions for Couple/Uncouple			Channels 1 and 3 and channels 2 an 4 are always coupled. Channels 1 and 2 can be set either at Couple or Uncouple.	Traces in the same channel are coupled; traces in different channels are not coupled.
	Trigger mode			Continuous, single, hold, specified number of sweeps	Continuous, single, hold

F. Replacing the 8753ES with the E5070B/E5071B

Table F-5 Functions of the 8753ES vs. the E5070B/E5071B

Function			**8753ES**	**E5070B/E5071B**
Measurement (cont'd.)	Trigger source		Internal, external (per sweep, per point), manual (per point)	Internal, external (per sweep), bus, manual (per sweep)
	External trigger line		Can be set to High or Low	Low
Display	Memory trace	Number	One per channel	One per trace
		Data math	Data / Memory Data – Memory	Data / Memory Data × Memory Data – Memory Data + Memory
		Display	Data trace only Memory trace only Simultaneous display of memory traces and data traces Data math only	Data trace only Memory trace only Simultaneous display of memory traces and data traces Data math only Simultaneous display of data math and memory traces
	Frequency display		On/Off setting is definable for all channels.	On/off setting is definable channel by channel.
	Graph layout		Up to four graphs can be displayed.	Windows are assigned to each channel; up to sixteen windows can be displayed. Up to sixteen graphs can be displayed in each window.
	Math between data traces		The results for channel 1/channel 2 can be displayed on the trace for channel 2.	Not available
	Scale	Auto scale	Available	←
		Reference line	Both value and position can be specified.	←
		Scales per division	Definable	←
		Number of divisions	Fixed at 10	Can be set in increments of 2 from 4 to 30.
	Turning the softkey area On/Off		Available	←
	List display		Available	Not available
	List display of Instrument State		Available	Not available
	Color settings		Available	←
	Screen brightness setting		Available	Not available
	Turning the LCD On/Off		Available	←
	Turning the update On/Off		Always updates.	Available

Table F-5 Functions of the 8753ES vs. the E5070B/E5071B

Function			8753ES	E5070B/E5071B
Calibration	Calibration kit		Available calibration kits: 7 mm: 85031B 3.5 mm: 85033C/D/E N type (50 Ω): 85032B/E/F N type (75 Ω): 85036B/E 2.4 mm: 85056A/D TRL 3.5 mm: 85052C User defined calibration kit	3.5 mm:85033D/E, 85052D N type (50 Ω): 85032B/F N type (75 Ω): 85036B/E Up to six user defined calibration kits can be registered.
	Calibration type	Not more than two ports	Response calibration Response and isolation calibration Enhanced response calibration S11 1-port calibration S22 1-port calibration Full 2-port calibration TRL*/LRM* Calibration Receiver calibration Power meter calibration	Response calibration (OPEN,SHORT, THRU) Full 1-port calibration Full 2-port calibration TRL Calibration (VBA) The response calibration includes isolation measurement as an option.
		Not less than three ports	Not available	Full 3-port calibration (Opts. 313, 314, 413, and 414 only) Full 4-port calibration (Opts. 413 and 414 only) TRL Calibration (VBA)
	Omission of the isolation measurement		Possible (Can be omitted by designating it using the softkeys on the front panel or sending a GPIB command from the front panel)	Possible (Isolation measurement is performed as an option accompanying a response calibration and 2-, 3-, and 4-port calibration.)
	Power meter calibration		Available	←
	Receiver calibration		Available	Not available
	Adapter removal		Available	Not available
	Velocity factor		Definable	←
	Characteristic impedance of the measurement system		Definable	Definable with fixture simulator
	Port extension		Definable for ports 1 and 2 and inputs A and B	Definable for each port per channel
	Selection between chop sweep and alternate sweep		Can be changed over.	Chop sweep for traces in a channel and alternate sweep between channels
	Error correction		On/Off setting is definable.	←
	Interpolating the calibration coefficient		On/Off setting is definable.	Always On.

Table F-5 Functions of the 8753ES vs. the E5070B/E5071B

Function				8753ES	E5070B/E5071B
Calibration (cont'd.)	Defining the calibration kit	Calibration class		S11A (OPEN) S11B (SHORT) S11C (LOAD) S22A (OPEN) S22B (SHORT) S22C (LOAD) Forward Transmission Forward Match Reverse Transmission Reverse Match Response Response & Isolation TRL Thru TRL Reflect TRL Line/Match	OPEN SHORT LOAD THRU (OPEN, SHORT, and LOAD are set for each port; THRU is set between ports)
		Class indication label		Editable	Not editable
		Number of standards that can be registrated in calibration classes		Up to seven types	One type
		Type of standard		OPEN, SHORT, LOAD, and THRU Arbitrary Impedance	OPENOPEN, SHORT, LOAD, and THRU Arbitrary Impedance, None
		Standard parameters	Common to standards	Offset delay Offset loss Offset characteristic impedance Frequency range Offset type (coaxial, waveguide)	Offset delay Offset loss Offset characteristic impedance
			Unique to OPEN	C0, C1, C2, C3	←
			Unique to SHORT	Not available	L0, L1, L2, L3
			Unique to LOAD	Type of standard (fixed, sliding, offset)	Not available (the type of standard is treated as fixed load.)
			Unique to THRU	Not available	←
			Arbitrary Impedance	Type of standard (fixed, sliding) Arbitrary Impedance	Arbitrary Impedance
		Standard label		Editable	←
	ECal	Type of calibration		Enhanced response calibration S11 1-port calibration S22 1-port calibration Full 2-port calibration	Response (thru) calibration Full 1-port calibration Full 2-port calibration Full 3-port calibration (Opts. 313/314/413/414) Full 4-port calibration (Opts. 413/414)
		Omission of isolation		Allowed	←
		Manual THRU measurement		Allowed	Not allowed
		Reading the frequency array		Allowed	Not allowed
		Reading the module information		Allowed	Not allowed

Table F-5 Functions of the 8753ES vs. the E5070B/E5071B

Function		8753ES	E5070B/E5071B
Reading/Writing data	Transfer format	Intra-device binary IEEE 32-bit floating point IEEE 64-bit floating point ASCII PC-DOS 32-bit floating point	IEEE 32-bit floating point IEEE 64-bit floating point ASCII PC-DOS 32-bit floating point
	Object to be read/written	Raw data array Calibration coefficient array (before interpolating) Corrected data array Formatted memory array Memory trace Calibration kit array data Power meter calibration coefficient array (before interpolating)	Corrected data array Corrected memory array Formatted data array Formatted memory array Power meter calibration coefficient array (after interpolating)
	Object to be read only	Pre-raw data (in Take4 mode) Calibration coefficient array (after interpolating) Power meter calibration coefficient array (after interpolating)	
	Reading data for a designated point or scope	Allowed only for data traces	Not allowed
Marker	Number of markers	Up to five markers per channel	Nine markers per tracer (exclude reference marker)
	Active marker	One marker per channel	One marker per trace
	Delta marker (Reference marker)	Designates the marker displayed as the reference marker.	You can designate the reference marker independently from the markers displayed.
	Marker coupling	Setting of Couple/Uncouple definable	Setting of Couple/Uncouple definable (coupling available only between markers on the same channel)
	Marker move mode	Continuous/discrete (definable channel by channel)	Continuous/discrete (definable trace by trace)
	Fixed marker	One marker definable per channel	Not available
	Marker value display	On/Off setting for the marker value display definable per channel	All marker values for active traces are displayed on each channel. Display/No Display setting for the marker table displaying all marker values definable

Table F-5 Functions of the 8753ES vs. the E5070B/E5071B

Function			8753ES	E5070B/E5071B
Markers (cont'd.)	Marker search	Search function	Maximum, minimum, target value, bandwidth	Maximum, minimum, target value, peak
		Object of search	Active marker	Arbitrary marker (during remote control) Active marker (when manipulating the front panel)
		Parameters for bandwidth search	Bandwidth, bandwidth center frequency Q factor, loss	Bandwidth, bandwidth center frequency Upper and lower frequency of the bandwidth Q factor, loss
		Target value	Definable for an active marker	Definable for each marker
		Target transition type	Not definable	Setting of Positive/Negative transition definable (per marker)
		Search tracking	On/Off setting definable for the active marker (Markers other than the active marker are always turned off.)	On/Off setting definable for each marker
	Marker reading set at a parameter		Values of the start, stop, center, span, CW frequency, and reference line in the sweep range	Values of the start, stop, center, span, and reference line in the sweep range
	Reading the marker value (for remote control)		Possible for the active marker	Possible for any marker
Device test	Limit test	Limit test table	One per channel Number of segments: Up to 18 per table	One per trace Number of segments: Up to 100 per table
		Offset	Definable	Not definable
		Creating a table by using the GPIB command	Create a table by using two or more commands	Create a table by using one command
		Reading the results	Per channel, Per segment Pass/fail at each point, Number of points per segment that failed the maximum/minimum, Stimulus value at a failed point	Pass/Fail of the active trace on each channel Number of failed points Stimulus value at a failed point
	Ripple test		Available	Not available
	Bandwidth test		Available	Not available (Marker search function can be used for the bandwidth search.)
Analysis	Fixture simulator		Not available	Available

Table F-5 Functions of the 8753ES vs. the E5070B/E5071B

Function		8753ES	E5070B/E5071B
Status report	Register types	Status byte register Service request enable register Standard event status register Standard event status register B and enable register	Status byte register Service request validation register Standard event status register Operation status register and validation register Questionable status register and validation register
	For limit test	Included in the standard event status register B and validation register	Questionable limit status register Questionable limit status channel register Questionable limit status extra channel register
Save/Recall	Storage	Internal registers Internal disk (floppy disk) External disk (connected through GPIB)	Internal hard disk Floppy disk
	Storage initialization	Possible	Available with mouse
	Save only	LCD screen image	Formatted data array LCD screen image
	Object to be saved/recalled	Instrument State (You can simultaneously save formatted data array for the active trace, raw data array, corrected data array, and LCD images.) Color settings Test sequence	Instrument State (You can simultaneously save formatted data array for the active trace and calibration data.) Segment sweep table Limit line table VBA project
	File formats	Binary form, ASCII form	Binary form
	Format for saving the screen display	JPEG format	Windows® Bitmap format, PNG format
	File manipulation	Reading file information Deleting a file	Reading file information Deleting a file or folder Creating a folder Copying a file
Macros	Creating macros	Uses a test sequence.	Uses VBA.
	Automatic execution	Will execute if “AUTO” is given as the name of the sequence 6.	Only auto loading is possible.
System	Self-test	Can be executed by using the front panel and SCPI commands.	Can be executed by using the front panel.
	Internal clock	Available	Available
	Beep sound	On/Off setting definable for completion of actions, warnings, and limit test failures	On/Off setting definable for completion of actions and warnings
	Measuring instrument mode	Can be selected from a standard network analyzer, external signal source (automatic), external signal source (manual), and tuned receiver.	Always a network analyzer

Table F-5 Functions of the 8753ES vs. the E5070B/E5071B

Function			8753ES	E5070B/E5071B
Printer / Plotter output	Print range		Entire sheet, 1/4 of a sheet	Entire sheet
	Color settings		Settings definable for the colors of a trace, reference line, text, and warning messages	Highlighting/No highlighting of all elements
	Line settings		Possible	Always a solid line.
	Printer port		Parallel port Serial port GPIB	Parallel port USB
Others	Time domain transformation		Available	←
	Take4 mode		Available	Not available
	Mixer measurement function		Available	Not available
	Harmonics measurement		Available (Opt. 002)	Not available
	Key manipulation-related GPIB command		GPIB commands that perform the same processing as do the front panel key and softkey manipulation.	Not available
	LAN	interface	Not available	10 Base-T and 100 Base-TX
		protocol	Not available	TCP/IP
		function	Not available	Telnet, SICL-LAN
	GPIB	Debug mode	Can be turned On/Off	Not available
		pass control	Available	Not available
		GPIB address setup	The addresses of the main body, controller, external disk, LO control, power meter, printer, and plotter can be specified by using the GPIB command and from the front panel.	The address of the main body can be specified from the front panel. The addresses of the power meter can be specified by using the GPIB command and from the front panel.
		Parallel port	Can be used as a printer or GPIO connector.	For printer use

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