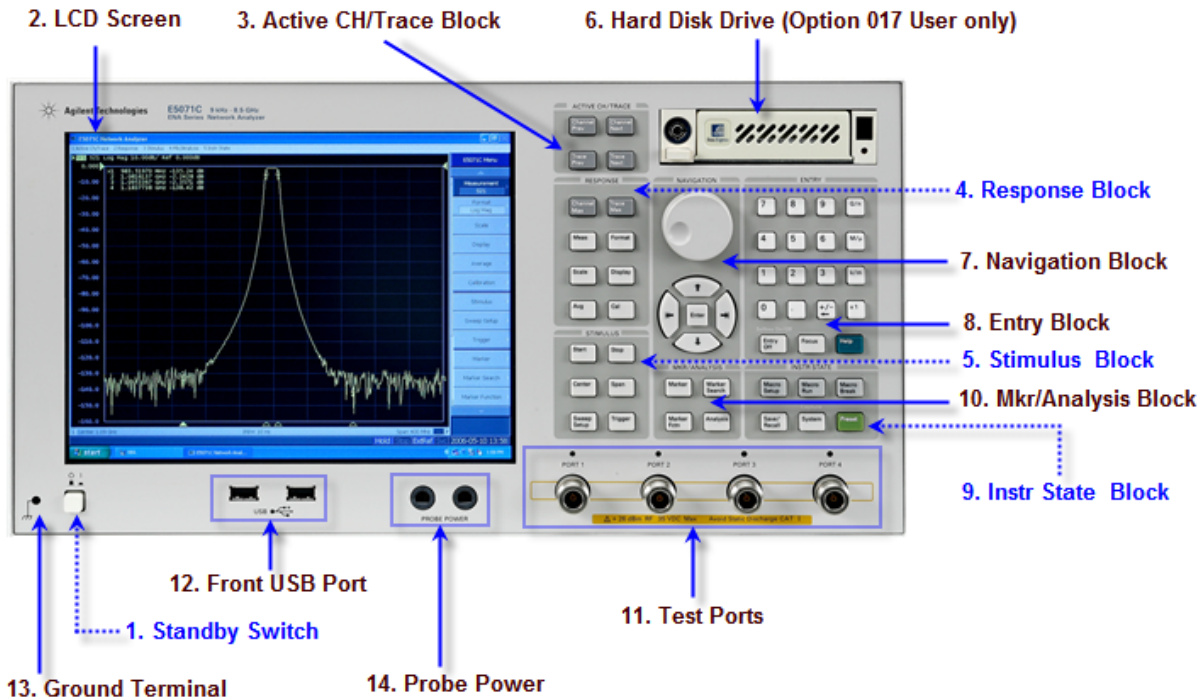# Quick Start

Quick Start

Quick Start helps you to understand the E5071C operation quickly.

- Overview
    - Front Panel
    - Rear Panel
    - Screen Area
- Three Methods of Operation
- Basic Measurement Procedures
- Measurement Example of a Bandpass Filter

Overview

Front Panel: Names and Functions of Parts

1. Standby Switch

Used for choosing between power-on (|) and standby (O) state of E5071C. Do not connect an USB memory at power on.

To turn off the power for the E5071C, 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 E5071C into the standby state.

2. Next, if necessary, turn off power supply to the Power Cable Receptacle (to LINE) on the rear panel.

   CAUTION   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 Line Switch (Always ON) at (|). Never turn it off (O).

   If you directly interrupt the power supply to the power cable receptacle when the power supply is on, or turn off the Line Switch (Always ON), the shutdown process will not work. This

could damage the software and hardware of the E5071C 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 to start up the system in normal mode.

2. LCD Screen

The E5071C is equipped with a 10.4-inch TFT color, touch-sensitive LCD screen for displaying traces, scales, settings, softkeys and other measurement related information. The touch screen LCD allows you to manipulate softkeys by touching the LCD screen directly with a finger. For more on the LCD screen, see Screen Area: Names and Functions of Parts.

NOTE Do not press the surface of the LCD screen 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.

NOTE Valid pixels are 99.998 % and more. Below 0.002 % of fixed points of black, blue, green or red are not regarded as failure.

3. ACTIVE CH/TRACE Block

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

Key Name	Description
Channel Next Key	Selects 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). A channel must be active before you can define such parameters as the sweep range. To change the settings for a channel, use this key to first make the channel active.
Channel Prev Key	Selects 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	Selects 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.) A trace must be active before you can define measurement parameters and other settings. To change the settings for a trace, use this key to first make the

	trace active.
Trace Prev Key	Selects 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 E5071C.

Key Name	Description
Channel Max Key	Changes between normal and maximum display of the active channel window. In normal display, all of 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.
Meas Key	Displays the Measurement Menu 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 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 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 the right side of the screen. Manipulating the Display Menu enables you to specify the number of channels and the channel window array, the number and arrangement of traces, the setup for data math, etc.
Avg Key	Displays the Average Menu 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 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).

Key Name	Description
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 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** Key.)
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** Key.)
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** Key.)
Sweep Setup Key	Displays the Sweep Setup Menu 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 the right side of the screen. Manipulating the Trigger Menu enables you to specify the trigger mode and trigger source. You can specify the trigger mode for each channel.

6. Hard Disk Drive (Option 017 User only)

The E5071C comes with a removable hard disk drive. For removal procedure, see Removing/Mounting Removable Hard Disk.

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 selected (highlighted) areas in a dialog box as well as 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 ENTRY Block to select the object to be manipulated (placing focus on the object) and then manipulate the **NAVIGATION** Block keys (knob) to move among selected (highlighted) objects or change numeric values.

The following descriptions show how the **NAVIGATION** Block keys work both when the focus is on a softkey menu and when the focus is on the data entry area. For more on manipulating tables and dialog boxes, refer to the manipulation procedure for each of these functions.

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

E5071C

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.

Key Name	Description
⊙Knob (turned clockwise or counterclockwise)	Moves the softkey selection (highlighted display) up or down.
⬆/⬇Keys	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 (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 on the data entry area (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.

Key Name	Description
⊙Knob (turned clockwise or counterclockwise)	Increases or decreases the numeric value in the data entry area in small steps.
⬆/⬇Keys	Increases or decreases the numeric value in the data entry area in large steps.
⬅➡ Keys	Moves the cursor (|) in the data entry area laterally back and forth. Use it together with the ENTRY Block keys to change data one character at a time.
⊙Knob or **Enter** key (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 is provided on the front panel of the E5071C.

Key Name	Description
0, 1, 2, 3 ..... **9 , .** Keys (numeric keys)	Type numeric characters or 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. ⬅ is the backspace key. • **+/-** key works only when there are no numerical values in the entry area. When a numerical character is entered in the entry area, the **+/-** key transforms into (⬅) backspace key.
G/n, M/u, k/m, x1 Keys	Adds a prefix to the numeric data typed by using the numeric key and **+/-** key 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.
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 closes the dialog box. If the data entry bar and dialog box are not displayed, turns the softkey menu display on/off.
Help Key	Displays online help for E5071C.
Focus Key	Changes the selection (focus) among 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) among 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 keys related to the macro function, store and call function, control/management function, and the presetting of the E5071C (returning it to the preset state).

Key Name	Description
Macro Setup Key	Displays the Macro Setup Menu on the right side of the screen. Manipulating the Macro Setup Menu enables you to start up the VBA editor or to create, call, or store a VBA project.

Macro Run Key	Executes a VBA procedure called "main" that has a VBA module named Module1.
Macro Break Key	Stops the VBA procedure being executed.
Save/Recall Key	Displays the Save/Recall Menu on the right side of the screen. Manipulating the Save/Recall Menu enables you to store the setup conditions to or read from the storage devices, 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 to the internal memory (clipboard). Immediately after that, displays the System Menu on the right side of the screen. Manipulating the System Menu enables you to define the setup for the limit test and then execute it or to define the setup for the control and management of the analyzer. Using the **Dump Screen Image** option enables you to store the image data in the clipboard to a file on the storage devices. Also, using the **Print** option in the System menu enables you to print the image data in the clipboard to a printer.
Preset Key	Displays the Preset Menu on the right side of the screen. Clicking **OK** in the Preset Menu enables you to return the analyzer to the initial setup state, called the preset setup.

10. MKR/ANALYSIS Block

A group of keys used for analyzing the measurement results by using the markers, fixture simulator, etc. For more on the functions of the keys in the **MKR/ANALYSIS** Block, see Overview of Functions.

Key Name	Description
Marker Key	Displays the Marker Menu 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 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 the right side of the screen. Manipulating the Marker Function Menu enables you to not only specify the marker sweep range and the coupling of markers on a channel but also to display statistics data on traces.
Analysis	Displays the Analysis Menu on the right side of the screen. Manipulating the Analysis Menu enables you to use the analytical function called the

Key	fixture simulator.

⚠️ **11. Test Port**

The port to which the DUT is connected. Number of ports depends on the option. While signals are being output from a test port, the yellow LED above the test port is lit.

Test Port for options 2D5, 4D5, 2K5 and 4K5

Options	Connector type
230, 430, 235, 435, 240, 440, 245, 445, 260, 460, 265, 465, 280, 480, 285, 485	50 ohm, N-type, female
2D5, 4D5, 2K5 and 4K5	50 ohm, 3.5 mm, male

- Do not apply DC voltage or current to the test port. Applying DC voltage or current may lead to device failure. In particular, the capacitor might remain 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 maximum DC limit of test port is 35V.

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

12. Front USB Port

Two USB (Universal Serial Bus) ports are provided that can be used for connecting to ECal (Electronic Calibration) module, USB, Multiport test set or a printer. Connecting a designated ECal module to this port enables ECal measurements to be taken. Connecting a compatible printer to this port enables screen information on the E5071C to be printed. For more on executing ECal measurements, see Calibration, and for printing, see Printing Displayed Screen.

> NOTE   The specifications of this port are identical to those of the Rear USB port.

13. Ground Terminal

Connected to the chassis of the E5071C, a ground terminal is provided with the E5071C. You can connect a banana-type plug to this terminal for grounding.

14. Probe Power

E5071C

The E5071C comes with two ports that can be used to provide power to external probes. See the Data sheet for the voltage and maximum current.

Rear Panel: Names and Functions of Parts
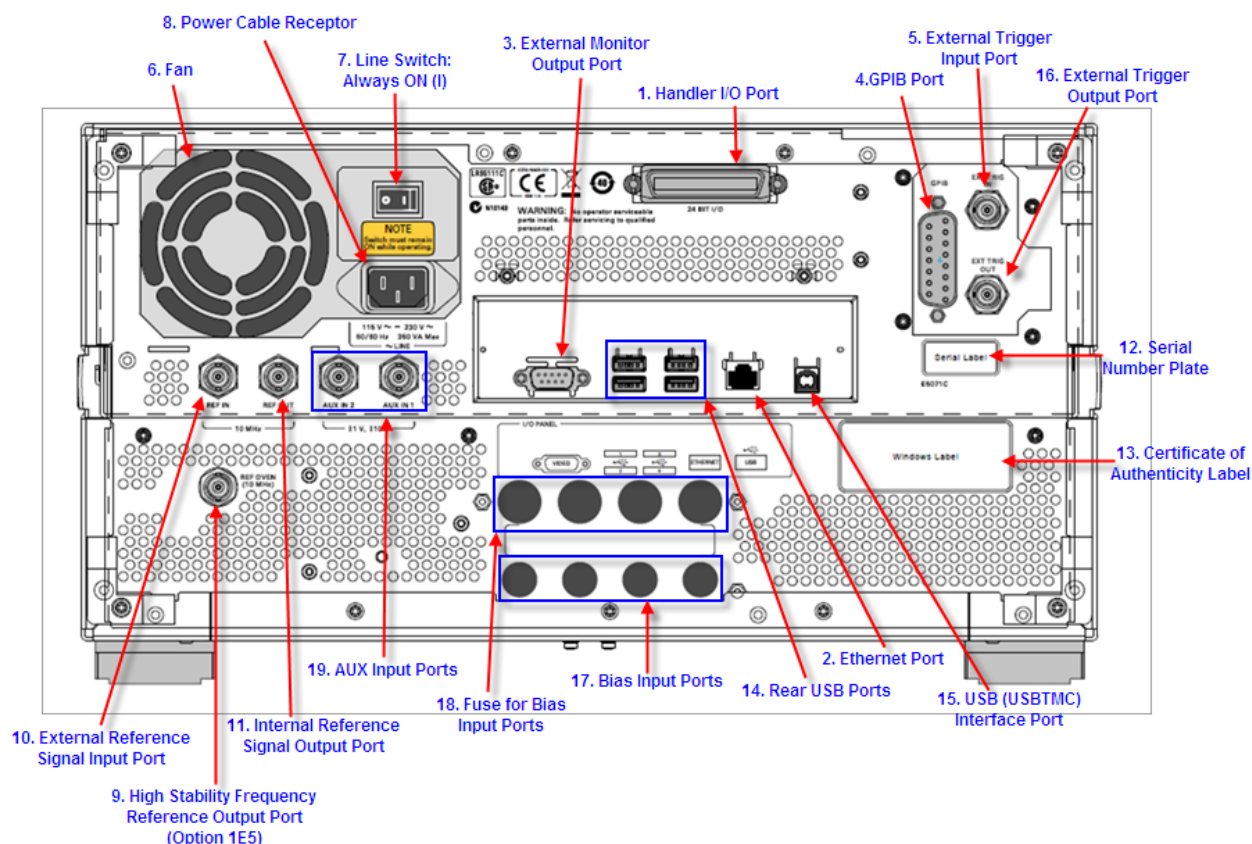
1. Handler I/O Port

The terminal to which an automatic machine (handler) used on a production line is connected. See Handler I/O Port.

Connector type: 36-pin Ribbon (Centronics) connector

2. Ethernet Port

A terminal for connecting the E5071C 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.

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

3. External Monitor Output Port (Video)

A terminal to which an external color monitor (display device) can be connected. By connecting a 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

The connection of an external controller through General Purpose Interface Bus (GPIB) connector allows you to configure an automatic measurement system.

This GPIB connector is used only for controlling the E5071C from an external controller. Use USB/GPIB interface to control other devices from the E5071C. You cannot control other devices from the E5071C through this GPIB connector.

5. External Trigger Input Port (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 "external" (key operation: **Trigger** > **Trigger Source** > **External**).

Connector type: BNC connector, female

6. Fan

The cooling fan for controlling the temperature inside the E5071C. 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 (O) the mains. Doing so may cause the analyzer to fail. For more information, see the description of the Standby Switch.

8. Power Cable Receptacle (to LINE)

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

> **NOTE** To connect the device to a power source (outlet), use the supplied 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 E5071C. When the power supply must be cut off to avoid such danger as electric shock, 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 Standby Switch.

For more on the power supply, see the Installation Guide.

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

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

Specification	Value
Connector type	BNC connector, female
Output signal (Typical)	10 MHz ± 1 ppm, 0 dBm minimum

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

10. External Reference Signal Input Port (Ref In)

The reference signal input connector for phase-locking the measurement signal from the E5071C to the external frequency reference signal. Inputting the reference signal to this connector improves the accuracy and frequency stability of the measurement signal from the E5071C.

Specification	Value
Connector type	BNC connector, female
Input signal (Typical)	10 MHz ± 10 ppm, -3 dBm to +10 dBm

NOTE   When the frequency reference signal is input to this connector, the measurement signal from the E5071C is automatically phase-locked to the reference signal. When an input signal is not present, the frequency reference signal inside the E5071C 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 High Stability Frequency Reference Output Connector (Ref Oven, Option 1E5 only) by using the BNC(m)-BNC(m) cable included with the option.

### 11. Internal Reference Signal Output Port (Ref Out)

E5071C

A connector for outputting the internal frequency reference signal from the E5071C. 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 E5071C and used under this condition.

Specification	Value
Connector type	BNC connector, female
Output signal (Typical)	10 MHz ± 5 ppm, 0 dBm ± 3 dBm
Output impedance (Typical)	50 ohm

12. Serial Number Plate

The label showing the product number, serial number and the installed option number. The accessary and system rack options are not listed on this label. (CFGxxx or ATOxxx in the first line is for Agilent Use Only.)
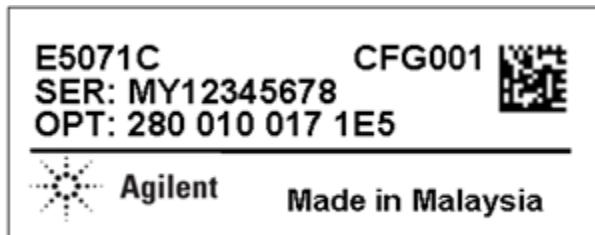
e5071c501

13. Certificate of Authenticity Label

The label showing the information of the Certificate of Authenticity of Windows.

14. Rear USB Port

Four USB (Universal Serial Bus) ports are provided that can be used for connecting to ECal (Electronic Calibration) module, USB, Multiport test set or a printer. Connecting a designated ECal module to this port enables ECal measurements to be taken. Connecting a compatible printer to this port enables screen information on the E5071C to be printed.

NOTE   The specifications of this port are identical to the Front USB Port.

15. USB (USBTMC) Interface Port

Through this port, you can control the E5071C from external controllers. For more information on the measurement system using the USB port, see the USB Remote Control System.

Specification	Value
Connector type	Universal serial bus (USB) jack, type B (4 contact positions),

	Female
Compliance Standards	USBTMC-USB488 and USB2.0

16. External Trigger Output Port

The External Trigger Output Port can output the pulse with the specified polarity either before or after the measurement of each point.
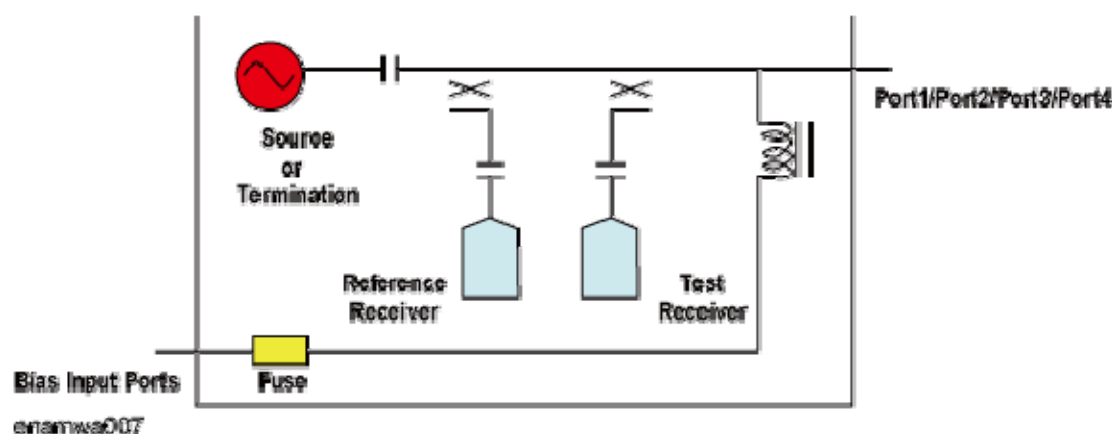
NOTE   The External Trigger Output Port can safely handle a maximum Output Current of 50mA.

Symbol	Parameter	Typical Value	Unit	Condition
	Pulse Width	1	μsec	
VOH	HIGH Level Output Voltage	5	Volt	I_{out}=-50μA
VOL	LOW Level Output Voltage	0	Volt	I_{out}=50μA

⚠ 17. Bias Input Ports

This BNC female connector allows external bias to be applied at the test ports.

CAUTION   Do not apply DC voltage exceeding 35 Volt.

NOTE   Bias Input Port is an optional component of E5071C. Valid for options: 235, 435, 285, 485.

18. Fuse for Bias Input Ports

Fuse for Bias Input Ports is an optional component of E5071C. Valid for options: 235, 435, 285, 485.

E5071C

Specification	Description
Fuse Rating	0.5A/125V
Part Number	2110-0046

19. Aux Input Ports

The Aux Input Ports are used to input DC signal for DC signal measurement.

Screen Area

Screen Area: Names and Functions of Parts
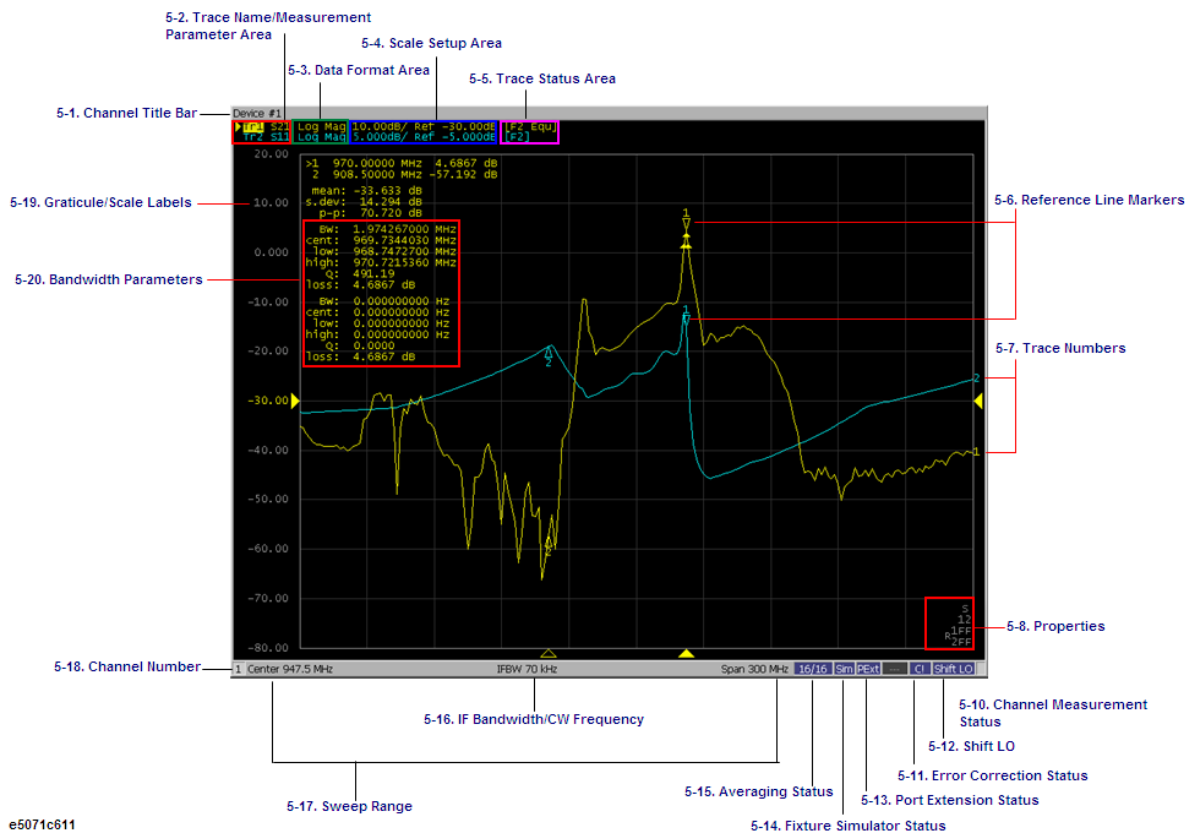
Click on the name or area for details of the topic:

- Menu Bar

- Data Entry Bar

- Softkey Menu Bar

- Instrument Status Bar

- Channel Window

- **Windows XP Status Bar** - Windows XP Status Bar may or may not appear, depending on the Windows license. Under the same condition, either Windows resize buttons or E5071C resize button will appear. For more information, refer to Windows License.

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 the following figure, Channel 1 (the upper window) is the active channel. To make a channel active, use **Channel Next** or **Channel Previous** key. Clicking inside a channel window will also make the channel active.

NOTE Channel 1 Window and Channel 2 Window describes different measurement parameters available in the channel measurement window. The measurement parameters described in the Channel 1 and 2 Window correspond to the same channel measurement window and are displayed in separate windows for ease of read.

Channel 1 Window

e5071c611

Channel 2 Window

5-21. Marker Number Area

5-22. Marker Stimulus Value Area

5-23. Marker Response Value Area

5-26. Statistical Data

5-24. Markers

5-25. Marker Indicators

e5071c058
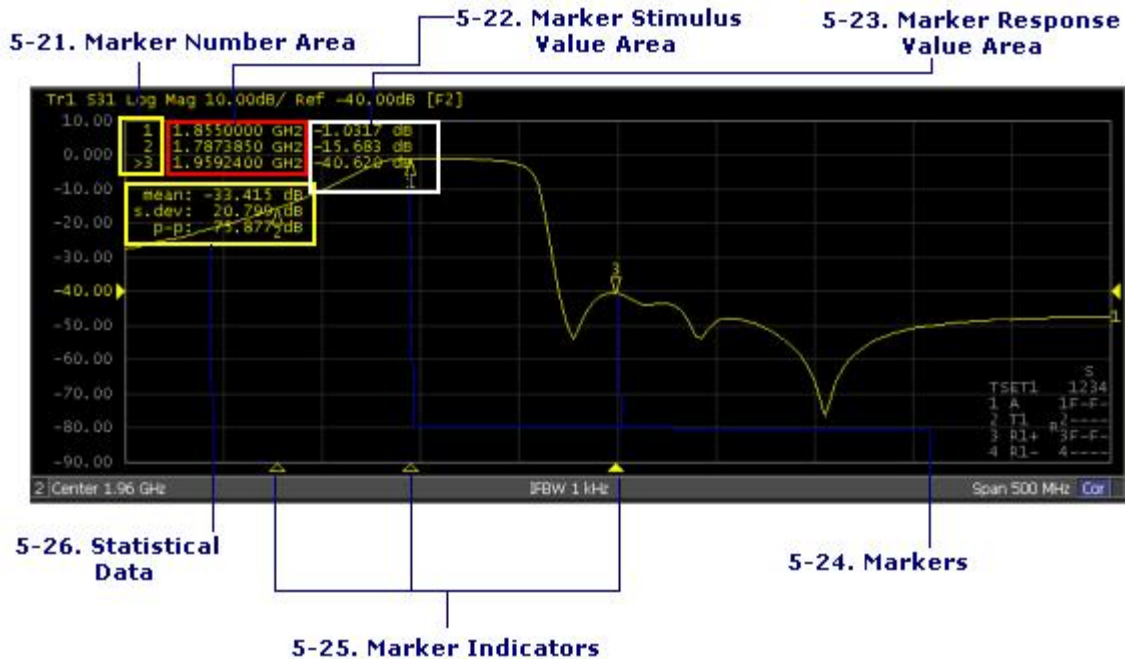
Channel Title Bar

You can assign a title to each channel and have the title displayed on the bar. For more on setting up a channel title bar, see Labeling a window.

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** Key or **Trace Prev** Key. Clicking the line where the trace name is placed (the mouse pointer

changes from ↖ to ✋) also makes a trace active.

Data Format

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

Scale Settings

The scale setting for each trace is displayed here. This example shows that "10.00dB/" corresponds to 10 dB per division. "Ref 0.000dB" shows that the value of the reference line is 0 dB. For more on setting scales, see Setting the Scales.

E5071C

Displays the Shift LO status on the channel.

Trace Status Area

The setup for each trace is displayed here.

Trace status display

Classification	Contents inside [ ]	Meaning
Error correction (In the option TDR, this information should be ignored.)	**RO**	Error correction: ON (OPEN (n) response calibration)
	RS	Error correction: ON (SHORT (n) response calibration)
	RT	Error correction: ON (THRU (n) response calibration)
	ER	Error correction: ON (Enhanced response calibration)
	F1	Error correction: ON (1-port calibration)
	F2	Error correction: ON (Full 2-port calibration / 2-port TRL calibration)
	F3	Error correction: ON (Full 3-port calibration / 3-port TRL calibration)
	F4	Error correction: ON (Full 4-port calibration / 4-port TRL 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 **When a memory trace is ON, see the contents inside ()**	**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)
	Ztsh	Conversion: ON (Impedance: Transmission-Shunt measurement)
	Yr	Conversion: ON (Admittance: Reflection measurement)
	Yt	Conversion: ON (Admittance: Transmission measurement)
	Ytsh	Conversion: ON (Admittance: Transmission-Shunt measurement)
	1/S	Conversion: ON (Inverse S-parameter)
	Conj	Conversion: ON (Conjugation)
Power correction	**PC**	Error correction: ON (Power calibration)
Receiver correction	**RC**	Error correction: ON (Receiver calibration)
Scalar-mixer correction	**Cor**	Error correction: ON (Scalar-mixer calibration)
Equation Editor	**Equ**	Equation Editor: ON

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 is to the right and the other is 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 the 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 (i.e., 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

e5071e444

Displays the following properties.

Property Name	Description
Calibration Property	Displays the status of the obtained calibration coefficients on the channel. For details, see Acquisition status of calibration coefficient for each channel.
E5091A Property	Displays the assignment information of the test ports on the channel. For details, see Displaying the multiport test set properties.
Balanced Measurement Topology Property	Displays the topology for balanced measurement on the channel. For details, see Checking device type and port assignment.

5-9. Channel Status Bar

40

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 been 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.

5-12. Power Calibration Status

Displays the execution status of power level error correction on the channel. For details, see Turning Power Level Error Correction ON/OFF.

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** Key + 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 on the bandwidth search function, see Determining the Bandwidth of the Trace (Bandwidth Search).

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

Here, "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 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 on the statistics data function, see Determining the Mean, Standard Deviation, and p-p of the Trace

Data Entry Bar

Used to enter numeric data into the E5071C. 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.

Data entry bar

e5070bue054

> **NOTE** To manipulate the data entry bar by using the front panel keys, the data entry bar must be selected as the object to manipulate (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** Key in the ENTRY Block 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.

You can hide the frequency information in order to ensure its confidentiality or for other reasons. For detailed information, see Hiding Softkey's Frequency Information.

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 mouse to manipulate this button.

Instrument Status Bar

The instrument status bar displays the status of the entire instrument.

e5070bue056
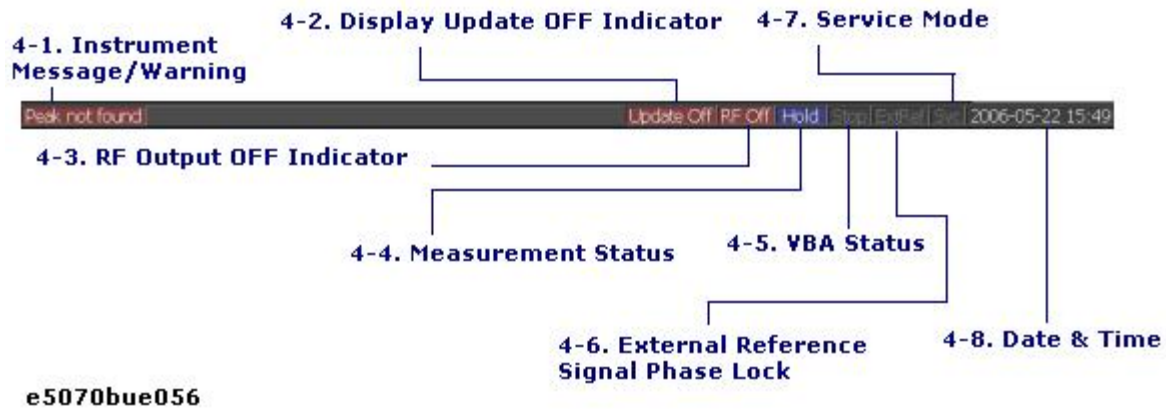
4-1. Instrument Message/Warning

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 Troubleshooting.

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 RF signal output is turned off, this indicator is displayed.

4-4. Measurement Status

Displays the measurement status of the E5071C.

Value	Description
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 E5071C.

Value	Description
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 External Reference Signal Input Connector (Ref In) on the rear panel and the measurement signal of the E5071C is phase-locked to the reference signal, ExtRef is displayed in blue.

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

4-7. Service Mode

Indicates the service mode status.

Value	Description
SVC (displayed in blue)	The E5071C is in one of the following mode. • Service mode, which is used for self-diagnosis • 8 term calibration mode • Advanced Mode in TDR 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 E5071C. The unit may be damaged. Notify the Customer Contact listed at the end of this manual or the distributor from whom the unit was purchased.
SVC (displayed in gray)	The E5071C is in normal mode.

4-8. Date and Time

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

YYYY-MM-DD HH:MM

Where:

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

> NOTE   You can turn the date and time display on/off by:
> **System** > **Misc Setup** > **Clock Setup** > **Show Clock.**

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 E5071C. The menus on the menu bar correspond to the key blocks, and their submenus to the hardkeys inside the key blocks.

Softkey Menu Bar

A group of keys on the screen called by the softkeys and menu bars. You can manipulate these keys by using the **NAVIGATION** Block keys on the front panel, the mouse, or the keyboard. You can perform manipulations by directly touching the screen with your finger instead of using a mouse.

Softkey Menu Bar

E5071C

3-1. Softkey Menu Title

3-9. Scroll Arrow (small)

3-8. Scroll Box

3-4. Highlighted Selection Key

3-5. Selection Mark

3-3. Softkeys

3-6. Softkey Status Box

3-7. Scroll Bar

3-2. Scroll Arrow (big)

Display

Allocate Channels
Num of Traces
1
Allocate Traces
Display
Data
Data -> Mem
Data Math
OFF
Edit Title Label
Title Label
OFF
Graticule Label
ON
Invert Color
OFF
Frequency
ON
Update
ON
Return

Allocate Channels
×1
×2
×2
×2
×2
×3
×3
×3
×3
×3
×3
×4

e5070aue075

NOTE   To manipulate a menu bar, it has to be selected as the object to manipulate (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** Key in the ENTRY Block enables you to move the focus to the desired object.

50

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** key on the front panel or pressing **Enter** key 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 a softkey's setup status.

You can hide the frequency information in order to ensure its confidentiality or for other reasons. See Hiding Softkey's Frequency Information.

3-7. Scroll Bar

When the softkeys in a menu overflow the screen, clicking on the blank part of the 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 indicate the length and position of the currently displayed part of the softkey menu relative to the entire 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.

Three Methods of Operation

You can operate the E5071C using one of three operating methods: using keys on the front panel, using a mouse and keyboard, and using the touch screen. This section illustrates these three operating methods through the example in which the channel window layout is set to the four-channel display as shown in the following figure.

In the next section and those following it, a series of operations is expressed as follows:

Display > **Allocate Traces** >

Four-Trace Display

e5071c193
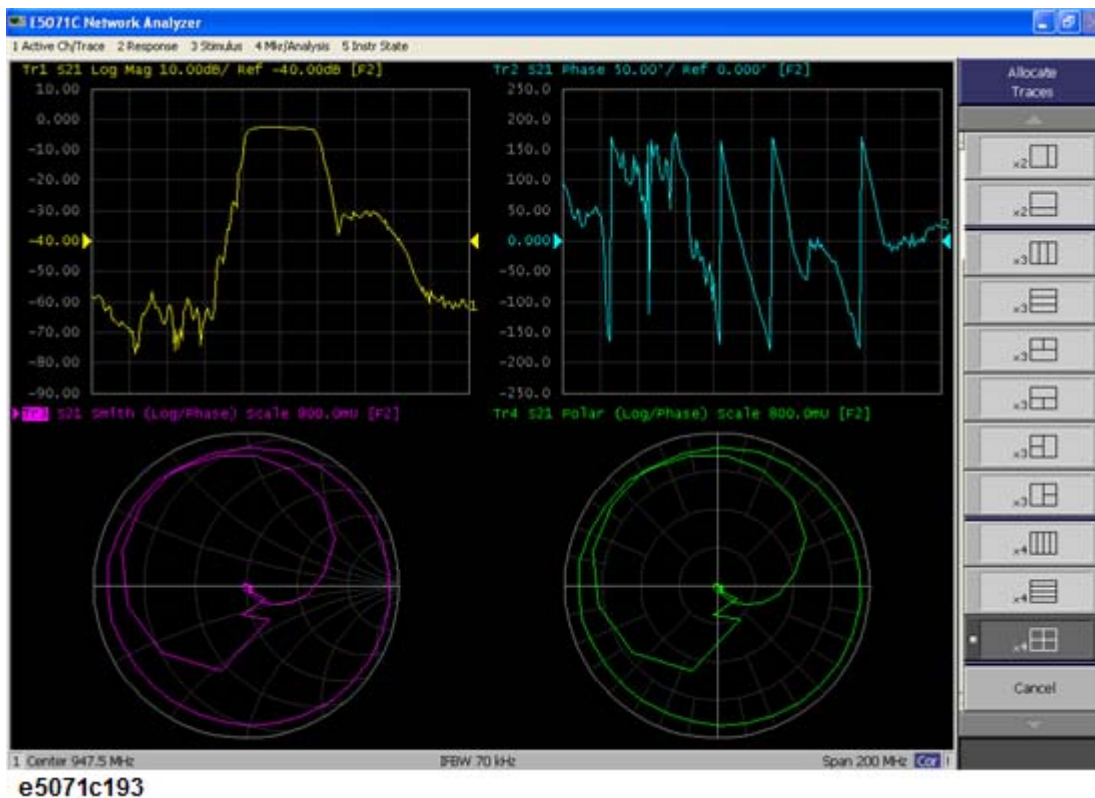
Operating Method Using Keys

1. Press the **DISPLAY** key in the **RESPONSE** Block.
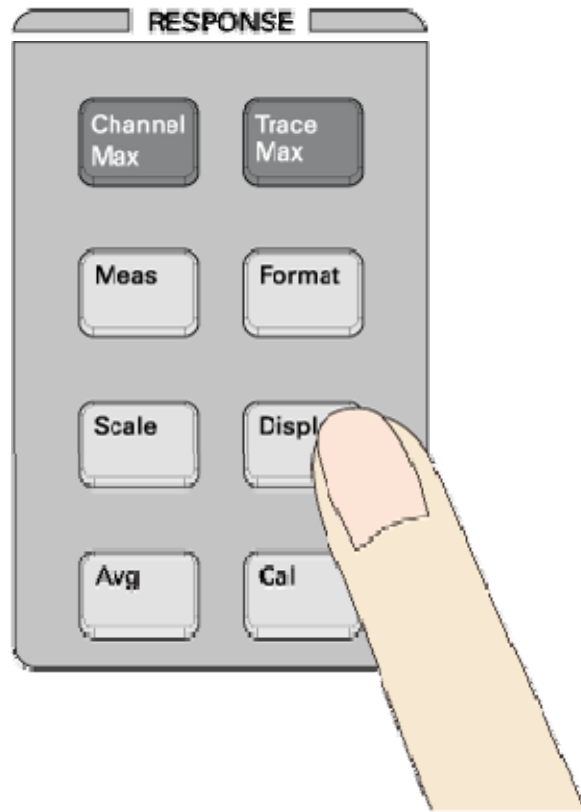
e5071c307

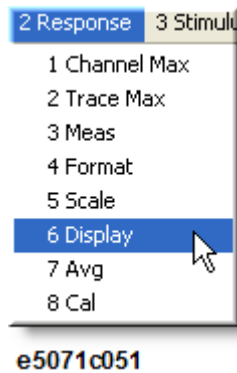2. Press ⊽or ⊼key to move the cursor to the **Allocate Traces**, then press **Enter** or (⟳) key.

e5071c002

3. Press ⊽or ⊼ key to move the cursor to ▦ ×4 , then press **Enter** key.

Operation Method Using a Mouse

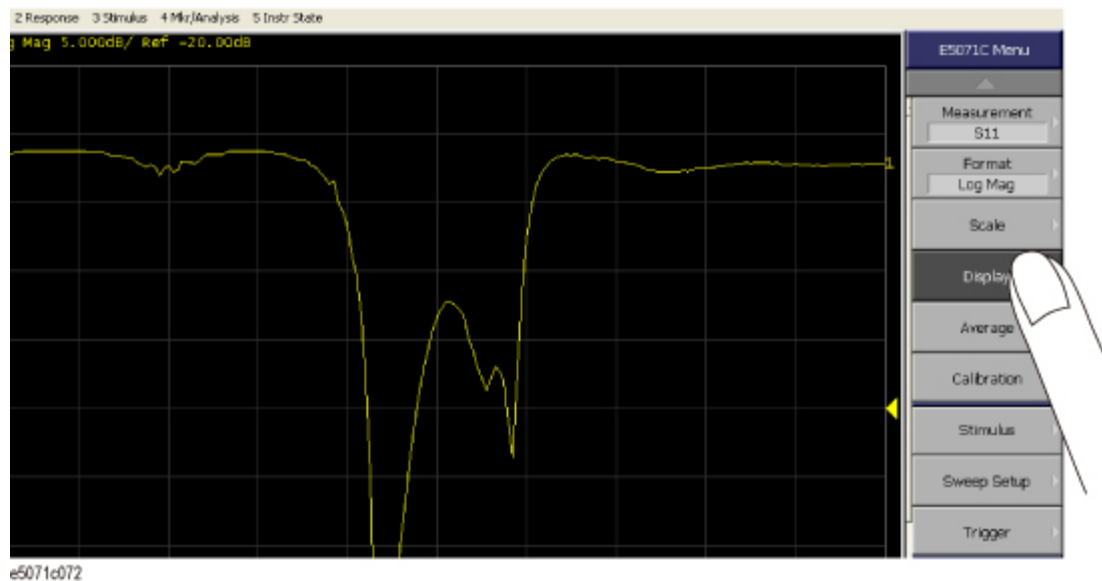1. From the **Response** menu, press **Display** key.

e5071c051

2. Click **Allocate Traces**.

3. Click

Operation Method Using the Touch Screen

1. Press **Display** key after presetting the E5071C (Executing **Preset** key).

e5071c072

2. Click/Press **Allocate Traces.**

3. Click/Press any desired setting.

Basic Measurement Procedures

To better understanding how to use the E5071C, this section describes the basic measurement procedure using the E5071C and presents an example of the transmission measurement of a bandpass filter.

Basic Measurement Flow

1. Determining measurement conditions

- Presetting the E5071C
- Select:
    - S-parameter
    - Data format
    - Frequency range
    - Number of measurement points
    - Power level
    - IF bandwidth

2. Calibration

- Specify calibration kit
- Select calibration type
- Measure calibration data
- Make error correction ON
- Save calibartion data

3. Connecting the Device Under Test (DUT)

- Connect DUT
- Adjust the scale

4. Analyzing measurement results

- Analysis using markers

5. Outputting measurement results

- Store measurement file to a disk

Measurement Example of a Bandpass Filter

This section describes how to measure the transmission characteristics of a 947.5 MHz bandpass filter. The measurement conditions for this measurement example are those suitable for a 947.5 MHz bandpass filter. To measure another device under test (DUT), change the measurement conditions to suit the particular DUT.

STEP 1. Determining Measurement Conditions

1. Preset the E5071C.

   Preset > **OK**

2. Set the S-parameter to S21.

   Meas > **S21**

   3. When measuring the reverse transmission characteristics, set the S-parameter to S12.

3. Set the data format to the log magnitude format

   Format > **Log Mag**

4. Set the center frequency to the bandpass filter center frequency. Next, specify the span frequency, which is set to 200 MHz in this measurement example.

   Center > **9** > **4** > **7** > **. 5** > **M/m**
   Span > **2** > **0** > **0** > **M/m**

   3. When entering the frequency unit using the keyboard, type "G" for GHz, "M" for MHz, and "k" for kHz.

5. Specify the number of measurement points per sweep. The number of measurement points in this measurement example is set to 401.

   Sweep Setup > **Points** > **4** > **0** > **1** > **x1**

6. Specify the power level of the signal source. The power level in this measurement example is set to -10 dBm.

   Sweep Setup > **Power** > **+/-** > **1** > **0** > **x1**

7. Specify the IF bandwidth of the receiver as necessary. In this measurement example, the IF bandwidth is set to 10 kHz because of the need to lower the noise floor.

Avg > **IF Bandwidth** > **1** > **0** > **k/m**

STEP 2. Calibration

To turn the error correction ON, set the calibration type to the full 2-port calibration and measure the calibration data.

For details about calibration, see Calibration.

1. Select the calibration kit suitable for the measurement cable. In this measurement example, Calibration Kit 85032F is selected.

Cal > **Cal Kit** > **85032F**

2. Set the calibration type to the full 2-port calibration using the test port 1 and 2.

Cal > **Calibrate** > **2-Port Cal** > **Select Ports - 1-2**

3. Connect the OPEN standard (included in the calibration kit) to the other end of the measurement cable that is connected to the test port 1 as shown in the following figure, and measure the open calibration data at the test port 1. After measuring the open calibration data, a checkmark is displayed to the left of the **Port 1 Open** menu.

Cal > **Calibrate** > **2-Port Cal** > **Reflection** > **Port1 Open**

In the same way, measure the calibration data for the SHORT/LOAD standards at the test port 1.

***Connecting the OPEN/SHORT/LOAD standards***
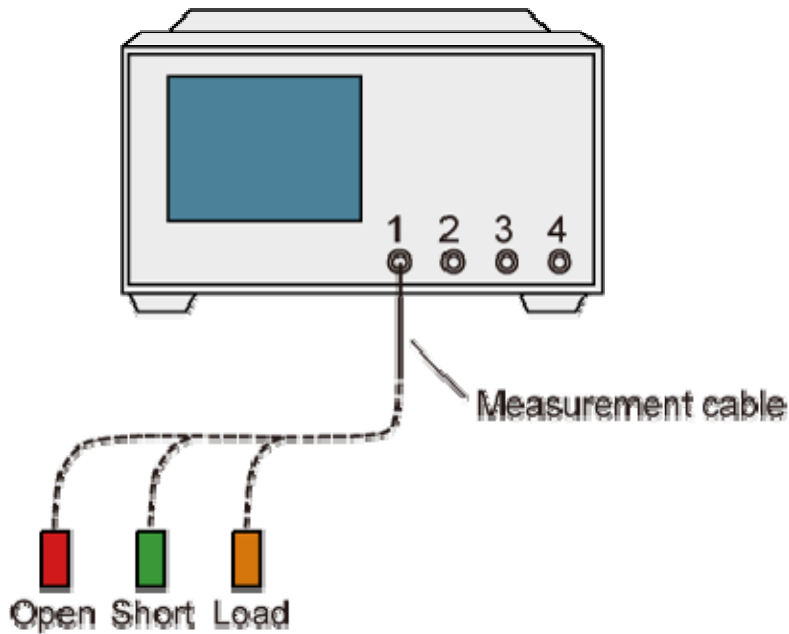
Open Short Load

e5071c323

4. In the same way as described above, measure the calibration data for the OPEN/SHORT/LOAD standards at the test port 2.

5. Connect the THRU standard (included in the calibration kit) between the measurement cables as shown in the figure below , and measure the thru calibration data. After measuring the thru calibration data, a checkmark ☑ appears is displayed to the left of the **Port 1-2 Thru** button.

Cal > **Calibrate** > **2-Port Cal** > **Transmission** > **Port 1-2 Thru**

Connecting the THRU standard
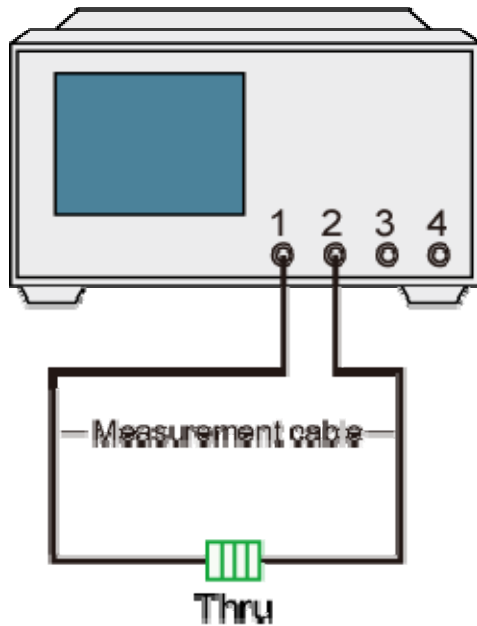
e5071e816

6. Make the full 2-port calibration measurement DONE. The calibration factor is calculated based on the calibration data acquired, and the error correction is turned ON.

Cal > **Calibrate** > **2-Port Cal** > **Done**

7. Select the type in which the data is to be saved before saving the calibration factor (calculated based on the calibration data).

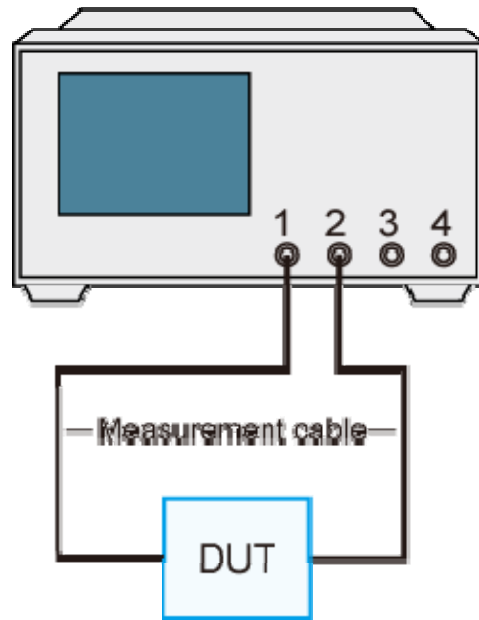**Save/Recall** > **Save Type** > **State & Cal**

8. Store the calibration file to the disk of the E5071C. The symbol "X" appearing in the operations below represent the assigned numbers to be used when the file is saved.

Save/Recall > **Save State** > **State 0X**

STEP 3. Connecting the Device Under Test (DUT)

1. Connect to the DUT to the E5071C. (See the below figure)

Connecting the DUT

e5071c315

2. Set the appropriate scale by executing the auto scale. (See the below figure)

   Scale > **Auto Scale**

   You can also adjust the scale by entering arbitrary values in the **Scale/Div** button, **Reference Position** button, and **Reference Value**.

S21 trace after executing the auto scale

e5071c053

STEP 4. Analyzing Measurement Results

This section describes how to use the marker function to read out important parameters for the transmission measurement of the bandpassfilter (insertion loss, -3 dB bandwidth).

Measuring the Insertion Loss

1. Display a marker.

   Marker > **Marker 1**

2. Using one of the following methods, move the marker to the center frequency of the bandpass filter.

   - On the entry bar, press **9**> **4** > **7** > **.** > **5** > **M/m**

   - Turn the rotary knob ⊙ on the front panel to set it to the center frequency (947.5 MHz).

3. Read the marker value displayed as shown in the figure below. In this example, the response value denotes the insertion loss.

Measuring an Insertion Loss

e5071c054

Measuring the -3 dB Bandwidth

Using the marker bandwidth search function, the bandwidth, center frequency between two cutoff frequency points, Q value, and insertion loss are all read out. These parameters are described in the following table.

> **NOTE**   If the two cutoff frequency points are not found, all data items except the insertion loss revert to zero.

Parameter	Description
BW (Bandwidth)	Stimulus width between two cutoff frequency points (low and high)
cent (Center Frequency)	Center point between cutoff frequency points (low and high)
low (Left-side Cutoff Frequency)	The lower frequency of the two cutoff frequency points

high (Right-side Cutoff Frequency)	The higher frequency of the two cutoff frequency points
Q (Q Value)	Q = cent/BW
loss (Insertion Loss)	The measurement value of the active marker.

1. Display a marker.

Marker > **Marker 1**

2. Using one of the following methods, move the marker to the center frequency of the bandpass filter.

- On the entry bar, press **9** > **4** > **7** > **.** > **5** > **M/m**

- Turn the rotary knob on the front panel to set it to the center frequency (947.5 MHz).

3. Specify the bandwidth definition value that defines the pass band of the filter. In this measurement example, it is set to -3 dB.
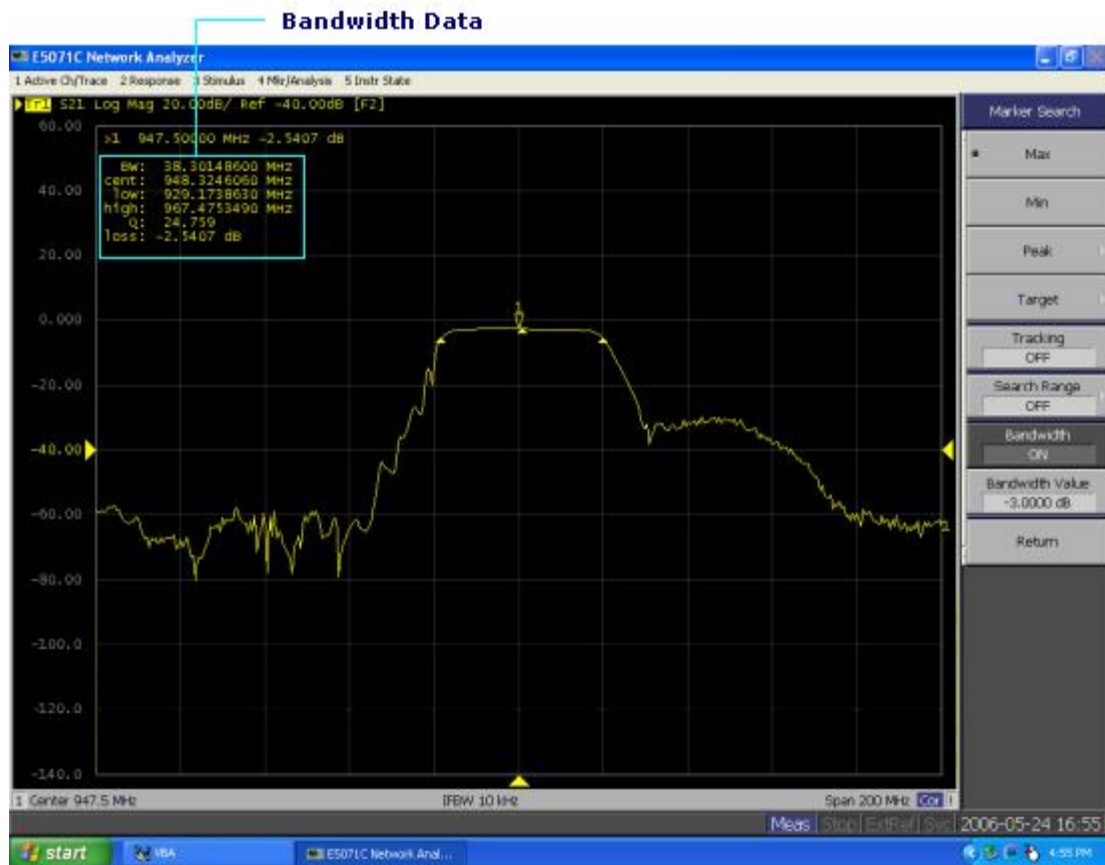
Marker Search > **Bandwidth Value** > **+/-** > **3** > **x 1**

4. Set the bandwidth search function ON.

Marker Search > **Bandwidth**

5. The bandwidth data items (BW, cent, low, high, Q, loss) will be displayed. (See the following figure)

Measuring the -3 dB Bandwidth

e5071c055

STEP 5. Outputting Measurement Results (Save)

You can save not only the internal data but also the measurement results such as trace data and display screens to the disk .

Saving the Trace Data(in CSV format)

You can save the trace data to the disk of the E5071C in CSV file format (extension: .csv). Since the CVS-formatted data to be saved is a text file, you can analyze the data using Microsoft Excel.

Follow the step below to save the trace data:

Save/Recall > **Save Trace Data**

Saving the Display Screen

You can save the screen displayed on the E5071C to the disk of the E5071C in Windows bitmap file format (extension: .bmp) or Portable Network Graphics format (extension: .png).

Follow the step below to save the display screen:

System > **Dump Screen Image**

NOTE   The image on the LCD display memorized in the volatile memory (clipboard) (the image on the LCD display when the **Capture/System** key is pressed) is saved.