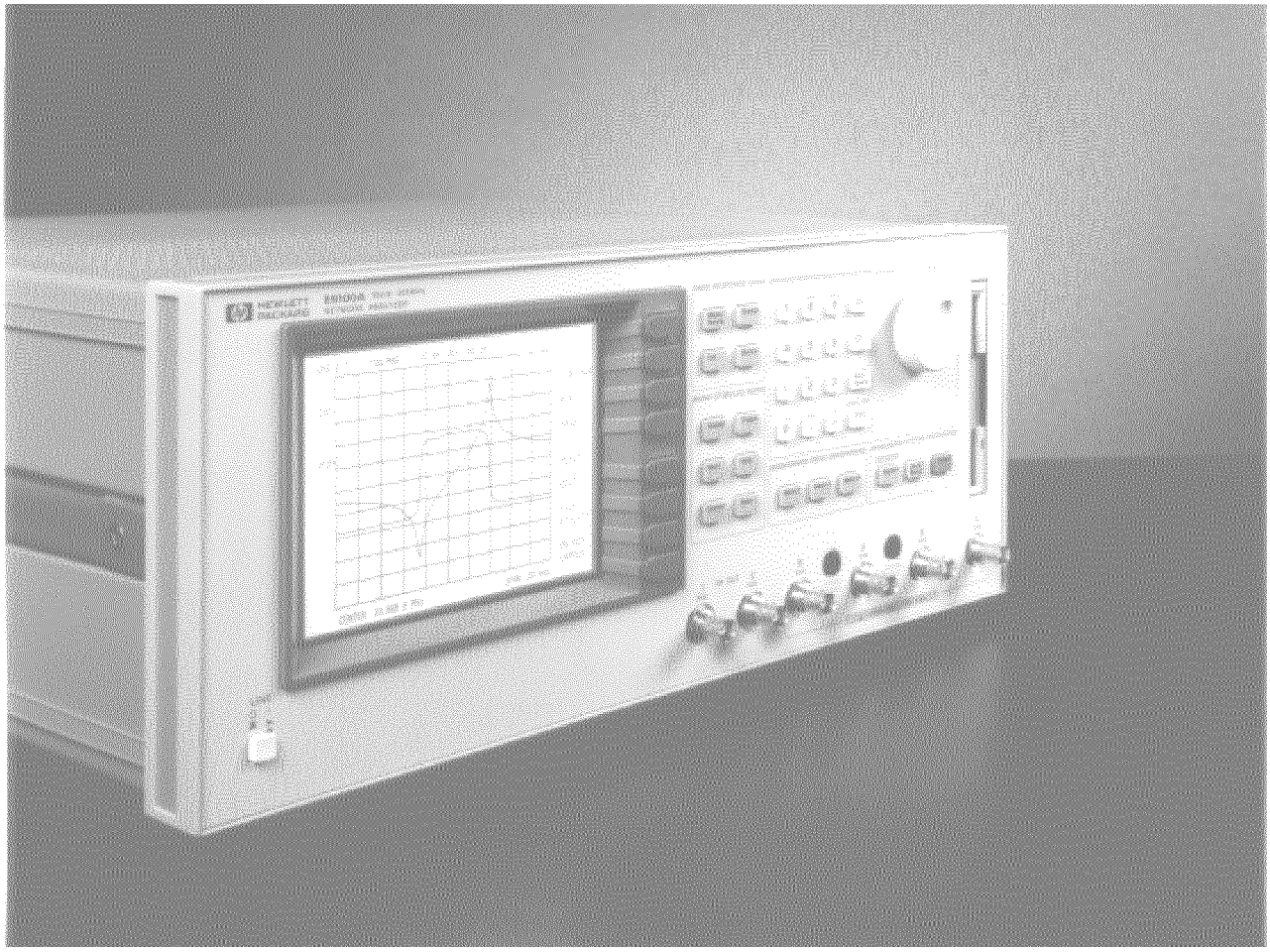
HEWLETT® PACKARD

HP E5100A/B 10 kHz to 300 MHz Network Analyzer

Product Overview

Hewlett-Packard's fastest analyzer improves production capability and reduces costs



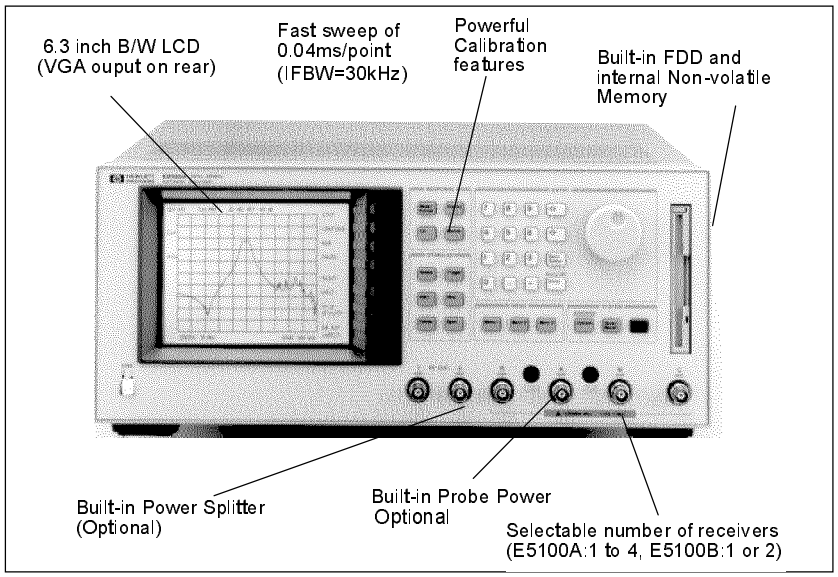


Figure 1. The HP E5100A/B.

The HP E5100A/B is a 10 kHz - 300 MHz network analyzer best fitted for production lines of electronic component manufacturers, especially crystal and ceramic resonator or crystal and ceramic filter manufacturers, whom require extra-high throughput.

The HP E5100A/B improves production line productivity with its fast measurement speed (fastest sweep speed is 0.04 ms/point), fast waveform analysis commands, and speedier processor. It provides faster measurements with lower fluctuations because of its low noise performance and fine resolution IFBW.

The HP E5100A is a versatile network analyzer with many functions and options to fit your needs with a minimum investment.

The HP E5100B is used for in-process testing of crystal plating and for production adjustments. The HP E5100B provides the best tuning functions without compromising performance.

Major Specifications of the HP E5100A/B

Frequency Range: 10 kHz - 300 MHz

Power (at SINGLE): -48 to +22 dBm (option), -9 to +11 dBm (standard)

Measurement Parameters: Gain (Amplitude Ratio), Phase, Group-Delay, Amplitude, Gain-Phase, Gain-Delay

IFBW: 10 Hz - 30 kHz (1, 1.5, 2, 3, 4, 5, 8 steps)

Dynamic Range: 120 dB (IFBW = 1 kHz) (HP E5100A only)

Dynamic Accuracy: +/- 0.05 dB, +/- 0.3 degrees

Measurement Speed: 0.04 ms/point (IFBW = 30 kHz, Ramp-sweep)

Display: 6.3 inch monochrome LCD (640 x 480 dots)

Programming: HP Instrument BASIC

Mass Storage: FDD and internal Non-volatile Memory

The HP E5100A/B Adds Value to Resonator and Filter Production Lines

- 0.04 ms/point measurement speed

  This fast sweep increases throughput and reduces testing costs.

- Ramp Sweep and Step Sweep

  Ramp sweep provides fast measurements without dead-time between points. Step sweep provides better accuracy and stability to measurements, by pausing for signal output and receiver settling before making a measurement.

- Fine Resolution IFBW

  Seven IFBW choices per decade provides the best compromise of measurement time and data stability.

- Stable measurements

  The low-noise design of the HP E5100 has a 120 dB dynamic range and makes low noise measurements. The HP E5100's design will allow you to get more stable data at wider IFBW settings.

- Fast processing

  The HP E5100's fast CPU design shortens processing time, and improves the total throughput. Now, HP's waveform analysis commands and HP Instrument BASIC run even faster.

Note: for detailed specifications refer to the HP E5100A/B Technical Specifications (P/N 5963-5560E).

Various Options

- Selectable number of receivers

  Number of receivers on the E5100 can be tailored to your needs. The best instrument configuration can be chosen for each production line. The HP E5100A can have up to 4 receivers, and the HP E5100B can have up to 2 receivers.

- Selectable Source Output

  The E5100 can have ***single, dual*** (built-in power splitter), or ***switched*** source outputs.

- 50ohm/1Mohm switchable input impedance

  Input impedance of receivers A and B can be changed to 50ohm/1Mohm switchable. (Standard is 50 ohm fixed.)

- Supports active probes

  Probe power sockets are installed on the front panel. Input connectors on receivers A and B can be changed to type N for connecting active probes. (Standard is BNC.)

- Optical-isolated parallel I/O

  A TTL level parallel interface is standard for interfacing with auto-handlers. For noise immunity, an optical-isolated open-collector parallel I/O is available.

- Color LCD Display (**New**)

  A 6.5 inch TFT Color LCD display is optional. (Standard is 6.3 inch B/W LCD.)

Small-Sized, Light-Weight

- Shorter depth

  The HP E5100's shorter depth allows for a larger work area in front of the instrument.

- Light weight

  Easy to carry and move when production lines layouts change.

Other Features

- PC compatible external keyboard and external CRT

  The external DIN keyboard and the external display output (VGA) are compatible with popular personal computers.

- 3-mode DOS Floppy Disk Drive

  The built-in FDD supports 3 modes -720 kbyte (2DD), 1.2 Mbyte, and 1.44 Mbyte (2HD) DOS formats.

The HP E5100A is a Great Fit for Productions' Final Tests

During final tests, both precision and high-speed are required, for better yield and better productivity. The HP E5100A makes high quality and high speed tests with its fine IFBW resolution and low noise circuitry. Its convenient analysis and processing functions improve the productivity of the final test processes.

For Resonator Tests

High Speed Evaluation Using The Waveform Analysis Command:

The waveform analysis commands of the HP E5100A perform accurate parameter extraction in a very short time. The commands are enhanced from those on the HP 87510A and are executed by a faster CPU. For example, a single command extracts resonant frequency (Fr) and impedance (CI) simultaneously. In addition, various commands necessary for complex tests of resonators, such as peak-search, ripple-analysis, etc. are available on the HP E5100A. (See Figure 2.)

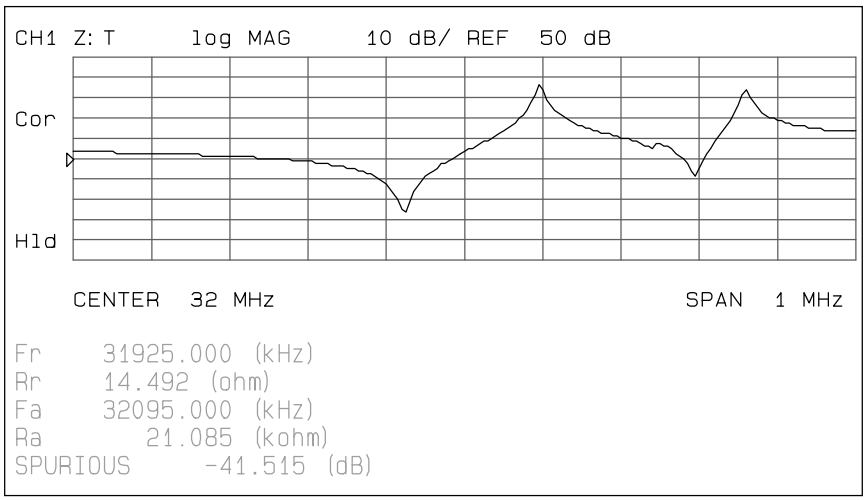


Figure 2. Example of detecting resonant point and spurs of a resonator.

For Crystal Resonator Tests with a PI Network

The HP E5100A supports high frequency crystal resonator tests using the HP 41900A PI Network Fixture. Accurate measurements can be done by eliminating the residual impedance and stray admittance around the fixture using the HP E5100A's 3-term PI calibration and the HP 41900A's furnished calibration standards. Resonator tests with load capacitors can also be done with the HP 41900A Option 001 Load Capacitor Adapter Kit.

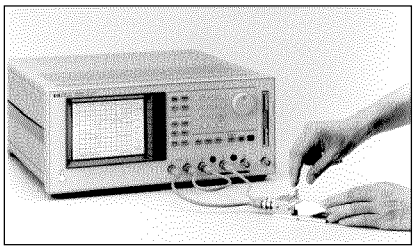


Figure 3. Crystal resonator test with a PI network.

Equivalent Circuit Analysis Function

The HP E5100A has equivalent circuit analysis commands which support not only the conventional 4 element model (see Figure 4), but also the 6 element model (which separates the resonator from the electrodes) (see Figure 5) and a Co extraction command which is not affected by sub-resonance. More precise analysis of resonators can be done using this new analysis tool. (See Figure 6.)

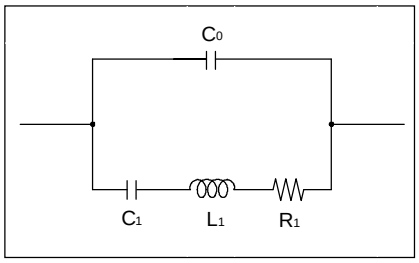


Figure 4. Four element equivalent circuit model.

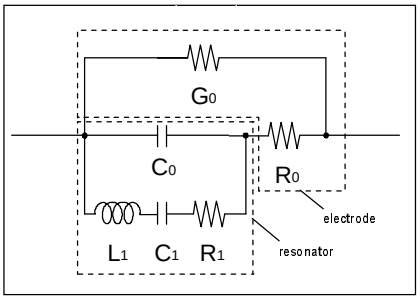


Figure 5. Six element equivalent circuit model.

[Watt] and [Amp] Are Available To Set Output Power (New)

The drive level of crystal resonators is defined as power or current. Actually, the output power of the Network analyzer is set by dBm. The HP E5100A/B provides convenient functions that you can set drive level as Watt or Ampere with nominal crystal impedance. No calculator is needed to convert dBm to Watt or Ampere (See Figure 7.)

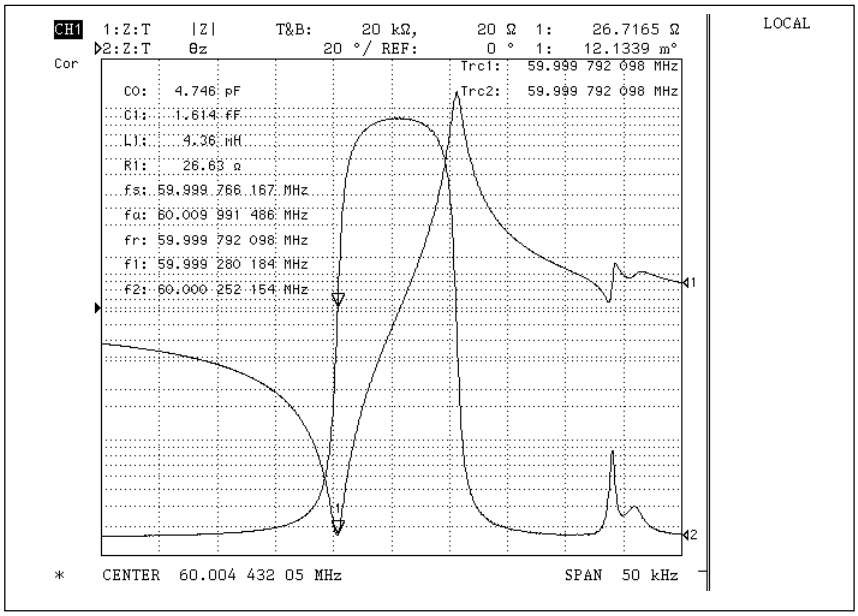


Figure 6. Example of Equivalent Circuit Analysis of a Resonator.

Phase Tracking Function Improves Throughput of DLD Measurement (New)

HP E5100A with Option 023 is a good solution to measure the Drive Level Dependency of crystals units. This option realizes a very quick measurement because it measures only the resonant frequency (Fr) and the resonant impedance (CI) as it sweeps the drive level. (See Figure 7.)

For Filter Tests

The HP E5100's List Sweep capability reduces sweep time on filters.

The test frequency range of filters varies depending on the rejection band, the pass band, and the end-users' specifications. The HP E5100A has List Sweep capability for such various frequency range applications. List Sweep separates the sweep frequency range into segments (up to 31), and each segment can have an independent frequency range, number of sweep points, IFBW, and power level settings. By using List Sweep, separate frequency bands can be measured in one sweep, or different IFBW can be set for pass band and rejection band, and wide dynamic range measurements can be done in a shorter time.

Efficient Spurious Detection

When detecting high-Q spurs, narrow span sweeps are necessary after wide span sweeps, but changing the span degrades the test throughput. The HP E5100A's short setup changing time improves test efficiency. (See Figure 8.)

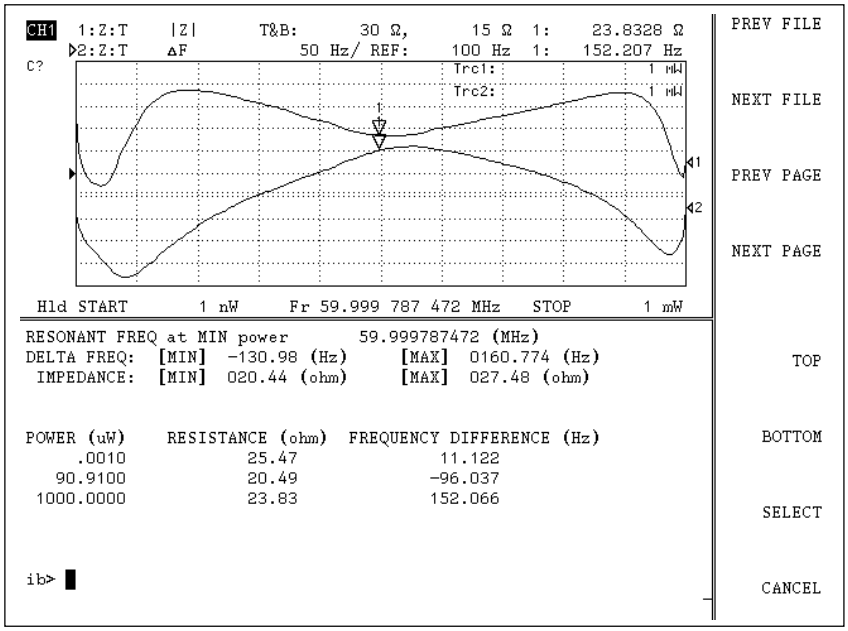


Figure 7. Example of DLD Measurement using Option 023 Phase Tracking Function.

Quick and Easy Filter Parameter Extraction

The HP E5100A can analyze data very fast using the built-in waveform analysis commands. These commands provide parameters within the pass band (such as insertion loss, 3 dB bandwidth) or parameters within the rejection band. Many commands for analyzing passband ripple or group-delay time are also available. (See Figure 9.)

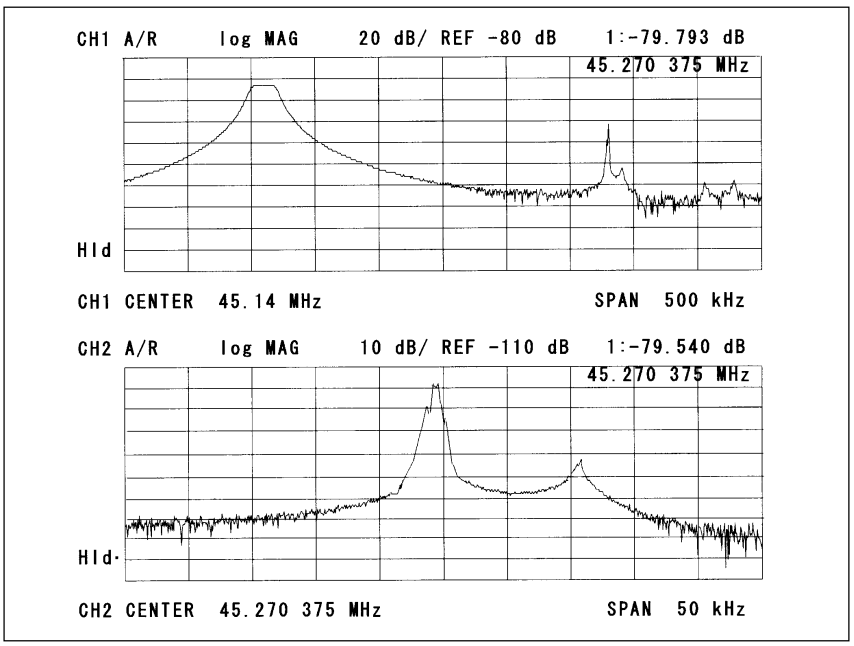


Figure 8. Spurious Measurement results (top: wider span, bottom: narrower span).

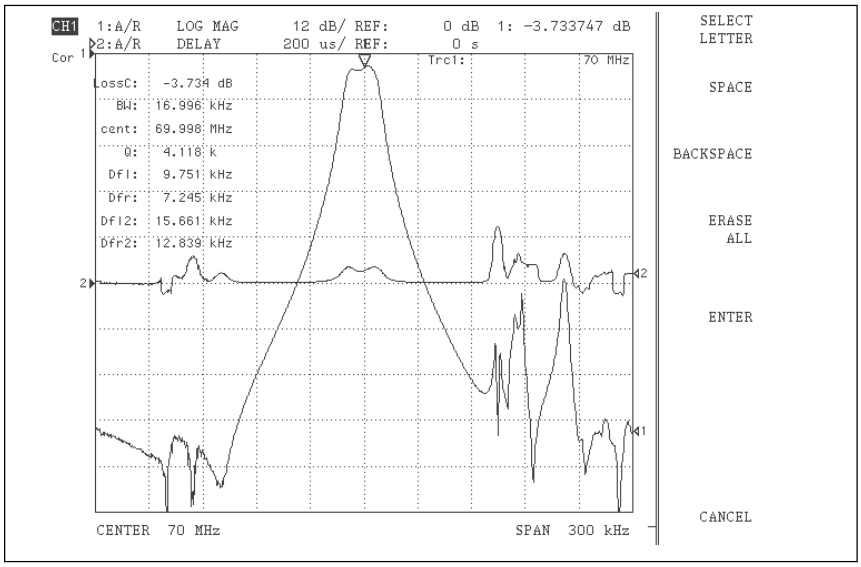


Figure 9. Example of filter parameter extraction.

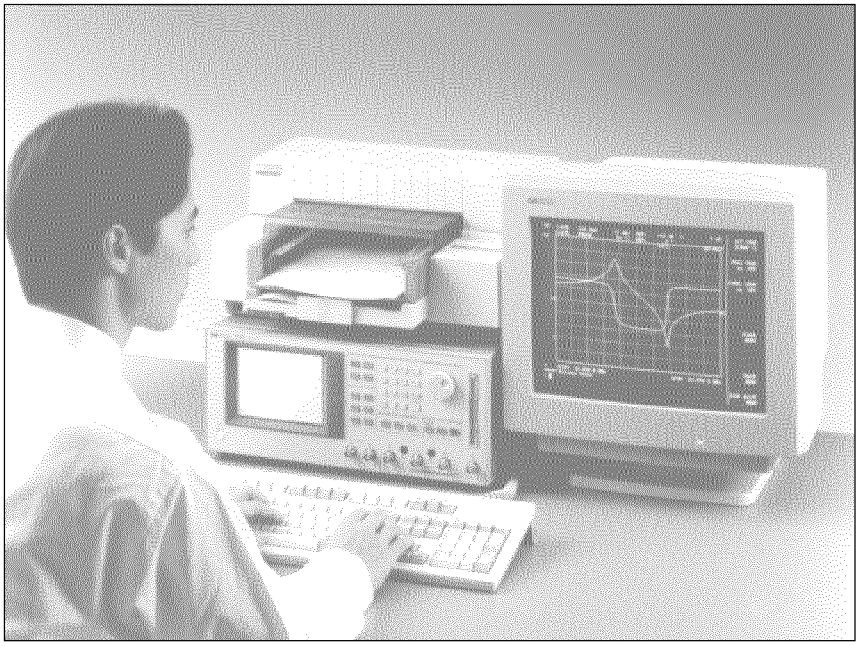


Figure 10. The HP E5100A improves productivity.

Improving Filter Adjustment Productivity

When manually adjusting filters, the HP E5100A's quick display of the filter response (waveform) and Pass/Fail results improve productivity. An external VGA monitor can be connected to the HP E5100A for an even larger display, improving productivity and reducing human fatigue.

For other applications

Incoming Inspection

The HP E5100A can be used for incoming inspection of filters and resonators. When inspecting many kinds of devices, the HP E5100A's floppy disk drive and non-volatile memory are helpful for saving and recalling test conditions, calibration data, and test data.

Adjustments of Active Components and Electronic Circuits

The HP E5100A's fast sweep is helpful for adjusting filter circuitry or active devices such as amplifiers or modulators.

The HP E5100B is Best for In-Process Testing of Filters and Resonators

The requirements of in-process testing are different from that of final tests. They need fast measurements and low price. HP E5100B network analyzer has the same measurement quality and speed as the HP E5100A, but has reduced functionality. The HP E5100B reduces production costs and is a valuable tool for in-process testing. (See Table 1.)

Table 1. Comparison of HP E5100A vs HP E5100B

Model	HP E5100A	HP E5100B
Number of Receivers	1 to 4	1 or 2
Number of Points per Sweep	2 to 1601	2 to 401
List Sweep capability	Yes	No
Dynamic Range (dB)	120	100
Phase Tracking Function (Option 023)	Yes	No

For Resonator Tests

For Blank Crystal Tests

The demand for higher frequency crystal components is growing, which means blank crystals are thinner. Currently a combination of an oscillator and a frequency counter is used to test these higher frequency crystals, but it isn't accurate. The HP E5100B's fast measurement speed of 0.04 ms/pt and fast waveform analysis commands improves crystal test productivity.

For Vacuum Evaporation Testing (Frequency Adjustment) of Crystals

HP E5100B is the best process monitoring tool in the vacuum evaporation process of crystal resonators and filters. The HP E5100B outputs information necessary to control the evaporation process in a real-time manner, so the evaporation chamber throughput and the adjustment accuracy will be improved. The Option 022 Evaporation monitoring function is a good solution for adjustment of crystal resonators.

HP 41900A PI-Network Test Fixture
HP 41901A SMD PI-Network Test Fixture

Product Overview

Two types of test fixtures for precise quartz crystal resonator measurements

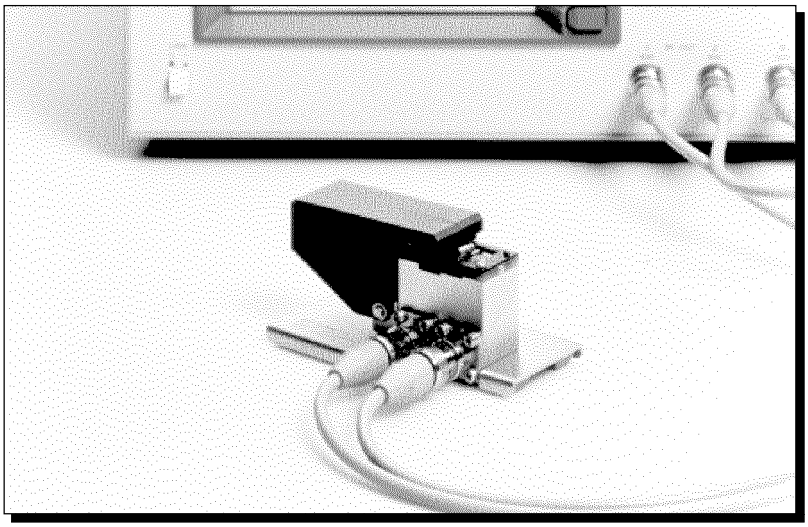


Figure 11. The HP 41901A/HP E5100A combination enables measurements on different types of surface mount crystal resonators

HP 41900A PI-Network Test Fixture and HP 41901A SMD PI-Network Test Fixture provide a good solution for measuring crystal resonators with the HP E5100A/B Network Analyzer or HP 87510A Gain-Phase Analyzer. The frequency range of the HP 41901A is 1 MHz to 300 MHz. The PI-Network fixture for leaded mount type crystals is introduced in IEC standard Publication 444 and JIS C6701. The HP 41900A is designed to meet the IEC Pub.444 and JIS C6701 standards. The HP 41901A is new PI-Network Test fixture for surface mount type crystals.

Excellent Performance

Electrical properties of the test fixture, such as a phase rotation and other unwanted stray parasitics, cause significant measurement errors. The HP 41900A and the HP 41901A are furnished the short and load (50Ω) standards to correct these measurement errors using the 3-Term Calibration function of the HP E5100A and HP 87510A.

Applicable to Various Device Dimension

The Quartz Crystal Industry Association of Japan (QIAJ) regulates physical dimension of surface mount crystal resonator in the QIAJ-B-002 standard. The HP 41901A attachment kits (Option 001 to 006) meet QS06, QS07, and QS08 packages recommended in QIAJ-B-002. (Refer to Figure 13.)

Measurement of Crystal with Load Capacitance

The HP 41900A option 001 and each HP 41901A attachment kit (option 001 to 006) includes a Capacitance Load (CL) board and SMD capacitors. The load capacitance value is adjustable up to 33 pF. Capacitance loaded resonance frequency and resistance are easily measured using the HP 41900A and the HP 41901A.

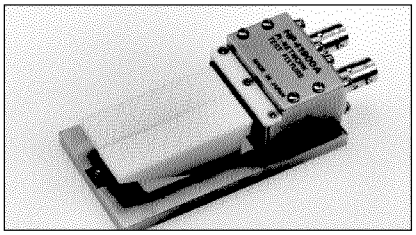


Figure 12. The HP 41900A meets IEC and JIS standards.

HP 41900A Specifications (Supplemental Characteristics)

Frequency range:
1 MHz - 200 MHz
Maximum input level:
– 500 mW (7 mW @DUT)
– @ Input BNC connector
Load capacitance value:
4 pF - 33 pF (with option 001)
Operating condition:
– Temperature: 0°C to 55°C
– Relative humidity: < 95% @ 40°C
Accessories furnished:
– OP/SVC Manual
– Short Bar
– 50 ohm STD
Option 001:
– CL adapter board, Capacitor set, 0 ohm resister
– Sample program for adjusting CL value (contained on 3.5" FD)

HP 41901A Specifications (Supplemental Characteristics)

Frequency range:
1 MHz - 300 MHz
Maximum input level:
– 500 mW (7 mW @ DUT)
– @ Input BNC connector
Load capacitance value:
3 pF - 33 pF
Repeatability:
– Fr (Resonance Freq.): 0.1 ppm
– CI(Crystal Impedance): ± 0.1 %
– @ 20 MHz fundamental wave
Operating conditions:
– Temperature: 0°C to 55°C
– Relative humidity: < 95% @ 40°C
Accessories furnished:
- OP/SVC Manual
- Sample program for adjusting CL value (contained on 3.5" FD)
- Carrying case
- Option 001 - 006: Attachment kit
  – Applicable device dimension: (See Figure 13.)
  – Each attachment kit includes: a contact board, a CL board, a device positioner, SMD capacitors (2 each of 7 different values), and calibration standards (short and 50Ω)

Ordering Information

- HP 41900A PI-Network Test Fixture
  – Option 001: CL adapter kit
- HP 41901A SMD PI-Network Test Fixture
  – Option 001: Attachment kit: QIAJ-QS06, 4 terminals
  – Option 002: Attachment kit: QIAJ-QS06, 2 terminals
  – Option 003: Attachment kit: QIAJ-QS07, 4 terminals
  – Option 004: Attachment kit: QIAJ-QS07, 2 terminals
  – Option 005: Attachment kit: QIAJ-QS08, 4 terminals
  – Option 006: Attachment kit: QIAJ-QS08, 2 terminals

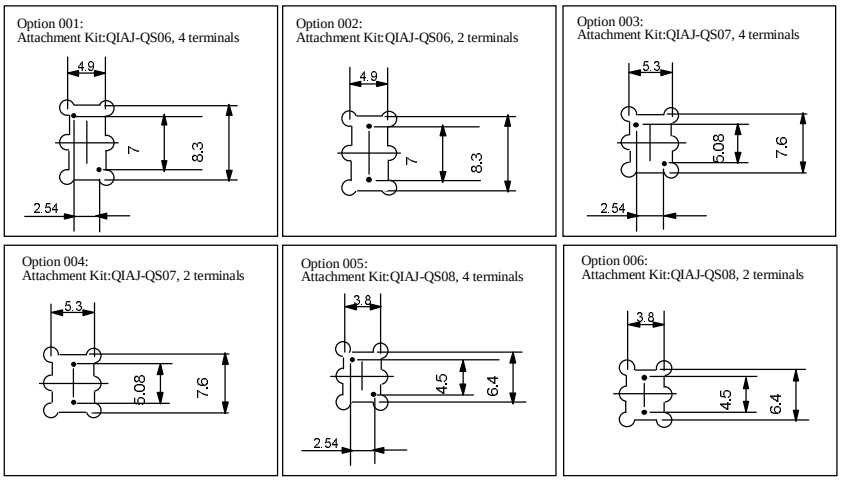


Figure 13 Physical dimension and electrode position of QS06,QS07, and QS08 (unit [mm]).

HP E5090A 2-Port Transmission/Reflection Test Set

Product Overview

For easy and economical 2-port device evaluation using the HP E5100A Network Analyzer

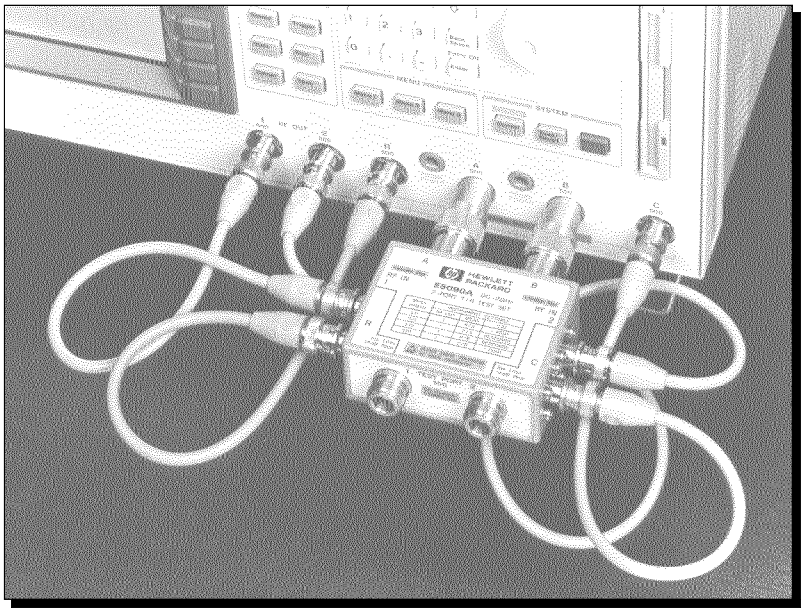


Figure 14. The HP E5090A provides 2-Port transmission and reflection measurements

Excellent Performance

The HP E5090A directly connects to the HP E5100A. The test set includes 2 power splitters and 2 precision resistive dividers in a compact box. The HP E5100A's normalization, one-port calibration, and port extension capabilities enhance the measurement performance.

For Transmission / Reflection Measurement

Insertion loss, gain, attenuation, phase, group delay, and reflection coefficient are easily measured using the HP E5090A with the HP E5100A.

HP E5090A 2-Port Transmission / Reflection Test Set provides a good solution for performing both transmission and reflection measurements of 2-port device with the HP E5100A Network Analyzer. The E5090A is used for 50 ohm applications.

For 2-Port Device Measurement

The HP E5090A and HP E5100A with required options 003, 010, 302, and 400 provide the capability to measure reflection and transmission characteristics of 2-port devices in both directions with a single connection. (Switching is done internally in the HP E5100A.)

Specifications

Impedance (nominal): 50 ohm

Frequency range: DC to 2 GHz

Typical equivalent source match:
– 30 dB @ DC - 500 MHz
– 18 dB @ 500 MHz - 2 GHz

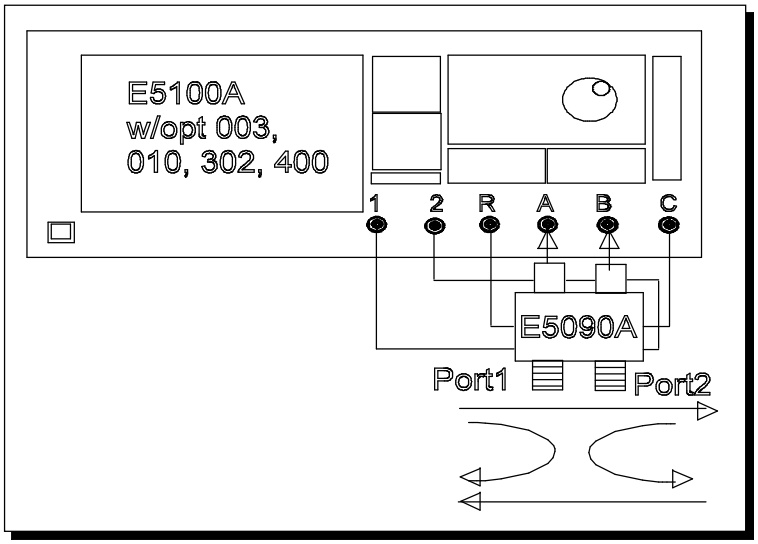


Figure 15. Using the HP E5090A test set with the HP E5100A network analyzer

Return Loss (Test Port1 and Test Port2):
– 30 dB @ DC - 500 MHz
– 18 dB @ 500 MHz - 2 GHz
Nominal insertion loss (RF IN to Test Port): 14 dB

Typical isolation: 100 dB (Port 1 to Port 2, @ 10 kHz to 500 MHz)

Maximum input level: +23 dBm

Connectors:

- Port1, 2: 50 ohm type N(f)
- A, B: 50 ohm type N(m)
- R, C: 50 ohm BNC(f)

Operating conditions:

- Temperature: 0°C to 55°C
- Relative humidity: < 95% @ 40°C

Accessories furnished:

- 50 ohm BNC Cable x 4
- OP/ SVC Manual

Optional accessories:

- HP 85032E Economy 50-ohm Type-N calibration kit
- HP 85032B 50-ohm Type-N calibration kit

Ordering Information

- HP E5090A 2-Port Transmission/ Reflection Test Set
- Required HP E5100A Network Analyzer options for using the HP E5090A (all must be ordered):
  - HP E5100A option 003: Two RF OUT Ports, switched single output
  - HP E5100A option 010: Extended output power range
  - HP E5100A option 302: Type-N input connectors, Ports A and B
  - HP E5100A option 400: 4 Receivers, Ports R, A, B, and C

Ordering Information

HP E5100A Network Analyzer

Options

100 1 Receiver, Port A
200 2 Receivers, Ports R and A
300 3 Receivers, Ports R, A, and B
400 4 Receivers, Ports R, A, B, and C
(*Note*: choose one option from 100 to 400.)

001 One RF OUT port
002 Two RF OUT ports, built-in power splitter
003 Two RF OUT ports, switched single output
(*Note*: choose one option from 001 to 003.)
(*Note*: option 003 cannot be ordered with option 101 or 301.)

101 50 Ohm / 1 Mohm selectable input on Port A
102 Type-N input connector on Port A
(*Note*: options 101 and 102 are for options 100 and 200 only.)
(*Note*: option 101 cannot be ordered with option 003.)

301 50 Ohm / 1 Mohm selectable inputs, Ports A and B
302 Type-N input connectors, Ports A and B
(*Note*: options 301 and 302 are for options 300 and 400 only.)
(*Note*: option 301 cannot be ordered with option 003.)

010 Extended output power range, -48 to +22 dBm
022 Evaporation monitoring function
023 Phase tracking function
030 Color LCD display

1D5 High stability frequency reference

005 Parallel I/O mode A
006 Parallel I/O mode B
007 Opto-isolated parallel I/O
(*Note*: a 24 bit TTL I/O is included standard.)
(*Note*: select only one of options 005, 006, 007, or choose none.)

UKR Delete HP Instrument BASIC

1F0 Add DIN keyboard

1CM Rack mount kit
1CN Front handle kit
1CP Rack and handle kit

ABA U.S. English localization
ABJ Japan Japanese localization
0B0 Delete manual set
(Note: Must choose one of options ABA, ABJ, and 0B0.)
0B1 Extra operation manual
(*Note*: language selection depends on option ABA or ABJ.)

UK6 Commercial calibration certificate with test data

HP E5100B Network Analyzer

Options

100: 1 Receiver, Port A
200: 2 Receivers, Ports R and A
(*Note*: Must choose either option 100 or 200.)

001 Single RF OUT port
002 Dual RF OUT ports, built-in power splitter
(*Note*: Must choose either option 001 or 002.)

010 Extended output power range, -48 to +22 dBm
022 Evaporation monitoring function
030 Color LCD display

101 50 Ohm / 1 Mohm selectable input, Port A
102 Type-N input connector, Port A

1D5 High stability frequency reference
005 Parallel I/O mode A
006 Parallel I/O mode B
007 Opt-isolated parallel I/O
(*Note*: a 24 bit TTL I/O is included standard.)
(*Note*: select only one of options 005, 006, 007, or choose none.)

UKR: Delete HP IBASIC
1F0: Add DIN keyboard
1CM Rack mount kit
1CN Front handle kit
1CP Rack and handle kit

ABA U.S. English localization
ABJ Japan Japanese localization
0B0 Delete manual set
(*Note*: Must choose one of options ABA, ABJ, and 0B0.)

0B1: Extra operation manual
(*Note*: language selection depends on option ABA or ABJ.)

UK6: Commercial calibration certificate with test data

Accessories

- HP 41800A Active Probe
- HP 41802A 1-Mohm Input Adapter
- HP 41900A PI-Network Test Fixture
  - option 001 Adapter Kit for Load capacitor
- HP 41901A SHD PI-Network Test Fixture
  - option 001-006 Attachemtn kit
- HP E5090A 2 Post Transmission/ Reflection Test Set
- HP 87512A Transmission/ Reflection Test Kit
- HP 11850C 50 ohm Three-Way Power Splitter

Centronics Interface Printers

- HP DeskJet 560C (HP C2168A) printer (monochrome mode only)
- HP DeskJet 1200C (HP C1676A) printer (monochrome mode only)
- HP 92284A Centronics Cable, 2.1m

HEWLETT® PACKARD

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Netherlands:
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