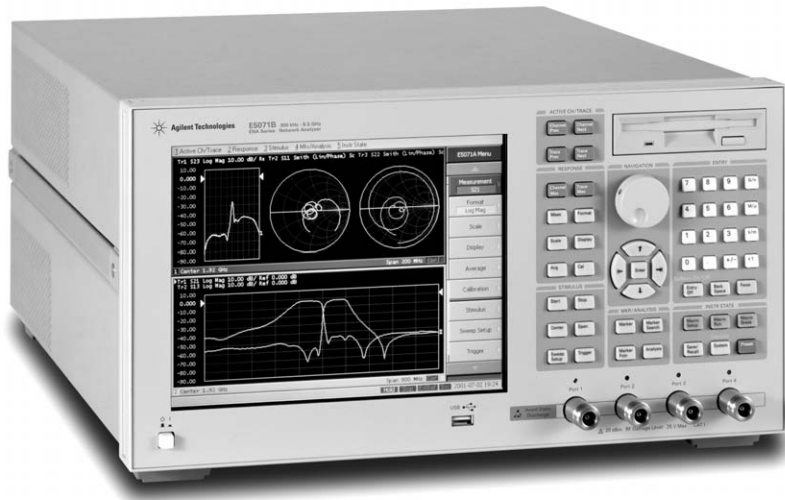
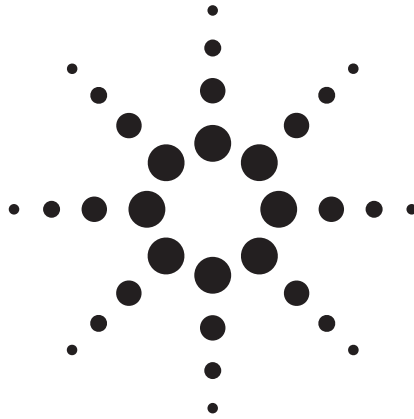


# Agilent ENA 2, 3 and 4 Port RF Network Analyzers

## Configuration Guide

<b>E5070B</b>	<b>300 kHz to 3 GHz</b>
<b>E5071B</b>	<b>300 kHz to 8.5 GHz</b>
<b>E5091A</b>	<b>Multiport test set</b>



This configuration guide describes standard configurations, options, accessories and peripherals for the ENA RF network analyzers. Refer to the ENA Technical Specifications for a complete description of the ENA RF network analyzers and the E5091A multiport test set.

# Ordering guide for the ENA

This guide is intended to assist you in the ordering process. Additional information and products (such as multiport test set, calibration kits and cables) are described throughout this document.

= Choose ONE and ONLY one

= Choose any combination

**In step 2 through 9, to order options for the E5071B, replace E5070B with E5071B (e.g. E5071B-XXX)**

**Step 1:** Choose a frequency range

- 300 kHz to 3 GHz, choose E5070B
- 300 kHz to 8.5 GHz, choose E5071B

**Step 2:** Choose the number of test ports and source power range

- 2 ports S-parameter, choose Option E5070B-214
- 3 ports S-parameter, choose Option E5070B-314
- 4 ports S-parameter, choose Option E5070B-414

**Step 3:** Would you like to add frequency-offset measurement capability?

- Yes, choose Option E5070B-008
- No

**Step 4:** Would you like to add time domain analysis?

- Yes, choose Option E5070B-010
- No

**Step 5:** Would you like to add Measurement Wizard Assistant (MWA) Software?

- Yes, choose Option E5070B-790
- No

**Step 6:** Would you like a high-stability time base?

- Yes, choose Option E5070B-1E5
- No, choose Option E5070B-UNQ

**Step 7:** Would you like a touch screen?

- Yes, choose Option E5070B-016
- No, choose Option E5070B-015

**Step 8:** Would you like any rack mount accessories?

- Rack mount kit only, choose Option E5070B-1CM
- Front handle kit only, choose Option E5070B-1CN
- Rack mount and front handle kit, choose Option E5070B-1CP

**Step 9:** Would you like to add any accessories?

- Add a keyboard, choose Option E5070B-810
- Add a mouse, choose Option E5070B-820

**Step 10:** Choose a language of manual set and specify quantity

- English manual set, choose Option E5070B-ABA and specify quantity
- Japanese manual set, choose Option E5070B-ABJ and specify quantity

**Step 11:** Would you like a commercial calibration certificate (ISO 17025 compliant) with test data?

- Yes, choose Option E5070B-1A7
- No

**Step 12:** Would you like to add external test set?

- Yes, order E5091A
- No

**Step 13:** Which would you like, a nine-port test set or thirteen/sixteen-port configurable test set?

- Nine-port, choose E5091A-009
- Thirteen/sixteen-port configurable test set, choose E5091A-016

**Step 14:** Would you like any rack mount accessories for the test set?

- Rack mount kit only, choose Option E5091A-1CM
- Front handle kit only, choose Option E5091A-1CN
- Rack mount and front handle kit, choose Option E5091A-1CP

**Step 15:** Choose a language of the manual or delete a manual set

- Add English manual set, choose Option E5091A-ABA
- Add Japanese manual set, choose Option E5091A-ABJ
- Delete a manual set, choose Option E5091A-0B0

**Step 16:** Would you like additional manual set?

- Extra English manual set, Choose Option E5091A-800 and specify quantity
- Extra Japanese manual set, Choose Option E5091A-801 and specify quantity

**Step 17:** Would you like a calibration certificate (ISO 17025 compliant) with test data?

- Yes, choose E5091A-1A7
- No

# Agilent ENA

## RF network analyzer

The ENA is an integrated RF network analyzer with two-, three- or four-port S-parameter test set, synthesized RF source, 10.4-inch color LCD, floppy and hard disc drives. Included with the each ENA Series is a 1-year return-to-Agilent service warranty.

- **E5070B** 300 kHz to 3 GHz
- **E5071B** 300 kHz to 8.5 GHz

Options for the E5070B are listed in this section. To order options for the E5071B, replace E5070B with E5071B (e.g. E5071B-XXX)

### Options

#### **Test ports and source power range options**

- **Option E5070B-214** 2-port S-parameter test set
- **Option E5070B-314** 3-port S-parameter test set
- **Option E5070B-414** 4-port S-parameter test set

#### **Additional feature option**

- Option E5070B-008** add frequency-offset measurement capability  
Adds frequency-offset sweep and harmonics measurement capabilities.
- Option E5070B-010** add time domain analysis capability  
Adds time domain transform and gating capabilities.
- Option E5070B-790** add Measurement Wizard Assistant (MWA) Software  
Adds Measurement Wizard Assistant (MWA) software to further simplify your multipoint measurements.

#### **Display options**

- **Option E5070B-015** standard color LCD  
Add standard 10.4-inch color LCD without touch screen capability
- **Option E5070B-016** touch screen color LCD  
Adds touch screen capability to the standard 10.4-inch color LCD.

#### **Frequency stability options**

- **Option E5070B-1E5** high stability time base  
Replace standard time base reference with a higher stability unit.
- **Option E5070B-UNQ** standard stability time base

#### **Accessories options**

- Option E5070B-1CM** rack mount kit  
Adds a rack mount kit (part number 5063-9216)
- Option E5070B-1CN** front handle kit  
Adds a front handle kit (part number 5063-9229)
- Option E5070B-1CP** rack mount and front handle kit  
Adds a rack mount kit (part number 5063-9223)
- Option E5070B-810** Adds a keyboard
- Option E5070B-820** Adds a mouse

#### **Documentation options**

- Option E5070B-ABA** add specified quantities of English manual set
- Option E5070B-ABJ** add specified quantities of Japanese manual set

#### **Certification option**

- Option E5070B-1A7** ISO 17025 compliant calibration

For online information about Agilent's service and support products visit: [www.agilent.com/find/tm\\_services](http://www.agilent.com/find/tm_services)

# Measurement accessories

A complete line of RF test accessories can be found in the Agilent RF and Microwave Test Accessories Catalog (literature number 5968-4314EN) or by visiting [www.agilent.com/find/mta](http://www.agilent.com/find/mta)

Accessories are available in these connector types: 50 ohm Type-N, 3.5 mm, 7 mm, and 7-16. Test port cables and a calibration kit should be added for a complete measurement system. A verification kit is used to verify corrected system performance.

## Test-port cables

Test port cables are used to connect the network analyzer to the device under test.

- **N6314A** 50 ohm Type-N RF cable, 300 kHz to 9 GHz  
Includes one 610 mm (24 in) cable with male connectors (part number 8120-8862)
- **N6315A** 50 ohm Type-N RF cable, 300 kHz to 9 GHz  
Includes one 610 mm (24 in) cable with both female and male connectors (part number 8121-0027)
- **11500E** cable, APC 3.5 mm (m), DC to 26.5 GHz
  - **Option 11500E-060** 60 cm cable, APC 3.5 mm (m)  
Includes one 610 mm (24 in) with male connectors. 3.5 mm (f) to 50 ohm Type-N (m) adapters (1250-1744) are recommended to connect to the network analyzer's test ports.
- **11500F** 150 cm cable, APC 3.5 mm (m), DC to 26.5 GHz  
Includes one 1520 mm (60 in) with male connectors. 3.5 mm (f) to 50 ohm Type-N (m) adapters (1250-1744) are recommended to connect to the network analyzer's test ports.

## Calibration kits

Mechanical calibration kits include standards, such as opens, shorts and loads, which are measured by the network analyzer for increased measurement accuracy.

Electronic calibration (ECal) kits replace mechanical calibration standards with one solid-state calibration module that is controlled by the network analyzer to present many different impedances to the test ports. A full two-, three-, four-port calibration can be performed quickly with a single connection. This technique reduces operator errors and connector wear and abrasion.

Choose a calibration kit for each connector type to be used.

**Economy**, includes:

- open standards (male and female)
- short standards (male and female)
- fixed-termination standards (male and female)
- in-series adapters

**Standard**, includes the devices in the economy kit and adds:

- connector tools

**Precision**, includes the devices in the economy kit and adds:

- 50 ohm airline for TRL calibration
- TRL adapters
- connector tools

## For devices with 50 ohm Type-N connectors

### Mechanical calibration kits

- **85032F** economy: 30 kHz to 9 GHz. Includes:
  - 85032-60017 Type-N (m) fixed load
  - 85032-60018 Type-N (f) fixed load
  - 85032-60013 Type-N (m) open
  - 85032-60014 Type-N (f) open
  - 85032-60016 Type-N (m) short
  - 85032-60015 Type-N (f) short
  - **Option 85032F-100** adds:
    - 85032-60021 Type-N (f) to Type-N (f) adapter
  - **Option 85032F-200** adds:
    - 85032-60019 Type-N (m) to Type-N (m) adapter
  - **Option 85032F-300** adds:
    - 85032-60020 Type-N (m) to Type-N (f) adapter
  - **Option 85032F-500** adds:
    - 85054-60001 Type-N (f) to 7 mm adapter (two included)
    - 85054-60009 Type-N (m) to 7 mm adapter (two included)
- **85054D** economy: 45 MHz to 18 GHz. Includes:
  - 85054-60025 Type-N (m) short
  - 85054-60026 Type-N (f) short
  - 85054-60027 Type-N (m) open
  - 85054-60028 Type-N (f) open
  - 85054-60031 Type-N (f) to 7 mm adapter
  - 85054-60032 Type-N (m) to 7 mm adapter
  - 85054-60037 Type-N (f) to Type-N (f) adapter
  - 85054-60038 Type-N (m) to Type-N (m) adapter
  - 85054-60046 Type-N (m) fixed load
  - 85054-60047 Type-N (f) fixed load

### Electronic calibration kits

- **85092C** RF ECal: 300 kHz to 9 GHz, 2 ports. Includes:
  - **Option 85092C-MOF** module with:
    - 85092-60008 Type-N (f) to Type-N (m) RF ECal module
  - **Option 85092C-00M** module with:
    - 85092-60009 Type-N (m) to Type-N (m) RF ECal module
  - **Option 85092C-00F** module with:
    - 85092-60010 Type-N (f) to Type-N (f) RF ECal module
  - **Option 85092C-00A** adds:
    - 85054-60037 Type-N (f) to Type-N (f) adapter
    - 85054-60038 Type-N (m) to Type-N (m) adapter
- **N4431B** 4-port RF ECal module: 300 kHz to 13.5 GHz, 4 ports.
  - **Option N4431B-020**
    - Adds four Type-N, 50 ohm female module connectors
  - **Option N4431B-1A7**
    - ISO 17025 compliant calibration

## For device with 3.5 mm or SMA connectors

### **Mechanical calibration kits**

- **85033E** economy: 30 kHz to 9 GHz. Includes:
  - 85033-60016 3.5 mm (m) load
  - 85033-60017 3.5 mm (f) load
  - 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
- **Option 85033E-100** adds:
  - 85027-60005 3.5 mm (f) to 3.5 mm (f) adapter
- **Option 85033E-200** adds:
  - 85027-60007 3.5 mm (m) to 3.5 mm (m) adapter
- **Option 85033E-300** adds:
  - 85027-60006 3.5 mm (m) to 3.5 mm (f) adapter
- **Option 85033E-400** adds:
  - 1250-1744 3.5 mm (f) to 50 ohm Type- N (m) adapter
  - 1250-1743 3.5 mm (m) to 50 ohm Type- N (m) adapter
  - 1250-1745 3.5 mm (f) to 50 ohm Type- N (f) adapter
  - 1250-1750 3.5 mm (m) to 50 ohm Type- N (f) adapter
- **Option 85033E-500** adds:
  - 1250-1746 3.5 mm (m) to 7 mm adapter (two included)
  - 1250-1747 3.5 mm (f) to 7 mm adapter (two included)
- **85052C** precision TRL: 45 MHz to 26.5 GHz. Includes:
  - 00902-60003 3.5 mm (m) fixed load
  - 00902-60004 3.5 mm (f) fixed load
  - 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) to 3.5 mm (f) adapter
  - 85052-60033 3.5 mm (m) to 3.5 mm (m) adapter
  - 85052-60034 3.5 mm (f) to 3.5 mm (m) adapter
  - 85052-60035 3.5 mm short TRL line
  - 85052-60036 3.5 mm long TRL line
- **85052D** economy: 45 MHz to 26.5 GHz. Includes:
  - 00902-60003 3.5 mm (m) fixed load
  - 00902-60004 3.5 mm (f) fixed load
  - 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) to 3.5 mm (f) adapter
  - 85052-60013 3.5 mm (f) to 3.5 mm (m) adapter
  - 85052-60014 3.5 mm (m) to 3.5 mm (m) adapter

### **Electronic calibration kits**

- **85093C** RF ECal: 300 kHz to 9 GHz, 2 ports. Includes:
  - **Option 85093C-MOF** module with:
    - 85093-60008 3.5 mm (f) to 3.5 mm (m) RF ECal module
  - **Option 85093C-00M** module with:
    - 85093-60009 3.5 mm (m) to 3.5 mm (m) RF ECal module
  - **Option 85093C-00F** module with:
    - 85093-60010 3.5 mm (f) to 3.5 mm (f) RF ECal module
- **Option 85093C-00A** adds:
  - 85052-60012 3.5 mm (f) to 3.5 mm (f) adapter
  - 85052-60014 3.5 mm (m) to 3.5 mm (m) adapter
- **N4431B** 4-port RF ECal module: 300 kHz to 13.5 GHz, 4 ports.
  - **Option N4431B-010**
    - Adds four 3.5 mm female module connectors
  - **Option N4431B-1A7**
    - ISO 17025 compliant calibration

### **Adapters**

- **11853A** 50 ohm Type-N accessory kit. Includes:
  - 1250-1472 Type-N (f) to Type-N (f) adapter (two included)
  - 1250-1475 Type-N (m) to Type-N (m) adapter (two included)
  - 11511A Type-N (f) short
  - 11512A Type-N (m) short
- **11878A** Type-N to 3.5 mm adapter kit. Includes:
  - 1250-1744 3.5 mm (f) to 50 ohm Type- N (m) adapter
  - 1250-1743 3.5 mm (m) to 50 ohm Type- N (m) adapter
  - 1250-1745 3.5 mm (f) to 50 ohm Type- N (f) adapter
  - 1250-1750 3.5 mm (m) to 50 ohm Type- N (f) adapter
- **11524A** 7 mm to Type-N (f) adapter
- **11525A** 7 mm to Type-N (m) adapter

## For device with 75 ohm Type-N connectors

### **Mechanical calibration kits**

- **85036B** 300 kHz to 3 GHz, includes:
  - 00909-60019 75 ohm Type-N (m) broadband load
  - 00909-60020 75 ohm Type-N (f) broadband load
  - 85036-60012 75 ohm Type-N (m) short
  - 85036-60011 75 ohm Type-N (f) short
  - 85032-60007 75 ohm Type-N (m) open
  - 85032-20001 75 ohm Type-N (f) open body
  - 85036-60010 75 ohm Type-N (f) open center conductor extender
  - 85036-60013 75 ohm Type-N (m) to (m) adapter
  - 85036-60014 75 ohm Type-N (f) to (f) adapter
  - 85036-60015 75 ohm Type-N (m) to (f) adapter
- **85036E** 300 kHz to 3 GHz, includes:
  - 00909-60019 75 ohm Type-N (m) broadband load
  - 85036-60016 75 ohm Type N (m) combined open/short

### **Adapters**

- **11852B** Minimum-loss pad
  - **Option 11852B-004** Type-N connectors, 50 ohm (m) to 75 ohm (f)

Calibration must be done with a 75 ohm calibration kit with a 11852B minimum-loss pad, and impedance conversion to 75 ohm with the ENA's fixture simulator function is required.

## General accessories

### Power meters and sensors

Recommended for source output power calibration.

- E4416A** single-channel power meter
- E4417A** dual-channel power meter
- E4418B** single-channel power meter
- E4419B** dual-channel power meter
- 8482A** power sensor, 100 kHz to 4.2 GHz, Type-N (m), 100 mW
- E4412A** CW power sensor, 10 MHz to 18 GHz, Type-N (m), 200 mW

### System racks and cases

- 5063-9229** handle kit, may be ordered as option 1CN (two included)
- 5063-9216** rack mount kit, for use without handles: may be ordered as option 1CM
- 5063-9223** rack mount kit, for use with previously supplied handles; may be ordered as option 1CP
- E3663AC** rack mount rail kit, for use with 5063-9216 or 5063-9223
- 9211-2658** transit case

### Interface cables

The following GPIB cables can be used to connect the network 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)

### Monitors

- VGA-compatible monitor

### Printers

- Hewlett Packard® 930C<sup>1</sup> and 948C<sup>1</sup> via both USB and parallel ports

## Upgrade kits

### Upgrade kits for the E5070B and E5071B

Upgrade kits are available to add options after initial purchase. To order an upgrade kit for a ENA, order the analyzer's model number followed by a "U", then indicate the option to be added:

- Option E5070BU-008 and E5071BU-008** frequency-offset measurement capability
- Option E5070BU-010 and E5071BU-010** time domain analysis capability
- Option E5070BU-790 and E5071BU-790** Measurement Wizard Assistant (MWA) software
- Option E5070BU-017 and E5071BU-017** removable hard disk drive capability
- Option E5070BU-018 and E5071BU-018** hard disk drive kit

The serial number of the ENA to be retrofitted must be specified when ordering this kit. Installation is not included.

## Agilent E5091A multiport test set

The E5091A is a multiport test set used with 4-port ENA Series network analyzers to expand the number of test ports up to sixteen.

### Options

#### **Test set configuration options**

- Option E5091A-009** 9-port configuration  
Includes nine test ports to the device under test and four interconnection ports to an analyzer.
- Option E5091A-016** 13/16-port configurable test set configuration  
Includes thirteen to sixteen configurable test ports to the device under test and four interconnection ports to the analyzer.

### Accessories options

- Option E5091A-1CM** rack mount kit  
Adds a rack mount kit (part number 5063-9212) for use without handles.
- Option E5091A-1CN** front handle kit  
Adds a front handle kit (part number 5063-9226) for use with analyzer handles.
- Option E5091A-1CP** rack mount and front handle kit  
Adds a rack mount and a handle kit (part number 5063-9219) for use with analyzer handles.

### Included documentation options

- Option E5091A-ABA** add English manual set
- Option E5091A-ABJ** add Japanese manual set
- Option E5091A-0B0** delete manual set

### Additional documentation options

- Option E5091A-800** extra English manual set
- Option E5091A-801** extra Japanese manual set

### Certification option

- Option E5091A-1A7** ISO 17025 compliant calibration

1. These printers are available as of June 15, 2002.

## Literature and information

### **ENA Series Brochure**

Literature number 5988-3765EN

### **ENA Series Technical Specifications**

Literature number 5988-3780EN

### **Agilent Network Analyzer Selection Guide**

Literature number 5968-5260E

### **PNA and ENA Network Analyzer Frequency Converter and Mixer Test Selection Guide**

Literature number 5988-8149EN

## Application and product notes

### ***Introduction to the Fixture Simulator Function of the ENA Series RF Network Analyzers: Network De-embedding/Embedding and Balanced Measurement, Product Note E5070/71-1***

Literature number 5988-4923EN

### ***Evolution of Test Automation Using Built-in VBA with the ENA Series RF Network Analyzers, Product Note E5070/71-2***

Literature number 5988-6192EN

### ***On-wafer Multiport Calibration Using the ENA Series RF Network Analyzer with the Cascade Microtech Probing System, Product Note E5070/71-3***

literature number 5988-5886EN

### ***In-Fixture Characterization Using the ENA Series RF Network Analyzer with Cascade Microtech Probing System, Product Note E5070/71-4***

Literature number 5988-6522EN

### ***Characterizing Differential Amplifiers with True Differential Signals***

Application Note 1463

literature number 5988-9463EN

### ***Improve the Circuit Evaluation Efficiency of Wireless LAN Chip Set Design***

Application Note 1463-2

Literature number 5988-9803EN

### ***Differential S-parameter Measurements of PCI Express Connectors using the ENA Series Network Analyzer***

Application Note 1463-3

Literature number 5988-9848EN

### ***On-Wafer Impedance Measurements using the ENA and the Impedance Parameter Display Software***

Application Note 1472

Literature number 5989-0033EN

### ***Impedance Characteristic Evaluation of SMD by Using the ENA with Inter-Continental Microwave (ICM)***

Application Note 1463-5

Literature number 5989-0547EN

### ***Accurate Mixer Measurements Using the Frequency-Offset Mode***

Application Note 1463-6

Literature number 5989-1420EN

### ***Accurate Mixer Conversion Loss Measurement Techniques***

Application Note 1463-7

Literature number 5989-1986EN

### ***7 Reasons to Migrate from Your 8753 to an ENA Network Analyzer***

Application Note 1478

Literature number 5989-0206EN

## Key web resources

For additional information on the ENA Series, visit:  
[www.agilent.com/find/ena](http://www.agilent.com/find/ena)



## Agilent Email Updates

[www.agilent.com/find/emailupdates](http://www.agilent.com/find/emailupdates)

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### Agilent Technologies' Test and Measurement Support, Services, and Assistance

Agilent Technologies aims to maximize the value you receive, while minimizing your risk and problems. We strive to ensure that you get the test and measurement capabilities you paid for and obtain the support you need. Our extensive support resources and services can help you choose the right Agilent products for your applications and apply them successfully. Every instrument and system we sell has a global warranty. Two concepts underlie Agilent's overall support policy: "Our Promise" and "Your Advantage."

#### Our Promise

Our Promise means your Agilent test and measurement equipment will meet its advertised performance and functionality. When you are choosing new equipment, we will help you with product information, including realistic performance specifications and practical recommendations from experienced test engineers. When you receive your new Agilent equipment, we can help verify that it works properly and help with initial product operation.

#### Your Advantage

Your Advantage means that Agilent offers a wide range of additional expert test and measurement services, which you can purchase according to your unique technical and business needs. Solve problems efficiently and gain a competitive edge by contracting with us for calibration, extra-cost upgrades, out-of-warranty repairs, and onsite education and training, as well as design, system integration, project management, and other professional engineering services. Experienced Agilent engineers and technicians worldwide can help you maximize your productivity, optimize the return on investment of your Agilent instruments and systems, and obtain dependable measurement accuracy for the life of those products.



## Agilent Open

### [www.agilent.com/find/open](http://www.agilent.com/find/open)

Agilent Open simplifies the process of connecting and programming test systems to help engineers design, validate and manufacture electronic products. Agilent offers open connectivity for a broad range of system-ready instruments, open industry software, PC-standard I/O and global support, which are combined to more easily integrate test system development.

#### United States:

(tel) 800 829 4444  
(fax) 800 829 4433

#### Canada:

(tel) 877 894 4414  
(fax) 800 746 4866

#### China:

(tel) 800 810 0189  
(fax) 800 820 2816

#### Europe:

(tel) 31 20 547 2111

#### Japan:

(tel) (81) 426 56 7832  
(fax) (81) 426 56 7840

#### Korea:

(tel) (080) 769 0800  
(fax) (080)769 0900

#### Latin America:

(tel) (305) 269 7500

#### Taiwan:

(tel) 0800 047 866  
(fax) 0800 286 331

#### Other Asia Pacific

#### Countries:

(tel) (65) 6375 8100  
(fax) (65) 6755 0042

Email: [tm\\_ap@agilent.com](mailto:tm_ap@agilent.com)

Contacts revised: 05/27/05

**For more information on Agilent Technologies' products, applications or services, please contact your local Agilent office. The complete list is available at:**

**[www.agilent.com/find/contactus](http://www.agilent.com/find/contactus)**

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