Agilent Technologies
87050E Option H08
User's and Service Guide Supplement

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87050E Option H08

User's and Service Guide Supplement

Use this manual with the following documents:

87050E User's Guide
Part Number 87050-90026

Agilent Technologies

Manufacturing Part Number: 87050-90083

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Warranty Statement

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Definitions

- *Specifications* describe the performance of parameters covered by the product warranty (temperature - 0 to 55 °C, unless otherwise noted.)
- *Typical* describes additional product performance information that is not covered by the product warranty. It is performance beyond specification that 80% of the units exhibit with a 95% confidence level over the temperature range 20 to 30 °C. Typical performance does not include measurement uncertainty.
- *Nominal* values indicate expected performance, or describe product performance that is useful in the application of the product, but is not covered by the product warranty.

Safety Notes

The following safety notes are used throughout this manual. Familiarize yourself with each of the notes and its meaning before operating this instrument. All pertinent safety notes for using this product are located in Chapter 4, “Safety and Regulatory Information,” on page 43.

WARNING	**Warning denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a warning note until the indicated conditions are fully understood and met.**

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1 General Information

Description

The Agilent Technologies 87050E Option H08 Multiport Test Set is designed for use with 50 Ω network analyzers such as the Agilent Technologies 8712/14 ET/ES and 8753ET/ES.

The test set provides single-connection measurements of multiport devices with up to eight ports such as distribution amplifiers, taps, switches and couplers. The throughput is increased by reducing the number of device reconnects the operator must perform. Switching is achieved with solid-state switches; no mechanical parts are used.

The test set can be controlled with the network analyzer's internal IBASIC capability (if available), an external GPIB controller, or parallel control.

NOTE The 87050E Option H08 User's and Service Guide documents the use of the test set with an 8753ET/ES analyzer only.

This User's and Service Guide Supplement is to be used in conjunction with the Agilent Technologies 87050E User's and Service Guide, 87050-90026.

When necessary, part numbers will be provided in parentheses after the description of a part for clarification. Example: "Use any two Type-N 50 Ω jumper cables (8120-6995)...."

Verify the Shipment

After the test set has been unpacked, keep the original packaging materials so they can be used if you need to transport the instrument.

Verify that you have received the items listed below in Table 1-1.

Inspect the test set and all accessories for any signs of damage that may have occurred during shipment. If your test set or any accessories appear to be damaged or missing, refer to "Contacting Agilent" on page 48.

Table 1-1 Content List

Description	Quantity	Part Number
Power Cord	1	Figure on page 41
Front Handle Kit	1	5063-9227
Parallel Port Interface Cable	1	8120-6818
Type-N to Type-N Cable 50 Ohm	2	8120-6995
Cal Constant Disk for 871x Self-Cal	1	08712-10016
Adapter, APC-7 to Type-N	2	85054-60001
Disk, Sample Program	1	87050-10022
Cable Assembly-Test Port	1	87050-60058
Cable Assembly-Test Port	1	87050-60060
Addendum to 87050E Option H08/H12 User's and Service Guide Supplement	1	87050-90084
87050E Option H08 User's and Service Guide Supplement	1	87050-90083
87050E User's and Service Guide	1	87050-90026

Specifications and Characteristics

Table 1-2 87050E Option H08 Specifications, Test Set Input/Output

Parameter	Specifications, dB	
	3 MHz to 1.3 GHz	1.3 GHz to 2.2 GHz
Source Match, test port[a]	≥ 14	≥ 11
Load Match, test port unselected	≥ 18	≥ 18
Load Match, test port selected[a]	≥ 14	≥ 14
Interconnect Match, reflection port	≥ 12	≥ 10
Insertion Loss, reflection port to port-n	≤ 7.5	≤ 9.5
Insertion Loss, transmission port to port-n	≤ 7.5	≤ 9.5
Interconnect Match, transmission port	≥ 11	≥ 8
Crosstalk, uncalibrated, adjacent ports	≥ 90	≥ 90

a. Specification from 3 MHz to 10 MHz is ≥ 13 dB.

Table 1-3 Test Set Input/Output Performance 50Ω

RF Input Power	
Description	**Supplemental**
Maximum Input Power at 0.1 dB compression	16 dBm (Typical)
Input Damage Power	20 dBm (characteristic)

Requirements

Electrical

The alternating-current (AC) power that is supplied to the test set must meet the following requirements:

Voltage: 90 to 250 Vac

Frequency: 48 to 66 Hz

Available power: 40 watts minimum

If the available AC line voltage is outside the 90 to 250 Vac range, an autotransformer that provides third wire continuity to earth ground may be used.

Environmental

Operating Environment

Indoor use only

Operating temperature: 0 to 55 °C

Maximum relative humidity: 80 percent for temperatures up to 31 °C decreasing linearly to 50 percent relative humidity at 40 °C

Altitude: up to 15,000 feet (4,572 meters)

Enclosure protection: IP 20, according to IEC 529

CAUTION This product is designed for use in INSTALLATION CATEGORY II, and POLLUTION DEGREE 2, per IEC 101 and 664 respectively.

Non-Operating Storage Conditions

Temperature: –40 °C to +70 °C

Humidity: 0 to 90 percent relative at +65 °C (non-condensing)

Altitude: 0 to 15,240 meters (50,000 feet)

Weight

Net: Approximately 7 kg

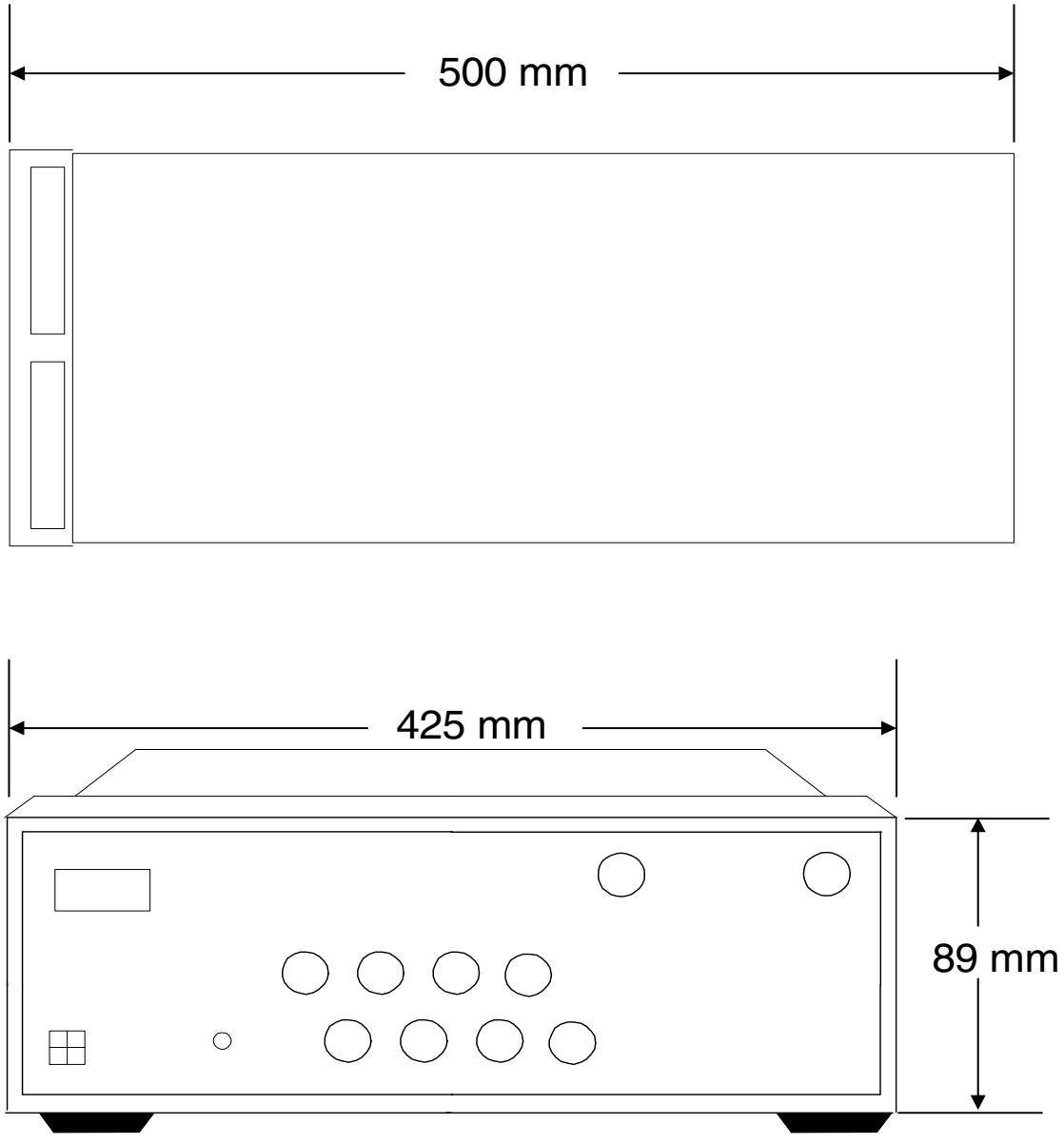
Shipping: Approximately 20 kg

Cabinet Dimensions

These dimensions exclude front and rear panel protrusions.

132.81 mm H by 425mm W by 497 mm L
(5.23 in by 16.75 in by 19.6 in)

Figure 1-1 Physical Dimensions



87050E Option H08 Options

UK6
Option UK6 provides a test data package for all critical specifications. A calibration and test data package is shipped with the test set when the UK6 Option is selected.

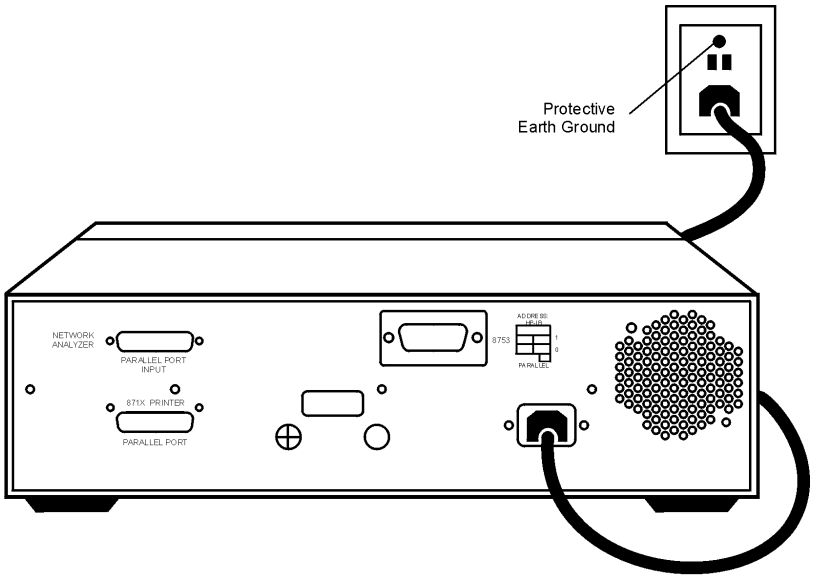
Preparations

Electrical

1. Ensure that the “Requirements” on page 11 are met.
2. Verify that the power cable is not damaged and that the power source outlet provides a protective earth ground contact. Note that Figure 1-2 depicts only one type of power source outlet. Refer to Figure 3-4 on page 42 to see the different types of power cord plugs that can be used with your test set.

   Cables are available in different lengths. For descriptions and part numbers of cables other than those described in Figure 3-4, Refer to “Contacting Agilent” on page 48.
3. If this product is to be powered by autotransformer, make sure the common terminal is connected to the neutral (grounded) side of the ac power supply.

Figure 1-2 Protective Earth Ground



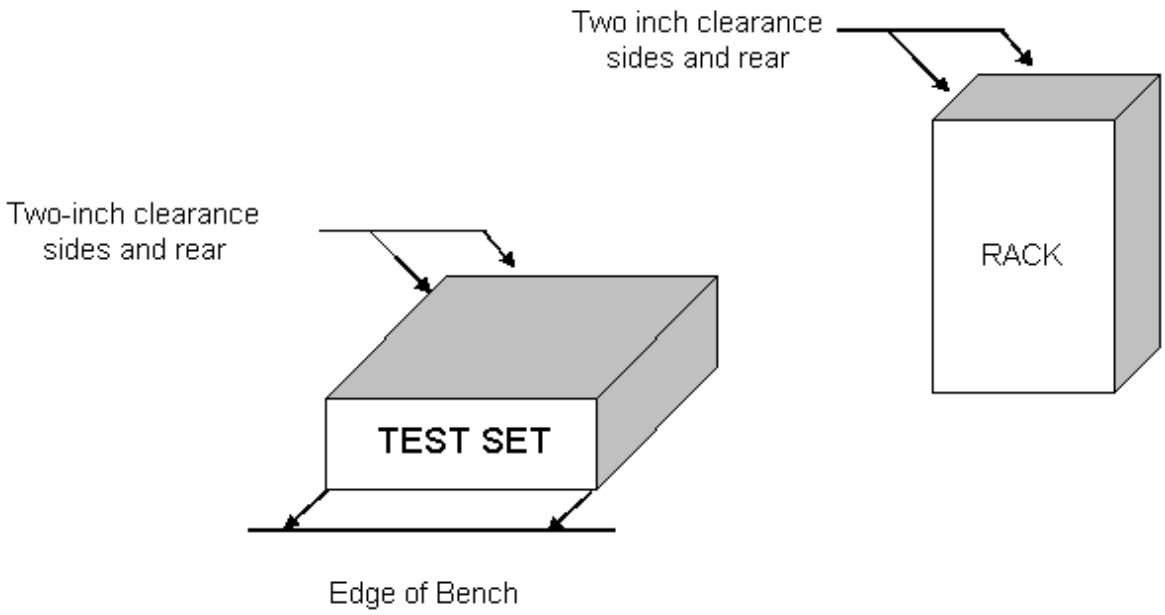
ur63c

WARNING **This is a Safety Class I product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted into a socket outlet provided with a protective earth contact. Any interruption of the protective conductor, inside or outside the instrument, is likely to make the instrument dangerous. Intentional interruption of the protective conductor is prohibited.**

Environmental

1. Ensure that the “Requirements” on page 11 are met.
2. If you are installing the test set into a cabinet, ensure there are at least two inches of clearance around the sides and back of the test set and the system cabinet. See Figure 1-3. The convection into and out of the test set must not be restricted. The ambient temperature (outside the cabinet) must be less than the maximum operating temperature of the test set by 4 ×C for every 100 watts dissipated in the cabinet.

Figure 1-3 Ventilation Clearance Requirements



CAUTION If the total power dissipated in the cabinet is greater than 800 watts, forced convection must be used.

Electrostatic Discharge Protection

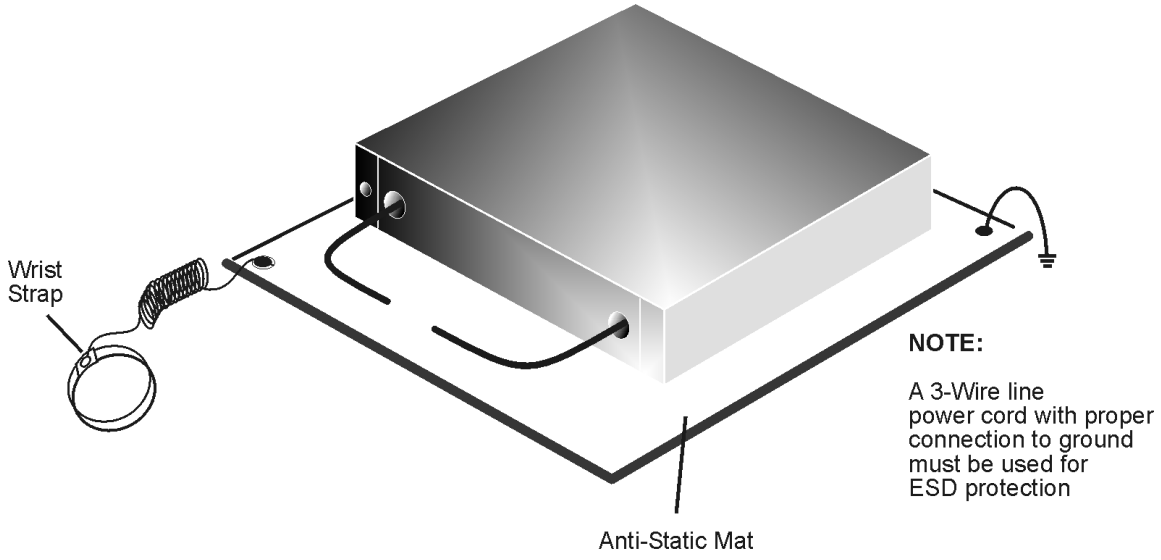
Protection against electrostatic discharge (ESD) is essential while removing or connecting cables or assemblies within the network analyzer or test set.

Static electricity can build up on your body and can easily damage sensitive internal circuit elements when discharged. Static discharges too small to be felt can cause permanent damage. To prevent damage to the instruments:

- *always* wear a grounded wrist strap having a 1 MΩ resistor in series with it when handling components and assemblies.
- *always* use a grounded, conductive table mat while working on the instrument.
- *always* wear a heel strap when working in an area with a conductive floor. If you are uncertain about the conductivity of your floor, wear a heel strap.

Figure 1-4 shows a typical ESD protection setup using a grounded mat and wrist strap.

Figure 1-4 ESD Protection Setup



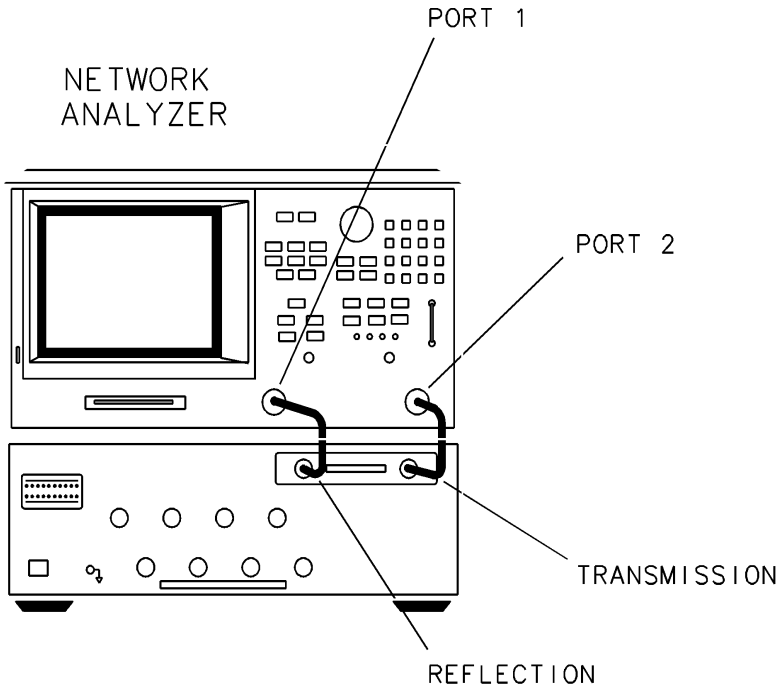
Getting Started

Connecting and Turning on the Test Set

The test set is designed to be placed underneath the network analyzer in a system rack and connected as shown in Figure 1-5. Use the two Type-N 50 Ω jumper cables that are included with the test set. See Table 1-1, “Content List,” on page 9.

CAUTION The front panel LINE switch disconnects the mains circuits from the mains supply after the EMC filters and before other parts of the instruments.

Figure 1-5 Connecting the Test Set to the Network Analyzer



After all of the proper connections have been made, turn on the test set using the front panel line switch.

CAUTION For accurate, repeatable measurements, be sure to let the test set warm up for at least two hours. It is recommended that the test set not be turned off on a regular basis. For the most stable and accurate measurements, leave the test set turned on at all times.

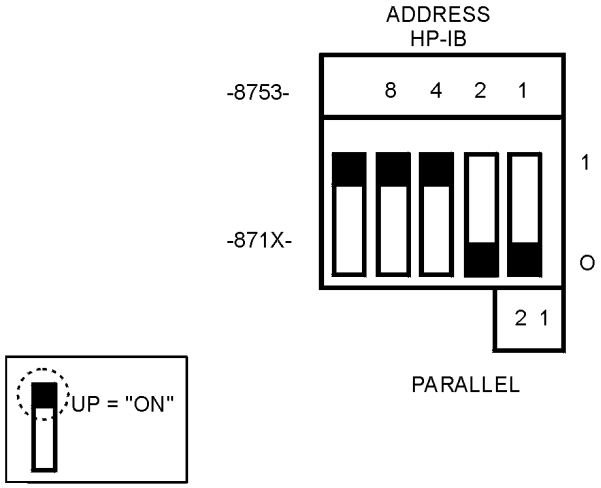
Setting the Test Set Address Switch

The test set is shipped with the GPIB address set to 12, which sets the parallel address to 00 as in Figure 1-6 on page 17. The last switch is also shown in the up or On position which is required for operation with the 8753x network analyzer or GPIB operation of the test set. Refer to Chapter 2, "Controlling the Test Set and Making Measurements," for the definition of the parallel address.

To set the GPIB address, set four switches (8, 4, 2, and 1) so that the sum of the switches in the On or 1 position equals the desired address. The last switch, labeled 8753/871x, must also be in the On or 1 position if the test set is going to be controlled via GPIB or through the 8753x series network analyzer. In the example below, the three switches in the On position are 8753, 8 and 4. Thus the test set is set to work with GPIB/8753 and the address is 12.

To set the parallel address use only the number 1 and 2 switches. The possibilities for parallel port addressing are an address of 0, 1, 2, or 3. When GPIB is used, the parallel address is ignored.

Figure 1-6 The Test Set Address Switch



CAUTION The address switch is set only when the test set has been turned off.

The last switch is used to specify whether the test set will work with an 8753ET/ES or an 8712/14ET/ES. When the switch is up, the test set will work with an 8753ET/ES and behaves as indicated in Chapter 2, "Controlling the Test Set and Making Measurements." When the switch is down, the test set will work with 8712/14ET/ES. Refer to the standard 87050E User's and Service Guide (87050-90026) for operating instructions.

Performing the Operator's Check

The following operator's check is designed to provide you with a high degree of confidence that your test set is working properly. It is not designed to verify specifications. To verify specifications, refer to "87050E Option H08 Specifications, Test Set Input/Output" on page 10. In the event that your test set is not working properly, it must be returned to Agilent for servicing. Contact the nearest sales or service office for instructions on returning the test set to Agilent. See "Contacting Agilent" on page 48.

For information on how to control the test set, refer to page 22.

Equipment Required

- Network Analyzer, 50 Ω impedance (Agilent 8753ET/ES)
- Computer (Agilent 9000 series 200/300/700)
- CONTROL program. See "The Control Program" on page 31.
- Cable, 50 Ω Type-N, (p/n 8120-4781 or equivalent)
- Calibration Kit, 50 Ω (85032B)

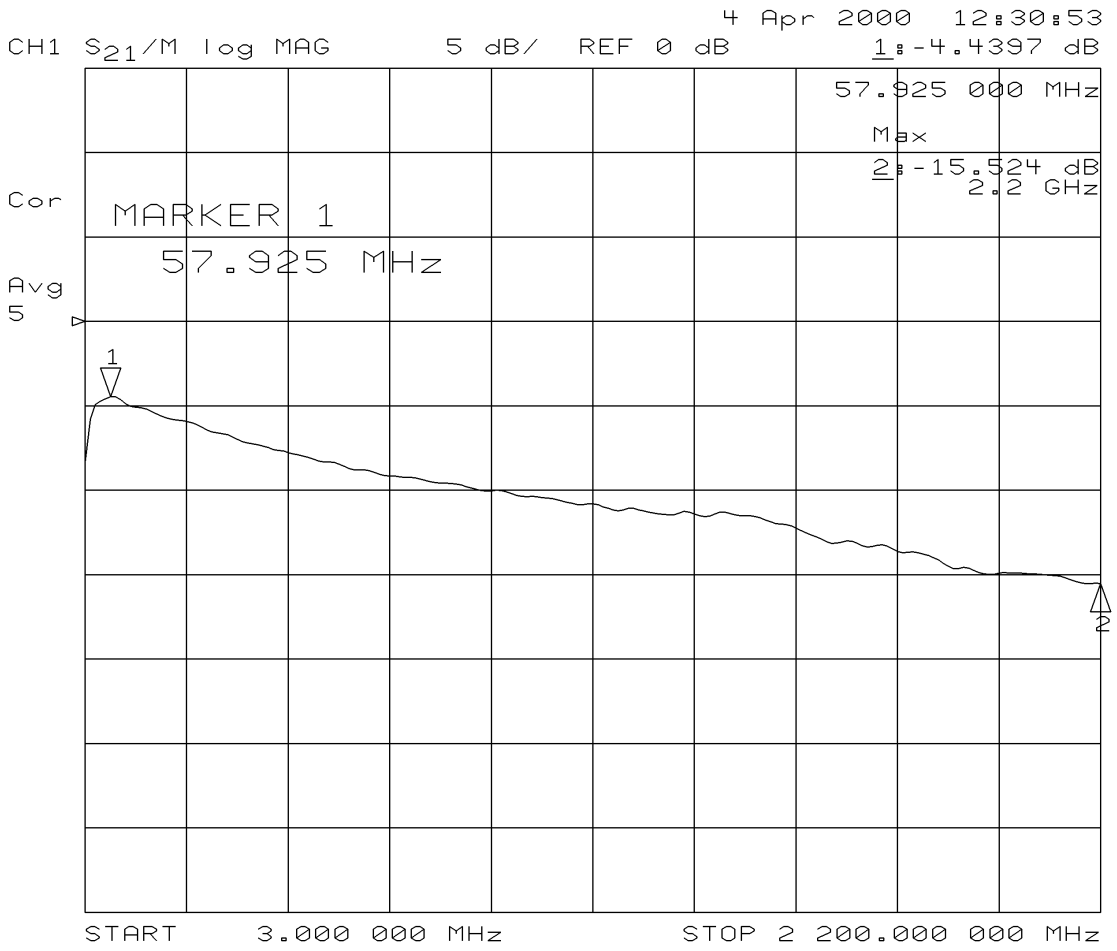
Procedure

This procedure is for performing a simple operator's check using a network analyzer of the proper frequency range and impedance.

1. Perform a full two-port calibration at the ends of the 50 Ω cables that connect the network analyzer to the 87050E test set over the frequency range of 3 MHz to 2.2 GHz.
2. Connect a 50 Ω cable, such as the 8120-4781, as a through between these two cables on the network analyzer and normalize the trace.
3. Connect the network analyzer to the 87050E test set REFLECTION and TRANSMISSION ports. Connect the 50 Ω cable (8120-4781) between ports 1 and 2 on the test set.
4. Select Port 1 and Port 2 with the "Control" program and measure the insertion loss of the test set (S_{21}). The insertion loss measured will be approximately twice the insertion loss of a single path, since you are measuring the loss of the path from REFLECTION to Port 1 and the loss of the path from TRANSMISSION to Port 2.

   The insertion loss value should be approximately –5 dB at the lower frequencies to approximately –19 dB at the higher frequencies. See Figure 1-7.

Figure 1-7 Insertion Loss Example



5. Reversing the port connections with the "Control" program (connecting REFLECTION to Port 2 and TRANSMISSION to Port 1) will verify that these two paths are operational.
6. Repeat this procedure for the remaining ports, testing Ports 3 and 4, Ports 5 and 6 etc.

2 Controlling the Test Set and Making Measurements

Introduction

The 87050E Option H08 is a slave instrument: a controller must be used to control the test set. See Figure 2-2, “Controlling the Test Set Over GPIB.” There are three ways in which the test set can be controlled:

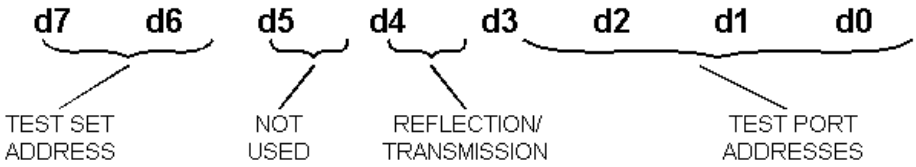
- The controller can talk to the network analyzer using GPIB which then controls the test set via the parallel connection.
- The controller can control the test set using GPIB commands via the GPIB connector.
- A network analyzer equipped with a parallel connection can control the test set directly.

An example program listing is provided at the end of this chapter.

Control Bits

Eight control bits are required to write to the test set.

Figure 2-1 Eight Control Bits



Test Set Address

These two bits allow up to four test sets to be addressed from the parallel port connector of the network analyzer. Test set addresses are set with a rear panel switch on the test set. These two bits are ignored with GPIB is used.

Not Used

This bit may be used for future customizing. It must be set to zero.

Reflection/Transmission

This bit selects which input port of the test set is to be connected. When set to “0”, this bit selects reflection as active. When the bit is set to “1”, transmission is selected as active.

Test Port Addresses

These four bits select which port of the test set is connected to the active input port.

Commands

As previously mentioned, there are three ways to control the test set. The first two involve the use of a separate computer. The third way uses the network analyzer manually. These methods of control are detailed in the following sections.

Computer Control

- One way to control the test set is to write GPIB commands to the 8753ES/ET network analyzer which then writes to the test set by way of the parallel port. See Figure 2-2 on page 2-26 for a diagram of connections for this type of control. The following examples use the variable [D] which is defined in Table 2-1 on page 26.

  To use a parallel port connection with the 8753ET/ES analyzer, use a GPIB command to write bits on the parallel port. The following example assumes that the address of the network analyzer is 16.

  ```
  OUTPUT 716;"PARALGPIO;"Sets the parallel port for GPIO function
  ```

  ```
  OUTPUT 716;"PARAOUT[D];"Programs all GPIO output bits (0 to 256) at once
  ```

- Another way to control the test set is to address the 87050E Option H08 test set directly over GPIB using a controller to write directly to the test set's GPIB port. The following example assumes that the address of the test set is 12.

  ```
  OUTPUT 712;CHR$([D]);
  ```

NOTE Be sure to use the ending semi-colon.

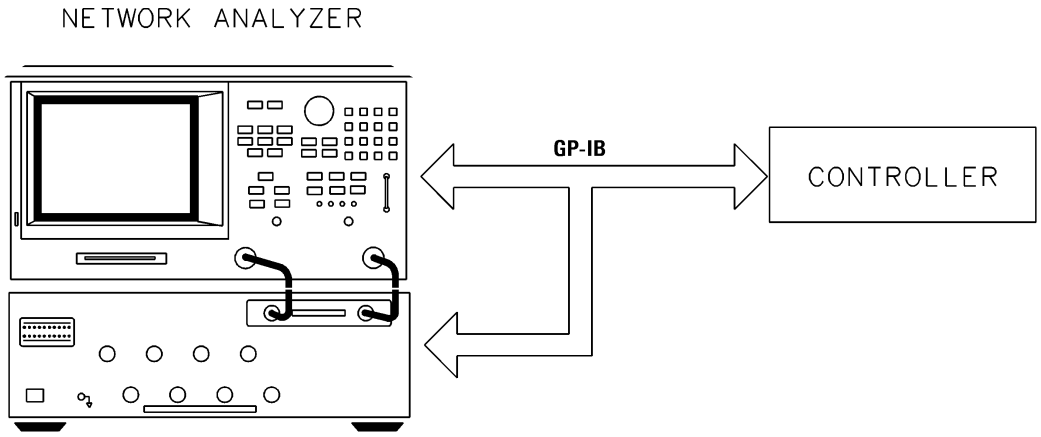
If using Quick Basic or Visual Basic, be sure to disable EOI and EOL before sending commands to the test set. Including the semicolon will not insure that these commands are disabled as would be the case in Basic/RMB. Using the Agilent 82335 GPIB Interface and Visual Basic, the following commands will disable the EOI and EOL, send the necessary data to the test set, and re-enable EOI and EOL. Be sure to re-enable the EOI and EOL before sending data to another instrument.

```
HpibEoi(hHpib;7,0) 'disable EOI
HpibEol(hHpib;7,"",0) 'disable EOL
HpibOutput(hHpib;712,chr$([D])) 'send command to
test set
HpibEol(hHpib;7,chr$(13)+chr$(10),2) 're-enable EOL
and set to'chr$(13)+chr$(10)
HpibEoi(hHpib;7,1,) 're-enable EOI
```

where Hpib specifies the handle returned by HpibOpen.

For more information on the EOI and EOL commands, refer to the programming library manual supplied with the Agilent 82335 interface.

Figure 2-2 Controlling the Test Set Over GPIB



NOTE Connection to the network analyzer is not required when controlling the test set over GPIB.

Table 2-1 Test Port Addresses

Connection	d7 d6[1]	d5 . . . d0[2]	D
Reflection to Port 1	0 0	0 0 0 0 0 0	0
Reflection to Port 2	0 0	0 0 0 0 0 1	1
Reflection to Port 3	0 0	0 0 0 0 1 0	2
Reflection to Port 4	0 0	0 0 0 0 1 1	3
Reflection to Port 5	0 0	0 0 0 1 0 0	4
Reflection to Port 6	0 0	0 0 0 1 0 1	5
Reflection to Port 7	0 0	0 0 0 1 1 0	6
Reflection to Port 8	0 0	0 0 0 1 1 1	7
All Reflection Ports Terminated	0 0	0 0 1 1 0 1	13
Transmission to Port 1	0 0	0 1 0 0 0 0	16
Transmission to Port 2	0 0	0 1 0 0 0 1	17
Transmission to Port 3	0 0	0 1 0 0 1 0	18
Transmission to Port 4	0 0	0 1 0 0 1 1	19
Transmission to Port 5	0 0	0 1 0 1 0 0	20
Transmission to Port 6	0 0	0 1 0 1 0 1	21
Transmission to Port 7	0 0	0 1 0 1 1 0	22
Transmission to Port 8	0 0	0 1 0 1 1 1	23
All Transmission Ports Terminated	0 0	0 1 1 1 0 0	28

1. These two bits are used for parallel port addressing and are ignored when GPIB is used. See "Setting the Test Set Address Switch" on page 17.
2. See Figure 2-1 for an explanation of these bits.

An easy way to remember these numbers is:

Reflection = Port Number - 1

Transmission = Port Number + 15

For example, to connect Port 8 to Reflection, the “D” number is 7, (8 - 1). To connect Port 8 to Transmission, the “D” number is 23, (8 + 15).

To connect all eight of the test port to their internal 50 Ω loads, send the following commands:

```
OUTPUT 716;"PARALGPIO;"

OUTPUT 716;"PARAOUT13;"

OUTPUT 716;"PARALGPIO;"

OUTPUT 716;"PARAOUT28;"
```

or

```
OUTPUT 712;CHR$(13);

OUTPUT 712;CHR$(28);
```

NOTE When a test set port is not in use (not connected to transmission or reflection) it is terminated in 50 Ω.

Calibrating the Test System

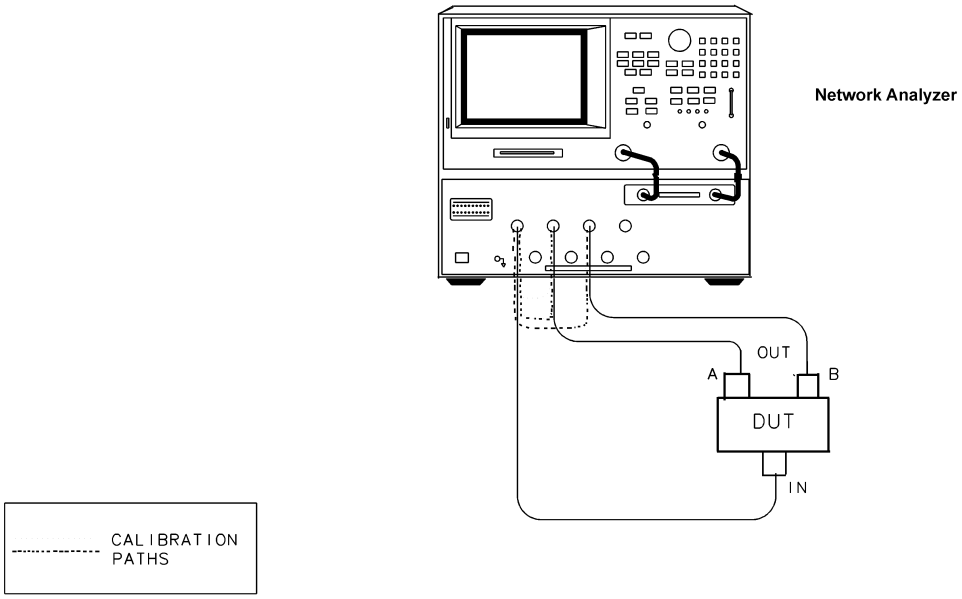
After the test set has warmed up for two hours, it should be calibrated before making any measurements. Refer to the network analyzer's user's guide to determine the type of calibration needed for the measurements you will be making.

You will need to calibrate each measurement path separately and store the calibration as an instrument state in the network analyzer. Refer to your network analyzer's user's guide for information on how to calibrate and store instrument states. See Figure 2-3 on page 29 for an example of the setup.

In this example setup the following tests will be made:

- Return Loss on the DUT's (device under test) input and two output ports (A and B).
- Insertion Loss (or gain) between the DUT's input and port A.
- Insertion Loss (or gain) between the DUT's input and port B.

Figure 2-3 Calibrating the Test System



For the best accuracy perform a full two-port calibration between the test set PORT 1 and PORT 3, and again between PORT 1 and PORT 5. Save the calibrations as instrument states. Refer to the standard documentation for information on calibrations and saving instrument states.

CAUTION When performing a full two-port calibration and making subsequent measurements, you must use the transfer switch internal to the 8753ET/ES analyzer to change the RF signal path direction. Do not use the test set to change the RF signal path direction when you are entering a full two-port calibration. Doing so will render the calibration invalid.

NOTE The SelfCal feature (described in the standard documentation) is not available when using the Option H08 with the 8753ET/ES analyzer.

Making Measurements

The following examples assume that you are using a parallel port connection with an 8753ET/ES with the test set's parallel address set to "0". See "Setting the Test Set Address Switch" on page 17 for information on setting the test set's address.

Measuring Return Loss of the DUT

Refer to Figure 2-3 on page 29 for the following discussion.

With the 8753ET/ES set to measure REFLECTION (S_{11}), the analyzer's RF power is reflected back into the network analyzer's PORT 1 is being measured.

To measure the return loss of the DUT for the signal path "IN" to "A" it will be necessary to select REFLECTION to PORT 1 and TRANSMISSION to PORT 3 on the test set. Remember to RECALL the instrument state that contains the calibration for these two ports. Use the following commands to connect the network analyzer's PORT 1 to the test set's PORT 1 and the network analyzer's PORT 2 to the test set's PORT 3.

For computer control through the 8753ET/ES network analyzer:

```
OUTPUT 716;"PARALGPIO;"
OUTPUT 716;"PARAOUT0;"

OUTPUT 716;"PARALGPIO;"
OUTPUT 716;"PARAOUT18;"
```

For direct control of the test set through the GPIO:

```
OUTPUT 712;CHR$(0);
OUTPUT 712;CHR$(18);"
```

Measuring Insertion Loss (Gain) of the DUT

To measure the insertion loss for this same path, the 8753ET/ES is set to measure TRANSMISSION (S21). Where the RF source power is sent through the DUT and any loss or gain is determined by the signal received at PORT 2 of the network analyzer.

Connecting to PORT "B" on the DUT

Since PORT 1 of the network analyzer has already been connected to PORT 1 of the test set, to measure the signals at the third port of the DUT will require selecting TRANSMISSION to PORT 5 on the test set. Remember to RECALL the instrument state that contains the calibration that was saved for PORT 1 to PORT 5. Use the following commands to connect PORT 2 of the network analyzer to PORT 5 on the test set.

For computer control through the 8753ET/ES network analyzer:

```
OUTPUT 716;"PARALGPIO;"
OUTPUT 716;"PARAOUT20;"
```

For direct control of the test set through the GPIO:

```
OUTPUT 712;CHR$(20);
```

The insertion loss and return loss can be measured by setting the network analyzer to measure TRANSMISSION (S_{21}) and REFLECTION (S_{11}).

Example Program

An example program is provided in this section to aid you in creating a program specific to your DUT. This program is written in BASIC and is for use with an Agilent 9000 series 200/300/700 computer. The program is briefly described below and listed following the description.

Control

This program demonstrates the control of the 87050E Option H08 via GPIB and/or the parallel port. This program can be used to manually select any port combination.

The Control program (listed below) will first ask the user which method will be used to control the 87050E Option H08; either GPIB or parallel port. It will then ask which ports are to be enabled. The port entries are done in pairs (reflection/transmission) with the numbers in the pair separated by a comma. The numbers may range from 0 through 8 for the test ports. For example, the entry of "2,5" will connect the REFLECTION port to PORT 2 and the TRANSMISSION port to PORT 5. The program is a continuous loop. Press STOP to end the program execution.

The Control Program

```
10    !  CONTROL:  This example program allows "manual" control of
the
20    ! 87050E-H08 via the parallel port of the 8753ET/ES
30    ! or via GPIB directly.
40    !
50    !  NOTE: You MUST select either GPIB control or Parallel Port
60    ! control.  If Parallel Port control, via the 8753ET/ES
70    ! is selected this program will return the analyzer to
80    ! LOCAL control after the switches are set.  Set GPIB
90    ! address as required below.
100   !
110   ! The 87050E-H08 can be set to one of 4 Parallel Port
120   ! addresses.  This program (SUB Set_switches) assumes it
130   ! is set to address 00.
140   !
150   !  Copyright:  Agilent Technologies, Palo Alto, CA 94304
160   !              p/n 87050-10022
170   !              Developed at Microwave Instrument Division
180   ! Santa Rosa, CA
```

```
190   ! Revision A.01.00     26 January 2000    rm
200   !
210   Nwa_addr=716 ! 8753ET/ES GPIB address
220   Ts_addr=712 ! 87050E-H08 GPIB address
230   !
240   !
250   CLEAR SCREEN
260   PRINT USING "3/,K,/";"***  DEMONSTRATION PROGRAM FOR 87050E
MANUAL CONTROL  ***"
270   PRINT "Either direct GPIB control to the 87050E may be
selected (G),"
280   PRINT "or indirect control via the Parallel Port (P) of the
8753ET/ES."
290   REPEAT
300   Answ$="P"
310   OUTPUT 2;Answ$&CHR$(255)&"G";
320   BEEP 300,.1
330   INPUT "Select desired test-set control.  GPIB or Parallel
Port? (Enter G or P)",Answ$
340   Answ$=UPC$(Answ$[1,1])
350   UNTIL Answ$="P" OR Answ$="G"
360   Controller$=Answ$
370   !
380   ABORT 7
390   CLEAR SCREEN
400   IF Controller$="P" THEN
410   Addr=Nwa_addr ! Assign address to the analyzer.
420   PRINT "Test set is being controlled via Parallel Port;
8753ET/ES  GPIB address =";Addr
430   ELSE
440   Addr=Ts_addr ! Assign address to the test set.
450   CLEAR Addr
460   PRINT "test set is being controlled directly via GPIB.  GPIB
address =";Addr
470   END IF
480   Isc=Addr DIV 100 ! Interface Select Code
490   !
500   PRINT USING "/,K,/";RPT$("-",77)
510   PRINT "For manual operation of this switch box, enter two
numbers separated by a"
```

```
520   PRINT "comma (,).  the two numbers represent the Reflection
port and Transmission"

530   PRINT "port to be used (respectively).  Setting a port to `0'
will terminate the"

540   PRINT "corresponding port."

550   PRINT "Unless both numbers are `0', the two values cannot be
the same."

560   PRINT "To terminate the program, press STOP or PAUSE."

570   PRINT

580   PRINT "Example:  2,3  Sets the switch box Reflection to Port
2; Transmission to"

590   PRINT " Port 3."

600   PRINT " 4,0  Sets Reflection to Port 4; Transmission is not
used."

610   LOOP

620   LOOP ! Enter port numbers here

630   Refl=0

640   Trans=0

650   BEEP 500,.1

660   INPUT "Enter the Refl/Trans Port selections separated by
commas,  e.g.  2,4",Refl,Trans

670   Refl=INT(Refl)

680   Trans=INT(Trans)

690   EXIT IF (Refl<>Trans OR (Refl=0 AND Trans=0)) AND Refl<9 AND
Trans<9 AND Refl>=0 AND Trans>=0

700   DISP "Port selections MUST be different if non-zero; Range = 0
to 8.  Try again!  Refl=";Refl;", Trans=";Trans

710   BEEP 1500,.3

720   WAIT 3

730   END LOOP

740   Set_switches(Addr,"REFL",VAL$(Refl),Controller$)   ! Sets
Reflection Port

750   Set_switches(Addr,"TRANS",VAL$(Trans),Controller$) ! Sets
Transmission Port

760   PRINT TABXY(1,16),"Current Reflection Port  =";Refl

770   PRINT TABXY(1,17),"Current Transmission Port =";Trans

780   LOCAL Isc

790   END LOOP

800   END

810   !

820   SUB Set_switches(Addr,Main_port$,Switched_port$,Controller$)
```

```
830
!=================================================================
840   !  PURPOSE:  To set the 87050E-H08 switches.
850
!-----------------------------------------------------------------
860   !  PARAMETERS:
870   !
880   !  Controller$ [P|G]  P = Parallel via 8753ET/ES or G = GPIB
890   !  Main_port$ [REFL|TRANS]
900   !  Switched_port$ [0|1|2|...|8]
910   !  Addr GPIB address of 8753ET/ES or 87050E-H08
920   ! depending upon G or P above.
930
!-----------------------------------------------------------------
940   !  DESCRIPTION:
950   !
960   ! Eight bits control the HP 87075C:  d7|d6|d5|d4|d3|d2|d1|d0
970   !
980   ! d7 \  Test set address bits.  Two bits allow up to 4 test
sets
990   ! d6 /  to be addressed with Centronics connector.  Test set
1000  ! addresses are set with rear panel switch.
1010  !
1020  ! d5    For future customization.
1030  !
1040  ! d4    Selects port1|port2 (Reflection or Transmission)
1050  ! "0" selects port 1 as active.  "1" selects port 2.
1060  !
1070  ! d3 \
1080  ! d2  \ Four bits select which port of the 87050E-H08 is
1090  ! d1  / connected to the active network analyzer port.
1100  ! d0 /
1110  !
1120  ! Commands can be sent via Centronics (Parallel) port of via
GPIB
1130  ! Choice depends upon variable, Controller$ (P\G).
1140  !
1150
!=================================================================
1160 Set_switches:   !
```

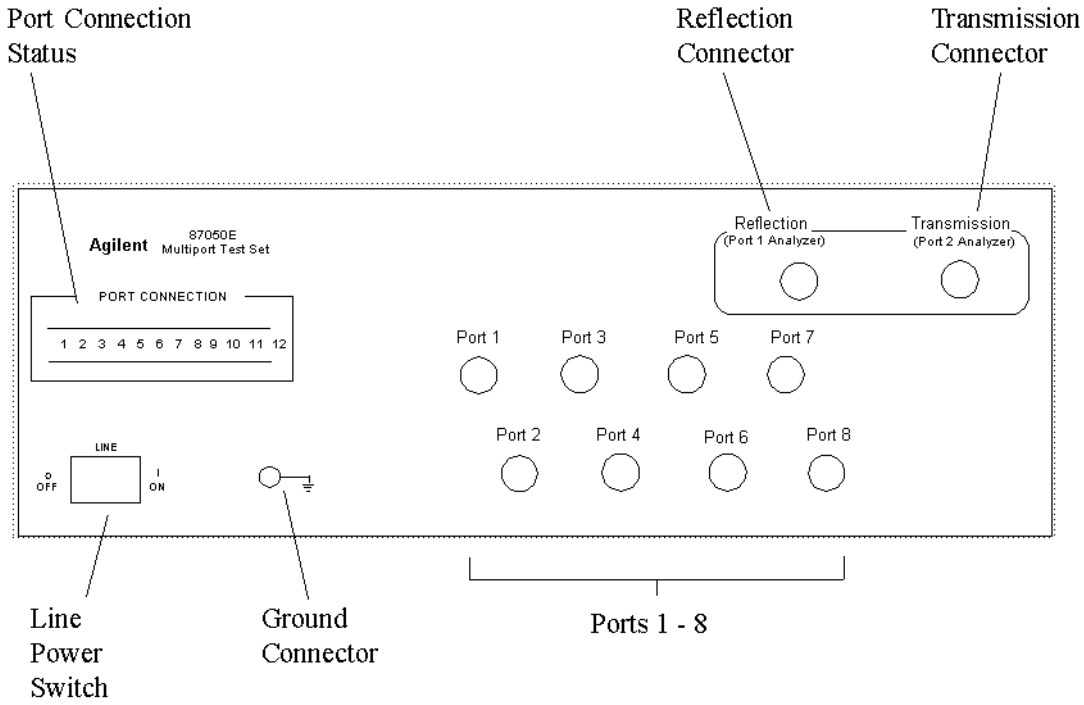
```
1170  !
1180   SELECT UPC$(TRIM$(Main_port$))
1190   CASE "REFL","REFLECTION"
1200   SELECT UPC$(TRIM$(Switched_port$))
1210   CASE "1","PORT 1"
1220   Switch_code$="0"
1230   CASE "2","PORT 2"
1240   Switch_code$="1"
1250   CASE "3","PORT 3"
1260   Switch_code$="2"
1270   CASE "4","PORT 4"
1280   Switch_code$="3"
1290   CASE "5","PORT 5"
1300   Switch_code$="4"
1310   CASE "6","PORT 6"
1320   Switch_code$="5"
1330   CASE "7","PORT 7"
1340   Switch_code$="6"
1350   CASE "8","PORT 8"
1360   Switch_code$="7"
1370   CASE "0","TERMINATE","RESET"
1380   Switch_code$="13"
1390   CASE ELSE
1400 DISP "Unrecognized Switched_port$
parameter;"""&Switched_port$&""""
1410   WAIT 2
1420   END SELECT
1430  !
1440   CASE "TRANS","TRANSMISSION"
1450   SELECT UPC$(TRIM$(Switched_port$))
1460   CASE "1","PORT 1"
1470   Switch_code$="16"
1480   CASE "2","PORT 2"
1490   Switch_code$="17"
1500   CASE "3","PORT 3"
1510   Switch_code$="18"
1520   CASE "4","PORT 4"
1530   Switch_code$="19"
```

```
1540   CASE "5","PORT 5"
1550   Switch_code$="20"
1560   CASE "6","PORT 6"
1570   Switch_code$="21"
1580   CASE "7","PORT 7"
1590   Switch_code$="22"
1600   CASE "8","PORT 8"
1610   Switch_code$="23"
1620   CASE "0","TERMINATE","RESET"
1630   Switch_code$="28"
1640   CASE ELSE
1650   DISP "Unrecognized Switched_port$
parameter;"""&Switched_port$&""""
1660   WAIT 2
1670   END SELECT
1680   CASE ELSE
1690   DISP "Unrecognized Main_port$ parameter;"""&Main_port$&""""
1700   WAIT 2
1710   END SELECT
1720  !
1730   IF Controller$="H" THEN
1740   OUTPUT Addr;CHR$(VAL(Switch_code$));  ! Sent via GPIB
1750   ELSE
1760   Output_cmd$=VAL$(VAL(Switch_code$))
1770   OUTPUT Addr;"PARALGPIO;"
1780   OUTPUT Addr;"PARAOUT"&Output_cmd$&";" ! Sent via Centronics
port
1790   END IF
1800   WAIT .1
1810  SUBEND
```

3 Front/Rear Panel

Front Panel

Figure 3-1 **Front Panel Features**



Line Power Switch

The test set line power switch is located at the bottom left corner of the front panel. See Figure 4-1. The line power switch turns the power to the test set either on (|) or off (O).

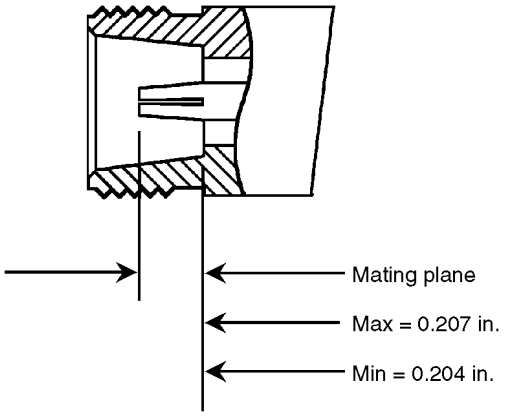
The front panel line switch disconnects the mains circuits from the mains supply after the EMC filters and before others parts of the instrument.

Ports 1—8

Ports 1 through 8 are used to connect to the device under test.

CAUTION Do not input more than +20 dBm or 25 Vdc to these ports or damage to the internal RF switches or the analyzer may occur.

Figure 3-2 **Physical Description of Type-N Connector**



The REFLECTION Connector

The REFLECTION connector is a female 50 Ω Type-N connector that connects directly to Port 1 of the network analyzer using the 50 Ω cable (8120-6995) and adapter (85054-60001) that are included with your test set.

CAUTION Check your analyzer's documentation for damage limits to Port 1. Make sure that your test setup will not cause those limits to be exceeded.

The TRANSMISSION Connector

The TRANSMISSION connector is a female 50 Ω Type-N connector that connects directly to Port 2 of the network analyzer using the 50 Ω cable (8120-6995) and adapter (85054-60001) that are included with your test set.

CAUTION Check your analyzer's documentation for damage limits to Port 2. Make sure that your test setup will not cause those limits to be exceeded.

The GROUND Connector

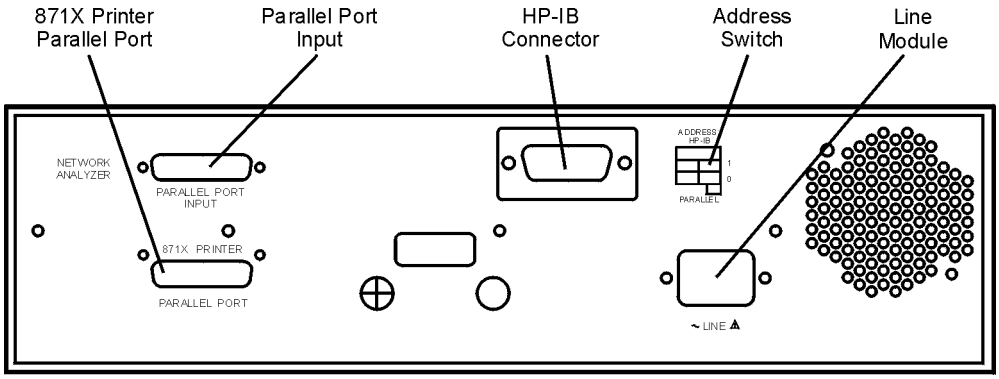
The GROUND connector provides a convenient front panel ground connection for a standard banana plug.

The PORT CONNECTION Status LEDs

The PORT CONNECTION status LEDs provide visual feedback of which port(s) are connected to the REFLECTION and TRANSMISSION ports of the test set. When neither LED is lit, the corresponding test port is internally terminated in 50 Ω.

Rear Panel

Figure 3-3 Rear Panel Features



The PARALLEL PORT INPUT Connector

This input is connected to the network analyzer. The analyzer provides control signals that drive the switches inside the test set. In pass-through mode, it also accepts signals required to drive a printer.

The 871X PRINTER PARALLEL PORT Connector

The output from this connector is provided to control a printer.

GPIB Connector (Agilent 8753ET/ES only)

This connector allows the test set to be connected directly to a controller. See Figure 2-2, “Controlling the Test Set Over GPIB” on page 26.

Address Switch

The address switch sets the GPIB or parallel address of the test set. For more information refer to, “Setting the Test Set Address Switch” on page 17.

Line Module

The line module contains the power cable receptacle and the line fuse.

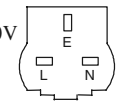
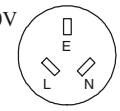
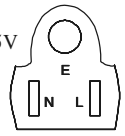
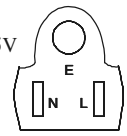
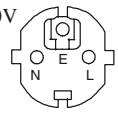
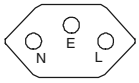
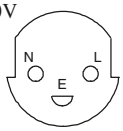
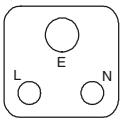
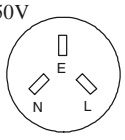
Power Cables

The line power cable is supplied in one of several configurations, depending on the destination of the original shipment.

Each instrument is equipped with a three-wire power cable. When connected to an appropriate ac power receptacle, this cable grounds the instrument chassis. The type of power cable shipped with each instrument depends on the country of destination. See Figure 3-4, “Power Cable and Line (Mains) Plug Part Numbers” on page 42 for the part numbers of the power cables. Cables are available in different lengths. Check with your nearest Agilent service center on page 48 for descriptions and part numbers of cables other than those described in Figure 3-4.

WARNING **This is a Safety Class I product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted into a socket outlet provided with a protective earth contact. Any interruption of the protective conductor, inside or outside the instrument, is likely to make the instrument dangerous. Intentional interruption is prohibited.**

Figure 3-4 Power Cable and Line (Mains) Plug Part Numbers

Plug Type [a]	Cable Part Number	Plug [b] Description	Length cm (in.)	Cable Color	For Use in Country
250V 	8120-8705 8120-8709	Straight BS 1363A 90˚	229 (90) 229 (90)	Mint Gray Mint Gray	Option 900 United Kingdom, Hong Kong, Cyprus, Nigeria, Singapore, Zimbabwe
250V 	8120-1369 8120-0696	Straight AS 3112 90˚	210 (79) 200 (78)	Gray Gray	Option 901 Argentina, Australia, New Zealand, Mainland China
125V 	8120-1378 8120-1521	Straight NEMA 5-15P 90˚	203 (80) 203 (80)	Jade Gray Jade Gray	Option 903 United States, Canada, Brazil, Colombia, Mexico,Philippines, Saudi Arabia, Taiwan
125V 	8120-4753 8120-4754	Straight NEMA 5-15P 90˚	229 (90) 229 (90)	Gray Gray	Option 918 Japan
250V 	8120-1689 8120-1692	Straight CEE 7/VII 90˚	200 (78) 200 (78)	Mint Gray Mint Gray	Option 902 Continental Europe, Central African Republic, United Arab Republic
230V 	8120-2104 8120-2296	Straight SEV Type 12 90˚	200 (78) 200 (78)	Gray Gray	Option 906 Switzerland
220V 	8120-2956 8120-2957	Straight SR 107-2-D 90˚	200 (78) 200 (78)	Gray Gray	Option 912 Denmark
250V 	8120-4211 8120-4600	Straight IEC 83-B1 90˚	200 (78) 200 (78)	Mint Gray Mint Gray	Option 917 South Africa, India
250V 	8120-5182 8120-5181	Straight SI 32 90˚	200 (78) 200 (78)	Jade Gray Jade Gray	Option 919 Israel

a. E =earth ground, L = line, and N = neutral.
b. Plug identifier numbers describe the plug only. The Agilent Technologies part number is for the complete cable assembly.

4 Safety and Regulatory Information

Safety and Regulatory Information

Introduction

Review this product and related documentation to familiarize yourself with safety markings and instructions before you operate the instrument. The documentation contains information and warnings that must be followed by the user to ensure safe operation and to maintain the product in a safe condition.

Connector Care and Cleaning

If alcohol is used to clean the connectors, the power cord to the instrument must be removed. All cleaning should take place in a well ventilated area. Allow adequate time for the fumes to disperse and moist alcohol to evaporate prior to energizing the instrument.

Before Applying Power

Verify that the product is configured to match the available main power source. If this product is to be powered by autotransformer, make sure the common terminal is connected to the neutral (grounded) side of the ac power supply.

Shipping Instructions

You must always call the Agilent Technologies Instrument Support Center to initiate service before retuning your instrument to a service office. See “Contacting Agilent” on page 48. Always transport or ship the instrument using the original packaging if possible. If not, comparable packaging must be used. Attach a complete description of the failure symptoms.

Statement of Compliance

This instrument has been designed and tested in accordance with IEC Publication 61010-1, Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, and has been supplied in a safe condition. The instruction documentation contains information and warnings which must be followed by the user to ensure safe operation and to maintain the product in a safe condition.

Warnings

WARNING **"WARNING": Warning denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a warning note until the indicated conditions are fully understood and met.**

Warnings applicable to this instrument are:

WARNING **If this product is not used as specified, the protection provided by the equipment could be impaired. This product must be used in a normal condition (in which all means for protection are intact) only.**

WARNING **No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock, do not remove covers.**

WARNING **For continued protection against fire hazard, replace line fuse only with same type and rating (H 3.15 A/250 Vac, part number 2110-0957). The use of other fuses or materials is prohibited.**

WARNING **This is a Safety Class I product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted into a socket outlet provided with a protective earth contact. Any interruption of the protective conductor, inside or outside the instrument, is likely to make the instrument dangerous. Intentional interruption is prohibited.**

WARNING **The power cord is connected to internal capacitors that may remain live for 5 seconds after disconnecting the plug from its power supply.**

WARNING **These servicing instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing unless you are qualified to do so.**

WARNING **The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the product from all voltage sources while it is being opened.**

WARNING **To prevent electrical shock, disconnect the Agilent Technologies model 87050E Option H08 from mains before cleaning. Use a dry cloth or one slightly dampened with water to clean the external case parts. Do not attempt to clean internally.**

Cautions

CAUTION CAUTION: Caution denotes a hazard. It calls attention to a procedure that, if not correctly performed or adhered to, could result in damage to or destruction of the product. Do not proceed beyond a caution sign until the indicated conditions are fully understood and met.

Cautions applicable to this instrument are:

CAUTION Always use the three-prong ac power cord supplied with this instrument. Failure to ensure adequate earth grounding by not using this cord may cause instrument damage.

CAUTION This instrument has autoranging line voltage input. Be sure the supply voltage is within the specified range.

CAUTION This product is designed for use in Installation Category II and Pollution Degree 2 per IEC 1010 and 664 respectively.

CAUTION **Ventilation Requirements:** When installing the instrument in a cabinet, the convection into and out of the instrument must not be restricted. The ambient temperature (outside the cabinet) must be less than the maximum operating temperature of the instrument by 4 ×C for every 100 watts dissipated in the cabinet. If the total power dissipated in the cabinet is greater than 800 watts, then forced convection must be used.

Instrument Markings

	When you see this symbol on your instrument, you should refer to the instrument's instruction manual for important information.
	This symbol indicates hazardous voltages.
	The laser radiation symbol is marked on products that have a laser output.
	This symbol indicates that the instrument requires alternating current (ac) input.
	The CE mark is a registered trademark of the European Community. If it is accompanied by a year, it indicates the year the design was proven.
	The CSA mark is a registered trademark of the Canadian Standards Association.
ISM1-A	This text indicates that the instrument is an Industrial Scientific and Medical Group 1 Class A product (CISPR 11, Clause 4).
	This symbol indicates that the power line switch is ON.
	This symbol indicates that the power line switch is OFF or in STANDBY position.
	This symbol indicates the product meets the Australian Standards.
	Safety Earth Ground. This is a Safety Class I product (provided with a protective earthing terminal). An uninterruptible safety earth ground must be provided from the main power source to the product input wiring terminals, power cord, or supplied power cord set. Whenever it is likely that the protection has been impaired, the product must be made inoperative and secured against any unintended operation.

Contacting Agilent

By internet, phone, or fax, get assistance with all your test and measurement needs.

This information supersedes all prior HP contact information.

Online assistance: www.agilent.com/find/assist

Americas			
Brazil *(tel)* (+55) 11 3351 7012 *(fax)* (+55) 11 3351 7024	**Canada** *(tel)* +1 877 894 4414 *(fax)* +1 303 662 3369	**Mexico** *(tel)* 1 800 254 2440 *(fax)* 1 800 254 4222	**United States** *(tel)* 800 829 4444 *(alt)* (+1) 303 662 3998 *(fax)* 800 829 4433
Asia Pacific and Japan			
Australia (*tel*) 1 800 225 574 (*fax*) 1 800 681 776 (*fax*) 1 800 225 539	**China** (*tel*) 800 810 0508 (*alt*) 800 810 0510 (*fax*) 800 810 0507 (*fax*) 800 810 0362	**Hong Kong** (*tel*) 800 933 229 (*fax*) 800 900 701	**India** *(tel)* 1600 112 626 (*fax*) 1600 112 727 (*fax*) 1600 113 040
Japan (Bench) (*tel*) 0120 32 0119 (*alt*) (+81) 426 56 7799 (*fax*) 0120 01 2144	**Japan (On-Site)** (*tel*) 0120 802 363 (*alt*) (+81) 426 56 7498 (*fax*) (+81) 426 60 8953	**Singapore** (*tel*) 1 800 275 0880 (*fax*) (+65) 6755 1235 (*fax*) (+65) 6755 1214	**South Korea** (*tel*) 080 778 0011 (*fax*) 080 778 0013
Taiwan (*tel*) 0800 047 669 (*fax*) 0800 047 667 (*fax*) 886 3492 0779	**Thailand** (*tel*) 1 800 2758 5822 (*alt*) (+66) 2267 5913 (*fax*) 1 800 656 336	**Malaysia** (*tel*) 1800 880 399 (*fax*) 1800 801 054	
Europe			
Austria (*tel*) 0820 87 44 11* (*fax*) 0820 87 44 22	**Belgium** (*tel*) (+32) (0)2 404 9340 (*alt*) (+32) (0)2 404 9000 (*fax*) (+32) (0)2 404 9395	**Denmark** (*tel*) (+45) 7013 1515 (*alt*) (+45) 7013 7313 (*fax*) (+45) 7013 1555	**Finland** (*tel*) (+358) 10 855 2100 (*fax*) (+358) (0) 10 855 2923
France (*tel*) 0825 010 700* (*alt*) (+33) (0)1 6453 5623 (*fax*) 0825 010 701*	**Germany** (*tel*) 01805 24 6333* (*alt*) 01805 24 6330* (*fax*) 01805 24 6336*	**Ireland** (*tel*) (+353) (0)1 890 924 204 (*alt*) (+353) (0)1 890 924 206 (*fax*)(+353) (0)1 890 924 024	**Israel** (*tel*) (+972) 3 9288 500 (*fax*) (+972) 3 9288 501
Italy (*tel*) (+39) (0)2 9260 8484 (*fax*) (+39) (0)2 9544 1175	**Luxemburg** (*tel*) (+32) (0)2 404 9340 (*alt*) (+32) (0)2 404 9000 (*fax*) (+32) (0)2 404 9395	**Netherlands** (*tel*) (+31) (0)20 547 2111 (*alt*) (+31) (0)20 547 2000 (*fax*) (+31) (0)20 547 2190	**Russia** (*tel*) (+7) 095 797 3963 (*alt*) (+7) 095 797 3900 (*fax*) (+7) 095 797 3901
Spain (*tel*) (+34) 91 631 3300 (*alt*) (+34) 91 631 3000 (*fax*) (+34) 91 631 3301	**Sweden** (*tel*) 0200 88 22 55* (*alt*) (+46) (0)8 5064 8686 (*fax*) 020 120 2266*	**Switzerland (French)** (*tel*) 0800 80 5353 opt. 2* (*alt*) (+33) (0)1 6453 5623 (*fax*) (+41) (0)22 567 5313	**Switzerland (German)** (*tel*) 0800 80 5353 opt. 1* (*alt*) (+49) (0)7031 464 6333 (*fax*) (+41) (0)1 272 7373
Switzerland (Italian) (*tel*) 0800 80 5353 opt. 3* (*alt*) (+39) (0)2 9260 8484 (*fax*) (+41) (0)22 567 5314	**United Kingdom** (*tel*) (+44) (0)7004 666666 (*alt*) (+44) (0)7004 123123 (*fax*) (+44) (0)7004 444555		

(tel) = primary telephone number; *(alt)* = alternate telephone number; *(fax)* = FAX number; * = in country number 11/16/04