

Agilent Technologies 87050E Option H08

User's and Service Guide Supplement

Use this manual with the following document:

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Part Number 87050-90026



Agilent Technologies

Manufacturing Part Number: 87050-90083

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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 37.

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.**

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 instrument. Do not proceed beyond a caution sign until the indicated conditions are fully understood and met.

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.
- *Characteristic Performance* describes performance parameter that the product is expected to meet before it leaves the factory, but is not verified in the field and is not covered by the product warranty. A characteristic includes the same guard bands as a specification.

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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 Sales and Service Offices”](#) on page 43.

Table 1-1 **Content List**

Description	Qty	Part Number
Power Cord	1	Figure 3-4 on page 36
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: 100/120/220/240 Vac

Frequency: 50/60 Hz

Available power: 40 watts minimum

Environmental

Operating Environment

Indoor use only

Operating temperature: 0 to 55 °C

Storage Temperature: -40 °C to +70 °C

Altitude: 0 to 4,600 meters (15,000 feet)

Enclosure protection: IP 20

CAUTION

This product is designed for use in INSTALLATION CATEGORY II, and POLLUTION DEGREE 2

Weight

Net: Approximately 7 kg

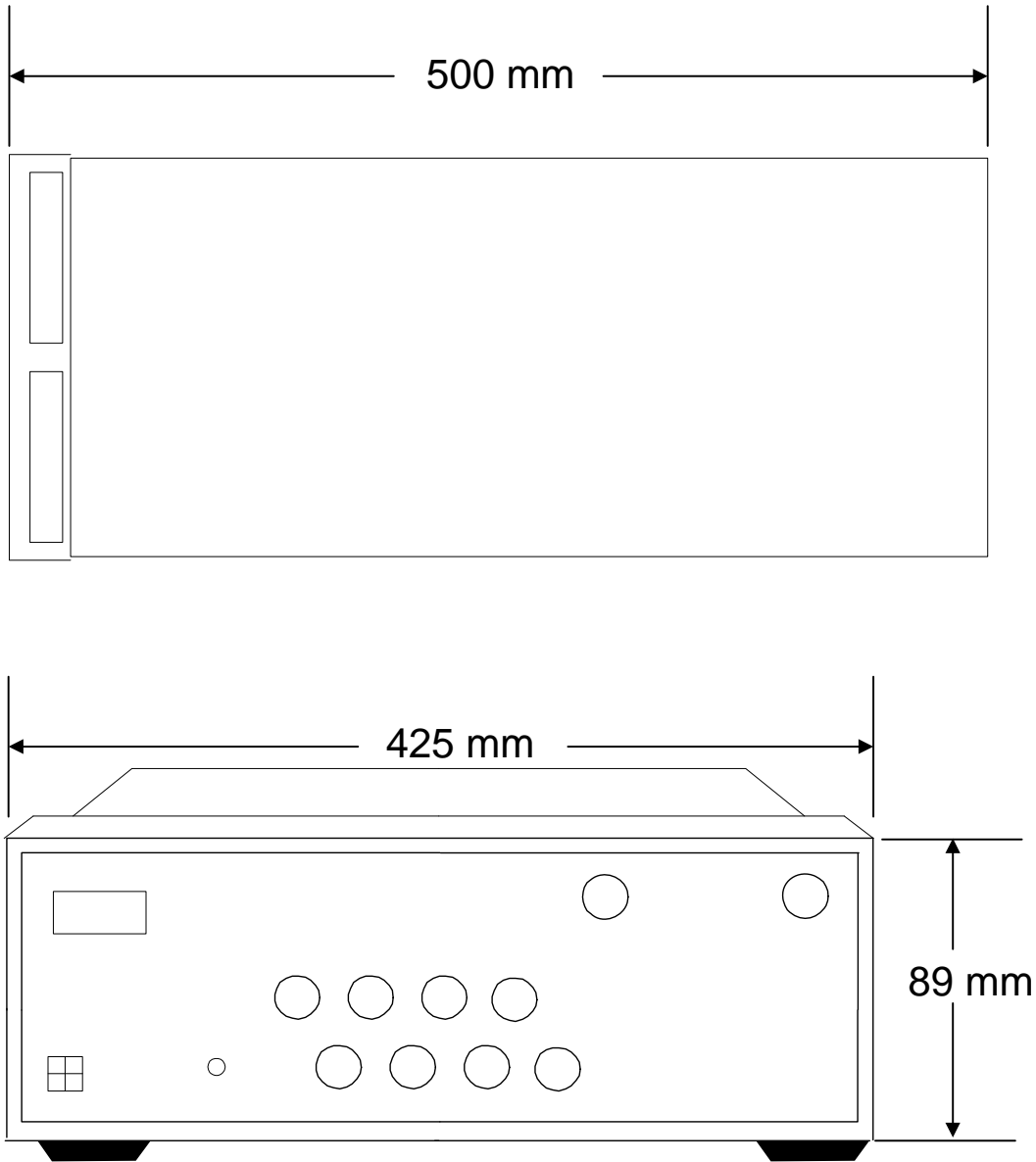
Shipping: Approximately 20 kg

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

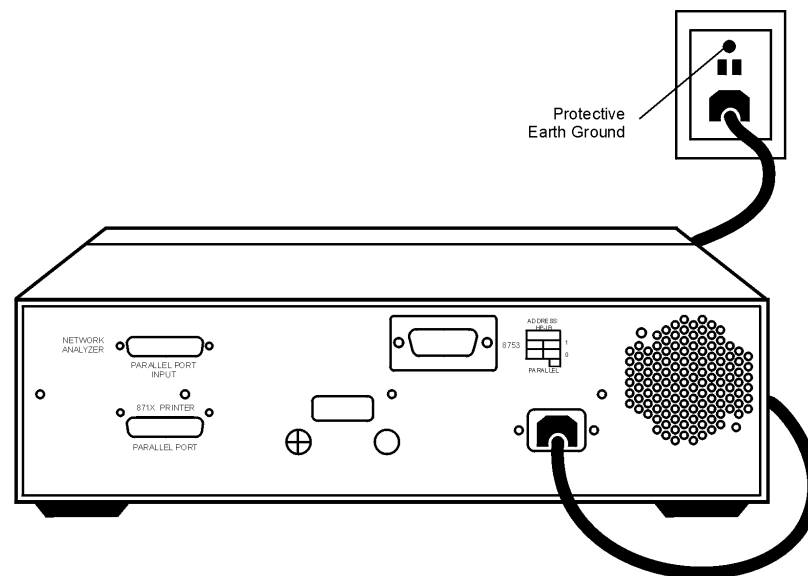
Electrical

1. Ensure that the “Requirements” on page 5 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 36 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 Sales and Service Offices” on page 43.

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

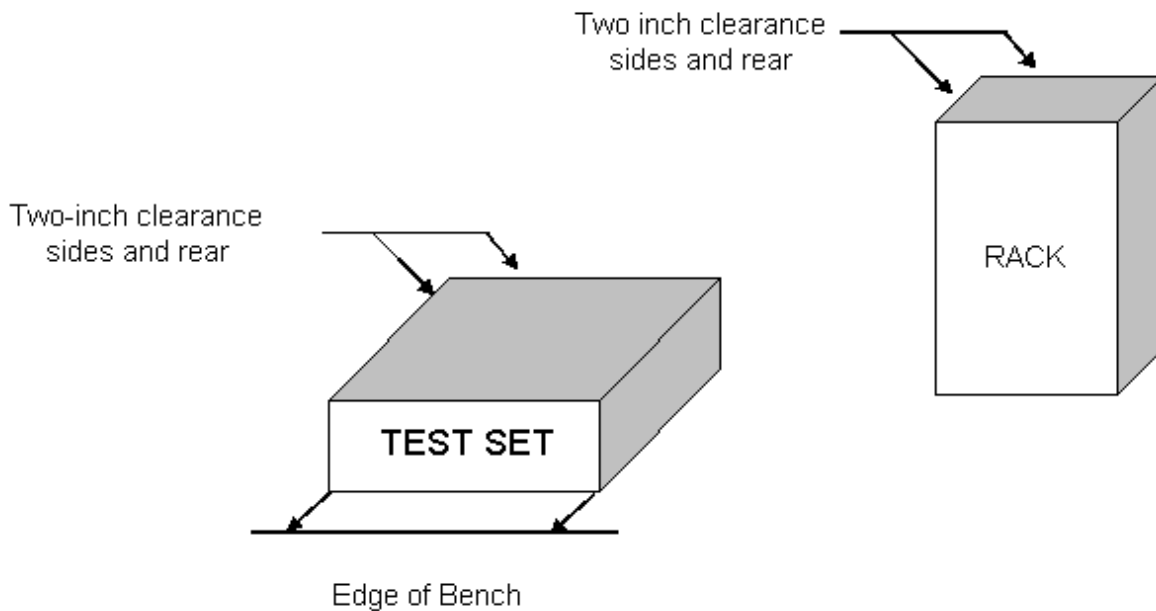
WARNING

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 5 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 $4 \times C$ for every 100 watts dissipated in the cabinet.

Figure 1-3 Ventilation Clearance Requirements



CAUTION

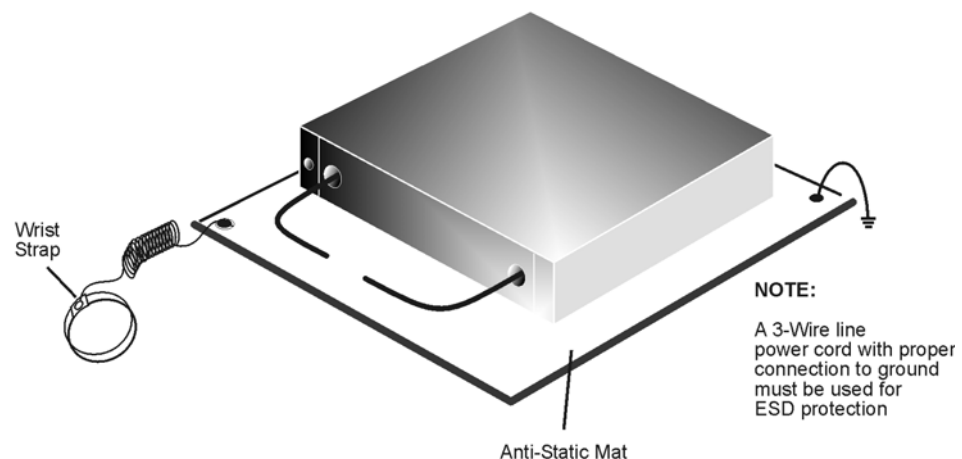
If the total power dissipated in the cabinet is greater than 800 watts, forced convection must be used.

Electrostatic Discharge Protection

Protection against electrostatic discharge (ESD) is essential while removing assemblies from or connecting cables to the network analyzer. 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 instrument:

- *always* have a grounded, conductive table mat (9300-0797) in front of your test equipment.
- *always* wear a grounded wrist strap (9300-1367) with grounding cord (9300-0980), connected to a grounded conductive table mat, having a 1 M Ω resistor in series with it, when handling components and assemblies or when making connections.
- *always* wear a heel strap (9300-1126) when working in an area with a conductive floor. If you are uncertain about the conductivity of your floor, wear a heel strap.
- *always* ground yourself before you clean, inspect, or make a connection to a static-sensitive device or test port. You can, for example, grasp the grounded outer shell of the test port or cable connector briefly.
- *always* ground the center conductor of a test cable before making a connection to the analyzer test port or other static-sensitive device. This can be done as follows:
 1. Connect a short (from your calibration kit) to one end of the cable to short the center conductor to the outer conductor.
 2. While wearing a grounded wrist strap, grasp the outer shell of the cable connector.
 3. Connect the other end of the cable to the test port and remove the short from the cable.

Figure 1-4 ESD Protection Setup



ku310b

Getting Started

Connecting and Turning on the Test Set

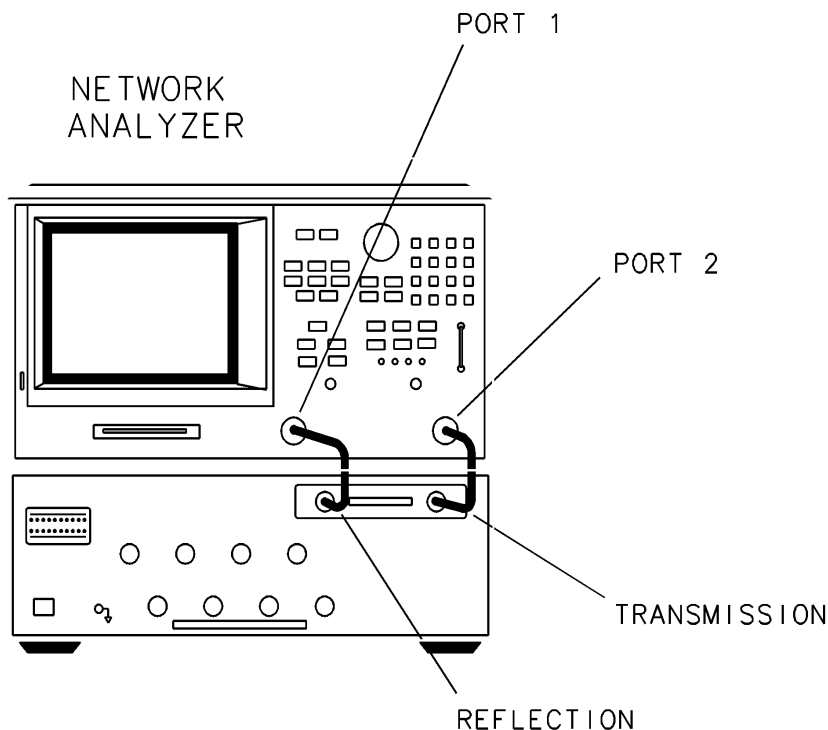
The test set is designed to be placed underneath the network analyzer in a system rack and connected as shown in [Figure 1-5](#). Use the two Type-N 50 Ω jumper cables that are included with the test set. See [Table 1-1, “Content List,”](#) on page 3.

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.

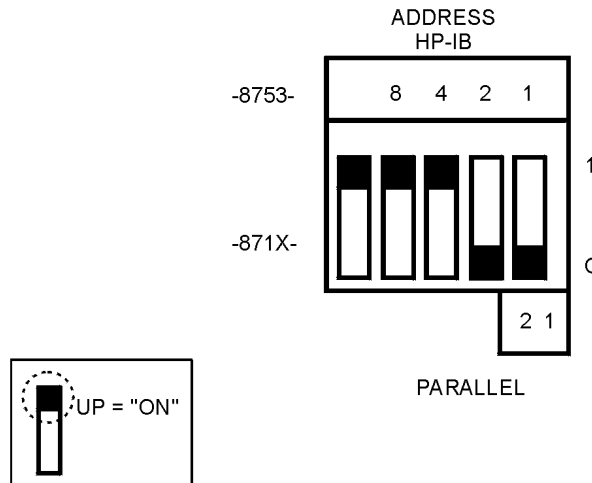
Setting the Test Set Address Switch

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 11](#). 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 4](#). 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 Sales and Service Offices” on page 43](#).

For information on how to control the test set, refer to [Chapter 2, “Controlling the Test Set and Making Measurements.”](#)

Equipment Required

- Network Analyzer, 50 Ω impedance (Agilent 8753ET/ES)
- Cable, 50 Ω Type-N, (p/n 8120-4781 or equivalent)
- Computer (Agilent 9000 series 200/300/700)
- CONTROL program. See [“The Control Program” on page 25](#).
- Calibration Kit, 50 Ω (85032B)

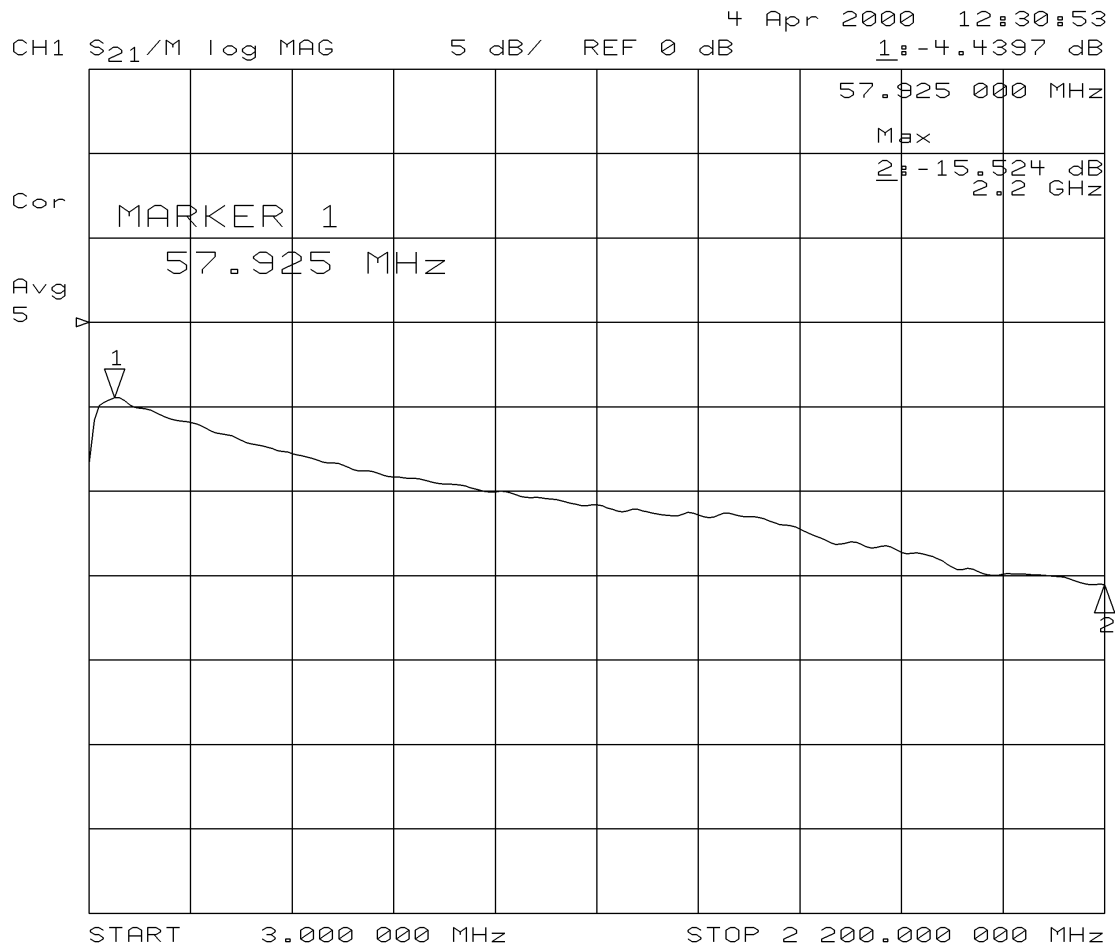
Procedure

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:

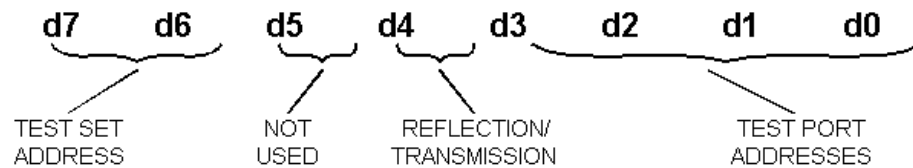
- The controller can talk to the network analyzer using GPIB which then controls the test set via the parallel connection.
- The controller can control the test set using GPIB commands via the GPIB connector.
- A network analyzer equipped with a parallel connection can control the test set directly.

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 2-20](#) 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 20](#).

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.

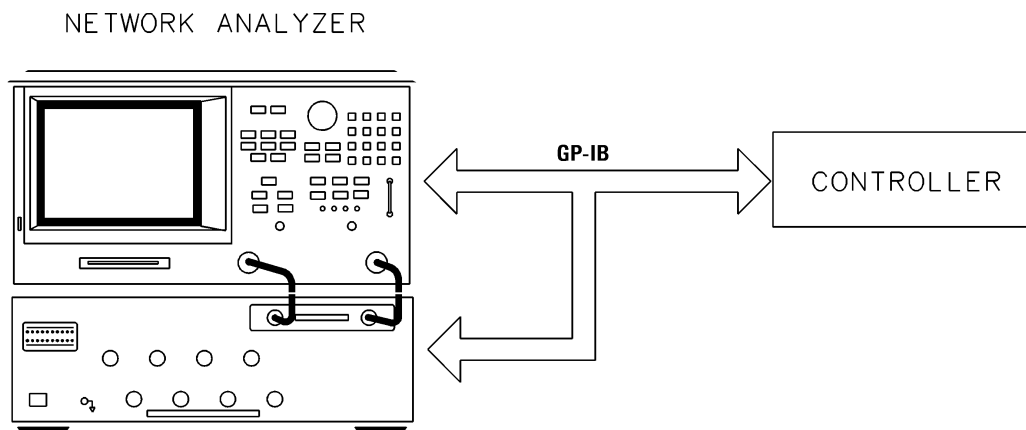
If using Quick Basic or Visual Basic, be sure to disable EOI and EOL before sending commands to the test set. Including the semicolon will not insure that these commands are disabled as would be the case in Basic/RMB. Using the Agilent 82335 GPIB Interface and Visual Basic, the following commands will 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	00	000000	0
Reflection to Port 2	00	000001	1
Reflection to Port 3	00	000010	2
Reflection to Port 4	00	000011	3
Reflection to Port 5	00	000100	4
Reflection to Port 6	00	000101	5
Reflection to Port 7	00	000110	6
Reflection to Port 8	00	000111	7
All Reflection Ports Terminated	00	001101	13
Transmission to Port 1	00	010000	16
Transmission to Port 2	00	010001	17
Transmission to Port 3	00	010010	18
Transmission to Port 4	00	010011	19
Transmission to Port 5	00	010100	20
Transmission to Port 6	00	010101	21
Transmission to Port 7	00	010110	22
Transmission to Port 8	00	010111	23
All Transmission Ports Terminated	00	011100	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 11.](#)
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

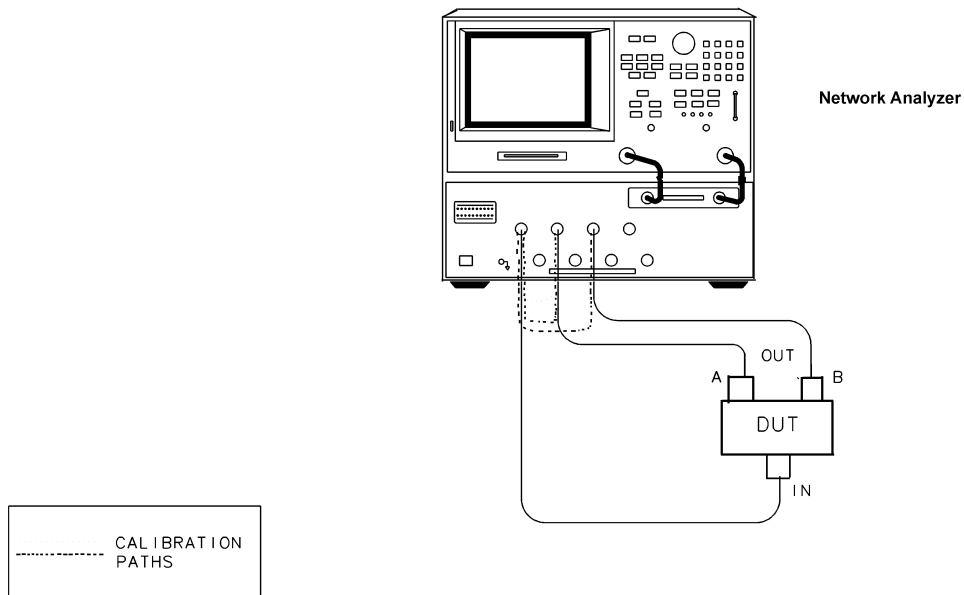
After the test set has warmed up for two hours, it should be calibrated before making any measurements. Refer to the network analyzer's user's guide to determine the type of calibration needed for the measurements you will be making.

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](#) 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 2-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 2-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 2-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 11](#) for information on setting the test set's address.

Measuring Return Loss of the DUT

Refer to [Figure 2-3 on page 22](#) 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 (S₂₁) and REFLECTION (S₁₁).

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
```

Controlling the Test Set and Making Measurements

Example Program

```
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 "/,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$)
```

Controlling the Test Set and Making Measurements

Example Program

```
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 or 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"
```

Controlling the Test Set and Making Measurements

Example Program

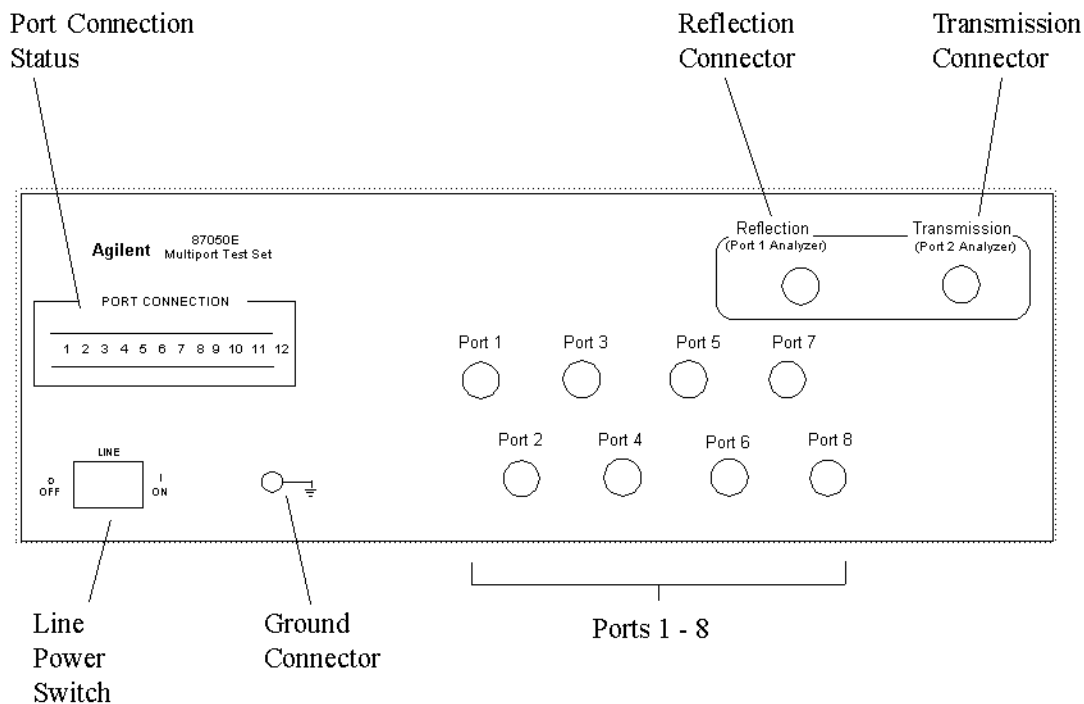
```
1540 CASE "5", "PORT 5"
1550 Switch_code$="20"
1560 CASE "6", "PORT 6"
1570 Switch_code$="21"
1580 CASE "7", "PORT 7"
1590 Switch_code$="22"
1600 CASE "8", "PORT 8"
1610 Switch_code$="23"
1620 CASE "0", "TERMINATE", "RESET"
1630 Switch_code$="28"
1640 CASE ELSE
1650 DISP "Unrecognized Switched_port$
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.

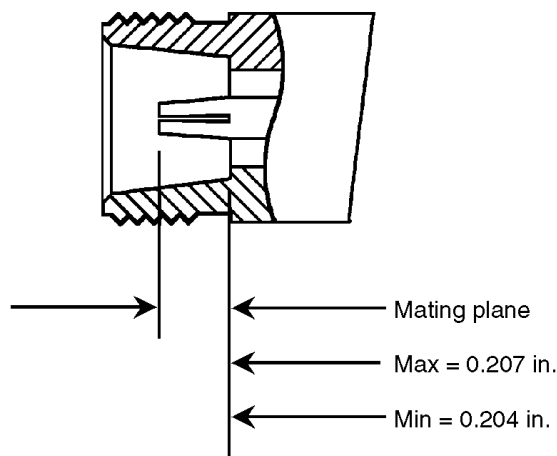
Ports 1—8

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

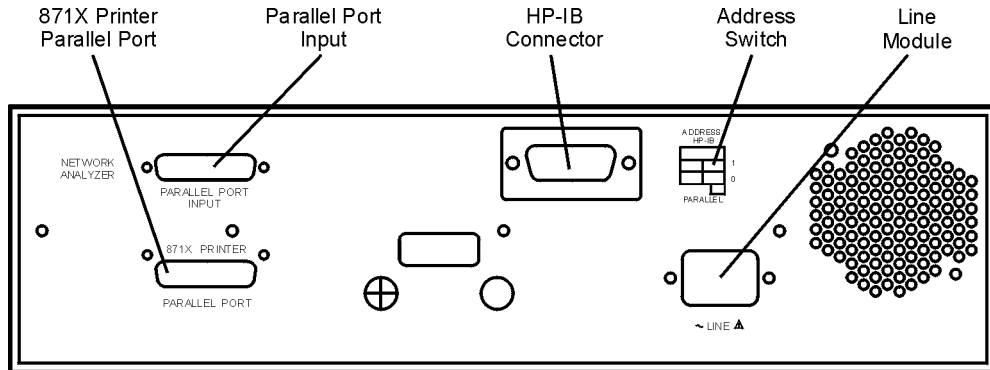
The GROUND connector provides a convenient front panel ground connection for a standard banana plug.

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 20.

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 11.

Line Module

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

Power Cables

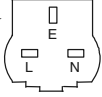
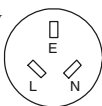
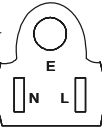
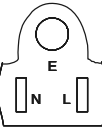
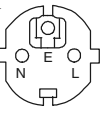
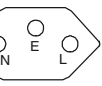

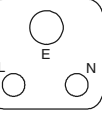

The line power cable is supplied in one of several configurations, depending on the destination of the original shipment.

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 36 for the part numbers of the power cables. Cables are available in different lengths. Refer to [“Contacting Agilent Sales and Service Offices”](#) on page 55 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	Straight BS 1363A	229 (90)	Mint Gray	Option 900 United Kingdom, Hong Kong, Cyprus, Nigeria, Singapore, Zimbabwe
	8120-8709	90°	229 (90)	Mint Gray	
250V 	8120-1369	Straight AS 3112	210 (79)	Gray	Option 901 Argentina, Australia, New Zealand, Mainland China
	8120-0696	90°	200 (78)	Gray	
125V 	8120-1378	Straight NEMA 5-15P	203 (80)	Jade Gray	Option 903 United States, Canada, Brazil, Colombia, Mexico, Philippines, Saudi Arabia, Taiwan
	8120-1521	90°	203 (80)	Jade Gray	
125V 	8120-4753	Straight NEMA 5-15P	229 (90)	Gray	Option 918 Japan
	8120-4754	90°	229 (90)	Gray	
250V 	8120-1689	Straight CEE 7/VII	200 (78)	Mint Gray	Option 902 Continental Europe, Central African Republic, United Arab Republic
	8120-1692	90°	200 (78)	Mint Gray	
230V 	8120-2104	Straight SEV Type 12	200 (78)	Gray	Option 906 Switzerland
	8120-2296	90°	200 (78)	Gray	
220V 	8120-2956	Straight SR 107-2-D	200 (78)	Gray	Option 912 Denmark
	8120-2957	90°	200 (78)	Gray	
250V 	8120-4211	Straight IEC 83-B1	200 (78)	Mint Gray	Option 917 South Africa, India
	8120-4600	90°	200 (78)	Mint Gray	
250V 	8120-5182	Straight SI 32	200 (78)	Jade Gray	Option 919 Israel
	8120-5181	90°	200 (78)	Jade Gray	

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.

Before Applying Power

Verify that the premises electrical supply is within the range of the instrument. The instrument has an autoranging power supply.

WARNING

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

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.

WARNING

Keep isopropyl alcohol away from heat, sparks, and flame. Store in a tightly closed container. It is extremely flammable. In case of fire, use alcohol foam, dry chemical, or carbon dioxide; water may be ineffective.

Declaration of Conformity

A declaration of conformity is on file for the PNA models, and a copy is available upon request, or a copy is available on the Agilent Technologies web site at <http://regulations.corporate.agilent.com/DoC/search.htm>

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 Sales and Service Offices”](#) on page 43. 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.

Compliance with German Noise Requirements

This is to declare that this instrument is in conformance with the German Regulation on Noise Declaration for Machines (Laermangabe nach der Maschinenlaermverordnung-3. GSGV Deutschland).

Acoustic Noise Emission/Geraeuschemission	
LpA<70 dB	Lpa<70 dB
Operator Position	am Arbeitsplatz
Normal Operation	normaler Betrieb
per ISO 7779	nach DIN 45635 t. 19

EMC Information

Complies with European EMC Directive 2004/108/EC

- IEC/EN 61326-1
- CISPR Pub 11 Group 1, class A
- AS/NZS CISPR 11
- This ISM device complies with Canadian ICES-001.
Cet appareil ISM est conforme a la norme NMB du Canada.

Safety Information

Complies with European Low Voltage Directive 2006/95/EC

- IEC/EN 61010-1, 2nd Edition
- Canada: CSA C22.2 No. 61010-1-04
- USA: UL Std. No. 61010-1 (2nd Edition)

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 the user to dangerous voltages. Disconnect the product from all voltage sources while it is being opened.**

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 and the risk of electrical shock.

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.

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



The instruction documentation symbol. The product is marked with this symbol when it is necessary for the user to refer to the instructions in the documentation.



This symbol indicates that the instrument requires alternating current (ac) input.



This symbol indicates separate collection for electrical and electronic equipment, mandated under EU law as of August 13, 2005. All electric and electronic equipment are required to be separated from normal waste for disposal (Reference WEEE Directive, 2002/96/EC).



This symbol indicates that the power line switch is ON.



This symbol indicates that the power line switch is in the STANDBY position.



This symbol indicates that the power line switch is in the OFF position.



This symbol is used to identify a terminal which is internally connected to the product frame or chassis.



The CE mark is a registered trademark of the European Community. (If accompanied by a year, it is when the design was proven.)



The CSA mark is a registered trademark of the CSA International. This instrument complies with Canada: CSA 22.2 No. 61010-1-04.



This is a symbol of an Industrial Scientific and Medical Group 1 Class A product.



This is a marking to indicate product compliance with the Canadian Interference-Causing Equipment Standard (ICES-001).



Direct Current.



This is a required mark signifying compliance with an EMC requirement. The C-Tick mark is a registered trademark of the Australian Spectrum Management Agency.



China RoHS regulations include requirements related to packaging, and require compliance to China standard GB18455-2001.



This symbol indicates compliance with the China RoHS regulations for paper/fiberboard packaging.

Contacting Agilent Sales and Service Offices

Assistance with test and measurement needs, and information on finding a local Agilent office are available on the Internet at:

<http://www.agilent.com/find/assist>

You can also purchase accessories or documentation items on the Internet at:

<http://www.agilent.com/find>

If you do not have access to the Internet, contact your field engineer.

NOTE

In any correspondence or telephone conversation, refer to the Agilent product by its model number and full serial number. With this information, the Agilent representative can determine the warranty status of your unit.
