Agilent Technologies
87050A Option K24

Multiport Test Set

User's and Service Guide

Use this manual with these documents:

8719D/20D/22D Network Analyzer User's Guide, Part Number 08720-90288
8753D Network Analyzer User's Guide, Part Number 08753-90257
8753E Network Analyzer User's Guide, Part Number 08753-90367

8719D/20D/22D Network Analyzer Service Guide, Part Number 08720-90292
8753D Network Analyzer Service Guide, Part Number 08753-90261
8753E Network Analyzer Service Guide, Part Number 08753-90374

Agilent Technologies

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Notices

Restricted Rights Legend

Warranty

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1 Agilent Technologies 87050A Option K24

The Agilent 87050A Option K24 multiport test set is designed for use with 50 Ω network analyzers such as the Agilent 8719, 8720, 8722, and 8753D/E.

The test set provides the ability to make single connection, multiple measurements of multiport devices with up to 24 ports, such as distribution amplifiers, taps, switches and couplers. Throughput is increased by reducing the number of device reconnects the operator must perform. Switching is performed with mechanical switches.

The test set can be controlled by using an external GPIB (HP-IB) controller, or parallel control

NOTE This User's and Service Guide documents the use of the test set with an Agilent 8720D only.

Installing the Test Set

This chapter will guide you through the steps necessary to correctly and safely install your multiport test set. The steps are:

1. Check the Shipment
2. Meet Electrical and Environmental Requirements

Checking the Shipment

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

Check the items received against Table 1-1 to make sure that you have received everything.

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, call Agilent Technologies (refer to "Contacting Agilent Technologies" on page 7-6 for the nearest office).

Table 1-1 87050A Option K24 Accessories Supplied

Description	Agilent Part Number	Quantity
Power Cord	See cross reference to figure	1
Adapter, 3.5 mm to APC-7	1250-1747	2
RF Cable (SMA to SMA)	5062-6682	2
Front Handle Kit	5063-9228	1
Rack Mount Kit	5063-9235	1
Parallel Port Interface Cable	8120-6818	1
RF Cable, Agilent 8720D to Option K24 Transmission or Reflection	08720-20245	2
3.5 mm Connector	85052-60012	2
User's and Service Guide	87050-90022	1

Meeting Electrical and Environmental Requirements

1. The line power module on your test set is an autoranging input. It is designed to be used with an ac power source with a nominal voltage of either 115 V or 230 V.
2. Ensure that the available ac power source meets the following requirements:

- 90 to 250 Vac
- 48 to 66 Hz
- 40 watts

CAUTION This product has an autoranging line voltage input. Be sure the supply voltage is within the specified range. If the ac line voltage does not fall within these ranges, an autotransformer that provides third wire continuity to earth ground should be used.

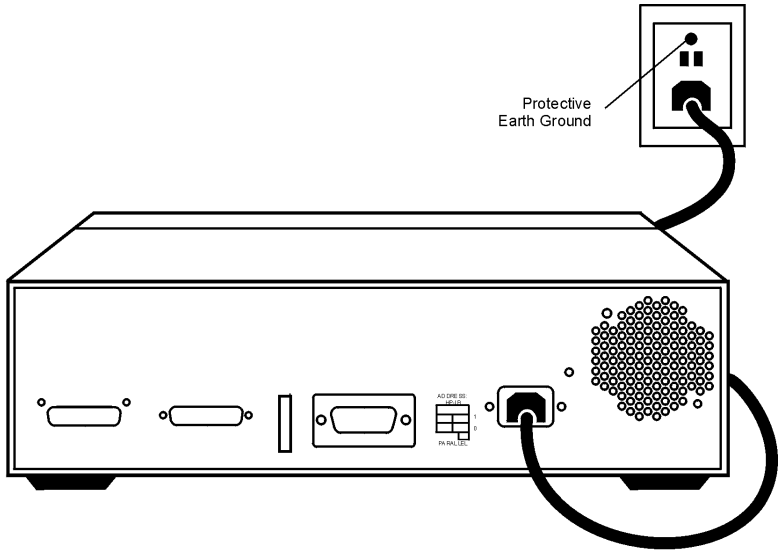
3. Ensure that the operating environment meets the following safety requirements for

- indoor use
- altitude up to 15,000 feet (4,572 meters)
- temperature range of 0 °C to 55 °C
- maximum relative humidity: 80% for temperatures up to 31 °C, decreasing linearly to 50% relative humidity
- 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.

4. Verify that the power cable is not damaged, and that the power source outlet provides a protective earth ground contact. Note that the Figure 1-1 depicts only one type of power source outlet. Refer to Figure 4-5 on page 4-7 to see the different types of power cord plugs that can be used with your test set.

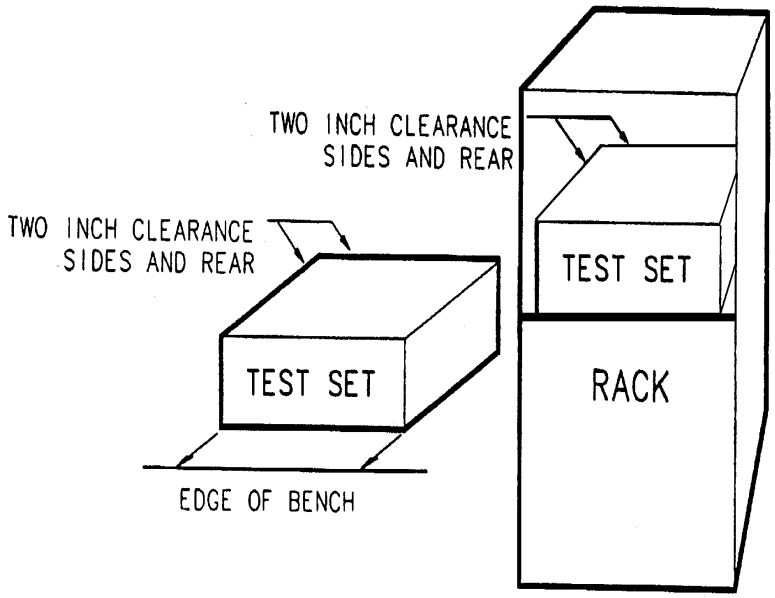
Figure 1-1 Protective Earth Ground



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.**

5. 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 1-2. 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.

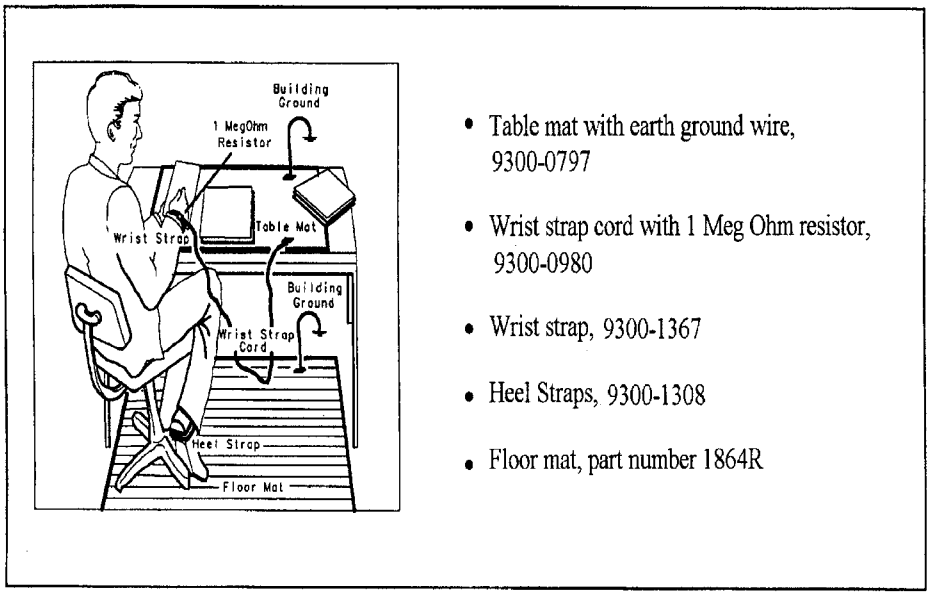
Figure 1-2 Ventilation Clearance Requirements



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

6. Set up a static safe workstation. Electrostatic discharge (ESD) can damage or destroy components (refer to Figure 1-3).

Figure 1-3 Example of an Antistatic Workstation

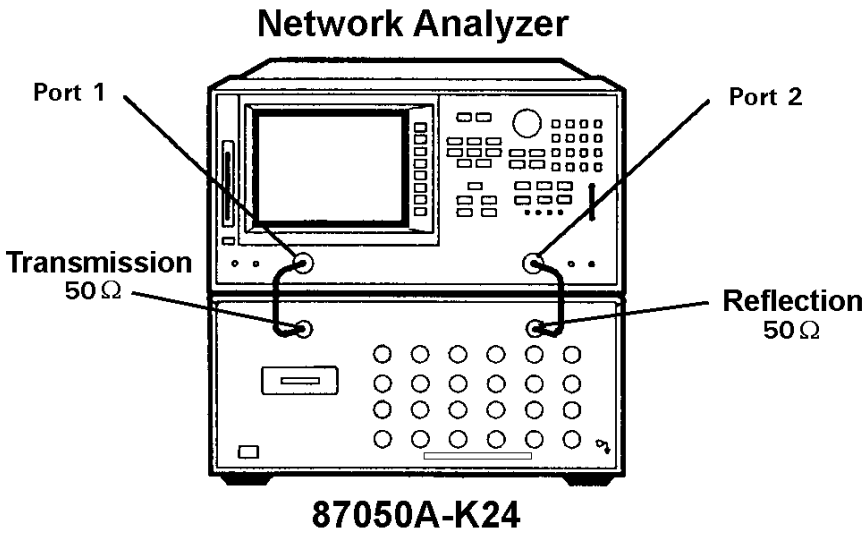


2 Getting Started

Connecting and Turning on the Test Set

The test set is designed to be placed underneath the network analyzer in a rack system and connected to it as shown in Figure 2-1. Use the two SMA 50 Ω jumper cables, part number 08720-20245, that were shipped with the test set. See Table 1-1 on page 1-3.

Figure 2-1 Connecting the Test Set to the Network Analyzer



After all the proper connections have been made, turn on the test set using the front panel line switch. The front panel line switch disconnects the mains circuits from the mains supply after the EMC filters and before other parts of the instrument.

NOTE For accurate, repeatable measurements, be sure to let the test set warm up for at least 2 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

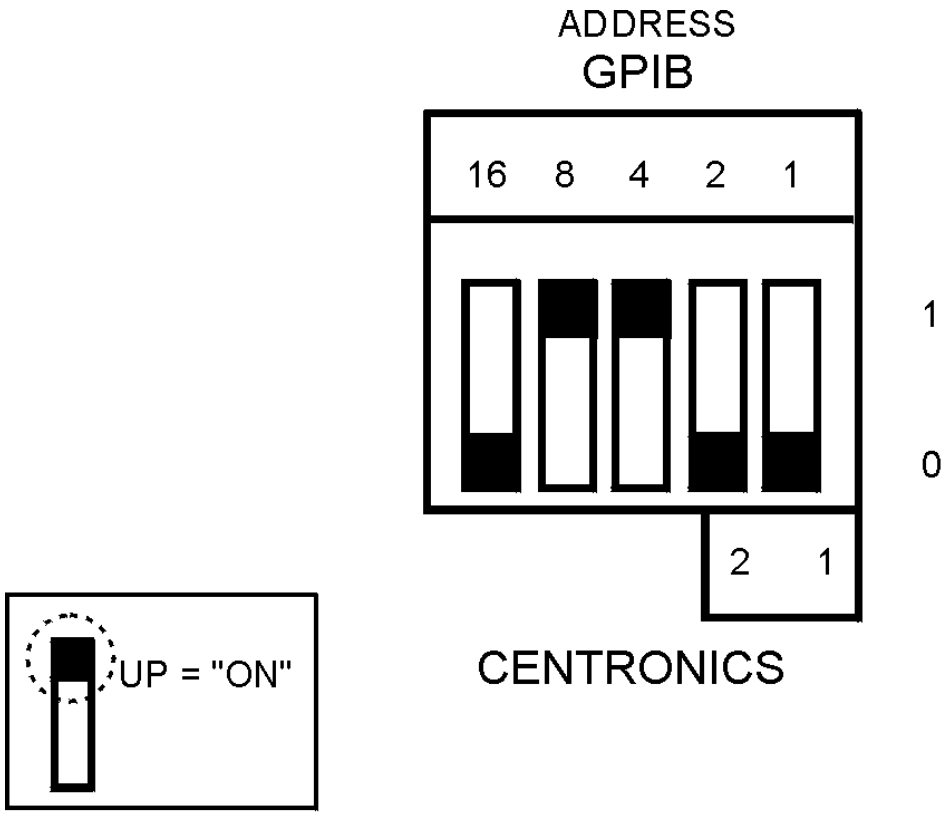
The test set is shipped with the GPIB (HP-IB) address set to 12, which sets the parallel address to 0 as in Figure 2-2. Refer to Chapter 3 "Controlling the Test Set and Making Measurements" for the definition of the parallel address.

To set the GPIB address, set all five switches so that the sum of the switches in the on or “1” position equal the desired address. In the example below, the two switches in the “on” position are 8 and 4, thus the GPIB address of 12.

To set the parallel address, use only the number 1 switch. Therefore the possibilities for parallel port addressing are an address of 0 or 1.

When GPIB is used, the parallel address is ignored.

Figure 2-2 The Test Set Address Switch



Performing the Operator's Check

For information on how to control the test set, refer to Chapter 3.

Description

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 Chapter 6.

Procedure

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

Equipment Required

- Network Analyzer, 50 Ω impedance (Agilent 8720D)
- Cable, 50 Ω 3.5 mm (part number 85131-60012 or equivalent)
- Calibration Kit, 50 Ω (Agilent 85052B)

Process

Step 1. Perform a one-port reflection calibration at the end of a 50 Ω cable over the frequency range of 50 MHz to 20 GHz on the analyzer. Verify the calibration is active and that a cable terminated with a short displays a return loss of 0 ±0.2 dB.

Step 2. Connect the cable (already connected to the reflection port of the analyzer) to the reflection port of the 87050A Option K24 test set.

Step 3. Measure the return loss of each section of the test set by selecting ports 1 through 24, one at a time, by using the network analyzer. Terminate each port being tested with a known good 50 Ω load (greater than –30 dB). The resulting return loss should be greater than –10 dB (the absolute value should be greater than 10).

NOTE This is an 80% confidence test only. A unit could pass this simple test and yet still not function properly. For more complete testing, see "Performance Tests" in Chapter 6.

3 Controlling the Test Set and Making Measurements

The Agilent 87050A Option K24 is a “slave” instrument: a controller must be used to control the test set. There are three ways in which the test set can be controlled:

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

NOTE

The following key conventions are used throughout this document.

- **[HARDKEYS]** are labeled front panel keys
- **SOFTKEYS** are unlabeled keys whose function is indicated on the instrument display

Commands

As mentioned earlier, the test set can be controlled in three ways. The first two involve the use of a separate computer. The third way uses the network analyzer manually. These methods of control are detailed below and on the following page.

Computer Control

The first way to control the test set is to write GPIB commands to the network analyzer which then writes to the test set by way of the parallel port. See Figure 3-1 for a diagram of connections for this type of control. The following examples use the variable [D] which is defined in Table 3-1.

To use a parallel port connection with the 8720D, use a GPIB command to write bits on the parallel port. The following example assumes that the address of the network analyzer is 16.

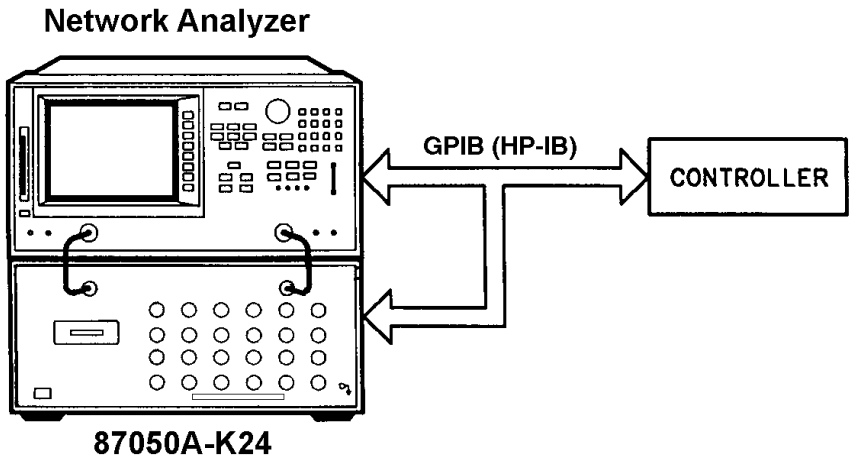
`OUTPUT 716;"PARALGPIO;"`	*Sets the parallel port for GP-IO function*
`OUTPUT 716;"PARAOUT[D];"`	*Programs all GP-IO output bits (0 to 256) at once*

NOTE Be sure to use the ending semi-colon.

The second way to control the test set is to address the 87050A Option K24 test set directly over GPIB, using a controller to write directly to the test set GPIB port. The following example assumes that the address of the test set is 12.

```
OUTPUT 712;"STRING$"
```

Figure 3-1 Controlling the Test Set Over GPIB (HP-IB)



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

Network Analyzer Control

The third method of sending commands uses the network analyzer to control the test set directly. This method is performed with the standard setup of the network analyzer working with the test set. A parallel cable is connected from the network analyzer output to the test set input on both rear panels.

Press: **[SEQ]**

TTL → I/O → PARALLEL ALL OUT

Use the arrow keys, ⇑ or ⇓, to scroll to the desired test port address, or input the number directly using the hard keys **[D]** → **[x1]**, where **D** represents the decimal value of the test port address (see Table 3-1 on page 3-4).

Table 3-1 Test Port Addresses

Connection Path	GPIB Command	Decimal [D]	Binary Equivalent
Transmission to Port 1	tran_01	0	00000000
Transmission to Port 2	tran_02	1	00000001
Transmission to Port 3	tran_03	2	00000010
Transmission to Port 4	tran_04	3	00000011
Transmission to Port 5	tran_05	4	00000100
Transmission to Port 6	tran_06	5	00000101
Transmission to Port 7	tran_07	6	00000110
Transmission to Port 8	tran_08	7	00000111
Transmission to Port 9	tran_09	8	00001000
Transmission to Port 10	tran_10	9	00001001
Transmission to Port 11	tran_11	10	00001010
Transmission to Port 12	tran_12	11	00001011
Transmission to Port 13	tran_13	12	00001100
Transmission to Port 14	tran_14	13	00001101
Transmission to Port 15	tran_15	14	00001110
Transmission to Port 16	tran_16	15	00001111
Transmission to Port 17	tran_17	16	00010000
Transmission to Port 18	tran_18	17	00010001
Transmission to Port 19	tran_19	18	00010010
Transmission to Port 20	tran_20	19	00010011
Transmission to Port 21	tran_21	20	00010100
Transmission to Port 22	tran_22	21	00010101
Transmission to Port 23	tran_23	22	00010110
Transmission to Port 24	tran_24	23	00010111
Transmission Terminated	*t_term	24	00011000
Reflection to Port 1	refl_01	25	00011001
Reflection to Port 2	refl_02	26	00011010
Reflection to Port 3	refl_03	27	00011011
Reflection to Port 4	refl_04	28	00011100

Table 3-1 Test Port Addresses

Connection Path	GPIB Command	Decimal [D]	Binary Equivalent
Reflection to Port 5	refl_05	29	00011101
Reflection to Port 6	refl_06	30	00011110
Reflection to Port 7	refl_07	31	00011111
Reflection to Port 8	refl_08	32	00100000
Reflection to Port 9	refl_09	33	00100001
Reflection to Port 10	refl_10	34	00100010
Reflection to Port 11	refl_11	35	00100011
Reflection to Port 12	refl_12	36	00100100
Reflection to Port 13	refl_13	37	00100101
Reflection to Port 14	refl_14	38	00100110
Reflection to Port 15	refl_15	39	00100111
Reflection to Port 16	refl_16	40	00101000
Reflection to Port 17	refl_17	41	00101001
Reflection to Port 18	refl_18	42	00101010
Reflection to Port 19	refl_19	43	00101011
Reflection to Port 20	refl_20	44	00101100
Reflection to Port 21	refl_21	45	00101101
Reflection to Port 22	refl_22	46	00101110
Reflection to Port 23	refl_23	47	00101111
Reflection to Port 24	refl_24	48	00110000
Reflection Terminated	*r term	49	00110001
Box Identity	idn?		
Reset	*rst	50	00110010
Serial Number	sn?		

To connect all ports to their internal 50 Ω loads, send the following two commands:

```
OUTPUT 716;"PARAOUT24;"

OUTPUT 716;"PARAOUT49;"
```

or

```
OUTPUT 712;"*t_term"

OUTPUT 712;"*r_term"
```

NOTE When a test set port is not in use, it is terminated in 50 Ω

If the 87050A Option K24 is being controlled by GPIB, you can read the serial number of the test set by sending the following commands:

```
OUTPUT 712;"sn?"

ENTER 712;Sn$

DISP Sn$
```

Reset Command:

When the Reset (*rst) command is sent, the box is set to a known state where all ports are terminated.

Switch Count Commands

To read the individual switch count, send the following two commands:

```
OUTPUT 712;"SW10?"

OUTPUT 712;J10$
```

The above example shows the J10 command only. To enter additional commands use Table 3-2.

Table 3-2 Switch Count Commands

Switch Number	GPIB Command
J10	SW10?
J11	SW11?
J12	SW12?
J13	SW13?
J14	SW14?
J15	SW15?
J16	SW16?
J17	SW17?
J18	SW18?
J19	SW19?
J50	SW50?
J51	SW51?
J52	SW52?
J53	SW53?
J54	SW54?
J55	SW55?
J56	SW56?
J57	SW57?
J58	SW58?
J59	SW59?
J60	SW60?
J61	SW61?

Table 3-2 Switch Count Commands

J62	SW62?
J63	SW63?
J64	SW64?
J65	SW65?
J66	SW66?
J67	SW67?
J68	SW68?
J69	SW69?
J70	SW70?
J71	SW71?
J72	SW72?
J73	SW73?

Calibrating the Test System

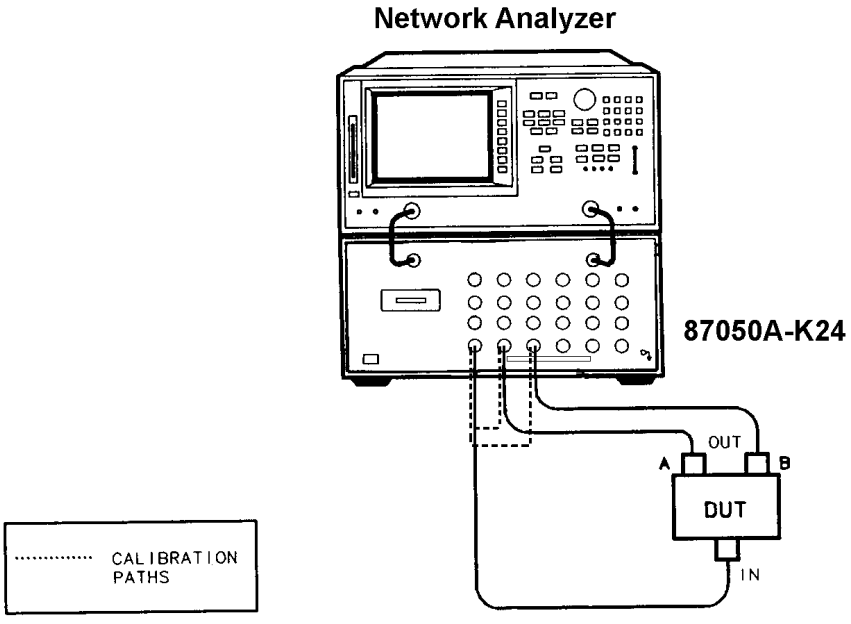
After the test set has warmed up for at least two hours, you should calibrate before making any measurements. Refer to your network analyzer user's guide to determine the type of calibration appropriate for the measurements you will be making.

You must calibrate each measurement path separately and store the calibration as an instrument state in the network analyzer. Refer to your network analyzer user's guide for information on how to calibrate and store instrument states.

Refer to Figure 3-2. In this example setup the following tests will be made:

- Return loss on the DUT input and 2 output ports (A and B)
- Insertion loss (or gain) between the DUT input and port A
- Insertion loss (or gain) between the DUT input and port B

Figure 3-2 Calibrating the Test System



For the best accuracy, you should perform a full two-port calibration between test set ports 1 and 2, and again between ports 1 and 3. As mentioned before, you must save the calibrations as instrument states. See your analyzer user's guide 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 8720D to change the RF signal path direction. Do not use the test set to change the RF signal path direction when you are using a full two-port calibration. Doing so will render the calibration invalid.

Making Measurements

The following examples assume that you are using a parallel port connection with an 8720D, with the test set's parallel address set to "0". See “Setting the Test Set Address Switch” on page 2-3 for information on setting the test set address.

Measuring Transmission

Refer to Figure 3-3 on page 3-12 for the following discussion. With the 8720D set to measure forward transmission (S_{21}), the analyzer RF source is output through the analyzer PORT 1, and PORT 2 is set to receive the RF signal.

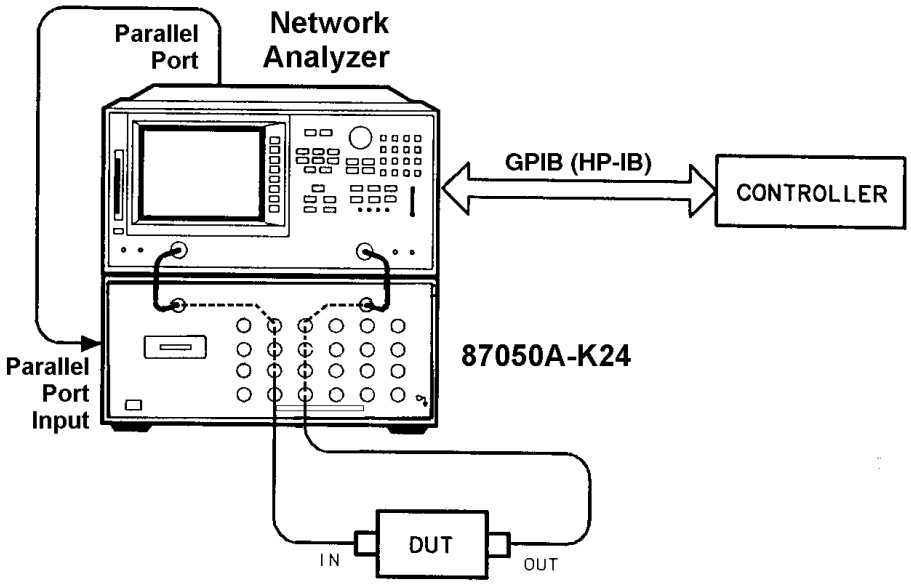
By using the following commands, you will connect PORT 20 of the test set to the Transmission port, and you will connect PORT 21 of the test set to the Reflection port. You will thus be measuring forward transmission through the device under test when measuring S_{21}. This will provide you with gain or insertion loss information.

```
OUTPUT 716;"PARALGPIO;"

OUTPUT 716;"PARAOUT19;"

OUTPUT 716;"PARALGPIO;"

OUTPUT 716;"PARAOUT45;"
```

If directly controlling the 87050A Option K24, use the following GPIB commands:

```
OUTPUT 712;"tran_20"

OUTPUT 712;"refl_21"
```

Figure 3-3 Controlling the Test Set



Measuring Reflection

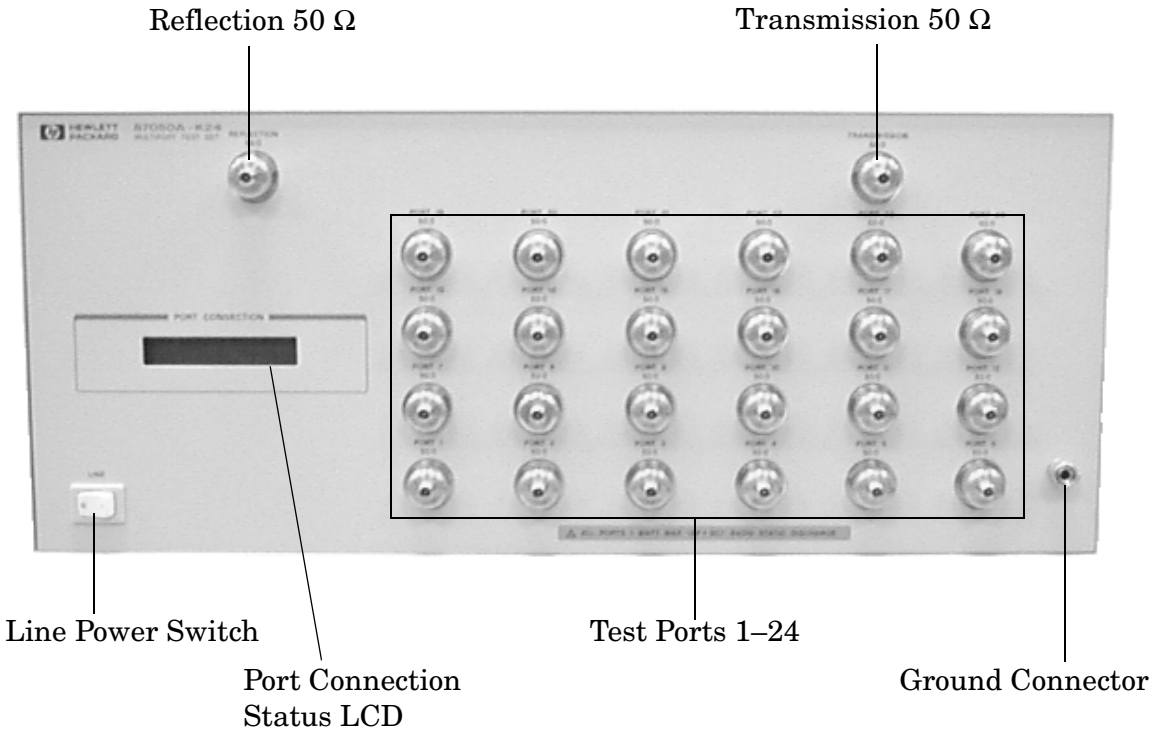
By leaving the DUT connected as in Figure 3-3 and setting the network analyzer to measure S_{11}, you can measure reflection or return loss.

4 Front and Rear Panels

This chapter contains information on the ports and switches found on the front and rear panels of the test set. This chapter is divided into two sections: front panel and rear panel.

Front Panel

Figure 4-1 Front Panel



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.

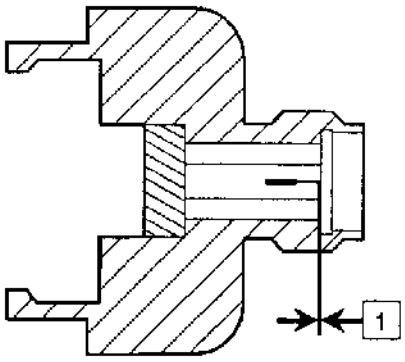
The front panel line switch disconnects the mains circuits from the mains supply after the EMC filters and before other parts of the instrument.

Ports 1–24

Ports 1 through 24 are 50 Ω 3.5 mm connectors that are used to connect to the device under test.

CAUTION Do not input more than 1 watt, RF and DC combined, to these ports or damage to the internal RF switches or the analyzer may occur.

Figure 4-2 Physical Characteristics of 3.5 mm Connector



NOTE:

1	Pin Depth: 0.0050 mm to 0.0381 mm (.0002 in. to .0012 in.)

The Transmission and Reflection Ports

The Transmission and Reflection Ports are female 3.5 mm 50 Ω connectors. A 50 Ω cable connects directly to the Port 1/Port 2 or Reflection/Transmission port of the network analyzer using the cable, part number 08720-20245, that was shipped with your test set.

CAUTION Check your analyzer documentation for damage limits to the RF OUT port. Make sure that your test setup will not cause those limits to be exceeded.

The Ground Connector

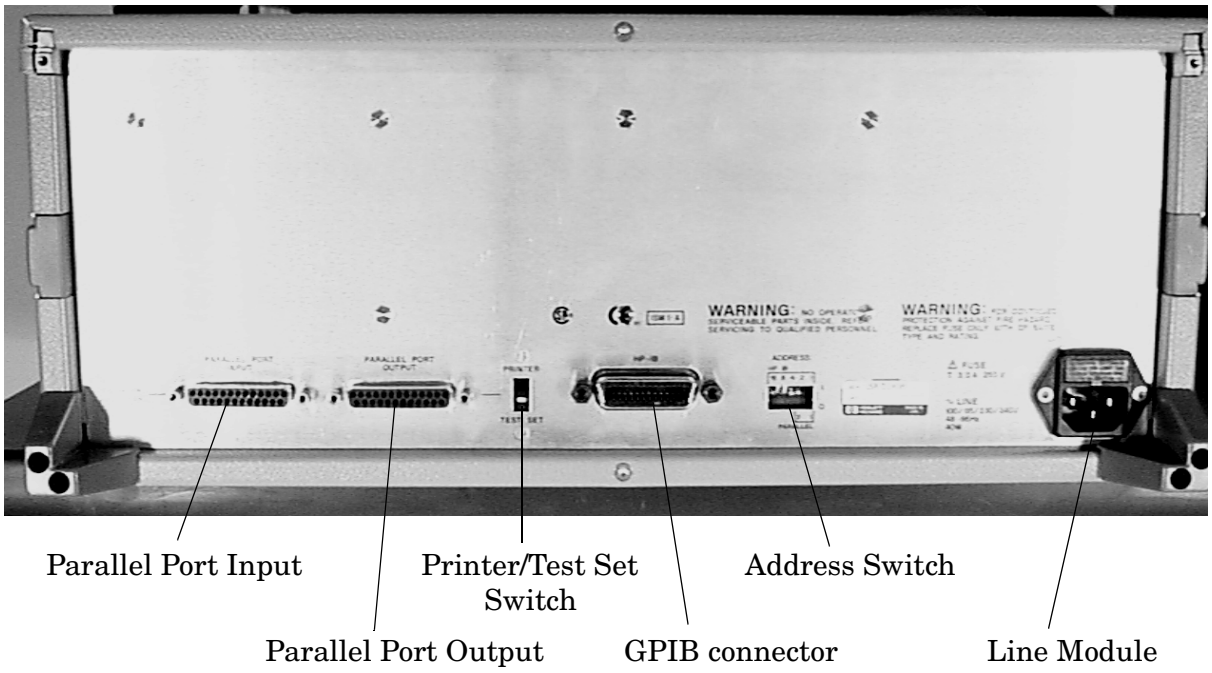
The Ground connector provides a convenient front panel ground connection for a standard banana plug.

The Port Connection Status LCD

The Port Connection Status LCD provides visual feedback of which port(s) are connected to the Transmission and Reflection ports of the test set. When the LCD displays a path connection, all other corresponding test ports are internally terminated in 50 Ω

Rear Panel

Figure 4-3 Rear Panel



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 Parallel Port Output Connector

The output from this connector is used either to control another test set, or to control a printer, depending upon how the Printer/Test Set switch is set.

The Printer/Test Set Switch

This switch determines the function of the Parallel Port Output connector. When switched to Printer, the Parallel Port Output will pass through printer driver signals. When switched to Test Set, an additional test set can be controlled from the Parallel Port Output connector.

GPIB Connector

This connector allows the test set to be connected directly to a controller. See Figure 3-3 on page 3-12.

Address Switch

The address switch sets the GPIB or parallel address of the test set. See “Setting the Test Set Address Switch” on page 2-3 for information.

Line Module

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

The line fuse and a spare reside within the line module. Figure 4-4 illustrates where the fuses are and how to access them.

Figure 4-4 Line Module

Available Fuses

United States (115V orientation):

- Fuse (F 3 A/250 V, part number 2110-0780) U.L. listed and CSA certified

Europe (230V orientation):

- Fuse (F 3.15 A/250V, part number 2110-0655) IEC certified and U.L. recognized

Power Cables

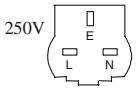
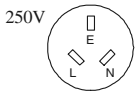
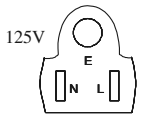
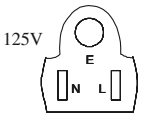
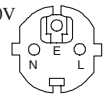
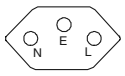
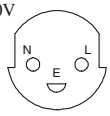
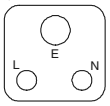
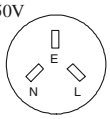
The line power cable is supplied in one of several configurations, depending on the destination of the original shipment.

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 4-5 on page 4-7 for the part numbers of these power cables. Cables are available in different lengths. Check with your nearest Agilent Technologies service center for descriptions and part numbers of cables other than those described in Figure 4-5. See “Contacting Agilent Technologies” on page 7-6.

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

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 in 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 4-5 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
	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
	8120-1369 8120-0696	Straight AS 3112 90˚	210 (79) 200 (78)	Gray Gray	Option 901 Argentina, Australia, New Zealand, Mainland China
	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
	8120-4753 8120-4754	Straight NEMA 5-15P 90˚	229 (90) 229 (90)	Gray Gray	Option 918 Japan
	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
	8120-2104 8120-2296	Straight SEV Type 12 90˚	200 (78) 200 (78)	Gray Gray	Option 906 Switzerland
	8120-2956 8120-2957	Straight SR 107-2-D 90˚	200 (78) 200 (78)	Gray Gray	Option 912 Denmark
	8120-4211 8120-4600	Straight IEC 83-B1 90˚	200 (78) 200 (78)	Mint Gray Mint Gray	Option 917 South Africa, India
	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.

5 Specifications

Table 5-1 Agilent 87050A Option K24 Specifications

Parameter	Specification
Frequency Range	50 MHz to 20 GHz
Isolation	
0.50 GHz to 1.3 GHz	≥85 dB
1.3 GHz to 3.0 GHz	≥100 dB
3.0 GHz to 6.0 GHz	≥95 dB
Return Loss	
0.50 GHz to 1.3 GHz	≥24 dB
1.3 GHz to 3.0 GHz	≥20 dB
3.0 GHz to 6.0 GHz	≥14 dB
6.0 GHz to 12.4 GHz	≥12 dB
12.4 GHz to 20 GHz	≥8 dB
Insertion Loss	
0.5 GHz to 6.0 GHz	≤2.5 dB
6.0 GHz to 12.4 GHz	≤3.5 dB
12.4 GHz to 20 GHz	≤4.5 dB
Phase Deviation	
Reflection Port to Ports 1–24 (0.5 GHz to 6.0 GHz)	±10°
Transmission Port to Ports 1–24 (0.5 GHz to 6.0 GHz)	±10°
Reflection Port to Ports 1–24 (6.0 GHz to 20 GHz)	±35°
Transmission Port to Ports 1–24 (6.0 GHz to 20 GHz)	±35°
Input Power Damage Level	>1 Watt (RF +dc)

General Characteristics

Environmental Characteristics

General Conditions

ESD (electrostatic discharge) must be eliminated by use of static-safe work procedures and an anti-static bench mat (such as part number 92175T).

Operating Environment

For indoor use only

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

Operating temperature: 0 °C to 55 °C

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

Enclosure protection IP 20, according to IEC 529

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% relative at 65 °C (non-condensing)

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

Weight

Net: Approximately 9 kg

Shipping: Approximately 20 kg

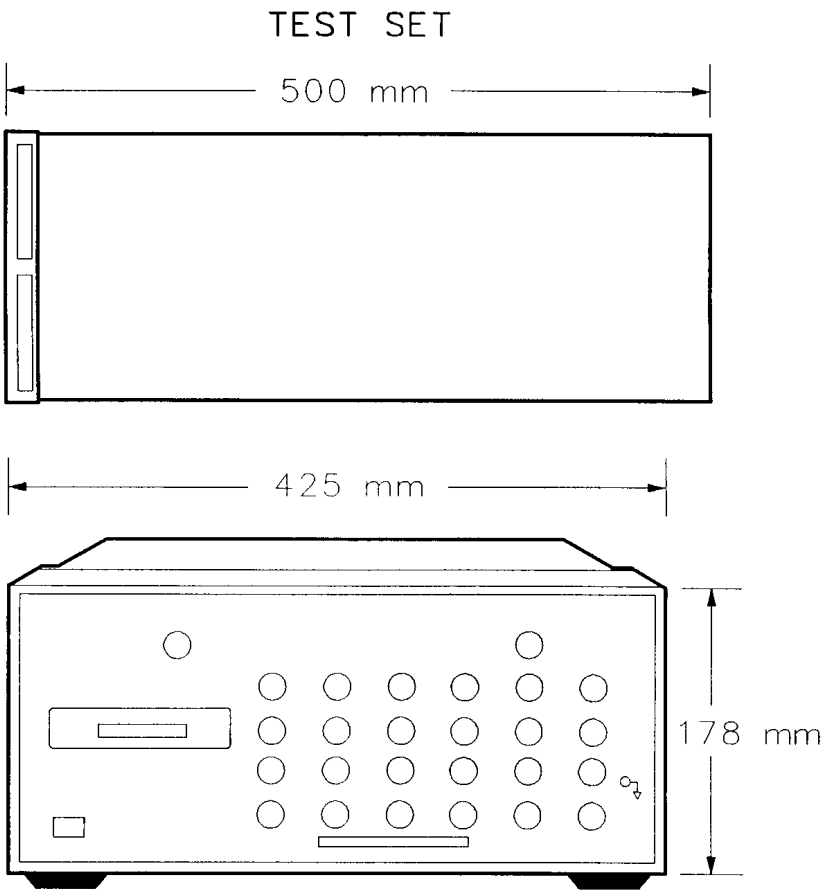
Cabinet Dimensions

These dimensions exclude front and rear panel protrusions.

178 mm H by 425 mm W by 500 mm D

(7.02 in by 16.75 in by 19.7 in)

Figure 5-1 Agilent 87050A Option K24 Physical Dimensions



If you need technical assistance, contact Agilent Technologies. Refer to “Contacting Agilent Technologies” on page 7-6.

Agilent 87050A Option K24 Options

UK6

Option UK6 provides a commercial calibration certificate including actual test data. Data includes test results of 95 tests including reflection, transmission, and isolation from all test ports.

Rack Ear Mounts

Option 908, part number 5062-3974, provides rack mounts that make it quick and easy to install or remove the test set from a mainframe.

For further information on these options please contact Agilent Technologies. Refer to “Contacting Agilent Technologies” on page 7-6.

6 Service

This chapter contains information on how to verify the performance of your test set, how to troubleshoot it if necessary, the theory of operation and a block diagram.

Please read all applicable safety warnings and cautions in Chapter 7 before servicing the test set.

Performance Tests

Performance testing consists of measuring insertion loss, return loss, and isolation between all ports. For the most accurate measurements, the use of an Agilent 8720D 50 Ω network analyzer is recommended and its use is assumed in these notes. Familiarity with RF/microwave measurements is also assumed. The use of adapters may be required and their effects should be accounted for. Performance tests will require the following equipment:

- Agilent 8720D Network Analyzer
- Test Port Extension Cables, part number 85131-60012
- Agilent 85052B Cal Kit
- Agilent 909D Option 040 or part number 00909-60007 50 Ω Terminator

NOTE Make a photocopy of the performance test record (later in this chapter) to record the results of the performance tests.

There are no adjustments required for the 87050A Option K24 test set.

Perform a full two-port calibration from 50 MHz to 20 GHz at the ends of two cables attached to the two test ports of the 8720D. Make sure the calibration is active. Save the results to disk, as they will be used again.

Set up the 8720D with the following:

1. Set the number of points to “201”
2. Set the Bandwidth to “300 Hz”
3. Set the 8720D to “Step Sweep”

NOTE The Isolation Cal Routine is done with 16 averages.

Insertion Loss

Step 1. Recall the full two-port calibration.

Step 2. Connect the cable that is attached to Port 1 of the 8720D to the Transmission port of the 87050A Option K24.

Step 3. Connect the cable from Port 2 of the analyzer to Port 1 of the 87050A Option K24. Select Transmission Port 1 using the 8720D. Record the results in the Performance Test Record, Table 6-1 beginning on page 6-6.

Step 4. Repeat step 3 for each of the remaining test ports 2 through 24.

Step 5. Repeat steps 2 through 4, but connect the cable in step 2 to the Reflection port of the 87050A Option K24. In step 3, select the Reflection port instead of the Transmission port.

Return Loss

This test will check both the internal termination load of each port and the through match when the appropriate input port is terminated with a load.

Step 1. Perform a one-port reflection calibration at the end of a 50 Ω cable over the frequency range of 50 MHz to 20 GHz on the analyzer. Verify the calibration is active and that the terminated cable displays a return loss of 0 ±0.2 dB.

Step 2. Connect the cable (already connected to the Reflection measurement port of the analyzer) to Port 1 of the 87050A Option K24. Connect a high-quality 50 Ω load to the Transmission port of the 87050A Option K24. Measure the return loss of Port 1 by selecting Port 1. Record the results in the Performance Test Record, Table 6-2 beginning on page 6-9.

Step 3. Repeat this measurement, but this time select no active port. The display should show “Transmission-Terminated, Reflection-Terminated”.

Step 4. Move the cable to Port 2 and repeat steps 2 and 3, selecting Port 2. Repeat steps 2 and 3 for the remaining ports.

Isolation

Isolation needs to be measured only on adjacent ports. Two 50 Ω loads are required for this test.

Step 1. Recall the full two-port calibration. Make sure the calibration is active and that averaging is “on” when making measurements.

Step 2. Connect a 50 Ω load to both the Transmission and Reflection ports of the 87050A Option K24.

Step 3. Connect the two cables that are attached to the network analyzer to Ports 1 and 2 of the 87050A Option K24. The exact order does not matter.

Step 4. Select Reflection Port 1 and Transmission Port 2. Set the 8720D to measure Transmission. Record the results in the Performance Test Record, Table 6-3 beginning on page 6-14.

Step 5. Repeat steps 3 and 4 for the next two adjacent ports; 2 and 3. Repeat again for ports 3 and 4, then 4 and 5, and so on, ending with ports 23 and 24.

Performance Test Record

NOTE The following pages (Performance Test Record) are designed to be duplicated and used as a template for either of the Transmission or Reflection ports during each of the performance tests (Insertion Loss, Return Loss, and Isolation). At the top of each page, circle the appropriate input port (Transmission or Reflection), and write in the test date.

Agilent 87050A Option K24 Test Record

Test Facility _____ Report Number _____

_____ Date _____

_____ Date of Last System Calibration _____

_____ _____

Tested by _____ Customer _____

Model _____ Serial Number _____

Ambient Temperature _____ °C Relative Humidity _____%

Test Equipment Used	Model Number	Trace Number	Cal Due Date
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Special Notes:

_____

_____

_____

_____

_____

Transmission / Reflection **Date** _____

Table 6-1 Agilent 87050A Option K24 Insertion Loss Test Record

Test Description	Port	Minimum Specifications	Measured Results	Measured Uncertainty
Insertion Loss to Band 1				
0.5 GHz to 6.0 GHz	Port 1	≤2.5 dB	_____	±0.3 dB
	Port 2	≤2.5 dB	_____	±0.3 dB
	Port 3	≤2.5 dB	_____	±0.3 dB
	Port 4	≤2.5 dB	_____	±0.3 dB
	Port 5	≤2.5 dB	_____	±0.3 dB
	Port 6	≤2.5 dB	_____	±0.3 dB
	Port 7	≤2.5 dB	_____	±0.3 dB
	Port 8	≤2.5 dB	_____	±0.3 dB
	Port 9	≤2.5 dB	_____	±0.3 dB
	Port 10	≤2.5 dB	_____	±0.3 dB
	Port 11	≤2.5 dB	_____	±0.3 dB
	Port 12	≤2.5 dB	_____	±0.3 dB
	Port 13	≤2.5 dB	_____	±0.3 dB
	Port 14	≤2.5 dB	_____	±0.3 dB
	Port 15	≤2.5 dB	_____	±0.3 dB
	Port 16	≤2.5 dB	_____	±0.3 dB
	Port 17	≤2.5 dB	_____	±0.3 dB
	Port 18	≤2.5 dB	_____	±0.3 dB
	Port 19	≤2.5 dB	_____	±0.3 dB
	Port 20	≤2.5 dB	_____	±0.3 dB
	Port 21	≤2.5 dB	_____	±0.3 dB
	Port 22	≤2.5 dB	_____	±0.3 dB
	Port 23	≤2.5 dB	_____	±0.3 dB
	Port 24	≤2.5 dB	_____	±0.3 dB

Transmission / Reflection **Date** _____

Table 6-1 Agilent 87050A Option K24 Insertion Loss Test Record

Test Description	Port	Minimum Specifications	Measured Results	Measured Uncertainty
Insertion Loss to Band 2				
6.0 GHz to 12.4 GHz	Port 1	≤3.5 dB	_____	±0.3 dB
	Port 2	≤3.5 dB	_____	±0.3 dB
	Port 3	≤3.5 dB	_____	±0.3 dB
	Port 4	≤3.5 dB	_____	±0.3 dB
	Port 5	≤3.5 dB	_____	±0.3 dB
	Port 6	≤3.5 dB	_____	±0.3 dB
	Port 7	≤3.5 dB	_____	±0.3 dB
	Port 8	≤3.5 dB	_____	±0.3 dB
	Port 9	≤3.5 dB	_____	±0.3 dB
	Port 10	≤3.5 dB	_____	±0.3 dB
	Port 11	≤3.5 dB	_____	±0.3 dB
	Port 12	≤3.5 dB	_____	±0.3 dB
	Port 13	≤3.5 dB	_____	±0.3 dB
	Port 14	≤3.5 dB	_____	±0.3 dB
	Port 15	≤3.5 dB	_____	±0.3 dB
	Port 16	≤3.5 dB	_____	±0.3 dB
	Port 17	≤3.5 dB	_____	±0.3 dB
	Port 18	≤3.5 dB	_____	±0.3 dB
	Port 19	≤3.5 dB	_____	±0.3 dB
	Port 20	≤3.5 dB	_____	±0.3 dB
	Port 21	≤3.5 dB	_____	±0.3 dB
	Port 22	≤3.5 dB	_____	±0.3 dB
	Port 23	≤3.5 dB	_____	±0.3 dB
	Port 24	≤3.5 dB	_____	±0.3 dB

Transmission / Reflection **Date** _____

Table 6-1 Agilent 87050A Option K24 Insertion Loss Record

Test Description	Port	Minimum Specifications	Measured Results	Measured Uncertainty
Insertion Loss to Band 3				
12.4 GHz to 20 GHz	Port 1	≤4.5 dB	_____	±0.3 dB
	Port 2	≤4.5 dB	_____	±0.3 dB
	Port 3	≤4.5 dB	_____	±0.3 dB
	Port 4	≤4.5 dB	_____	±0.3 dB
	Port 5	≤4.5 dB	_____	±0.3 dB
	Port 6	≤4.5 dB	_____	±0.3 dB
	Port 7	≤4.5 dB	_____	±0.3 dB
	Port 8	≤4.5 dB	_____	±0.3 dB
	Port 9	≤4.5 dB	_____	±0.3 dB
	Port 10	≤4.5 dB	_____	±0.3 dB
	Port 11	≤4.5 dB	_____	±0.3 dB
	Port 12	≤4.5 dB	_____	±0.3 dB
	Port 13	≤4.5 dB	_____	±0.3 dB
	Port 14	≤4.5 dB	_____	±0.3 dB
	Port 15	≤4.5 dB	_____	±0.3 dB
	Port 16	≤4.5 dB	_____	±0.3 dB
	Port 17	≤4.5 dB	_____	±0.3 dB
	Port 18	≤4.5 dB	_____	±0.3 dB
	Port 19	≤4.5 dB	_____	±0.3 dB
	Port 20	≤4.5 dB	_____	±0.3 dB
	Port 21	≤4.5 dB	_____	±0.3 dB
	Port 22	≤4.5 dB	_____	±0.3 dB
	Port 23	≤4.5 dB	_____	±0.3 dB
	Port 24	≤4.5 dB	_____	±0.3 dB

Transmission / Reflection **Date** _____

Table 6-2 Agilent 87050A Option K24 Return Loss Test Record

Test Description	Port	Minimum Specifications	Measured Results	Measured Uncertainty
Return Loss Band 1				
0.5 GHz to 1.3 GHz	Port 1	≥24 dB	_____	±1.5 dB
	Port 2	≥24 dB	_____	±1.5 dB
	Port 3	≥24 dB	_____	±1.5 dB
	Port 4	≥24 dB	_____	±1.5 dB
	Port 5	≥24 dB	_____	±1.5 dB
	Port 6	≥24 dB	_____	±1.5 dB
	Port 7	≥24 dB	_____	±1.5 dB
	Port 8	≥24 dB	_____	±1.5 dB
	Port 9	≥24 dB	_____	±1.5 dB
	Port 10	≥24 dB	_____	±1.5 dB
	Port 11	≥24 dB	_____	±1.5 dB
	Port 12	≥24 dB	_____	±1.5 dB
	Port 13	≥24 dB	_____	±1.5 dB
	Port 14	≥24 dB	_____	±1.5 dB
	Port 15	≥24 dB	_____	±1.5 dB
	Port 16	≥24 dB	_____	±1.5 dB
	Port 17	≥24 dB	_____	±1.5 dB
	Port 18	≥24 dB	_____	±1.5 dB
	Port 19	≥24 dB	_____	±1.5 dB
	Port 20	≥24 dB	_____	±1.5 dB
	Port 21	≥24 dB	_____	±1.5 dB
	Port 22	≥24 dB	_____	±1.5 dB
	Port 23	≥24 dB	_____	±1.5 dB
	Port 24	≥24 dB	_____	±1.5 dB

Transmission / Reflection **Date** _____

Table 6-2 Agilent 87050A Option K24 Return Loss Test Record

Test Description	Port	Minimum Specifications	Measured Results	Measured Uncertainty
Return Loss Band 2				
1.3 GHz to 3.0 GHz	Port 1	≥20 dB	_____	±1.5 dB
	Port 2	≥20 dB	_____	±1.5 dB
	Port 3	≥20 dB	_____	±1.5 dB
	Port 4	≥20 dB	_____	±1.5 dB
	Port 5	≥20 dB	_____	±1.5 dB
	Port 6	≥20 dB	_____	±1.5 dB
	Port 7	≥20 dB	_____	±1.5 dB
	Port 8	≥20 dB	_____	±1.5 dB
	Port 9	≥20 dB	_____	±1.5 dB
	Port 10	≥20 dB	_____	±1.5 dB
	Port 11	≥20 dB	_____	±1.5 dB
	Port 12	≥20 dB	_____	±1.5 dB
	Port 13	≥20 dB	_____	±1.5 dB
	Port 14	≥20 dB	_____	±1.5 dB
	Port 15	≥20 dB	_____	±1.5 dB
	Port 16	≥20 dB	_____	±1.5 dB
	Port 17	≥20 dB	_____	±1.5 dB
	Port 18	≥20 dB	_____	±1.5 dB
	Port 19	≥20 dB	_____	±1.5 dB
	Port 20	≥20 dB	_____	±1.5 dB
	Port 21	≥20 dB	_____	±1.5 dB
	Port 22	≥20 dB	_____	±1.5 dB
	Port 23	≥20 dB	_____	±1.5 dB
	Port 24	≥20 dB	_____	±1.5 dB

Transmission / Reflection **Date** _____

Table 6-2 Agilent 87050A Option K24 Return Loss Test Record

Test Description	Port	Minimum Specifications	Measured Results	Measured Uncertainty
Return Loss Band 3				
3.0 GHz to 6.0 GHz	Port 1	≥14 dB	_____	±0.6 dB
	Port 2	≥14 dB	_____	±0.6 dB
	Port 3	≥14 dB	_____	±0.6 dB
	Port 4	≥14 dB	_____	±0.6 dB
	Port 5	≥14 dB	_____	±0.6 dB
	Port 6	≥14 dB	_____	±0.6 dB
	Port 7	≥14 dB	_____	±0.6 dB
	Port 8	≥14 dB	_____	±0.6 dB
	Port 9	≥14 dB	_____	±0.6 dB
	Port 10	≥14 dB	_____	±0.6 dB
	Port 11	≥14 dB	_____	±0.6 dB
	Port 12	≥14 dB	_____	±0.6 dB
	Port 13	≥14 dB	_____	±0.6 dB
	Port 14	≥14 dB	_____	±0.6 dB
	Port 15	≥14 dB	_____	±0.6 dB
	Port 16	≥14 dB	_____	±0.6 dB
	Port 17	≥14 dB	_____	±0.6 dB
	Port 18	≥14 dB	_____	±0.6 dB
	Port 19	≥14 dB	_____	±0.6 dB
	Port 20	≥14 dB	_____	±0.6 dB
	Port 21	≥14 dB	_____	±0.6 dB
	Port 22	≥14 dB	_____	±0.6 dB
	Port 23	≥14 dB	_____	±0.6 dB
	Port 24	≥14 dB	_____	±0.6 dB

Transmission / Reflection **Date** _____

Table 6-2 Agilent 87050A Option K24 Return Loss Test Record

Test Description	Port	Minimum Specifications	Measured Results	Measured Uncertainty
Return Loss Band 4				
6.0 GHz to 12.4 GHz	Port 1	≥12 dB	_____	±0.5 dB
	Port 2	≥12 dB	_____	±0.5 dB
	Port 3	≥12 dB	_____	±0.5 dB
	Port 4	≥12 dB	_____	±0.5 dB
	Port 5	≥12 dB	_____	±0.5 dB
	Port 6	≥12 dB	_____	±0.5 dB
	Port 7	≥12 dB	_____	±0.5 dB
	Port 8	≥12 dB	_____	±0.5 dB
	Port 9	≥12 dB	_____	±0.5 dB
	Port 10	≥12 dB	_____	±0.5 dB
	Port 11	≥12 dB	_____	±0.5 dB
	Port 12	≥12 dB	_____	±0.5 dB
	Port 13	≥12 dB	_____	±0.5 dB
	Port 14	≥12 dB	_____	±0.5 dB
	Port 15	≥12 dB	_____	±0.5 dB
	Port 16	≥12 dB	_____	±0.5 dB
	Port 17	≥12 dB	_____	±0.5 dB
	Port 18	≥12 dB	_____	±0.5 dB
	Port 19	≥12 dB	_____	±0.5 dB
	Port 20	≥12 dB	_____	±0.5 dB
	Port 21	≥12 dB	_____	±0.5 dB
	Port 22	≥12 dB	_____	±0.5 dB
	Port 23	≥12 dB	_____	±0.5 dB
	Port 24	≥12 dB	_____	±0.5 dB

Transmission / Reflection **Date** _____

Table 6-2 Agilent 87050A Option K24 Return Loss Record

Test Description	Port	Minimum Specifications	Measured Results	Measured Uncertainty
Return Loss Band 5				
12.4 GHz to 20 GHz	Port 1	≥8 dB	_____	±0.5 dB
	Port 2	≥8 dB	_____	±0.5 dB
	Port 3	≥8 dB	_____	±0.5 dB
	Port 4	≥8 dB	_____	±0.5 dB
	Port 5	≥8 dB	_____	±0.5 dB
	Port 6	≥8 dB	_____	±0.5 dB
	Port 7	≥8 dB	_____	±0.5 dB
	Port 8	≥8 dB	_____	±0.5 dB
	Port 9	≥8 dB	_____	±0.5 dB
	Port 10	≥8 dB	_____	±0.5 dB
	Port 11	≥8 dB	_____	±0.5 dB
	Port 12	≥8 dB	_____	±0.5 dB
	Port 13	≥8 dB	_____	±0.5 dB
	Port 14	≥8 dB	_____	±0.5 dB
	Port 15	≥8 dB	_____	±0.5 dB
	Port 16	≥8 dB	_____	±0.5 dB
	Port 17	≥8 dB	_____	±0.5 dB
	Port 18	≥8 dB	_____	±0.5 dB
	Port 19	≥8 dB	_____	±0.5 dB
	Port 20	≥8 dB	_____	±0.5 dB
	Port 21	≥8 dB	_____	±0.5 dB
	Port 22	≥8 dB	_____	±0.5 dB
	Port 23	≥8 dB	_____	±0.5 dB
	Port 24	≥8 dB	_____	±0.5 dB

Transmission / Reflection **Date** _____

Table 6-3 Agilent 87050A Option K24 Isolation Test Record

Test Description	Port	Minimum Specifications	Measured Results	Measured Uncertainty
Isolation Band 1				
0.5 GHz to 1.3 GHz	Port 1	≥85 dB	_____	±5 dB
	Port 2	≥85 dB	_____	±5 dB
	Port 3	≥85 dB	_____	±5 dB
	Port 4	≥85 dB	_____	±5 dB
	Port 5	≥85 dB	_____	±5 dB
	Port 6	≥85 dB	_____	±5 dB
	Port 7	≥85 dB	_____	±5 dB
	Port 8	≥85 dB	_____	±5 dB
	Port 9	≥85 dB	_____	±5 dB
	Port 10	≥85 dB	_____	±5 dB
	Port 11	≥85 dB	_____	±5 dB
	Port 12	≥85 dB	_____	±5 dB
	Port 13	≥85 dB	_____	±5 dB
	Port 14	≥85 dB	_____	±5 dB
	Port 15	≥85 dB	_____	±5 dB
	Port 16	≥85 dB	_____	±5 dB
	Port 17	≥85 dB	_____	±5 dB
	Port 18	≥85 dB	_____	±5 dB
	Port 19	≥85 dB	_____	±5 dB
	Port 20	≥85 dB	_____	±5 dB
	Port 21	≥85 dB	_____	±5 dB
	Port 22	≥85 dB	_____	±5 dB
	Port 23	≥85 dB	_____	±5 dB
	Port 24	≥85 dB	_____	±5 dB

Transmission / Reflection **Date** _____

Table 6-3 Agilent 87050A Option K24 Isolation Test Record

Test Description	Port	Minimum Specifications	Measured Results	Measured Uncertainty
Isolation Band 2				
1.3 GHz to 3.0 GHz	Port 1	≥100 dB	_____	±5 dB
	Port 2	≥100 dB	_____	±5 dB
	Port 3	≥100 dB	_____	±5 dB
	Port 4	≥100 dB	_____	±5 dB
	Port 5	≥100 dB	_____	±5 dB
	Port 6	≥100 dB	_____	±5 dB
	Port 7	≥100 dB	_____	±5 dB
	Port 8	≥100 dB	_____	±5 dB
	Port 9	≥100 dB	_____	±5 dB
	Port 10	≥100 dB	_____	±5 dB
	Port 11	≥100 dB	_____	±5 dB
	Port 12	≥100 dB	_____	±5 dB
	Port 13	≥100 dB	_____	±5 dB
	Port 14	≥100 dB	_____	±5 dB
	Port 15	≥100 dB	_____	±5 dB
	Port 16	≥100 dB	_____	±5 dB
	Port 17	≥100 dB	_____	±5 dB
	Port 18	≥100 dB	_____	±5 dB
	Port 19	≥100 dB	_____	±5 dB
	Port 20	≥100 dB	_____	±5 dB
	Port 21	≥100 dB	_____	±5 dB
	Port 22	≥100 dB	_____	±5 dB
	Port 23	≥100 dB	_____	±5 dB
	Port 24	≥100 dB	_____	±5 dB

Transmission / Reflection **Date** _____

Table 6-3 Agilent 87050A Option K24 Isolation Test Record

Test Description	Port	Minimum Specifications	Measured Results	Measured Uncertainty
Isolation Band 3				
3.0 GHz to 6.0 GHz	Port 1	≥95 dB	_____	±5 dB
	Port 2	≥95 dB	_____	±5 dB
	Port 3	≥95 dB	_____	±5 dB
	Port 4	≥95 dB	_____	±5 dB
	Port 5	≥95 dB	_____	±5 dB
	Port 6	≥95 dB	_____	±5 dB
	Port 7	≥95 dB	_____	±5 dB
	Port 8	≥95 dB	_____	±5 dB
	Port 9	≥95 dB	_____	±5 dB
	Port 10	≥95 dB	_____	±5 dB
	Port 11	≥95 dB	_____	±5 dB
	Port 12	≥95 dB	_____	±5 dB
	Port 1	≥95 dB	_____	±5 dB
	Port 2	≥95 dB	_____	±5 dB
	Port 3	≥95 dB	_____	±5 dB
	Port 4	≥95 dB	_____	±5 dB
	Port 5	≥95 dB	_____	±5 dB
	Port 6	≥95 dB	_____	±5 dB
	Port 7	≥95 dB	_____	±5 dB
	Port 8	≥95 dB	_____	±5 dB
	Port 9	≥95 dB	_____	±5 dB
	Port 10	≥95 dB	_____	±5 dB
	Port 11	≥95 dB	_____	±5 dB
	Port 12	≥95 dB	_____	±5 dB

Transmission / Reflection **Date** _____

Table 6-3 Agilent 87050A Option K24 Isolation Test Record

Test Description	Port	Minimum Specifications	Measured Results	Measured Uncertainty
Isolation Band 4				
6.0 GHz to 20.0 GHz	Port 1	≥90 dB	_____	±7 dB
	Port 2	≥90 dB	_____	±7 dB
	Port 3	≥90 dB	_____	±7 dB
	Port 4	≥90 dB	_____	±7 dB
	Port 5	≥90 dB	_____	±7 dB
	Port 6	≥90 dB	_____	±7 dB
	Port 7	≥90 dB	_____	±7 dB
	Port 8	≥90 dB	_____	±7 dB
	Port 9	≥90 dB	_____	±7 dB
	Port 10	≥90 dB	_____	±7 dB
	Port 11	≥90 dB	_____	±7 dB
	Port 12	≥90 dB	_____	±7 dB
	Port 13	≥90 dB	_____	±7 dB
	Port 14	≥90 dB	_____	±7 dB
	Port 15	≥90 dB	_____	±7 dB
	Port 16	≥90 dB	_____	±7 dB
	Port 17	≥90 dB	_____	±7 dB
	Port 18	≥90 dB	_____	±7 dB
	Port 19	≥90 dB	_____	±7 dB
	Port 20	≥90 dB	_____	±7 dB
	Port 21	≥90 dB	_____	±7 dB
	Port 22	≥90 dB	_____	±7 dB
	Port 23	≥90 dB	_____	±7 dB
	Port 24	≥90 dB	_____	±7 dB

Assembly Replacement and Post-Repair Procedures

The following table contains the list of replaceable parts for the Agilent 87050A Option K24 test set. If any of these parts or assemblies is replaced, you must run all performance tests to verify conformance to specifications.

Table 6-4 Agilent 87050A Option K24 Replaceable Parts

Replacement Part	Part Number	Quantity
Power Supply	0950-2252	1
Rear Panel	08720-00102	1
Switch Bracket	08720-00103	4
Wire Harness, Multiport-short	08720-60191	1
Display Subassembly	08720-60193	1
Switch Support (12sw)	87050-00020	1
Deck	87050-00021	1
RF Cable-Refl	87050-20070	1
RF Cable-Trans	87050-20071	1
RF Cable-Port 1/6	87050-20072	1
RF Cable-Port 6/12	87050-20073	1
RF Cable-Port 13/18	87050-20074	1
RF Cable-Port 19/24	87050-20075	1
RF Cable-Sw A1-1	87050-20076	1
RF Cable-Sw A2-1	87050-20077	1
RF Cable- Sw A3-1	87050-20078	1
RF Cable- Sw A7-1	87050-20079	1
RF Cable- Sw A8-1	87050-20080	1
RF Cable- Sw A9-1	87050-20081	1
RF Cable- Sw A13-1	87050-20082	1
RF Cable- Sw A14-1	87050-20083	1
RF Cable- Sw A15-1	87050-20084	1
RF Cable- Sw A19-1	87050-20085	1
RF Cable- Sw A20-1	87050-20086	1
RF Cable- Sw A21-1	87050-20087	1

Table 6-4 Agilent 87050A Option K24 Replaceable Parts

Replacement Part	Part Number	Quantity
RF Cable- Sw A1-2	87050-20088	1
RF Cable- Sw A2-2	87050-20089	1
RF Cable- Sw A3-2	87050-20090	1
RF Cable- Sw A7-2	87050-20091	1
RF Cable- Sw A8-2	87050-20092	1
RF Cable- Sw A9-2	87050-20093	1
RF Cable- Sw A13-2	87050-20094	1
RF Cable- Sw A14-2	87050-20095	1
RF Cable- Sw A15-2	87050-20096	1
RF Cable- Sw A19-2	87050-20097	1
RF Cable- Sw A20-2	87050-20098	1
RF Cable- Sw A21-2	87050-20099	1
RF Cable-Sw B1-C	87050-20100	1
RF Cable- Sw B2-C	87050-20101	1
RF Cable- Sw B3-C	87050-20102	1
RF Cable- Sw B4-C	87050-20103	1
RF Cable- Sw C1-C	87050-20104	1
RF Cable- Sw C2-C	87050-20105	1
RF Cable- Sw C3-C	87050-20106	1
RF Cable- Sw C4-C	87050-20107	1
RF Cable (Option K24 to 8720D)	87050-20245	2
Wire Harness, Multiport-long	87050-60070	1
Controller Mother Board	87050-60149	1
Front Panel Subassembly	87050-60153	1
User's and Service Guide	87050-90022	1

NOTE The above parts are unique to this special option. To order replacements, contact the Component Test PGU Support Group at (707) 577-6802 with the part number, module/model number and option number. When ordering parts specify that they are ordered through the Component Test PGU Support Group.

NOTE Special options are built to order, therefore long lead times may be encountered when ordering replacement parts.

WARNING **Some parts in the instrument have sharp edges. Work carefully to avoid injury.**

CAUTION Before replacing an assembly or board, inspect for obvious, easily repaired defects such as bent pins on ICs or cold solder joints.

Connector Replacement

The 50 Ω 3.5 mm connectors are available separately as part number 5062-6618. It is possible to replace them in the field. An alternative to replacing a damaged connector would be to replace just the center pin components. The components for the assembly are:

Component	Part Number
3.5 mm Connector, RF (complete)	5062-6618
3.5 mm Pin and Bead Assembly (only)	5061-5394

When replacing just the pin and bead, a liquid thread-locking adhesive such as part number 0470-1590 will be needed. Re-use any shims and spacers from the connector being replaced. For best results, use a connector gauge to verify pin depth. See Figure 4-2 on page 4-3 for proper pin-depth. Add or subtract spacers as required. Spacers and shims are also available from Agilent Technologies.

Troubleshooting and Block Diagram

This section contains information on troubleshooting the test set to the assembly level only. By following these procedures you should be able to determine whether the power supply, front panel, or main switch board needs replacing. A block diagram is included at the end of this section as an aid in troubleshooting.

Theory of operation information can be found in the next section of this manual.

General Troubleshooting Notes

WARNING **Always turn the instrument power off before removing or installing an assembly.**

CAUTION If you need to disassemble the instrument, be sure to work at an antistatic workstation and use a grounded wrist strap to prevent damage from electrostatic discharge (ESD). See Figure 1-3 on page 1-7.

Troubleshooting Power Supply Problems

Turn the instrument on. Check the condition of the LCD on the front panel:

Step 1. If the LCD is off, check the main fuse located in the power supply filter at the rear of the instrument and replace if necessary.

Step 2. If the LCD is still off, there is still a possibility that the power supply is not supplying the necessary +24V, +12V, and +5V to the main board.

Step 3. If the LCD is still off, check the cable between the main board and front panel board.

Step 4. Finally, disconnect the DC power cable from the power supply to the main switch board and measure the voltages. They should be +24V, +12V, and +5V. If not, replace the power supply.

Troubleshooting the Front Panel Board

Turn the instrument power on and check the following:

Step 1. Check the condition of each of the switching paths by issuing commands to switch each of the paths to either the transmission or reflection path. Ensure that the LCD indicates the appropriate path.

Step 2. If the LCD indicates a wrong path, the problem can lie either with the front panel board or with the main switch board. Measure the RF path to determine where the problem is.

Step 3. If the LCD does not display the proper path, check to see if the RF path has indeed been switched. If the problem lies with the front panel board, replace it

Troubleshooting the Controller and Switch Driver Boards

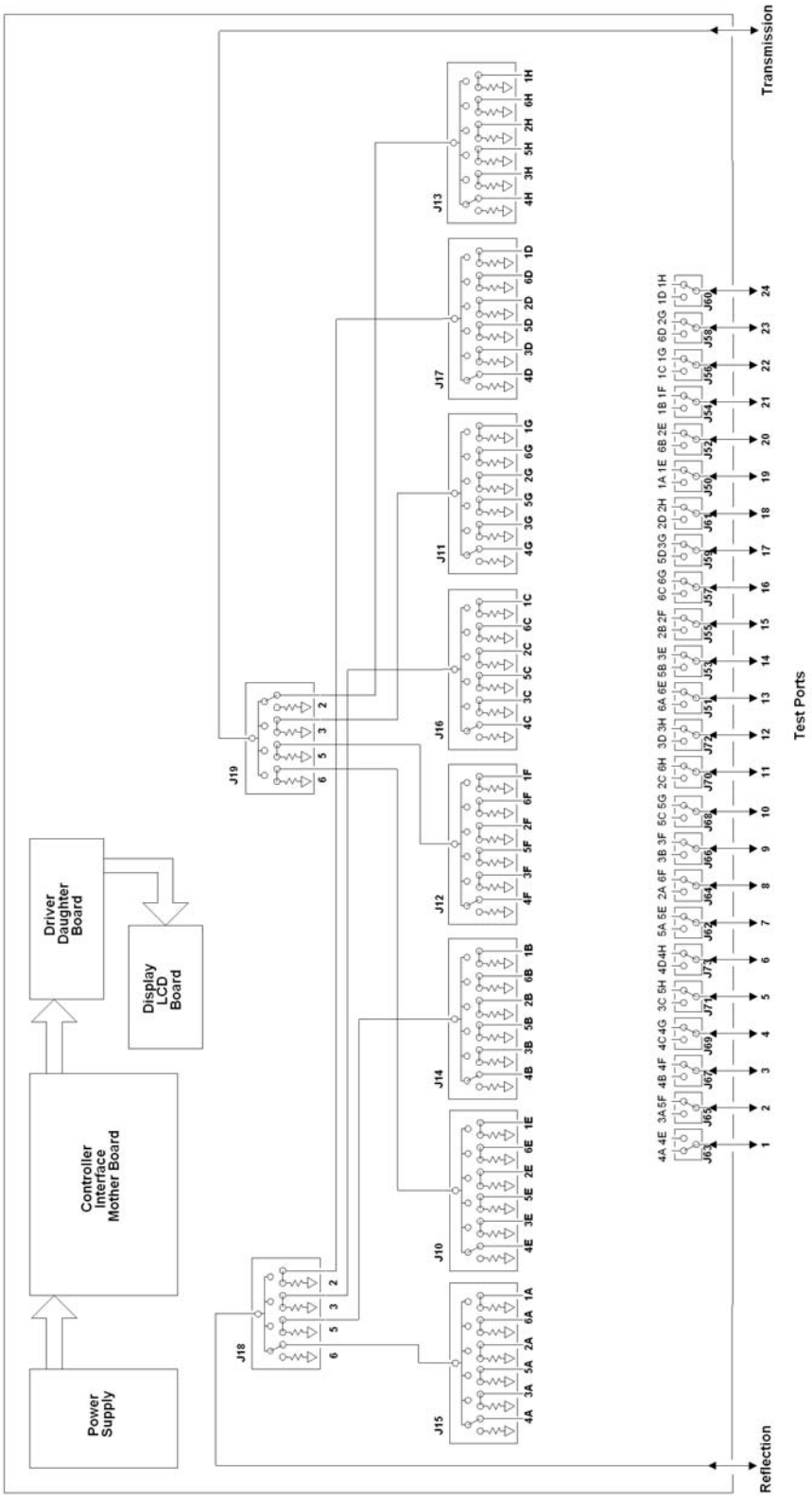
Turn the instrument power on.

Step 1. Check the condition of each of the switching paths by issuing commands to switch each of the paths to either the Transmission or Reflection path.

Step 2. Check each of the RF paths for connection.

Step 3. If an RF path is not connected to the necessary port or terminated in 50 Ω, replace the controller and switch driver board.

Figure 6-1 Agilent 87050A Option K24 Block Diagram



Theory of Operation

The theory of operation begins with a general description of the 87050A Option K24 multiport test set. This is followed by more detailed operating theory. The operation of each group is described briefly, to the assembly level only. Detailed component level circuit theory is not provided.

System Theory

The test set consists of three main components: a power supply, a front panel display, and a controller interface mother board. The purpose of the power supply is to provide power to both the front panel display and the main switch board. The front panel display serves to indicate the switching paths to the user. Finally, the controller interface mother board does the actual switching between the different ports.

A1 Power Supply Theory

The switching power supply provides regulated dc voltages to power all assemblies in the test set. A dc cable provides power to the main switch board. A connector from the main switch board to the front panel display provides dc power and control signals to the front panel. The power supply provides the following voltages: +24V, +12V, and +5V.

The power LED on the front panel indicates that the instrument is on and that the power supply is providing power.

A2 Front Panel Display Theory

The front panel display consists of an LCD. The LCD is divided into two lines, forward and reverse. The first line indicates which of the 24 ports is connected to the forward path. The second line indicates which of the 24 ports is connected to the reverse path. Control signals and dc power are provided by a cable connected to the main switch board.

A3 Controller Board (Mother Board) and Switch Driver Board (Daughter Board) Theory

Refer to Figure 6-1 on page 6-23 for the following discussion. The mother and daughter board provide the bias to switch the paths of the various ports to the Transmission and Reflection ports. The front panel display contains an LCD that indicates the switched ports. A particular test port (1 through 24) can be in one of three states. The three states are:

- Switched to the forward path
- Switched to the reverse path
- Terminated in 50 Ω

When a port is not connected, it is automatically terminated in 50 Ω.

The test set consists of twenty-four (24) 1x2 switches, eight (8) 1x6 switches, and two (2) 1x4 switches. The 1x2 switches divide each of the input ports (1 through 24) into two separate paths, the Transmission path or the Reflection path.

Each path, Transmission or Reflection, is routed to a bank of four (4) 1x6 switches, for a total of eight (8) 1x6 switches. Each bank of switches is routed to a single 1x4 switch where it becomes either the Transmission or Reflection port.

All switches are mechanical, biased according to the necessary switching path. A user interface through the GPIB and parallel ports converts the necessary input signals from the user to the necessary control signals to control the switching paths.

7 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. This product has been designed and tested in accordance with international standards.

Cleaning Instructions

Clean the instrument cabinet using a damp cloth only.

Shipping Instructions

Always transport or ship the instrument using the original packaging if possible. If not, comparable packaging must be used.

Before Applying Power

Verify that the product is configured to match the available main power source as described in the input power configuration instructions in this manual. 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.

Safety Information

Warnings

WARNING **The WARNING notice denotes a hazard. It calls attention to a procedure, practice, or the like, which if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.**

Warnings applicable to this instrument are:

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

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

WARNING **For continued protection against fire hazard replace line fuse only with same type and rating:**
• United States—F 3A/250V, Part Number 2110-0780
• Europe—F 3.15A/250V, Part Number 2110-0655
The use of other fuses or material 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 be inserted only 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 retain dangerous electrical charges 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 instrument from all voltage sources while it is being opened.**

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

Cautions

CAUTION The CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like, which if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice 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) can cause instrument damage.

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

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, 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 (CISPER 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 Technologies

A current list of Agilent Technologies Sales and Service Offices can be accessed on the internet at http://www.agilent.com/find/assist.

If you do not have access to the internet, refer to the information below to contact your nearest Agilent Technologies representative.

Online assistance: www.agilent.com/find/assist			
United States *(tel)* 1 800 452 4844 1 800 593 6635 *on-site service of systems*	**Latin America** *(tel)* (305) 269 7500 *(fax)* (305) 269 7599	**Canada** *(tel)* 1 877 894 4414 *(fax)* (905) 282-6495	**Europe** *(tel)* (+31) 20 547 2323 *(fax)* (+31) 20 547 2390
New Zealand *(tel)* 0 800 738 378 *(fax)* (+64) 4 495 8950	**Japan** *(tel)* (+81) 426 56 7832 *(fax)* (+81) 426 56 7840	**Australia** *(tel)* 1 800 629 485 *(fax)* (+61) 3 9210 5947	**Singapore** *(tel)* 1 800 375 8100 *(fax)* (65) 836 0252
Malaysia *(tel)* 1 800 828 848 *(fax)* 1 800 801 664	**Philippines** *(tel)* (632) 8426802 *(tel) (PLDT subscriber only):* 1 800 16510170 *(fax)* (632) 8426809 *(fax) (PLDT subscriber only):* 1 800 16510288	**Thailand** *(tel) outside Bangkok:* (088) 226 008 *(tel) within Bangkok:* (662) 661 3999 *(fax)* (66) 1 661 3714	**Hong Kong** *(tel)* 800 930 871 *(fax)* (852) 2506 9233
Taiwan *(tel)* 0800-047-866 *(fax)* (886) 2 25456723	**People's Republic of China** *(tel) (preferred):* 800-810-0189 *(tel) (alternate):* 10800-650-0021 *(fax)* 10800-650-0121	**India** *(tel)* 1-600-11-2929 *(fax)* 000-800-650-1101	