

# **Agilent Technologies 87075C Option H12**

## **User's and Service Guide**

This Guide applies to 87075C instruments  
with serial numbers greater than US37370244

**Use this manual with the following documents:**

87050E/75C User's Guide  
Part Number 87050-90026



**Agilent Technologies**

**Manufacturing Part Number: 87075-90023**

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## Safety Notes

The following safety notes are used throughout this document. Familiarize yourself with each of these notes and its meaning before performing any of the procedures in this document.

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

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**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.

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## Definitions

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



# Contents

## 87075C Option H12

Description	2
Verify the Shipment	3
Specifications and Characteristics	4
Requirements	5
Electrical	5
Environmental	5
Operating Environment	5
Weight	5
Cabinet Dimensions	6
87075C Option H12 Options	6
Preparations	7
Electrical	7
Environmental	8
Front Panel	9
Line Power Switch	9
Ports 1—12	9
The Reflection Connector	10
The Transmission Connector	10
The Ground Connector	10
The Port Connection Status LEDs	10
Rear Panel	11
The Parallel Port Input Connector	11
The 871X Printer Parallel Port Connector	11
GPIB Connector (Agilent 8753ET/ES only)	11
Address Switch	11
Line Module	11
System Setup	12
Connecting and Turning On the Test Set	12
Setting the Test Set Address Switch	13
Performance Verification	14
Equipment Required	14
Procedure	14
Controlling the Test Set and Making Measurements	15
Introduction	15
Commands	15
Computer Control via Network Analyzer	15
Direct Computer Control	16
Manual Control via Network Analyzer	17
Calibrating the Test System	20
Making Measurements	21
Measuring Transmission	21
Measuring Reflection	21
Power Cables	22
Programming Languages	24
Rocky Mountain Basic (RMB) or HP Basic	24
Quick Basic or Visual Basic	25
HPVVEE	26
National Instruments VISA	26
Replaceable Parts	27
Theory of Operation	28
Introduction	28
System Theory	28

# Contents

A1 Power Supply Theory . . . . .	28
A2 Front Panel Display Theory . . . . .	28
A3 Main Switch Board Theory . . . . .	28
A4 Controller Board Theory . . . . .	29
Bock Diagram . . . . .	29
Connector Replacement . . . . .	30
Safety and Regulatory Information . . . . .	31
Introduction . . . . .	31
Before Applying Power . . . . .	31
Connector Care and Cleaning . . . . .	31
Declaration of Conformity . . . . .	31
Statement of Compliance . . . . .	31
General Safety Considerations . . . . .	32
Cautions . . . . .	32
Servicing . . . . .	33
Regulatory Information . . . . .	34
Instrument Markings . . . . .	34
Battery Collection . . . . .	35
Compliance with German Noise Requirements . . . . .	35
EMC Information . . . . .	35
Electrostatic Discharge Protection . . . . .	36
Agilent Support, Services, and Assistance . . . . .	37
Service and Support Options . . . . .	37
Contacting Agilent . . . . .	37
Shipping Your Analyzer to Agilent for Service or Repair . . . . .	37

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# **87075C Option H12**

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## Description

The Agilent 87075C Option H12 multiport test set is designed for use with Agilent 75  $\Omega$  network analyzers such as the 8753C/D/E/ES/ET, the 8711B/C, the 8712B/C/ES/ET, the 8713B/C, and the 8714B/C/ES/ET.

The multiport test set provides the ability to make single connection, multiple measurements of multiport devices. Throughput is increased by reducing the number of device reconnects the operator must perform. Switching is performed with solid-state switches.

The test set can be controlled by using an external GPIB controller, or by a network analyzer's GPIB or parallel port.

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**NOTE** The 87075C Option H12 User's and Service Guide documents the use of the test set with an 8753E/ET/ES Option 075 Network Analyzer only.

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This User's and Service Guide Supplement is to be used in conjunction with the Agilent Technologies 87050E/75C 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 75  $\Omega$  Type-N 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](#).

After the test set has been unpacked, keep the original packaging materials so that it can be used if you need to transport the instrument. 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 [“Agilent Support, Services, and Assistance” on page 37](#).

**Table 1**      **87075C Option H12 Accessories Supplied**

Description	Part Number	Qty
Power Cord	See <a href="#">Figure 11 on page 23</a>	1
Front Handle Kit	5063-9227	1
Type-N to Type-N Cable, 13 inch, 75 Ohm	8120-8624	2
Type-N Semi-Rigid Jumper Cable, 10 inch, 75 Ohm	8120-6983	2
Cal Constant Disk for Agilent 871x Self-Cal	08712-10016	1
Cable Assembly - Test Port	87075-60026	1
Cable Assembly - Test Port	87075-60028	1
87050E / 87075C User's and Service Guide	87050-90026	1
87075C Option H12 User's and Service Guide	87075-90023	1

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## Specifications and Characteristics

Specifications for the 87075C Option H12 are typical. System performance for the PNA and Test Set are only characteristic and intended as non warranted information. A functional certificate is provided for the 87050A Option H10 only.

**Table 2**      **87075C Option H12 Performance Specifications**

Parameter	Specification
Frequency Range	3 MHz to 1.3 GHz
Isolation <sup>1</sup>	> 60 dB
Return Loss <sup>2</sup>	> 15 dB
Insertion Loss	< 6 dB <sup>3</sup> , < 10 dB <sup>4</sup>
Input Power Damage Level	≥ 16 dBm

1. Between any two non-connected signal paths.
2. When properly terminated in 75 Ω.
3. From any test port to the reflection port.
4. From any test port to the transmission port.

---

## Requirements

### Electrical

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

Range 1: 100/120 V (30 watts)

Range 2: 220/240 V (40 watts)

Frequency: 50/60Hz

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

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### Environmental

#### Operating Environment

Indoor use only

Operating temperature: 0 to 55 °C

Altitude: up to 9,843 feet (3,000 meters)

Storage Temperature: -40 °C to +70 °C

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**CAUTION** This product is designed for use in Installation Category II and Pollution Degree 2.

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#### Weight

Net: Approximately 7.8 kgm (17 pounds)

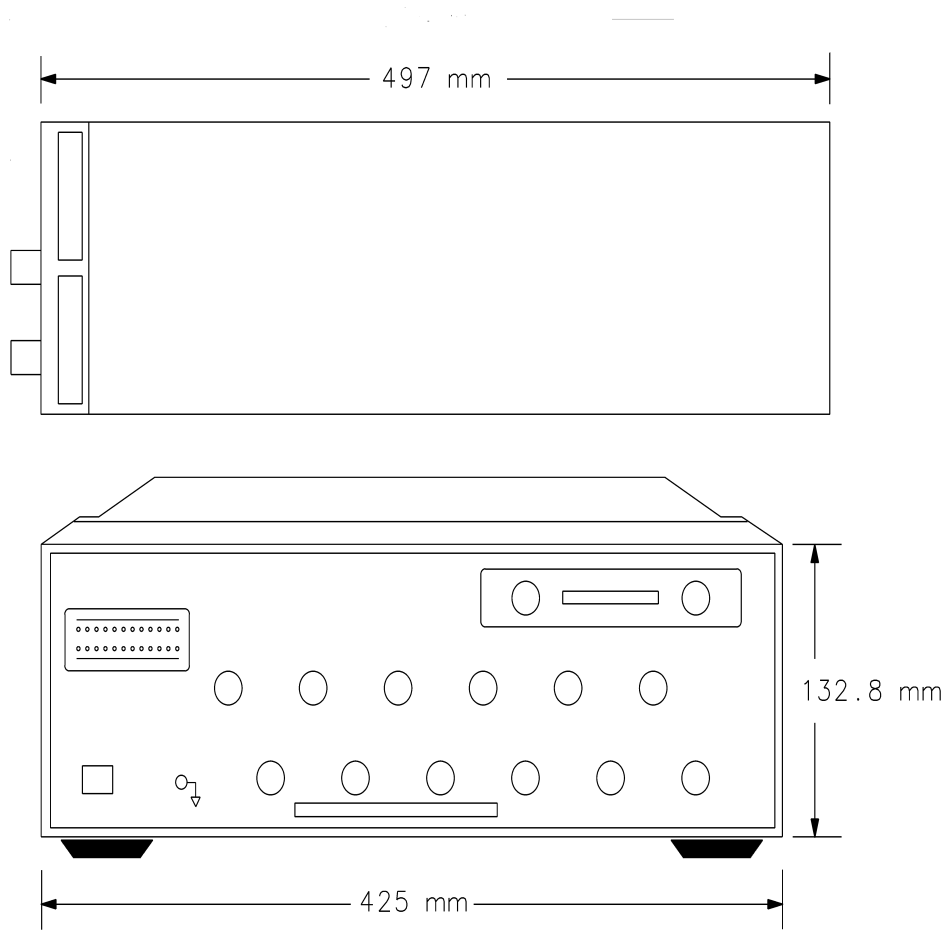
Shipping: Approximately 20 kg

## Cabinet Dimensions

These dimensions exclude front and rear panel protrusions.

14.0 cm x 43.2 cm x 54.6 cm (H x W x D)  
(5.51 in x 17.01 in x 21.50 in)

**Figure 1 Physical Dimensions**



## 87075C Option H12 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.

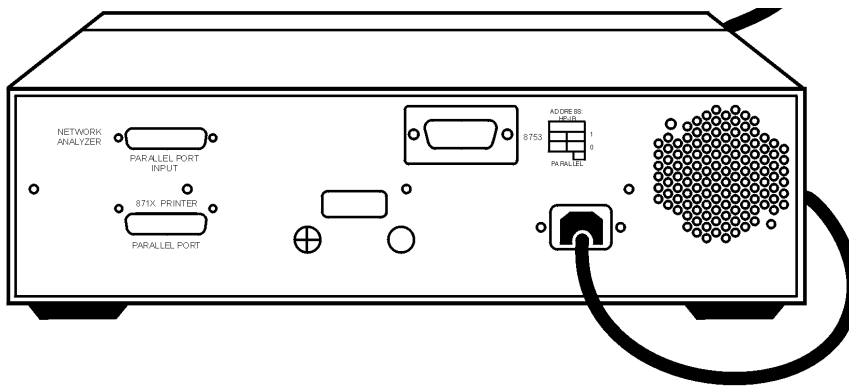
---

## 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 2 depicts only one type of power source outlet. Cables are available in different types and lengths. Refer to Figure 11 on page 23 for descriptions and part numbers of power cords that can be used with your test set.
3. If this product is to be powered by autotransformer, verify that the common terminal is connected to the neutral (grounded) side of the ac power supply.

**Figure 2** Protective Earth Ground



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#### 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.

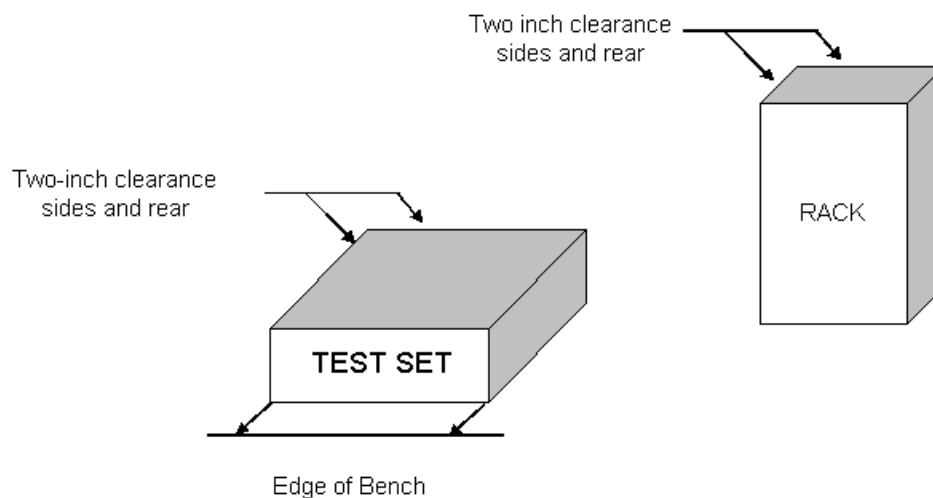
---

**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.

---

Install the instrument so that the ON/OFF switch is readily identifiable and is easily reached by the operator. The ON/OFF switch is the instrument disconnecting device. It disconnects the mains circuits from the mains supply before other parts of the instrument, or the detachable power cord can be removed from the electrical supply. Alternately, an externally installed switch or circuit breaker which is readily identifiable and is easily reached by the operator may be used as a disconnecting device

**Figure 3**      **Ventilation Clearance Requirements**



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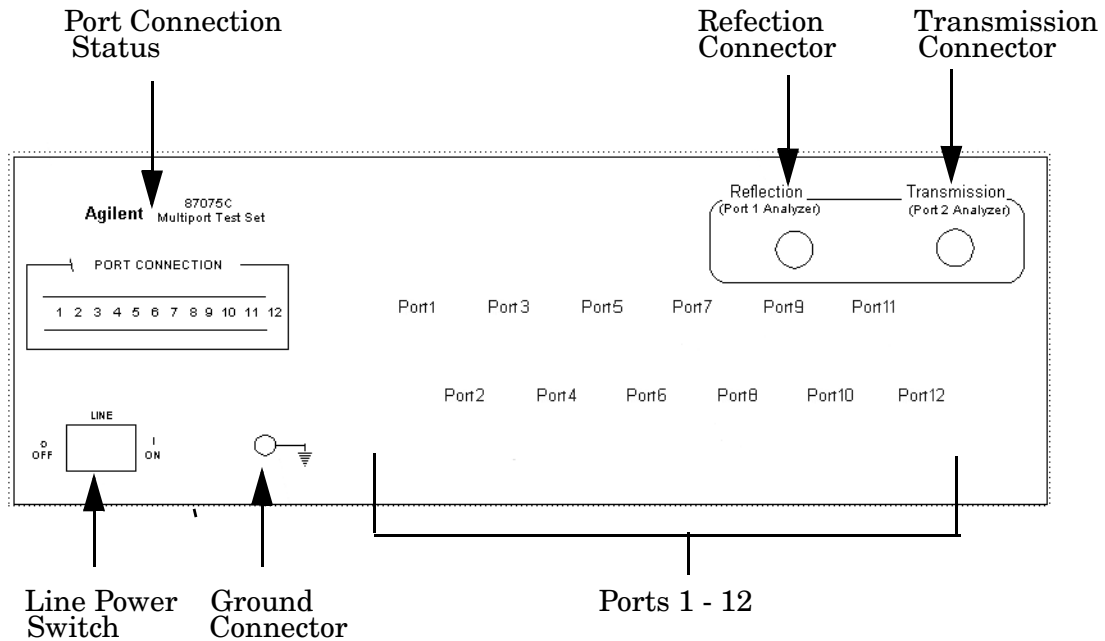
---

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

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# Front Panel

**Figure 4 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](#). 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 EMI filters and before others parts of the instrument.

## Ports 1—12

PORTS 1 through 12 are female Type-N 75 Ω connectors that are used to connect to the device under test.

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**CAUTION** Never attempt to use 50 Ω Type-N cables, connectors, or devices with a female Type-N 75 Ω connector. Irreparable damage *will* occur.

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**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.

---

## The Reflection Connector

The REFLECTION Connector is a female Type-N 75  $\Omega$  connector that connects directly to PORT 1 of the network analyzer using the semi-rigid cable (Agilent Part No. 8120-6983) that was shipped with your test set.

---

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

---

## The Transmission Connector

The TRANSMISSION Connector is a female Type-N 75  $\Omega$  connector that connects directly to PORT 2 of the network analyzer using the semi-rigid cable (Agilent Part No. 8120-6983) that was shipped with your test set.

---

**CAUTION** Check your analyzer's documentation for damage limits to Port 2. Verify 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.

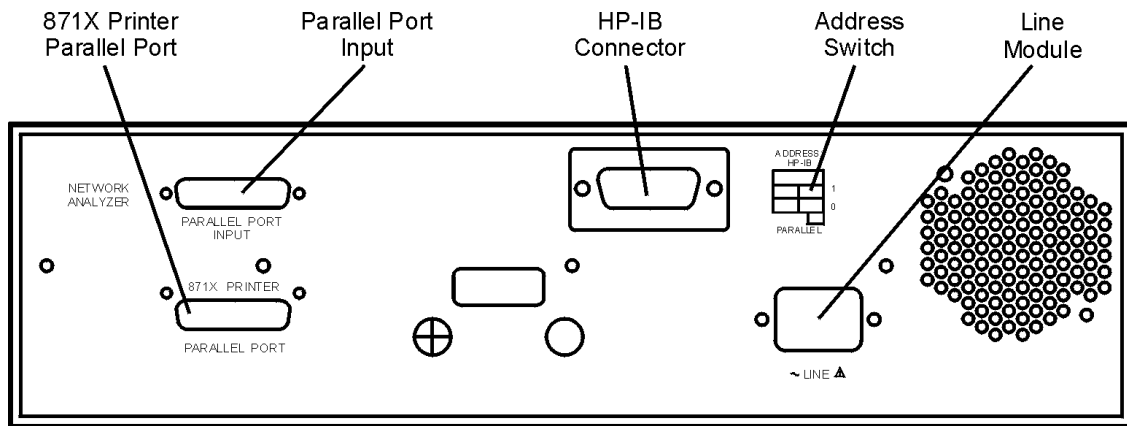
## The Port Connection Status LEDs

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 75  $\Omega$ .



## Rear Panel

**Figure 5 Rear Panel Features**



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### 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.

### 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 13.](#)

### Line Module

The line module contains the power cable receptacle.

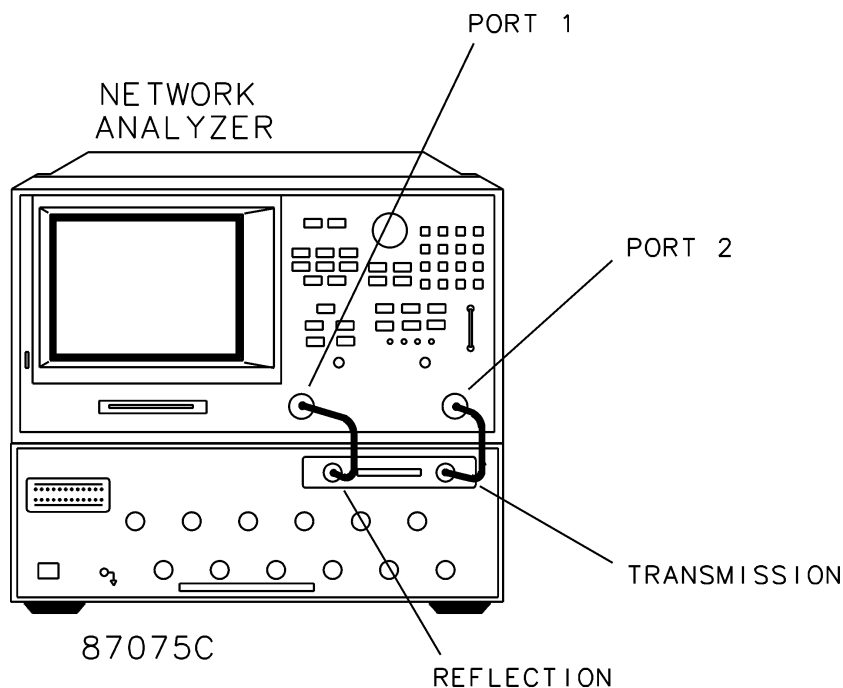
## System Setup

### Connecting and Turning On the Test Set

The 87075C Option H12 test set is designed to be placed underneath the network analyzer, in a rack system or on a bench top, and connected as shown in [Figure 6](#). Use the two Type-N 75  $\Omega$  jumper cables (Agilent Part No. 8120-6983) that were shipped with the test set. See [Table 1 on page 3](#) for a list of accessories supplied.

**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.

**Figure 6** Connecting the Test Set to the Network Analyzer



**CAUTION** Never connect 50  $\Omega$  cables to the test set or network analyzer, connector damage will occur.

After the proper front and rear panel 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 EMI filters and before other parts of the instrument.

## 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 7](#). The left most switch is also shown in the up, or “On”, position which is required for operation with the Agilent 8753 Series Network Analyzer or GPIB operation of the test set. Refer to [“Controlling the Test Set and Making Measurements” on page 15](#), for the definition of the parallel address.

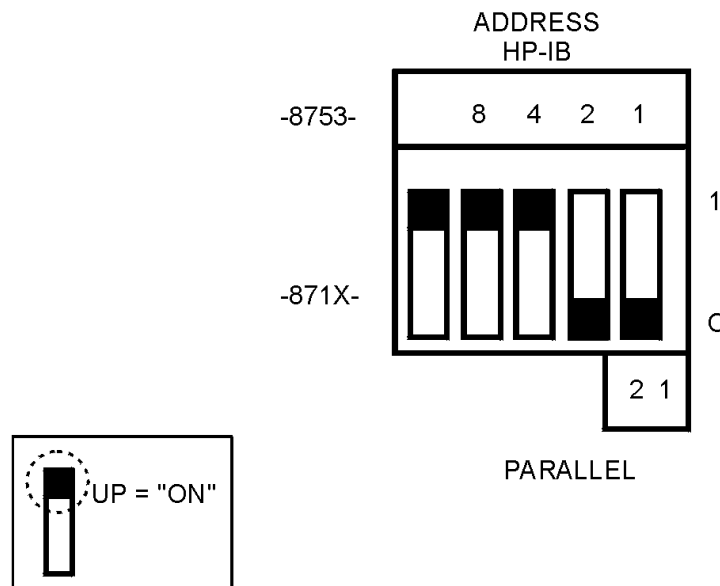
---

**CAUTION** Turned Off the test set before you change the position of any address switch.

---

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 7** The Test Set Address Switch




---

**NOTE** The left most switch is used to specify whether the test set will work with an Agilent 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 [“Controlling the Test Set and Making Measurements” on page 15](#). When the switch is down, the test set will work with 8712/14ET/ES.

---

## Performance Verification

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. 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 [“Agilent Support, Services, and Assistance” on page 37](#).

For information on how to control the test set, refer to [“Controlling the Test Set and Making Measurements” on page 15](#).

### Equipment Required

- Network Analyzer, 75  $\Omega$  impedance (8753)
- Cable, 75  $\Omega$ , Type-N, (8120-2408 or equivalent)
- Calibration Kit, 75  $\Omega$ , Type-N (85036B)

### Procedure

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

1. Connect the 75  $\Omega$  cable to the Reflection port of the analyzer.
2. Perform a 1-Port reflection calibration at the end of the 75  $\Omega$  cable over the frequency range of 3 MHz to 1.3 GHz on the analyzer. Verify that the calibration is active and that a cable terminated with a short displays a return loss of 0 dB  $\pm$  0.2 dB.
3. Connect the cable (already connected to the Reflection port of the analyzer) to the Reflection port of the 87075C Option H12 test set.
4. Measure the return loss of each path of the test set by selecting Ports 1 through 12, one at a time, viewing the display on the network analyzer. All twelve ports should be either unterminated or shorted.
5. The return loss value should be a maximum of 14 dB. This accounts for the maximum of 6 dB loss each way, plus a 2 dB margin of error to account for source match errors. Typically the return loss for each port will be about 4 dB to 8 dB, depending upon frequency, and all ports should look approximately the same.
6. Better accuracy can be obtained by averaging two measurements: one taken with a short attached and one taken with an open attached.

---

**NOTE** This is an 80% confidence test only. A test set could pass this simple test and yet still not function properly.

---

If a more complete test is desired, repeat the above procedure, but this time terminate each port being tested with a known good 75  $\Omega$  load (with a return loss of greater than 40 dB). The resulting return loss should be a maximum of 15 dB.

---

## Controlling the Test Set and Making Measurements

### Introduction

The 87075C Option H12 is a slave instrument: a controller or Network Analyzer must be used to control the test set. There are three ways in which the test set can be controlled:

- Computer control via network analyzer using GPIB, which controls the test set via the parallel port connection.
- Direct computer control using GPIB commands via the GPIB connector.
- Manual control via the network analyzer is equipped with a parallel connection can control the test set directly. The next three sections discuss the three methods of control.

The next three sections discuss the three methods of control.

---

**CAUTION** Do not connect the 8753 test set I/O interconnect to the 87075C parallel port input. The 8753 Test Set I/O interconnect has +22 Vdc on Pin 14, which if connected to the 87075C Option H12 parallel port will cause damage to the interface board and render the test set inoperable.

---

### 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 via Network Analyzer

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 8 on page 16](#) for a diagram of connections for this type of control. The following examples use the variable [D] which is defined in [Table 3, "Test Port Addresses," on page 18](#).

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
```

---

**NOTE** Be sure to use the ending semi-colon.

---

## Direct Computer Control

The second way to control the test set is to address the 87075C Option H12 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.

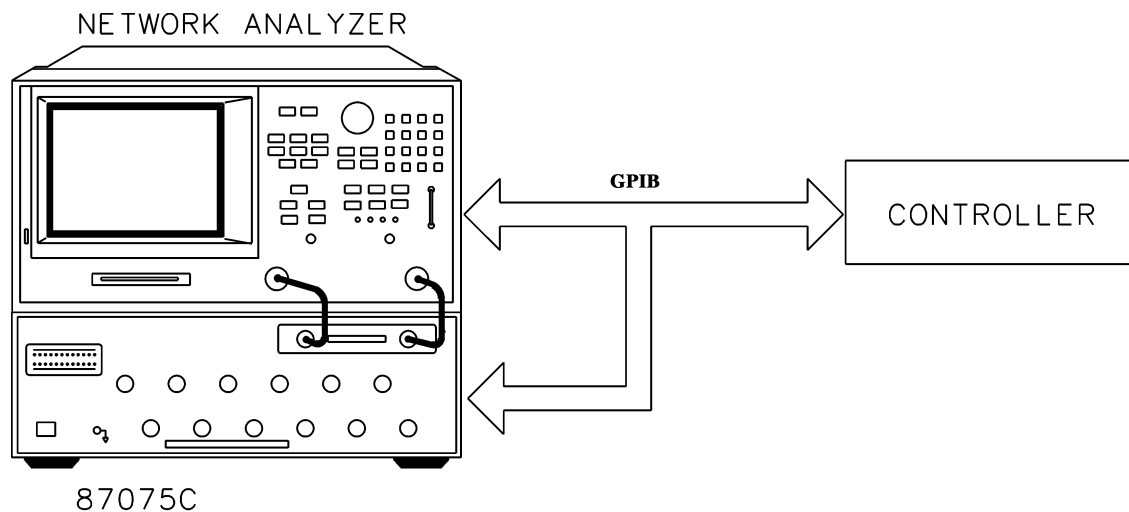
If using Quick Basic or Visual Basic, be sure to disable EOI and EOL before sending commands to the test set. Including the semicolon will not insure that these commands are disabled as would be the case in Basic/RMB. Using the Agilent 82335 GPIB Interface and Visual Basic, the following commands will 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 8 Controlling the Test Set Over GPIB**




---

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

---

### Manual Control via Network Analyzer

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.

The following example for manual control, using the network analyzer, uses normal text in brackets to indicate hard keys and italicized text in brackets to indicated soft keys.

Press: **[Seq]**  
**[TTL I/O] [PARALLEL OUT ALL]**

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 on page 18](#)).

**Table 3** Test Port Addresses

<b>Connection Path</b>	<b>Decimal [D]</b>	<b>Binary Equivalent</b>
Reflection to Port 1	0	00000000
Reflection to Port 2	1	00000001
Reflection to Port 3	2	00000010
Reflection to Port 4	3	00000011
Reflection to Port 5	4	00000100
Reflection to Port 6	5	00000101
Reflection to Port 7	6	00000110
Reflection to Port 8	7	00000111
Reflection to Port 9	8	00001000
Reflection to Port 10	9	00001001
Reflection to Port 11	10	00001010
Reflection to Port 12	11	00001011
Reflection Ports Terminated	13	00001101
Transmission to Port 1	16	00010000
Transmission to Port 2	17	00010001
Transmission to Port 3	18	00010010
Transmission to Port 4	19	00010011
Transmission to Port 5	20	00010100
Transmission to Port 6	21	00010101
Transmission to Port 7	22	00010110
Transmission to Port 8	23	00010111
Transmission to Port 9	24	00011000
Transmission to Port 10	25	00011001
Transmission to Port 11	26	00011010
Transmission to Port 12	27	00011011
Transmission Ports Terminated	28	00011100



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 75  $\Omega$  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 75  $\Omega$

---

## 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.

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 network analyzer user's guide for information on calibrations and saving instrument states.

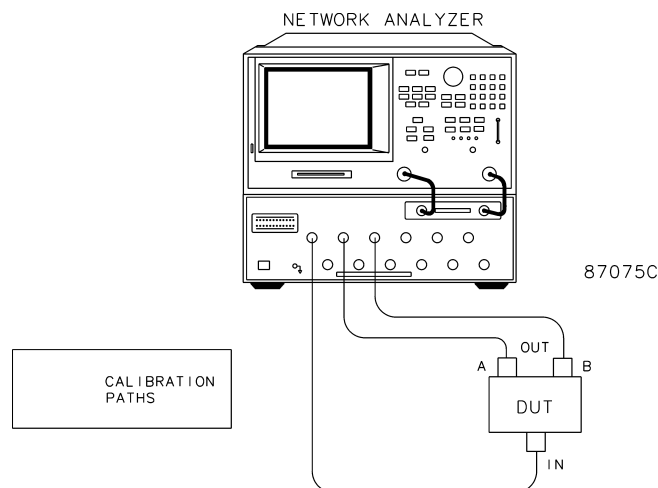
**CAUTION** When performing a full 2-Port calibration and making subsequent measurements, you must use the transfer switch internal to the 8753ET/ES analyzer to change the RF signal path direction. Do not use the test set to change the RF signal path direction when you are entering a full 2-Port calibration. Doing so will render the calibration invalid.

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 documentation for information on how to calibrate and store instrument states. See [Figure 9](#) 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 9** Calibrating the Test System



**NOTE** The SelfCal feature is not available when using the Option H12 with the 8753D/E/ET/ES analyzer or 871xC. The 871xC can be utilized, however it will not perform as indicated in the standard 87075C User's and Service Guide.

## Making Measurements

The following examples assume that you are using a parallel port connection with an 8753E, with the test set's parallel address set to "0". See ["Setting the Test Set Address Switch" on page 13](#) for information on setting the test set's address.

## Measuring Transmission

Refer to [Figure 10](#). With the 8753E/ES/ET set to measure forward transmission ( $S_{21}$ ), the analyzer's RF source is being output through the analyzer's PORT 1, and PORT 2 is set to receive the RF signal.

By using the following commands, you will connect PORT 3 of the test set to the REFLECTION port, and you will connect PORT 8 of the test set to the TRANSMISSION 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.

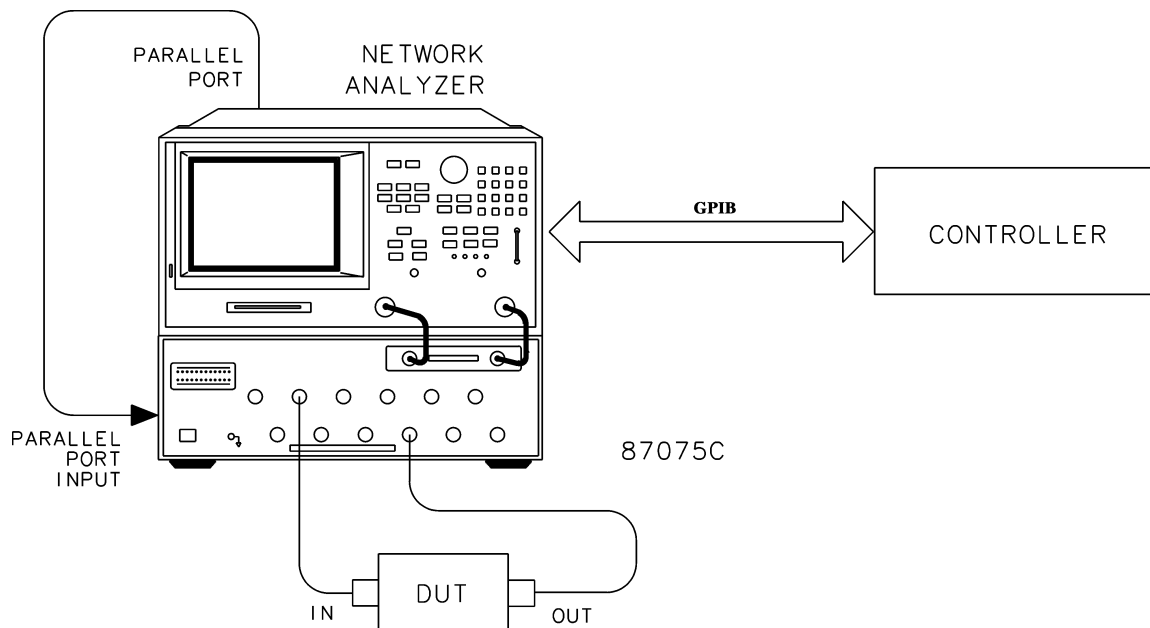
```
OUTPUT 716; " PARALGPIO; "  
OUTPUT 716; " PARAOUT2; "
```

```
OUTPUT 716; " PARALGPIO; "  
OUTPUT 716; " PARAOUT23; "
```

## Measuring Reflection

By leaving the DUT connected as in [Figure 10](#) and setting the network analyzer to measure  $S_{11}$ , you can measure reflection or return loss.

**Figure 10 A Transmission Measurement**



---

## 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 11 on page 23](#) for the part numbers of the power cables. Cables are available in different lengths. Use “[Agilent Support, Services, and Assistance](#)” on [page 37](#) for descriptions and part numbers of cables other than those described in [Figure 11 on page 23](#).

---

**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.



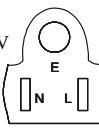
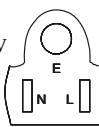

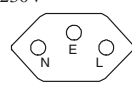
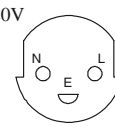
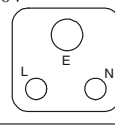
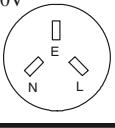
---

---

**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 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 11 Power Cable and Line (Mains) Plug Part Numbers**

Plug Type <sup>a</sup>	Cable Part Number	Plug <sup>b</sup> 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.

---

## Programming Languages

This section provides some tips on controlling the test set using different programming languages.

### Rocky Mountain Basic (RMB) or HP Basic

To address the test set directly over GPIB, use 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.

(Note the semi- colon “;” .)

Write Commands:

```
OUTPUT 712;"STRING$;" ! Output Command
```

Read Commands:

```
OUTPUT 712;"STRING$;" ! Output Command
```

```
ENTER 712;String$ ! Enter Command
```

---

## Quick Basic or Visual Basic

If you are using Quick Basic or Visual Basic, be sure to disable EOI and EOL before sending commands to the test set. Including the semicolon in program commands will not ensure that these commands are disabled as would be the case in HP Basic/RMB. When using the 82335 GPIB Interface and Visual Basic, use the following commands to disable EOI and EOL, send the necessary data to the test set, and re-enable EOI and EOL.

---

**NOTE** Be sure to re-enable EOI and EOL before sending data to another instrument.

---

### Write Commands:

```
info$="refl_01" `command for reflection to port 1
length%=len(info$) `length of command
HplibEoi(hHplib;7,0) `disable EOI
HplibEol(hHplib;7,"",0) `disable EOL
HplibOutputs (hHplib;712,info$,length%) `send command to test set
HplibEol(hHplib;7,chr$(13)+chr$(10),2) `re-enable EOL and set to
chr$(13)+chr$(10)
HplibEoi(hHplib;7,1,) `re-enable EOI hHplib specifies the handle returned
byHplibOpen.
```

### Read Commands:

```
info$="id?" `command for test set identification.
length%=len(info$) `length of command
max.len% = 10 `max length data from id? or swxx? function.
infi$ = space$(max.len%)
HplibEoi(hHplib;7,0) `disable EOI.
HplibEol(hHplib;7,"",0) `disable EOL
HplibOutputs (hHplib;712,info$,length%) `send command to test set.
HplibEnters(hHplib%,712,infi$,max.len%) `get data from test set.
HplibEol(hHplib;7,chr$(13)+chr$(10),2) `re-enable EOL and set to
chr$(13)+chr$(10).
HplibEoi(hHplib;7,1,) `re-enable EOI hHplib specifies the handle returned
byHplibOpen.
```

---

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

---

## HPVÉE

If you are using HPVÉE, be sure to set the Direct I/O in the Advance Device Configuration so that the Read Terminator and Write EOL Sequence are set to “\n”. In the I/O Transaction verify that the EOL is ON.

## National Instruments VISA

If you are using National Instruments VISA, be sure to set the following variables as follows:

`VI_ATTR_SEND_END = VI_FALSE` ` This specifies whether to assert END during the transfer of the last byte of the buffer

`VI_ATTR_TERMCHAR = 0x0A` ` This is the termination character. When the termination character is read and `VI_ATTR_TERMCHAR_EN` is enabled during a read operation, the read operation terminates.

`VI_ATTR_TERMCHAR_EN = VI_TRUE` ` This is a flag that determines whether the read operation should terminate when a termination character is received.

`VI_ATTR_SUPPRESS_END_EN = VI_FALSE` ` Specifies whether to suppress the END bit termination. If this attribute is set to `VI_TRUE`, the END bit does not terminate read operations. If this attribute is set to `VI_FALSE`, the END bit terminates read operations.

Write Commands:

Append all commands with “\n,” for example, `*rst\n`.

Read Commands:

The test set returns data terminated by `\r\n`.



---

## Replaceable Parts

The following table contains the list of replaceable parts for the 87075C Option H12 multiport test set.

---

**NOTE** Special options are built to order, therefore long lead times may be encountered when ordering replacement parts. For ordering information refer to [“Agilent Support, Services, and Assistance” on page 37.](#)

---

**Table 12**                      **Replaceable Parts**

<b>Replacement Part</b>	<b>Agilent Part Number</b>
Power Supply	0950-2023
Main Switch Board	87075-60013
Driver Board	87050-60007*
SRF Cables	87075-20053*
SRF Cables	87075-20054*
Port 1	87075-20055*
Port 2	87075-20056*
Port 3	87075-20057*
Port 4	87075-20058*
Port 5	87075-20059*
Port 6	87075-20060*
Port 7	87075-20061*
Port 8	87075-20062*
Port 9	87075-20063*
Port 10	87075-20064*
Port 11	87075-20065*
Port 12	87075-20066*
Front Panel Subassembly	87075-60006
Front Panel Display Board	87075-60014
Front Panel Assembly	87075-60017*
Front Panel Overlay	87075-60022

---

## Theory of Operation

The theory of operation begins with a general description of the 87075C Option H12 multiport test set. This is followed by more detailed operating theory. The operation of each group is described briefly but only to the assembly level. Detailed component level circuit theory is not provided.

### Introduction

This chapter contains theory of operation information, how to verify the performance of your test set, and a block diagram, see [Figure 13 on page 29](#).

Refer to [“Service and Support Options” on page 37](#) for servicing information.

### System Theory

The test set consists of four main components: a power supply, a controller board, a front panel display, and a main switch board. The purpose of the power supply is to provide power to the other three assemblies. The front panel display serves to indicate the switching paths to the user. The main switch board contains the switches and RF cabling. Finally, the controller 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 supplies: +15 V, -15 V, and +5 V.

#### A2 Front Panel Display Theory

The front panel display consists of 24 LEDs. Each test port has two LEDs associated with it: one for reflection and one for transmission. Control signals and DC power are provided by a cable connected to the main switch board.

#### A3 Main Switch Board Theory

Refer to [Figure 13](#) for the following discussion.

The main switch board contains all of the switches. A particular test port (1 through 12) can be in one of three states. The three states are:

- switched to the reflection port
- switched to the transmission port
- terminated in 75  $\Omega$

When a port is not connected to either the transmission port or the reflection port, it is automatically terminated in 75  $\Omega$ . Only one port can be connected to the transmission port and only one port can be connected to the reflection port at any given time.

The test set consists of fourteen 1 x 3 switches and six 1 x 4 switches. The 1 x 3 switches divide each of the input ports (1 through 12) into three separate paths. One path is terminated into 75 Ω. The other two are the reflection and transmission paths.

The six 1 x 4 switches combine each of the twelve 1 x 3 switches into six banks. These six banks are divided into three for the transmission port and three for the reflection port. Finally, the two 1 x 3 switches recombine the four banks into either the transmission port or reflection port.

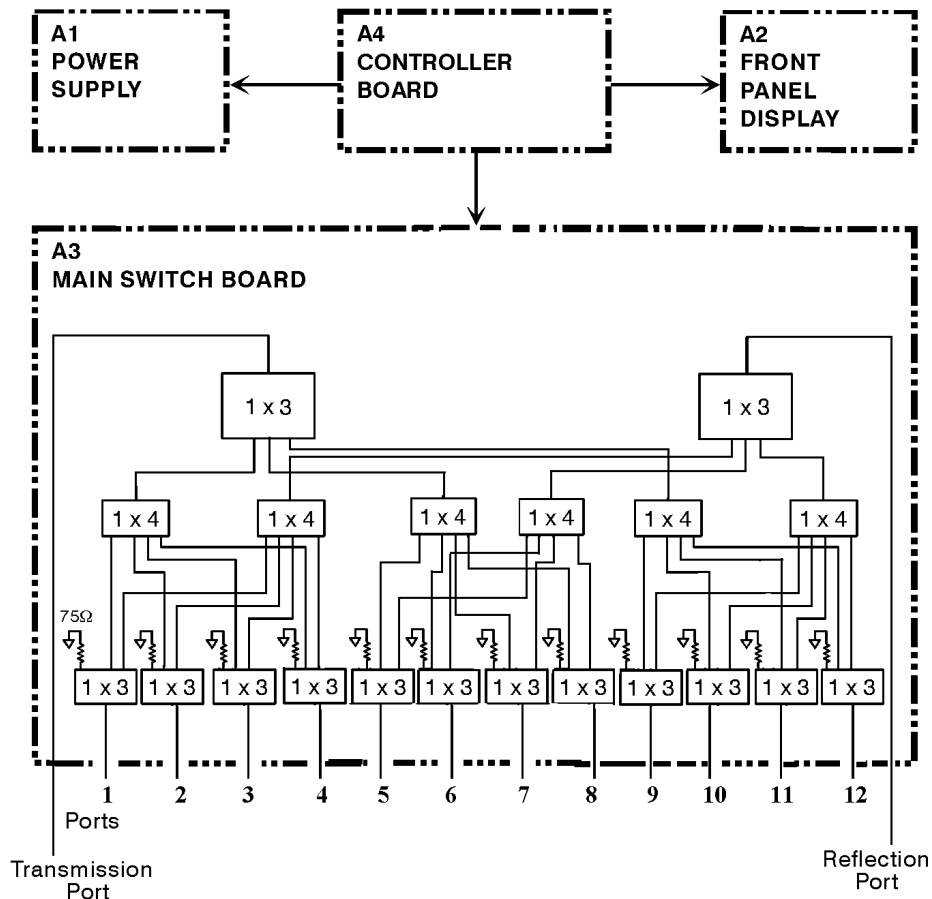
All switches are solid-state PIN diodes which are biased to the necessary switching path. A user interface, through the GPIB and parallel ports, converts the necessary input signals to the control signals, which then control the switching paths.

### A4 Controller Board Theory

The controller board provides the biases that control the states of the switches on the main switch board. The controller board also provides signals to the front panel display that indicate which switching paths have been activated.

### Block Diagram

Figure 13 87075C Option H12 Block Diagram



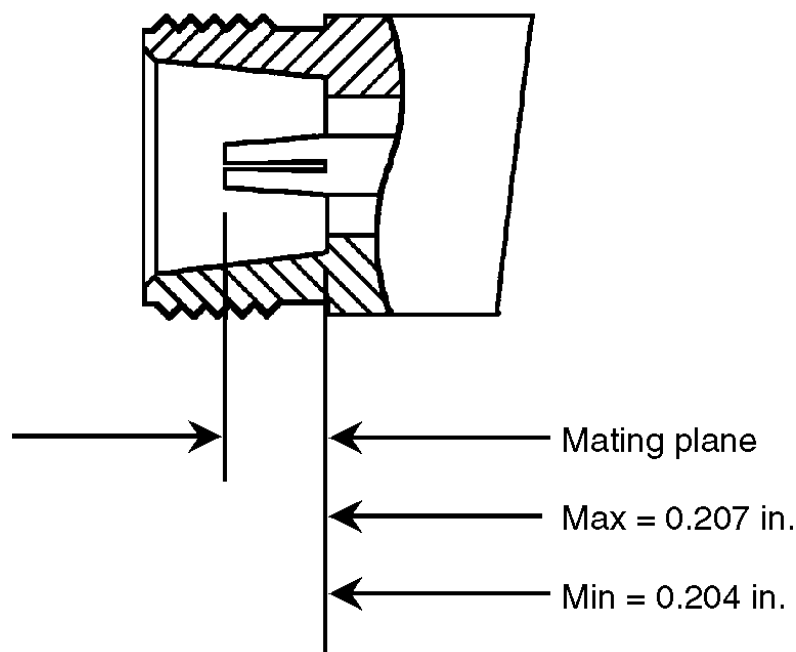
## Connector Replacement

Experience has shown that the female 75  $\Omega$  Type-N connectors on the front panel are subject to damage due to inadvertent mating of 50  $\Omega$  devices. These 75  $\Omega$  connectors are available separately as Agilent part number 08752-60009. However, they are designed to be press-fit into the aluminum front panel. It is generally not possible to do this in the field, since a special press is required. A possible alternative to replacing a damaged connector would be to just replace the center pin components. The three required components are:

Component	Agilent Part Number
Insulator, 75 $\Omega$	5020-8593
Contact, RF Connector, 75 $\Omega$	5021-0912
Center Conductor, 75 $\Omega$	08752-20009

The three components should be connected together using a liquid thread-locking adhesive such as Agilent part number 0470-1590. Re-use any shims and spacers from the connector being replaced. For best results, use a connector gauge to verify pin depth. See [Figure 14](#) for proper pin depth. Add or subtract spacers as required. Spacers and shims are also available from Agilent.

**Figure 14** Physical Description of Type-N Connector



po644 b\_c

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## 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 87075C Option H12 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 copy of the Declaration of Conformity is available upon request, or a copy is available on the Agilent Technologies web site at <http://regulations.corporate.agilent.com/DoC/search.htm>

### Statement of Compliance

This instrument has been designed and tested in accordance with CAN/CSA 22.2 No. 61010-1-04, UL Std No. 61010-1 (Second Edition), and IEC 61010-1 (Second Edition).

## General Safety Considerations

### Cautions

Cautions applicable to this instrument.

---

**CAUTION** The Mains wiring and connectors shall be compatible with the connector used in the premise electrical system. Failure, to ensure adequate earth grounding by not using the correct components may cause product damage, and serious injury.

---

---

**CAUTION** Always use the three prong AC power cord supplied with this product. Failure to ensure adequate earth grounding by not using this cord may cause product damage and the risk of electrical shock.

---

---

**CAUTION** This product is designed for use in Installation Category II and Pollution Degree 2.

---

---

**CAUTION** Verify that the premise electrical voltage supply is within the range specified on the instrument.

---

---

**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.

---

## Servicing

Warnings applicable to this instrument.

- 
- |                |  |
|----------------|--|
| <b>WARNING</b> | <b>Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended. Discard used batteries according to manufacturer's instructions.</b> |
|----------------|--|
- 
- |                |  |
|----------------|--|
| <b>WARNING</b> | <b>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 product is likely to make the product dangerous. Intentional interruption is prohibited.</b> |
|----------------|--|
- 
- |                |   |
|----------------|---|
| <b>WARNING</b> | <b>For continued protection against fire hazard replace line fuse only with same type and rating. The use of other fuses or material is prohibited.</b> |
|----------------|---|
- 
- |                |   |
|----------------|---|
| <b>WARNING</b> | <b>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.</b> |
|----------------|---|
- 
- |                |   |
|----------------|---|
| <b>WARNING</b> | <b>The opening of covers or removal of parts is likely to expose the user to dangerous voltages. Disconnect the instrument from all voltage sources while it is being opened.</b> |
|----------------|---|
- 
- |                |   |
|----------------|---|
| <b>WARNING</b> | <b>This product is designed for use in Installation Category II and Pollution Degree 2.</b> |
|----------------|---|
- 
- |                |  |
|----------------|--|
| <b>WARNING</b> | <b>No operator serviceable parts inside. Refer servicing to qualified personnel.</b> |
|----------------|--|
- 
- |                |   |
|----------------|---|
| <b>WARNING</b> | <b>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.</b> |
|----------------|---|
-

## Regulatory Information

This section contains information that is required by various government regulatory agencies.

### 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.



The instrument has been designed to meet the requirements of IP 2 0 for ingress and operational environment.



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.



### Battery Collection

Do not throw batteries away but collect as small chemical waste, or in accordance with your country's requirements. You may return the battery to Agilent Technologies for disposal. Refer to [“Contacting Agilent” on page 37](#) for assistance.

### 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 Maschinenlaermrrerordnung-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

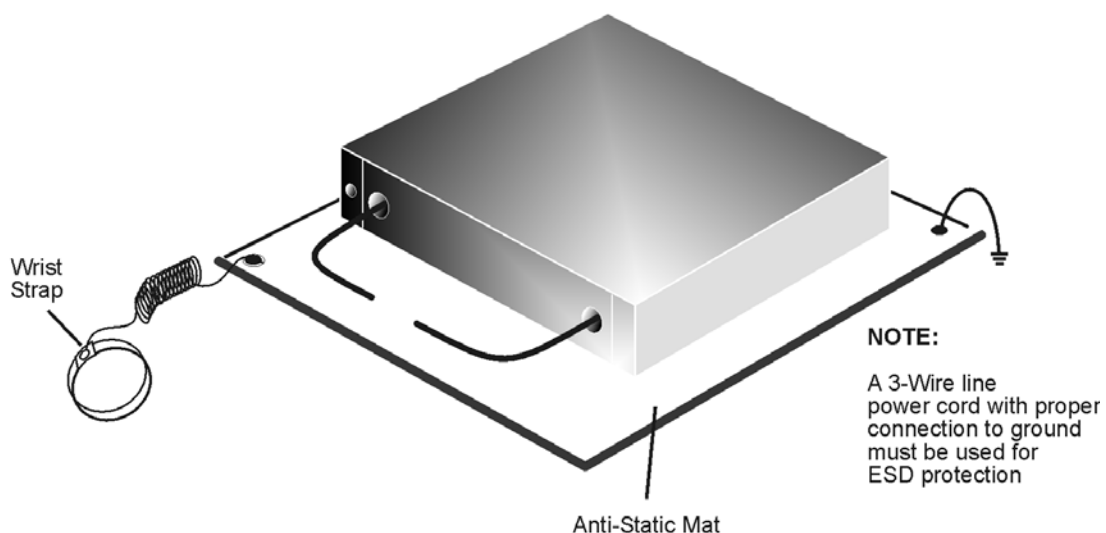
- IEC/EN 61326-1
- CISPR Pub 11 Group 1, class A
- AS/NZS CISPR 11
- This ISM device complies with Canadian ICES-001.  
Cet appareil ISM est conforme a la norme NMB du Canada.

## 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 $\Omega$  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 15 ESD Protection Setup**



ku310b

---

## Agilent Support, Services, and Assistance

### Service and Support Options

The analyzer's standard warranty is a one-year return to Agilent Technologies service warranty.

---

**NOTE** There are many other repair and calibration options available from the Agilent Technologies support organization. These options cover a range of service agreements with varying response times. Contact Agilent for additional information on available service agreements for this product.

---

### Contacting Agilent

Assistance with test and measurements needs and information or finding a local Agilent office are available on the Web 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.

---

### Shipping Your Analyzer to Agilent for Service or Repair

---

**IMPORTANT** Agilent Technologies reserves the right to reformat or replace the internal hard disk drive in your analyzer as part of its repair. This will erase all user information stored on the hard disk. It is imperative, therefore, that you make a backup copy of your critical test data located on the analyzer's hard disk before shipping it to Agilent for repair.

---

If you wish to send your instrument to Agilent Technologies for service or repair:

- Include a complete description of the service requested or of the failure and a description of any failed test and any error message.
- Ship the analyzer using the original or comparable antistatic packaging materials.
- Contact Agilent for instructions on where to ship your analyzer.

