

# Keysight Technologies Z5623A Option K01 Gain Compression Test Set

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User's and  
Service Guide

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## Manual Part Number

Z5623-90040

## Print Date

Edition 6, June 2017

Supersede April 2015

Printed in USA/Malaysia

Published by:  
Keysight Technologies Inc.  
1400 Fountaingrove Parkway  
Santa Rosa, CA 95403

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### WARNING

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**Z5623A-K01**

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## Description

The Keysight Z5623A-K01 gain compression Test Set is designed for use with PNA performance test software. This document guides you through the steps necessary to correctly and safely install the gain compression Test Set.

The Test Set provides the ability to test gain compression on the microwave PNA Network Analyzers. The Test Set is controlled by using an external GPIB controller.

---

## Verifying the Shipment

To verify the contents shipped with your product, refer to the “Box Content List” included with the shipment.

Inspect the shipping container. If the container or packing material is damaged, it should be kept until the contents of the shipment have been checked mechanically and electrically. If there is physical damage refer to [“Contacting Keysight” on page 38](#). Keep the damaged shipping materials (if any) for inspection by the carrier and a Keysight Technologies representative.

**Table 1**          **Content List**

Description	Keysight Part Number	Qty
Power Cord	<a href="#">Figure 9 on page 18</a>	1
Front Handle Kit	5063-9226	1
Rack Mount Kit	5063-9232	1
User’s and Service Guide	Z5623-90040	1

## Electrical and Environmental Requirements

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 115 V or 230 V.

Ensure that the available ac power source meets the following requirements:

- 100/120 V 30 Watts
- 220/240 V 40 Watts
- 50/60 Hz

### 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.

**Table 2** Operating Environment

Temperature	
Operation	0 °C to 55 °C (32 °F to 131 °F)
Storage	-40 °C to +70 °C (-104 °F to +158 °F)
Measurement Calibration	20 °C to 26 °C (68 °F to 79 °F)
Performance Verification	Temperature must be within 1 °C (1.8 °F) of the temperature at which the measurement calibration was performed.
Pressure Altitude (Operation or Storage)	0 to 3,000 meters (~ 10,000 feet)

### WARNING

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

Verify that the power cable is not damaged, and that the power source outlet provides a protective earth ground contact. Note that [Figure 3 on page 5](#) depicts only one type of power source outlet. Refer to [Figure 9 on page 18](#) to see the different types of power cord plugs that can be used with your Test Set.

**Table 3 Cabinet Dimensions**

Item	Dimensions/ Weight
Height	17.8 cm (7.02 in)
Width	42.5 cm (16.75 in)
Depth	50 cm (19.7 in)
Weight	9 kg (19.85 lb)
Shipping Weight	20 kg (44.10 lb)

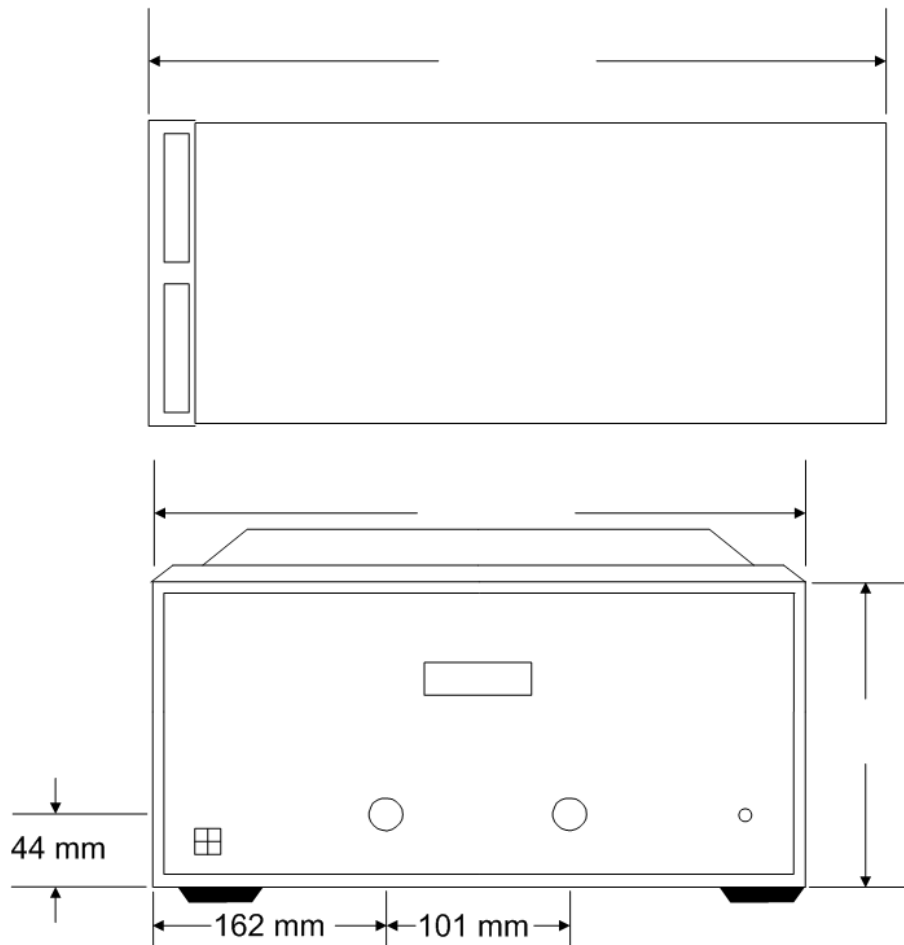
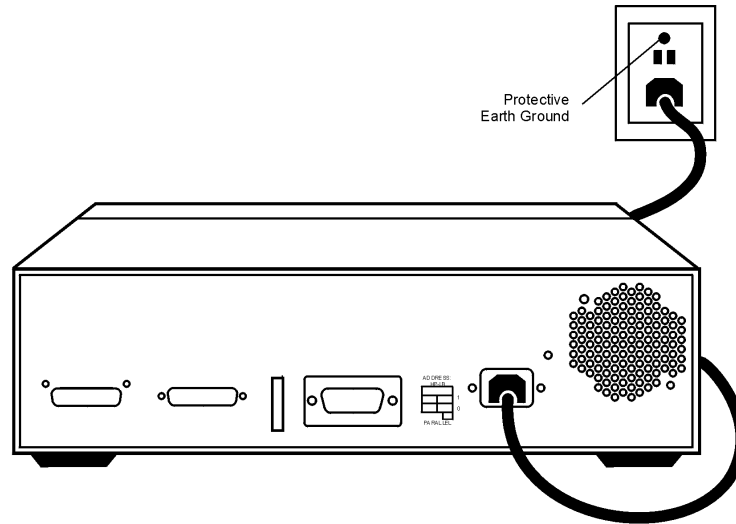
**Figure 1 Physical Dimensions**



Figure 2 Protective Earth Ground

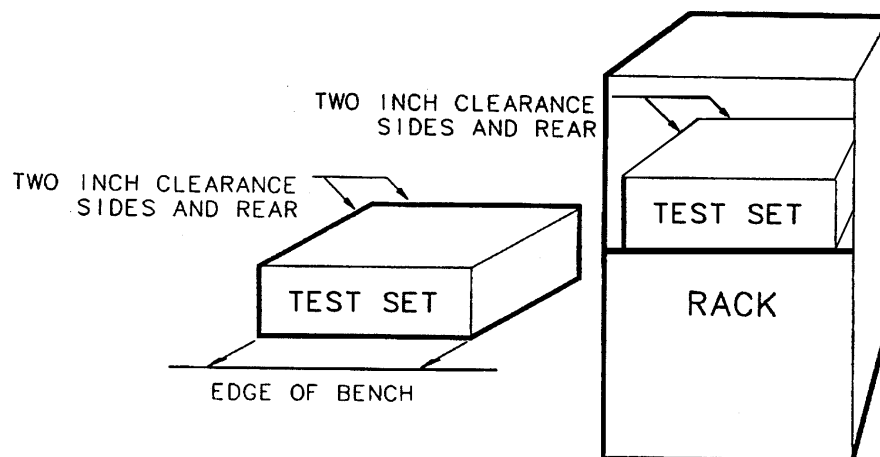


Ventilation Requirements: When installing the instrument in a cabinet, the convection into and out of the instrument must not be restricted. The ambient temperature (outside the cabinet) must be less than the maximum operating temperature of the instrument by 4 °C for every 100 watts dissipated in the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

**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.

Figure 3 Ventilation Clearance Requirements



## Performance Characteristics

**Table 4 Z5623A-K01 Performance Characteristics**

Parameter Range	Characteristics
Frequency Range	45 MHz to 50 GHz
Gain (all Atten's = 0 dB):	
45 MHz to 10 GHz	$\geq +5$ dB
10 to 30.GHz	$\geq +9$ dB
30 to 40 GHz	$\geq +10$ dB
40 to 45 GHz	$\geq +15$ dB
45 to 50 GHz	$\geq +18$ dB
Output Match (Output Atten = 0 dB):	
45 MHz to 35 GHz	$\leq -10$ dB
35 to 50 GHz	$\leq -9$ dB
Input Power Damage Level	$>+20$ dBm ( $\pm 10$ Vdc <sub>max</sub> )

## Connecting and Turning on the Test Set

The Z5623A-K01 is designed to be placed below the PNA network analyzer.

1. Connect the Test Set to the PNA using two 2.4 mm 50  $\Omega$  jumper cables as shown in [Figure 4](#).
2. Install a GPIB cable (Keysight part number 10833D) from the rear panel on the Test Set to the rear panel of the PNA. After the proper 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.

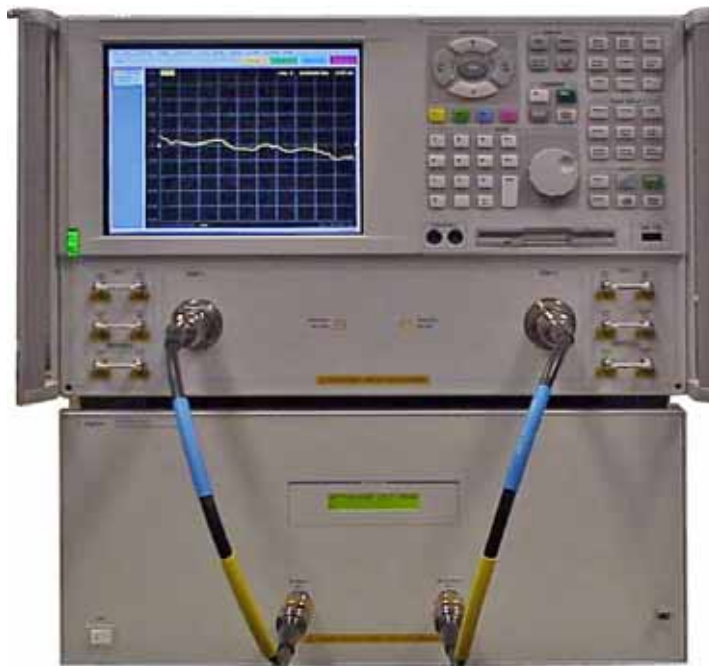
### NOTE

For accurate, repeatable measurement, allow the Test Set warm up for at least 30 minutes. For the most stable and accurate measurements leave the Test Set turned on at all times.

**Table 5** Cable Orientation E8364A

Description	Keysight Part Number	Network Analyzer Connections
RF Input	85133-60002 or 85133-60016	Port 1
RF Output	85133-60002 or 85133-60016	Port 2

**Figure 4** System Setup

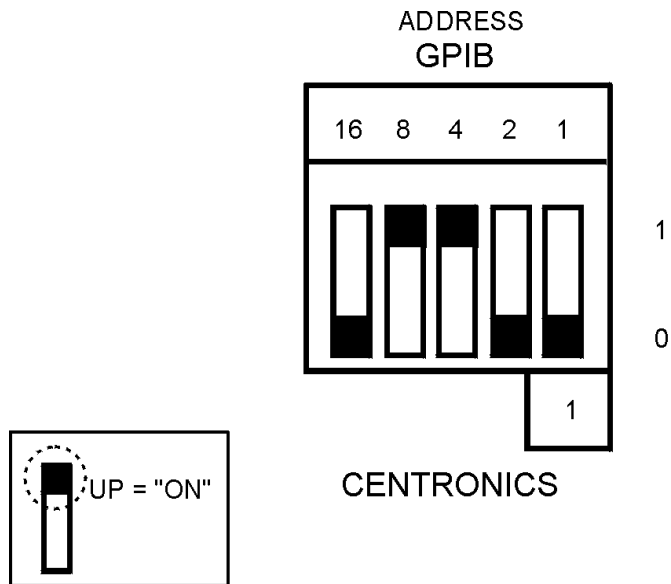


## Setting the Test Set Address Switch

The Test Set is shipped with the GPIB address set to 12 as shown in [Figure 5](#). Refer to ["Controlling the Test Sets and Making Measurements" on page 9](#).

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.

Figure 5 Address Switch



## Controlling the Test Sets and Making Measurements

The Keysight Z5623A-K01 is a "slave" instrument. A controller must be used to control the Test Set. There is one way in which the Test Set can be controlled.

- The controller can control the Test Set using GPIB commands via the GPIB connector.

### Computer Control

Address the Z5623A-K01 Test Set directly over GPIB, using a controller to write directly to the Test Set's GPIB port. The following example assumes that the address of the Test Set is 12.

OUTPUT 712;"<command>"

Table 6 Recommended Test Set Commands

Connection Path	GPIB Command	Display Result <sup>1</sup>	Explanatory Remarks	
Range Atten = 0dB	rng0	RNG → □□0	These are "A" display command forms.	
Range Atten = 10dB	rng10	RNG → □10		
Range Atten = 20dB	rng20	RNG → □20		
Range Atten = 30dB	rng30	RNG → □30		
Range Atten = 40dB	rng40	RNG → □40		
Range Atten = 50dB	rng50	RNG → □50		
Range Atten = 60dB	rng60	RNG → □60	Each command updates all three digits of the display.	
Input Atten = 0dB	inp0	INP → □□0		
Input Atten = 10dB	inp10	INP → □10		
Input Atten = 20dB	inp20	INP → □20		
Input Atten = 30dB	inp30	INP → □30		
Input Atten = 40dB	inp40	INP → □40		
Input Atten = 50dB	inp50	INP → □50	Because all three digits are changed for each command, when changing from an "B" display command form to a "A" display command form, the display will be correct after the first command written.	
Input Atten = 60dB	inp60	INP → □60		
Output Atten = 0dB	out0	OUT → □□0		Refer to "Display Examples" on page 11 for more details.
Output Atten = 10dB	out10	OUT → □10		
Output Atten = 20dB	out20	OUT → □20		
Output Atten = 30dB	out30	OUT → □30		
Output Atten = 40dB	out40	OUT → □40		
Output Atten = 50dB	out50	OUT → □50		
Output Atten = 60dB	out60	OUT → □60		
Clears line 2 of Disp	disp_clr			

**Table 6 Recommended Test Set Commands (Continued)**

Connection Path	GPIB Command	Display Result <sup>1</sup>	Explanatory Remarks
Display Test Set Rev.	disp_rev		Same as "idn."
Reset	*rst	100 100 100	Same display at Power Up
Serial Number	sn?	(no drwgs)	Serial number returned over GPIB.
Display Test Set ID (no GPIB response)	idn?		There is no response over the GPIB, just on the Test Set display.

1. □ = blank

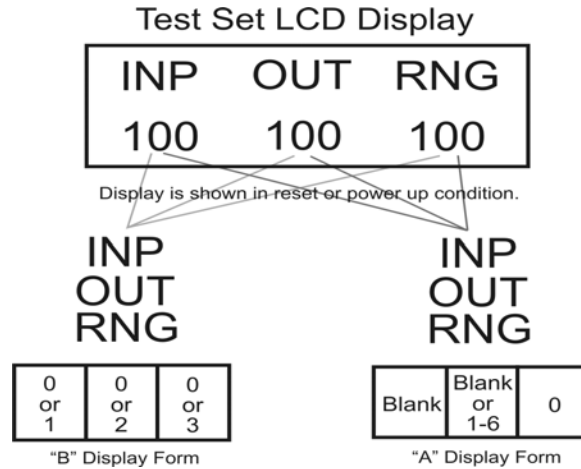
**Table 7 Alternate Test Set Commands**

Connection Path	GPIB Command	Display Result <sup>1</sup>	Explanatory Remarks
Range Atten 10dB In	rng_s10in	RNG → 1xx	
Range Atten 10dB Out	rng_s10out	RNG → 0xx	
Range Atten 20dB In	rng_s20in	RNG → x2x	
Range Atten 20dB Out	rng_s20out	RNG → x0x	
Range Atten 30dB In	rng_s30in	RNG → xx3	
Range Atten 30dB Out	rng_s30out	RNG → xx0	These are "B" display command forms.
Input Atten 10dB In	inp_s10in	INP → 1xx	Each command updates only one digit of the display.
Input Atten 10dB Out	inp_s10out	INP → 0xx	
Input Atten 20dB In	inp_s20in	INP → x2x	Because only one digit is changed for each command, when changing from a "A" display command form to an "B" display command form, the display may not be correct until all three digits have been written.
Input Atten 20dB Out	inp_s20out	INP → x0x	
Input Atten 30dB In	inp_s30in	INP → xx3	
Input Atten 30dB Out	inp_s30out	INP → xx0	
Output Atten 10dB In	out_s10in	OUT → 1xx	Refer to "Display Examples" on page 11 for more details.
Output Atten 10dB Out	out_s10out	OUT → 0xx	
Output Atten 20dB In	out_s20in	OUT → x2x	
Output Atten 20dB Out	out_s20out	OUT → x0x	
Output Atten 30dB In	out_s30in	OUT → xx3	
Output Atten 30dB Out	out_s30out	OUT → xx0	

1. x = any visible digit

### Display Examples

The commands given in [Table 6 on page 9](#) are generally recommended because the displayed result is more intuitive.



The following table demonstrates the effects of various commands. Command sequence may affect the display result.

Display Command Form (A/B)	Command	Display		
		INP	OUT	RNG
B	*rst (or power on)	100	100	100
B	rng_s10in	100	100	100
B	inp_s30in	103	100	100
A	rng0	100	100	0
A	inp60	60	100	0
A	out30	60	30	0
B	inp_s10in	160	30	0
B	inp_s30in	163	30	0
B	inp_s20out	103	30	0

### Serial Number Command

To identify the Test Set's serial number, send the following commands:

```
OUTPUT 712;"sn?"
ENTER 712;Sn$
DISP Sn$
```

This command will return a 10 digit serial number.

### Reset Command

```
OUTPUT 712;"*rst"
```

When the Reset command (\*rst) is sent, the Test Set is set to the default state, which sets the input, output, and range attenuators to 10 dB. The display will be: 100 100 100. This same condition exists for power-up.

### Switch Count Commands

Refer to the Z5623A-K01 block diagram, [Figure 10 on page 30](#) for the switch paths. To read the individual switch count, send the following command:

```
Output 712;"sw51?"
```

The example above illustrates the command for switch 51 only. This command returns a value which indicates the number of times the particular switch has been addressed and switched. To enter additional commands, refer to [Table 8](#).

**Table 8**      **Switch Count Commands**

Switch Number	Attenuator Section	GPIB Command
S50	Range 30 dB section	sw50?
S51	Range 20 dB section	sw51?
S52	Range 1 0dB section	sw52?
S53	Output 30 dB section	sw53?
S56	Output 10 dB section	sw56?
S57	Output 20 dB section	sw57?
S75	Input 20 dB section	sw75?
S76	Input 30 dB section	sw76?
S77	Input 10 dB section	sw77?



## 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.

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 by HplibOpen.
```

**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$(max.len%)
pibEoi(hHpib;7,0) 'disable EOI.
HpibEol(hHpib;7,"",0) 'disable EOL
HpibOutputs (hHpib;712,info$,length%) 'send command to Test Set.
HpibEnters(hHpib%,712,infi$,max.len%) 'get data from Test Set.
HpibEol(hHpib;7,chr$(13)+chr$(10),2) 're-enable EOL and set to chr$(13)+chr$(10).
HpibEoi(hHpib;7,1,) 're-enable EOI hHpib specifies the handle returned by HpibOpen.

```

**NOTE**

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

**HPVEE**

If you are using HPVEE, be sure to set the Direct I/O in the Advance Device Configuration so the Read Terminator and Write EOL Sequence is set to "\n". In the I/O Transaction make sure 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 "\n," to all commands for example, \*rst\n.

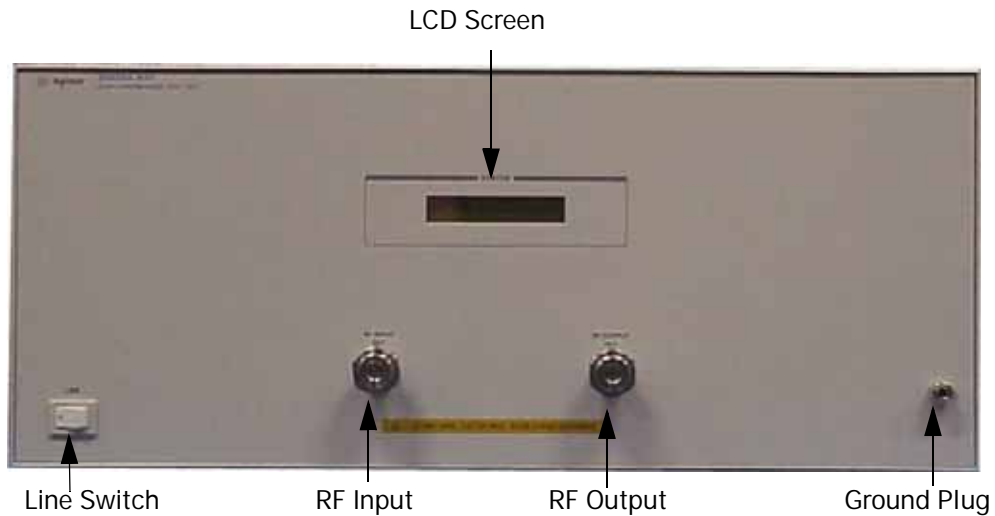
**Read Commands:**

The Test Set returns data terminated by \r\n.

---

## Front and Rear Panel Features

Figure 6 Front Panel



### Active LED

- When the Test Set power switch is On and is connected and addressed by a PNA, the LED is On (illuminated).
- The LED is Off (not illuminated) when the Test Set power switch is not addressed by a PNA.

### Line Switch

- – Off
- | – ON (Active LED On)

### Ground Connector

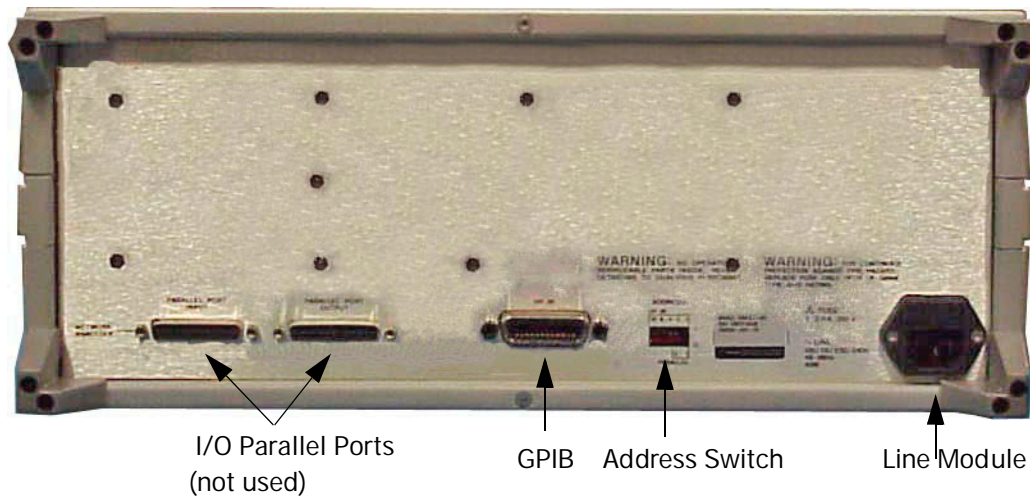
The ground connector provides a convenient front panel ground connection for a standard banana plug.

#### CAUTION

Do not input more than + 20 dBm or  $\pm$  10 Vdc to these ports, internal damage may occur.

---

Figure 7 Rear Panel



## GPIB Controller

This connector allows the Test Set to be connected directly to a controller.

## Address Switch

The address switch sets the GPIB of the Test Set. Refer to [Figure 5 on page 8](#).

## Line Module

The line module contains the power cable receptacle and the line fuse. The line module is an autoranging input and is designed to be used with an ac power source with a nominal voltage of either 115 V or 230 V.

## 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 9 on page 18](#) for power cables part numbers, or contact ["Keysight Support, Services, and Assistance"](#) on [page 38](#) for further information.

### 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 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.

---

**Available Fuses**

- Fuse (F 3 A/250V, 2110-0780) UL listed and CSA certified.

**WARNING**

For continued protection against fire hazard replace line fuse only with same type and rating. The use of other fuses or material is prohibited.

---

Figure 8 Line Fuse

**CAUTION**

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

---



















































