MODEL 56100A
SCALAR NETWORK ANALYZER

OPERATION AND PROGRAMMING MANUAL

490 JARVIS DRIVE ● MORGAN HILL, CA 95037-2809

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CAUTION	This indicates a hazardous procedure or danger that could result in light-to-severe injury, or loss related to equipment malfunction, if proper precautions are not taken.

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(Some or all of the following five symbols may or may not be used on all ANRITSU equipment. In addition, there may be other labels attached to products that are not shown in the diagrams in this manual.)

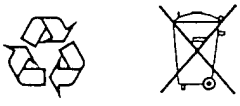
The following safety symbols are used inside or on the equipment near operation locations to provide information about safety items and operation precautions. Ensure that you clearly understand the meanings of the symbols and take the necessary precautions BEFORE operating the equipment.

This indicates a prohibited operation. The prohibited operation is indicated symbolically in or near the barred circle.

This indicates a compulsory safety precaution. The required operation is indicated symbolically in or near the circle.

This indicates warning or caution. The contents are indicated symbolically in or near the triangle.

This indicates a note. The contents are described in the box.



These indicate that the marked part should be recycled.

For Safety

WARNING

Always refer to the operation manual when working near locations at which the alert mark, shown on the left, is attached. If the operation, etc., is performed without heeding the advice in the operation manual, there is a risk of personal injury. In addition, the equipment performance may be reduced.
Moreover, this alert mark is sometimes used with other marks and descriptions indicating other dangers.

or

WARNING

When supplying power to this equipment, connect the accessory 3-pin power cord to a 3-pin grounded power outlet. If a grounded 3-pin outlet is not available, use a conversion adapter and ground the green wire, or connect the frame ground on the rear panel of the equipment to ground. If power is supplied without grounding the equipment, there is a risk of receiving a severe or fatal electric shock.

Repair

WARNING

This equipment can not be repaired by the operator. DO NOT attempt to remove the equipment covers or to disassemble internal components. Only qualified service technicians with a knowledge of electrical fire and shock hazards should service this equipment. There are high-voltage parts in this equipment presenting a risk of severe injury or fatal electric shock to untrained personnel. In addition, there is a risk of damage to precision components.

WARNING

Use two or more people to lift and move this equipment, or use an equipment cart. There is a risk of back injury, if this equipment is lifted by one person.

DECLARATION OF CONFORMITY

Manufacturer's Name: ANRITSU COMPANY

Manufacturer's Address: Microwave Measurements Division
490 Jarvis Drive
Morgan Hill, CA 95037-2809
USA

declares that the product specified below:

Product Name: Scalar Network Analyzers

Model Number: 56100A

conforms to the requirement of:

EMC Directive 89/336/EEC as amended by Council Directive 92/31/EEC & 93/68/EEC
Low Voltage Directive 73/23/EEC as amended by Council directive 93/68/EEC

Electromagnetic Interference:

Emissions:	CISPR 11:1990/EN55011:1991 Group 1 Class A
Immunity:	IEC 1000-4-2:1995/prEN50082-1:1995 - 4kV CD, 8kV AD IEC 1000-4-3:1993/ENV50140:1994 - 3V/m IEC 1000-4-4:1995/prEN50082-1:1995 - 0.5kV SL, 1kV PL IEC 1000-4-5:1995/prEN50082-1:1995 - 0.5kV - 1kV LN 0.5kV - 1kV NG 0.5kV - 1kV GL

Electrical Safety Requirement:

Product Safety:	IEC 1010-1:1990 + A1/EN61010-1:1993

Jon Blasi
Manager of Corporate Quality

Morgan Hill, CA

5-SEPT-97
Date

European Contact: For Anritsu product EMC & LVD information, contact Anritsu LTD, Rutherford Close, Stevenage Herts, SG1 2EF UK, (FAX 44-1438-740202)

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General Information

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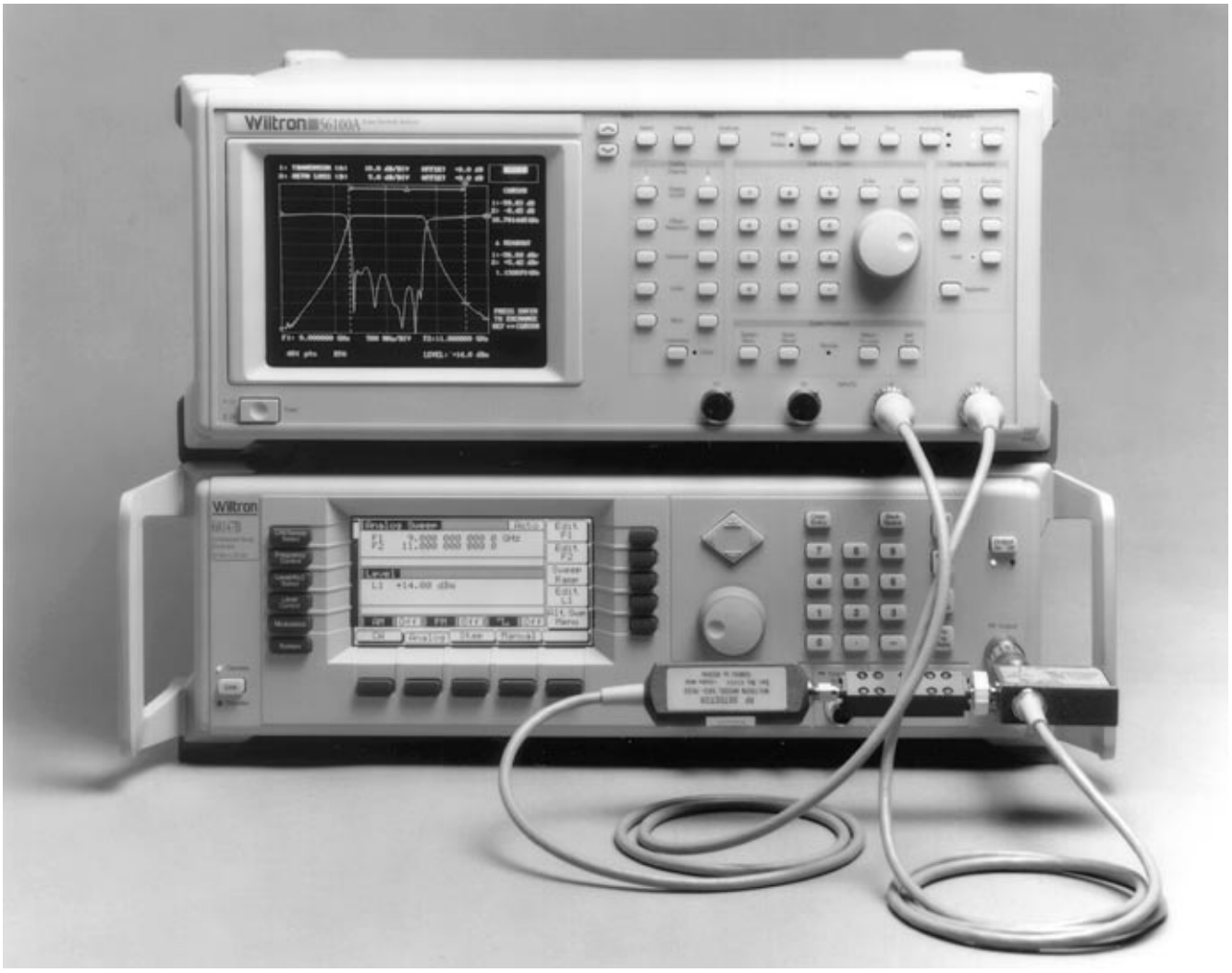


Figure 1-1. *Model 56100A Scalar Network Analyzer Shown With an ANRITSU Model 68147B Synthesized Sweep Generator*

NOTE: ANRITSU Company was formerly known as WILTRON Company.

Chapter 1
General Information

1-1 SCOPE OF THE MANUAL

This manual provides general, installation, operation, measurement, and programming information for the Model 56100A Scalar Network Analyzer (Figure 1-1).

1-2 INTRODUCTION

This chapter provides information about the equipment identification number, performance specifications, and options.

1-3 IDENTIFICATION NUMBER

All ANRITSU instruments are assigned a unique numeric six-digit ID number, such as 201001. (Some models also include an alphabetic prefix, for example: K202222.) The 56100A ID number is affixed to the rear panel. Please use the complete ID number when ordering parts or corresponding with ANRITSU Customer Service department.

1-4 RELATED MANUALS

This manual is one of a two-manual set that consists of an Operating Manual (OM) and a Maintenance Manual (MM). The ANRITSU part number for the Maintenance Manual is 10410-00179.

Both of these manuals are available on CD ROM as Adobe Acrobat™ (*.pdf) files. The files can be viewed using the Adobe Acrobat Reader™, a free program that is also available on the CD ROM. For price and availability, contact ANRITSU Customer Service by phone at 408-778-2000 or via our internet home page at *http:\\www.anritsuwiltron.com*.

1-5 NETWORK ANALYSIS DESCRIPTION

Network analysis consists of characterization through the measurement of the device transmission and impedance characteristics as a function of frequency. It includes the measurement of input match, output match, forward transmission, and reverse transmission. Each of these parameters is a complex quantity consisting of magnitude and phase.

A network analyzer system consists of three main elements: the signal source, the measurement components, and the network analyzer or signal processing element. There are two basic types of network analyzers: scalar and vector. Scalar network analyzers (SNA's) measure only the magnitude of the transmission or reflection signal. Vector network analyzers measure the magnitude and the phase of the transmission or reflection parameter. The 56100A is of the scalar network analyzer type.

1-6

56100A SCALAR NETWORK ANALYZER DESCRIPTION

The Model 56100A, shown in Figure 1-1 (preceding page), is a scalar network analyzer that has a frequency range of 10 MHz to 110 GHz, depending on the external test components and frequency sources used. An external signal source is normally required for operation of the 56100A.

1-7 MEASUREMENT SYSTEM OVERVIEW

With the addition of a programmable signal source, the 56100A becomes an automated transmission, return loss (SWR), and power measurement system. For example, with the appropriate test components and an ANRITSU synthesizer, the 56100A will operate over the 10 MHz to 67 GHz range from a single coaxial test port. Standard and custom waveguide components are available to 110 GHz. The 56100A provides fully annotated displays of test data and measurement parameters as shown in Figure 1-2.

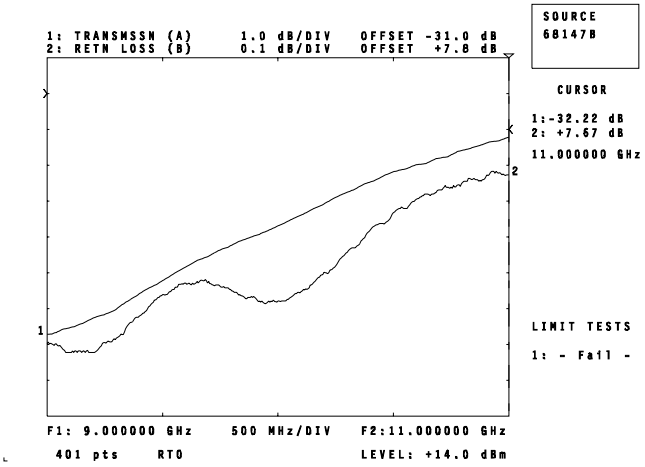


Figure 1-2. *Typical 56100A Annotated Display*

Under internal microprocessor control (no external controller required), the 56100A normalizes and simultaneously displays any two signals that are input on channels A, B, R1, and R2. The same inputs can be displayed as ratios A/R1, A/R2, B/R1, or B/R2. Depending on the external components used, the dynamic range for each channel is typically 76 dB (+16 dBm to –60 dBm). The noise floor is typically less than –62 dBm, providing a 76 dB (or greater) dynamic range for most applications.

Key 56100A features include:

- Automatic measurements and hard copy output without a controller.
- Accurate measurements from 10 MHz to 110 GHz.
- Nine stored setups to eliminate set-up time.
- Cursors, markers, and limit lines to improve productivity.

- Complete, annotated, step-by-step normalization and measurement procedures.
- Four measurement inputs.
- Low cost.

1-8 NORMALIZATION AND MEASUREMENT

In a typical 56100A test setup, the test device is inserted between the SWR Autotester and the detector (refer to Figure 1-3). Detected signals from the SWR Autotester vary in proportion to the reflections, while the detector output varies in proportion to transmission loss or gain. The detector can be used to measure power in dBm.

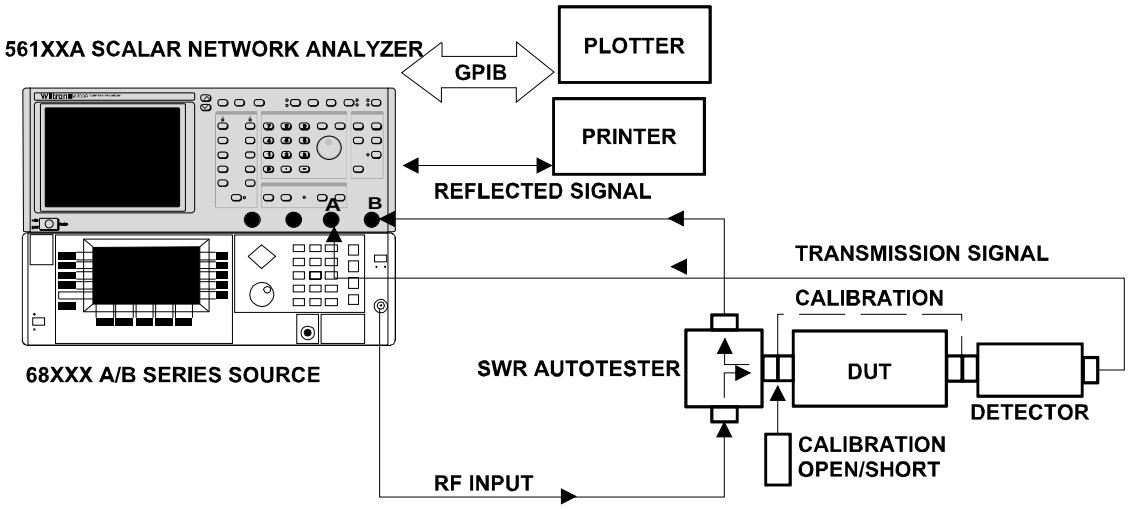


Figure 1-3. *Typical 56100A Test Setup*

During normalization, procedural guidance is automatically provided for transmission and return loss measurements. For a return loss test, a 0 dB reference is established by connecting an open, then a short, to the SWR Autotester test port. The normalization data are taken independent of sensitivity settings at the number of points selected, with 0.002dB resolution, and stored in memory for correction of test data or for recall. Furthermore, an algorithm interpolates between data points to hold interpolated test data accuracy usually to within ±0.1 dB. Once the 56100A has been normalized across a user-selected frequency range, measurements can be made over any portion of the range without renormalization. Set-up time is greatly reduced by storing parameters for up to nine test setups for later reuse.

During measurements, data is taken at 101, 201, or 401 points (user selected) with 0.005 dB vertical resolution on both channels. Typically, test data is updated every 100 ms, allowing “real time” adjustments of the test device.

1-9 56100A OM CURSORS, MARKERS, AND LIMIT LINES

The 56100A has an extensive number of cursor functions available. These cursor functions are in addition to the eight markers available from the ANRITSU Source. The 56100A communicates with the signal source through a dedicated GPIB link and displays an identifier for each marker.

To speed the interpretation of data, complex limit lines can be entered by the user via the front panel keys or via the GPIB interface. Limit lines may have up to ten segments that may slope or step with frequency. Each segment of the limit line is numerically identified during entry.

1-10 56100A OM AVERAGING AND SMOOTHING

When characteristics of the test device vary rapidly with frequency at very low signal levels, the trace can be smoothed by use of the averaging and/or smoothing functions. The smoothing control has three selections: Off, Min, and Max. To maintain the accuracy of the measurement data, smoothing is performed by reducing bandwidth, rather than by averaging adjacent data points in order to preserve measurement detail.

When averaging is selected, 2 to 256 successive traces can be averaged to smooth the trace display. As various combinations of smoothing and averaging are selected, the trace update time is automatically adjusted.

1-11 56100A MEASUREMENT ACCURACY

The return-loss accuracy of the 56100A is largely attributable to the high directivity of the ANRITSU SWR Autotesters. For example, the 560-97A50-1 Autotester with its GPC-7 test port connector has a directivity of better than 40 dB from 10 MHz to 18 GHz. The 560-98K50 has a directivity that exceeds 35 dB up to 18 GHz, 32 dB up to 26.5 GHz, and 30 dB up to 40 GHz. The same unit has a test port match of better than 23 dB up to 26.5 GHz and 15 dB up to 40 GHz. To avoid the use of error-producing adapters, the ANRITSU 560-98C50 Convertable Autotester tests SMA, 3.5 mm or K Connector devices using either male or female test port heads. When the GPC-7 test port is selected, the lowest reflection adapters obtainable are offered in Type N and WSMA, which is optimized for testing SMA devices.

The accuracy of a transmission loss, gain, or power measurement is affected by reflections from the test port, the device under test, and the detector. These errors are minimized by the very low reflections from the ANRITSU SWR autotesters and detectors. See the 54100A-1 Applications Note, ANRITSU Part Number 11410-00159, for more information on return loss accuracy. A free technical seminar is available covering measurement accuracy improvement.

Detector inputs are Auto-zeroed. This provides >70 dB dynamic range by using an AC modulation cycle during the sweep re-trace— thereby eliminating unwanted noise from the measurement. Since the ANRITSU synthesized sweep generators have very low harmonics and spurious, filters and frequency conversion devices such as receivers and mixers are tested with very high accuracy and dynamic range. Excellent RF detector return loss (low SWR) characteristics ensure accurate measurement characterization.

1-12 RECOMMENDED SIGNAL SOURCES

There are many advantages in selecting an ANRITSU synthesizer for use with the 56100A. One advantage is the power sweep. In this mode, the output power is swept over a 15 dB range, which enhances gain compression measurements. In the alternate sweep mode, the 56100A can display frequency response over different frequency ranges and/or power levels.

1-13 STORED TEST CONFIGURATION SETUPS

Set-up time is reduced substantially by storing up to nine front-panel setups, four of which include the associated calibration data. A unique preview feature allows stored setup parameters to be reviewed before recalling or storing a new setup in the memory location. The stored data are backed by a battery with an estimated 10-year life.

1-14 GPIB COMPATIBILITY

The implementation of the IEEE-488 General Purpose Interface Bus (GPIB) is standard on the 56100A and provides remote control of all front-panel functions except power on/off and CRT intensity. This mode of operation is explained and described in Chapter 5, Remote (GPIB) Operation. The high speed data transfer capability of this mode can be used to transfer measurement data to the host computer for further processing; this capability is especially useful in manufacturing environments where archiving of data is required.

1-15 OPTIONS

The 56100A has the following options available:

- Option 1, Rack Mount
- Option 12, Front Panel Cover
- Option 13, Front Mounted Handles
- Option 33, Portable Printer

1-16 ADDITIONAL EQUIPMENT REQUIRED

Transmission measurements require a suitable RF Detector for use with the 56100A. Reflection measurements require an ANRITSU SWR Autotester.

SWR Autotester The 560 Series SWR Autotesters integrate in one small package a broadband, high directivity bridge, a detector, a low reflection test port, a reference termination, and a connecting cable. The output of the SWR Autotester is a detected signal that varies in proportion to reflections from the test device connected to the test port. Optional extender cables can be used without degradation in performance. Part numbers and specifications for ANRITSU 560 series SWR Autotesters are listed in Table 1- 3.

RF Detectors The 560 Series detectors are used for coaxial transmission loss or gain and power measurements and also with coaxial adapters for waveguide reflectometer measurements. Zero-biased Schottky diodes provide –60 dBm sensitivity. Optional extender cables can be used without degradation in performance. Part numbers and specifications for ANRITSU 560 series RF Detectors are listed in Table 1-4.

1-17 ACCESSORIES

RF Components, cables and other accessories used with the 56100A are available from ANRITSU. Cable accessories are listed/referenced in paragraphs 1-9.1 through 1-9.3 below.

Part numbers and specifications for Open/Shorts, Terminations, Adapters, Air Lines, and other RF measurement components used with the 56100A are contained in the ANRITSU catalog. These components are available with the connector types listed below. Contact your ANRITSU representative for further information.

- GPC-7
- K Male
- K Female
- N Male
- N Female
- WSMA Male
- WSMA Female
- V Male
- V Female
- Waveguide SWR Autotesters and Detectors

Extender Cables

Extender cables can be used between the SWR Autotester or detector and the 56100A. Use of these cables allows measurements to be made up to 3000 feet from the 56100A. Standard extension cables are listed below. Contact ANRITSU for other lengths.

Model	Cable Length
800-109	7.6m (25 ft)
800-110	15.2m (50 ft)
800-111	30.5m (100 ft)
800-112	61m (200 ft)

Adapter Cables

The 560-10BX Adapter cable is used to connect to a calibration dc source during the performance/ verification and calibration procedures for the 56100A. The 560-15BX Adapter cable is used with the 56100A in the Volt Mode operating mode. The length of these cables is 1.2m (4 ft). Cable part numbers are:

Model	Connector
560-10BX	BNC Male
560-10BX-1	SMA Male
560-10BX-2	BNC Male
562-15BX	BNC Male

The 806 series adapter cables are used to connect the 56100A to various sweep generators. The 806-7 cable is provided with the 56100A and is used to connect to ANRITSU 6600B, 6700B, 68000B, and 69000A signal sources. Other cables available are:

Model	Usage
806-13	ANRITSU 56100A to HP 8350B, 8340B
806-14	ANRITSU 56100A to HP 8620C

GPIB Cables GPIB cables are used to interconnect the 56100A with an external computer/controller, a plotter, or other instruments connected to the GPIB. The part numbers for standard cable lengths are:

Model	Cable Length
2100-1	1m (3.3 ft)
2100-2	2m (6.6 ft)
2100-4	4m (13.2 ft)
2100-5	0.5m (1.65 ft)

Other Accessories Other accessories for the 56100A include:

- A carrying case for the RF components
- A transit case for the 56100A

1-18 PERFORMANCE SPECIFICATIONS

Performance specifications for the 56100A are provided in Appendix A.

1-19 SYSTEM RF COMPONENTS

The Series 560-9XXXX SWR Autotesters and Series 560-7XXX RF Detectors are the measurement components most commonly used with the 56100A.

For measurements below 3.0 GHz, Series 5400-6XXXX SWR Autotesters and Series 5400-7XXX RF Detectors also may be used with the 56100A.

1-20 560 SERIES SWR AUTOTESTERS (SPECIFICATIONS)

The ANRITSU SWR Autotesters integrate in one small package a broadband, high directivity bridge, a detector, a low reflection test port connector, a reference termination, and a connecting cable. The output of the SWR Autotester is a detected signal, varying in proportion to reflections from the test device connected to the test port.

Optional extender cables can be used with these units without degradation in performance. The precautions for using these components are described in paragraph 1-13. The SWR autotesters in this series operate from 10 MHz to 50 GHz (Tables 1-3 and 1-4). The performance verification procedures for SWR Autotesters are contained in the Series 560 Autotesters Operation and Maintenance Manual (P/N 10100-00028).

- **Accuracy:** See Table 1-4 or 1-5.
- **Maximum Input Power:** 500 mW
- **Cable Length:** 122 cm (4 ft)
- **Insertion Loss:** 6.5 dB nominal from input port to test port.

- **Dimensions:**
  97A, 97N, 97NF: 7.6 x 5.1 x2.8 cm (3 x 2 x 1-1/8 in.)
  98S, SF, 98K, KF: 1.9 x 3.8 x2.9 cm (3/4 x 1-1/2 x 1-3/8 in.)
  98V, VFA: 2.2 x 6.6 x 5.3 cm (7/8 x 2-5/8 x 2-1/8 in.)
  98C50A: 2.2 x 6.6 x 5.3 cm (7/8 x 2-5/8 x 2-1/8 in.)
- **Weight:**
  560-97XXXX Series: 340g (12 oz.)
  560-98XXXX Series: 198g (7 oz.)
  98C50A: 198g (7 oz.)

Table 1-3. *560 Series SWR Autotesters*

Model	Frequency Range (GHz)	Directivity (dB)	Frequency Sensitivity (dB, max)	Impedance (Ohms)	Test Port Connector	Input Connector
560-97A50 560-97A50-1	0.01 – 18	36 40	±1.2	50	GPC-7	N Female
560-97N50 560-97N50-1	0.01 – 18	35 38	±1.5	50	N Male	N Female
560-97NF50 560-97NF50-1	0.01 – 18	35 (<18 GHz) 38 (≥18 GHz)	±1.5	50	N Female	N Female
560-98S50 560-98SF50	0.01 – 26.5	37 (<18 GHz) 36 (≥18 GHz)	±2	50	WSMA Male WSMA Female	Ruggedized K Female
560-98S50-1 560-98SF50-1	0.01 – 26.5	40 (<18 GHz) 38 (≥18 GHz)	±2	50	WSMA Male WSMA Female	Ruggedized K Female
560-98K50 560-98KF50	0.01 – 40	35 (<18 GHz) 32 (18-26.5 GHz) 30 (≥26.5 GHz)	±3	50	K Male K Female	Ruggedized K Female
560-98VA50 560-98VFA50	0.01 – 50	30 (<40 GHz) 30 (<50 GHz)	±4 dB	50	V Male V Female	Ruggedized V Female

Table 1-4. *560-86C50A Convertable SWR Autotester, 10 MHz to 40 GHz*

Accuracy				Directivity	Frequency Sensitivity	Test Port Connector	Input Connector
0.01–2 GHz	0.2–20 GHz	20–26.5 GHz	26.5–40 GHz				
$0.071 \pm 0.02\rho^2$				34	±3 dB	WSMA (m) (f) 3.5 mm (m) (f) K Connector (m) (f)	K Female
	$0.071 \pm 0.025\rho^2$			32	±3 dB		
		$0.11 \pm 0.032\rho^2$		30	±3 dB		
			$0.13 \pm 0.05\rho^2$	26	±3 dB		

1-21 560 SERIES DETECTORS (SPECIFICATIONS)

The 560 Series Detectors are used for coaxial transmission loss or gain and power measurements. Zero-biased Schottky diodes provide a measurement range of –55 dBm to +16 dBm. Field replacement of these detector diodes is possible for most of the 560-7XXX Series RF Detectors (Table 1-5). Optional extender cables can be used without degradation in performance.

With suitable coaxial adapters they may be used for waveguide reflectometer measurements. The precautions for using these component are described in paragraph 1-13. The frequency ranges and input connector types for these detectors are listed below.

- **Maximum Input Power:** 100 mW
- **Cable Length:** 122 cm (4 ft)
- **Dimensions:** 7.6 x 2.9 x 2.2 cm (3 x 1-1/8 x 7/8 in.)
- **Weight:** 170g (6 oz)

Detector Return Loss (560 series):

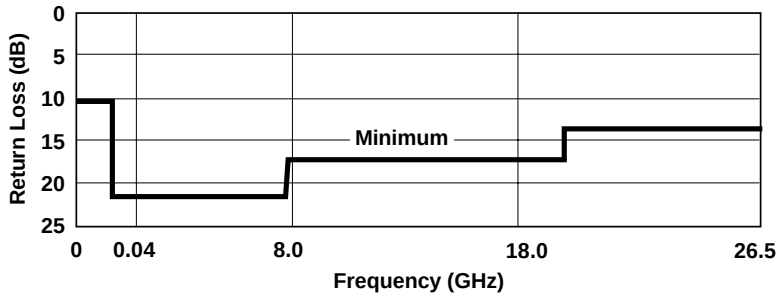


Table 1-5. *560 Series Detectors*

Model	Frequency Range	Impedance (Ohms)	Input Connector	Diode Replacement Module
560-7A50	10 MHz to 18.0 GHz	50	GPC-7	560-A-7219-A
560-7N50B	10 MHz to 20 GHz	50	N Male	560-A-C-24441
560-7S50B	10 MHz to 20 GHz	50	WSMA Male	560-A-C-24441
560-7S50-2	10 MHz to 26.5 GHz	50	WSMA Male	560-A-7219-B
560-7K50	10 MHz to 40 GHz	50	K Male	ND19393

1-22 PRECAUTIONS FOR USE OF SWR AUTOTESTERS AND RF DETECTORS

The 560 Series SWR Autotesters and RF Detectors are high-quality, precision laboratory devices that contain General Precision class Connectors (GPC's). Follow the precautions listed below when handling or connecting these devices. Complying with these precautions will guarantee longer component life and less equipment downtime due to connector or device failure. Such compliance will ensure that RF component failures are not due to misuse or abuse (these two failure causes not covered under the ANRITSU warranty).

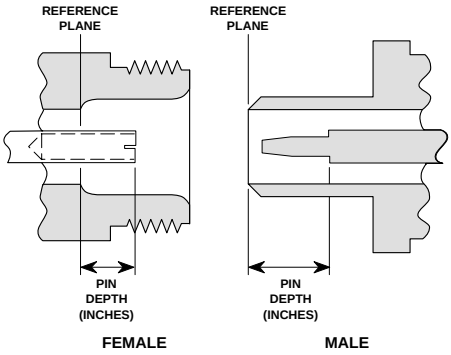


Figure 1-5. *N Connector Pin Depth*

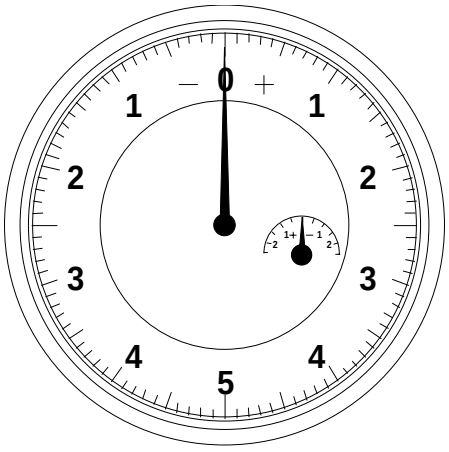


Figure 1-6. *Pin Depth Gauge*

Beware of destructive Pin Depth of Mating Connectors

Based on RF components returned for repair, destructive pin depth of mating connectors is the major cause of failure in the field. When an RF component connector is mated with a connector having a destructive pin depth, damage will usually occur to the RF component connector. A destructive pin depth is one that is too long in respect to the reference plane of the connector (Figure 1-5).

The center pin of a precision RF component connector has a precision tolerance measured in mils (1/1000 inch). The mating connectors of various RF components may not be precision types. Consequently, the center pins of these devices may not have the proper depth. The pin depth of DUT connectors should be measured to assure compatibility before attempting to mate them with SWR Autotester or detector connectors. An ANRITSU Pin Depth Gauge (Figure 1-6), or equivalent, can be used for this purpose.

If the measured connector is out of tolerance in the "+" region, the center pin is too long (see Tables 1-6 and 1-7). Mating under this condition will probably damage the precision RF component connector. If the test device connector measures out of tolerance in the "–" region, the center pin is too short. This will not cause damage, but it will result in a poor connection and a consequent degradation in performance.

Table 1-6. *Allowable Mating Connector Pin Depth*

Test Port Connector Type	Pin Depth (Inches)	Pin Depth Gauge Reading
N-Male	0.207–0.000 +0.003	0.207 +0.000 –0.003
N-Female	0.207 –0.003 +0.000	Same as Pin Depth
GPC-7	+0.000 –0.003	
WSMA-Male	–0.0025 –0.0035	
WSMA-Female	+0.0003 –0.0007	Same as Pin Depth
K-Male, K-Female	+0.000 –0.002	
V-Male, V-Female	+0.000 –0.003	

Table 1-7. *Allowable Mating Connector Pin Depth, 560-98C50A Convertable Autotester*

Test Port Head	Pin Depth (Inches)	Pin Depth Gauge Reading
SMA (f)	–0.0005 to –0.0015	Same as Pin Depth
SMA (m)	–0.0005 to –0.0015	
3.5 mm (f)	–0.006 to –0.008	
3.5 mm (m)	–0.006 to –0.008	
K (f)	–0.0000 to –0.0005	
K (m)	–0.0000 to –0.0005	

Avoid Over-Torquing Connectors

Over-torquing connectors is destructive; it may damage the connector center pin. Always use a connector torque wrench (8 inch-pounds) when tightening GPC-7, WSMA, and K type connectors. (Finger-tight is usually sufficient for Type N connectors). *Never* use pliers to tighten connectors.

Avoid Mechanical Shock

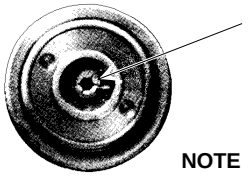
Do not drop or otherwise treat RF components roughly. These devices are designed to withstand years of normal bench handling. However, mechanical shock will significantly reduce their service life.

Avoid Applying Excessive Power

Series 560-9XXXX SWR Autotesters are rated at +27 dBm (0.5 W) maximum input power, and Series 560-7XXX Detectors are rated at +20 dBm maximum input power. Exceeding these input power levels, even for short durations, can permanently damage the internal components of these devices.

Not Disturb Teflon Tuning Washers On Connector Center Pins

The center conductor of many RF component connectors contains a small teflon tuning washer that is located near the point of mating (Figure 1-7). This washer compensates for minor impedance discontinuities at the interface. *Do not disturb this washer.* The location of this washer is critical to the performance of the RF component.



NOTE

The teflon washer is shown on a GPC-7 connector. A similar washer may be installed on any ANRITSU precision connector.

Figure 1-7. *Typical Tuning Washer Usage*

Compensation Washers (WSMA Connectors)

WSMA connectors are optimized for connection to standard SMA connectors. SMA connectors are not used on instruments because they are not designed for repeated connector insertions. Instead, instruments have mechanically compatible connectors that mate to SMA. The WSMA connector presents a slightly inductive interface to the SMA connection so as to cancel capacitance through the SMA's dielectric. Whenever two WSMA connectors are mated, a beryllium copper compensation washer should be inserted between the two connectors near the point of mating (to provide optimum mating depth for this connector combination). The only exceptions are: the WSMA Open/Short, and the RF Output connectors of the 54XXXA and other ANRITSU RF signal sources. Figure 1-8 shows a typical compensation washer installation.

An SWR Autotester with a WSMA test port connector is used to measure a precision WSMA termination. Without the capacitance added by the beryllium copper compensation washer, the termination's return loss would appear to be poor due to the inductance of the mated WSMA-WSMA connectors.

Keep Connectors Clean

The precise geometry that makes possible the RF component's high performance can be easily disturbed by dirt and other contamination adhering to connector interfaces. When not in use, keep the connectors covered.

To clean the connector interfaces, use a clean cotton swab that has been *dampened* with denatured alcohol. Proper techniques for cleaning male and female GPC type connectors are as follows.

Always use denatured alcohol as cleaning solvent. Never use industrial solvent or water, as damage to the connectors may result. Do not use excessive amount of alcohol as prolonged drying of the connector may be required as a result.

- Never put lateral pressure on the center pin of the connector.
- Verify that no cotton or other foreign material remains in the connector after cleaning it.

  If available, use compressed air to remove foreign particles and to dry the connector.
- After cleaning, verify that the center pin has not been bent or damaged.

NOTE

Most cotton swabs are too large to fit into the smaller connector types. In these cases it is necessary to peel off most of the cotton and then twist the remaining cotton tight. Be sure that the remaining cotton does not get stuck in the connector.

1-23 STATIC HANDING PRECAUTIONS

Take precautions to avoid acquiring a static charge of electricity. Refer to Figure 1-9 (page 1-19) for a listing of precaustions.

1-24 RECOMMENDED TEST EQUIPMENT

Table 1-8 is a list of recommended test equipment required for performance verification and calibration procedures and for troubleshooting the 56100A. Each equipment entry includes a USE code that indicates the type of usage for that piece of equipment. These codes are described below.

Code	Type of Testing
C	Calibration
O	Operational Checkout
P	Performance Verification
T	Troubleshooting

1-25 PREVENTIVE MAINTENANCE

Cleaning the rear panel fan filter is the only preventive maintenance required. DO NOT REMOVE THE FAN FILTER FROM THE INSTRUMENT. Use a soft brush to remove dust from the fan filter periodically as required to ensure good air flow.

WSMA connectors are optimized for connection to standard SMA connectors. Whenever two WSMA connectors are mated, a compensation washer should be inserted between the two connectors near the point of mating (to provide optimum mating depth for this connector combination). The only exceptions are: the WSMA Open/Short, and the RF Output connectors of the 56100A and other ANRITSU RF signal sources.

The washer is not necessary when testing devices with SMA connectors.

Step 1 Separate a single WSMA connector compensation washer and trim away the interconnecting tabs.

Step 2 Insert the compensation washer into the opening of the WSMA connector, as shown.

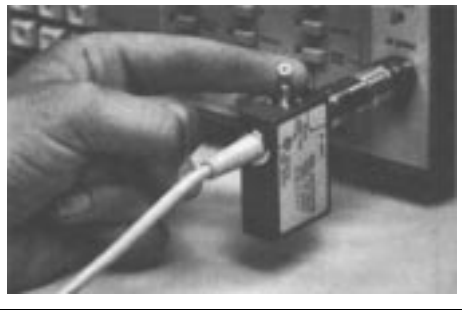


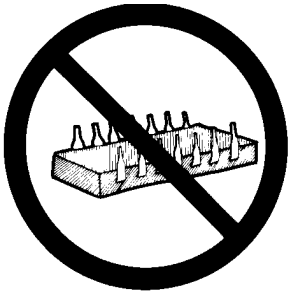
Figure 1-8. *Example for Using Compensation Washer with WSMA Connectors Prior to Measuring a Device with a WSMA Mating Connector.*

Table 1-8. *Recommended Test Equipment*

INSTRUMENT	CRITICAL SPECIFICATION	RECOMMENDED MANUFACTURER/MODEL	USE*
Adaptor Cable	Simulates 560-7 Series detectors	ANRITSU Model 560-10BX	C, P
Adapters (50Ω impedance)	Type N (male) to BNC (male) Type N (female) to BNC (male)	HP1250-0176 HP1250-0082	C, P
Connector Cable	Connects sweep generator signal for 56100A compatibility	ANRITSU 806-7	C, P, O
GPIB Cable	Connects 56100A to 68147B via dedicated bus	ANRITSU 2100-1	C, P, O
RF Detector	0.01 to 20 GHz	ANRITSU Model 560-7N50B	C, P, O
Digital Multimeter	Resolution: 4-1/2 digits (to 20V) *DC Accuracy:* 0.002% + 2 counts *DC Input Impedance:* 10 MΩ *AC Accuracy:* 0.07% + 100 counts (to 20 kHz)	John Fluke Mfg Co. Inc., Model 8840A	C
Oscilloscope	*Bandwidth*: DC to 150 MHz *Sensitivity:* 2 mV *Horiz. Sensitivity:* 50 ns/division	Tektronix, Inc. Model 2445	C, P
Power Meter, with: Power Sensor 50Ω input	*Power Range:* +10 to –55 dBm *Other:* 50 MHz Calibrated Output Frequency Range: 1.0 MHz to 2.0 GHz *Power Range:* –30 to +20 dBm	Anritsu Corp., Model ML4803A Anritsu Corp., Model MA4601A	C, P
Frequency Source	*Frequency Range:* 0.01 to 20 GHz *Power Range: +10 dB to –60 dBm*	ANRITSU Model 681XXB Series ANRITSU Model 683XXB Series	C, P, O
Step Attenuator	*Attenuation Range:* 60 dB, 10 dB/step 0.000 to 18.0 GHz	Hewlett-Packard, Model 8495B	C, P
Voltage Standard	Range: –1.462V to –1.313 mV Accuracy: 0.002% of set value.	John Fluke Mfg Co. Inc., Model 335D	C, P

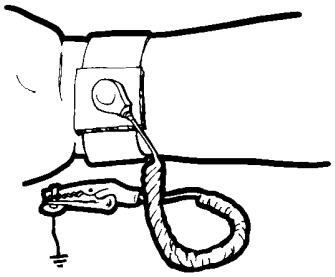
* C = Calibration, P = Performance verification, O = Operational

1. Do not touch exposed contacts on any static sensitive component.



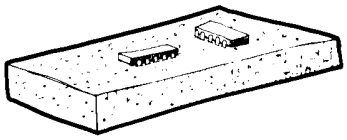
2. Do not slide static sensitive component across any surface.

3. Do not handle static sensitive components in areas where the floor or work surface covering is capable of generating a static charge.

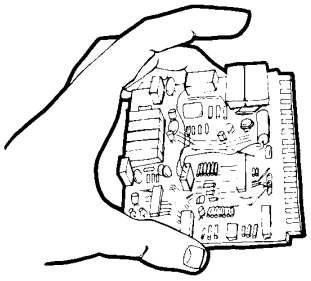


4. Wear a static-discharge wristband when working with static sensitive components.

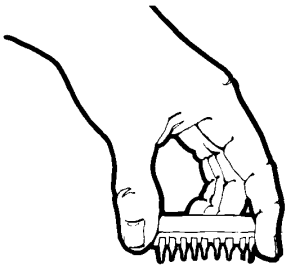
5. Label all static sensitive devices.



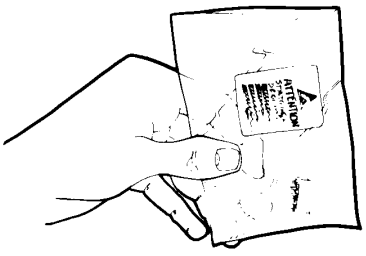
6. Keep component leads shorted together whenever possible.



7. Handle PCBs only by their edges. Do not handle by the edge connectors.



8. Lift & handle solid state devices by their bodies – never by their leads.



9. Transport and store PCBs and other static sensitive devices in static-shielded containers.

10. ADDITIONAL PRECAUTIONS:

- Keep workspaces clean and free of any objects capable of holding or storing a static charge.
- Connect soldering tools to an earth ground.
- Use only special anti-static suction or wick-type desoldering tools.

Figure 1-9. *Static Sensitive Component Handling Procedures*

Chapter 2
Installation

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Chapter 2
Installation

2-1 INTRODUCTION

This section provides information for the initial inspection and preparation for use of the 56100A Scalar Network Analyzer. Information for interfacing the 56100A to the IEEE-488 General Purpose Interface Bus and reshipment and storage information is also included.

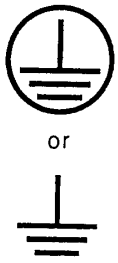
2-2 INITIAL INSPECTION

Inspect the shipping container for damage. If the container or cushioning material is damaged, retain until the contents of the shipment have been checked against the packing list and the instrument has been checked for mechanical and electrical operation.

If the 56100A is damaged mechanically, notify your local sales representative or ANRITSU Customer Service. If either the shipping container is damaged or the cushioning material shows signs of stress, notify the carrier as well as ANRITSU. Keep the shipping materials for the carrier's inspection.

2-3 PREPARATION FOR USE

Preparation for use consists of checking that the rear panel line voltage module is set for the correct line voltage. The voltage selector drum of this module may be set for either 110, 120, 220, or 240 Vac operation. The fuse sizes and part numbers are shown below. The 56100A is intended for Installation Category (Overvoltage Category) II.



WARNING

When supplying power to this equipment, always use a three-wire power cable connected to a three-wire power line outlet. If power is supplied without grounding the equipment, there is a risk of receiving a severe or fatal electric shock.

To minimize radiated emissions, consider connecting the chassis of the 56100A to the chassis of the frequency source being used. Cable B42041 is supplied for this purpose.

Line Voltage Setting	Area	Fuse Rating	Fuse Size	ANRITSU P/N Fuse	ANRITSU P/N Fuse Holder
100/120 Vac	Japan/USA	2A, Antisurge	3 AG	631-62	553-221
220/240 Vac	Europe	1A, Antisurge	5 x 20 mm	631-63	553-240

2-4 GPIB SETUP AND INTERCONNECTION

All functions of the 56100A (except power on/off) can be controlled remotely by an external computer/controller via the IEEE-488 GPIB. The information in this section pertains to interface connections and cable requirements for the rear panel GPIB connector. Refer to Chapter 5 for information about remote operation of the 56100A using the GPIB.

The 56100A GPIB controller operates with any IBM XT, AT, or PS/2 compatible computer/controller equipped with a GPIB control card.

Interface Connector

Interface between the 56100A and other devices on the GPIB is via a standard 24-wire GPIB interface cable. This cable uses a double-sided connector; one connector face is a plug, the other a receptacle. These double-function connectors allow parallel connection of two or more cables to a single instrument connector. The pin assignments for the rear panel GPIB connector are shown in Figure 2-1.

Cable Length Restrictions

The GPIB system can accommodate up to 15 instruments at any one time. To achieve design performance on the bus, proper timing and voltage level relationships must be maintained. If either the cable length between separate instruments or the accumulated cable length between all instruments is too long, the data and control lines cannot be driven properly and the system may fail to perform. Cable length restrictions are as follows:

- No more than 15 instruments may be installed on the bus.
- Total accumulative cable length in meters may not exceed two times the number of bus instruments or 20 meters—whichever is less.

NOTE

For low EMI applications, the GPIB cable should be a fully shielded type, with well-grounded metal-shell connectors.

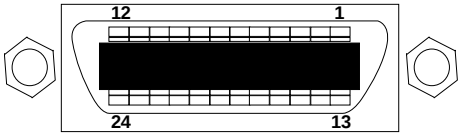
2-5 SYSTEM GPIB INTERCONNECTION

The rear panel GPIB IEEE-488 connector is used to interface the 56100A to an external computer/ controller (or plotter) via a standard GPIB cable. The WILTRONpart numbers for standard GPIB cables of various lengths are listed in the technical data sheet in Appendix A.

GPIB Interface to an External Plotter

The 56100A GPIB interface can be configured to control a suitable external plotter. In this mode of operation, the GPIB is dedicated to this application and only the 56100 A and the plotter are connected to the GPIB.

GPIB IEEE - 488



PIN NO.	FUNCTION/DESCRIPTION	PIN NO.	FUNCTION/DESCRIPTION
1	$\overline{\text{DIO1}}$	13	$\overline{\text{DIO5}}$
2	$\overline{\text{DIO2}}$	14	$\overline{\text{DIO6}}$
3	$\overline{\text{DIO3}}$	15	$\overline{\text{DIO7}}$
4	$\overline{\text{DIO4}}$	16	$\overline{\text{DIO8}}$
5	$\overline{\text{EOI}}$	17	$\overline{\text{REN}}$
6	$\overline{\text{DAV}}$	18	Logic Ground
7	NRFD	19	Logic Ground
8	$\overline{\text{NDAC}}$	20	Logic Ground
9	$\overline{\text{IFC}}$	21	Logic Ground
10	$\overline{\text{SRQ}}$	22	Logic Ground
11	$\overline{\text{ATN}}$	23	Logic Ground
12	Chassis Ground	24	Logic Ground

Figure 2-1. *Pinout for Rear Panel* GPIB *Connector*

Standard GPIB cables are used to interconnect to the plotter.

GPIB Addresses

The 56100A leaves the factory with the default address for the system GPIB interface set to 6 and the external plotter interface default address set to 8. These addresses may be changed using the menus invoked by the front panel System Menu and Return to Local keys. This procedure is explained in Chapter 3.

2-6 PREPARATION FOR STORAGE AND/OR SHIPMENT

The following paragraphs describe the procedure for preparing the 56100A for storage or shipment.

Preparation for Storage Preparing the 56100A for storage consists of cleaning the unit, packing the inside with moisture-absorbing desiccant crystals, and storing the unit in a temperature environment that is maintained between −40 and +70 degrees centigrade (−40 to 156 degrees Fahrenheit).

Preparation for Shipment To provide maximum protection against damage in transit, the 56100A should be repackaged in the original shipping container. If this container is no longer available and the 56100A is being returned to ANRITSU for repair, advise ANRITSU Customer Service; they will send a new shipping container free of charge. In the event neither of these two options is possible, instructions for packaging and shipment are given below.

Use a Suitable Container Obtain a corrugated cardboard carton with a 275-pound test strength. This carton should have inside dimensions of no less than six inches larger than the instrument dimensions to allow for cushioning.

Protect the Instrument Surround the instrument with polyethylene sheeting to protect the finish.

Cushion the Instrument Cushion the instrument on all sides by tightly packing dunnage or urethane foam between the carton and the instrument. Provide at least three inches of dunnage on all sides.

Seal the Container Seal the carton by using either shipping tape or an industrial stapler.

Address the Container If the instrument is being returned to ANRITSU for service, mark the address of the appropriate ANRITSU service center (Table 2-1) and your return address on the carton in one or more prominent locations.

2-6A RACK MOUNT (OPTION 1) INSTALLATION

To install the Option 1 Rack Mount rails, refer to the below-listed procedure.

Step 1. Disconnect the line cord and any other attachments from the instrument.

Step 2. Carefully place the instrument on its top (bottom-side up) on a secure and stable work surface.

Step 3. Using a Phillips screwdriver, remove the two handles or four bumper assemblies (and tilt bail, if installed) from the front of the unit, and the four feet at the rear (Figure 1). Save the screws for later use.

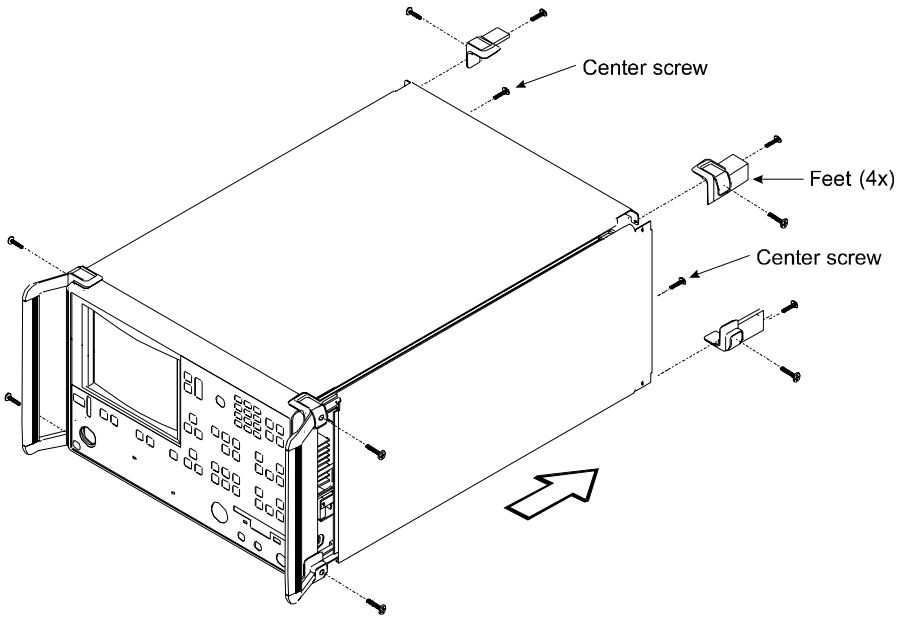


Figure 2-1A. *Side Panel Removal*

Notes:

- The green-headed screws are metric threads and must be used only in the appropriately tapped holes.
- The feet, handles, and bumpers are not reused in this application.

Step 4. Remove the center screw from the rear of the left side cover.

Step 5. Remove the two carrying handle screws (if so equipped) located under the plastic handle ends.

Step 6. Remove the left side cover. The side covers are not reused in this application.

Step 7. Place the left side slide assembly onto the instrument case with the handle towards the front of the instrument (Figure 2).

Step 8.

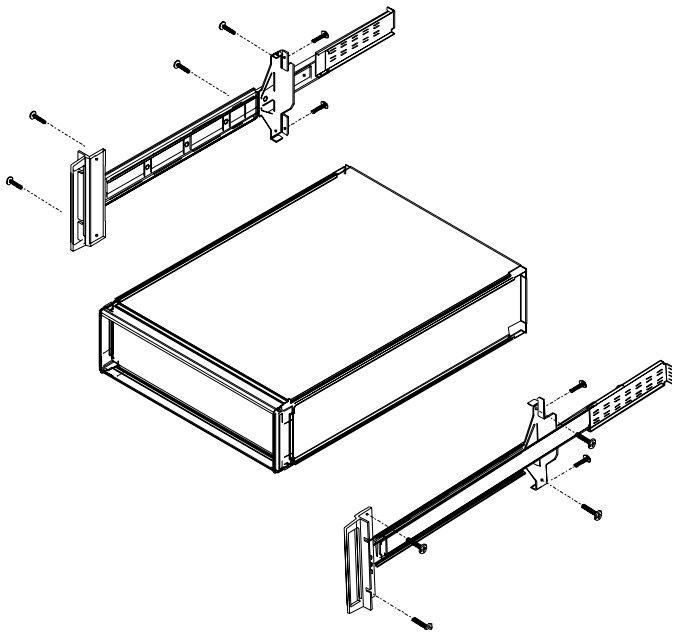


Figure 2-2B. *Side Rail Installation*

Step 9. Insert two green-headed screws through the holes in the slide assembly behind the handle and into the metric tapped holes in the side of the instrument.

Step 10. Insert two green-headed screws through the holes near the rear of the slide assembly and into the metric tapped holes in the side of the instrument.

Step 11. Insert the two SAE thread screws removed from the feet through the 90 degree tabs on the rear of the slide assembly and into the rear panel of the instrument.

Step 12. Remove the center screw from the rear of the right side cover.

Step 13. Remove the right side cover. The side covers are not reused in this application.

Step 14. Place the right side slide assembly onto the instrument case with the handle towards the front of the instrument.

Step 15. Insert two green-headed screws through the holes in the slide assembly behind the handle and into the metric tapped holes in the side of the instrument.

Step 16. Insert two green-headed screws through the holes near the rear of the slide assembly and into the metric tapped holes in the side of the instrument.

Step 17. Insert the two SAE thread screws removed from the feet through the 90 degree tabs on the rear of the slide assembly and into the rear panel of the instrument.

Step 18. This completes the installation of the slide assembly.

WARNING

Use two or more people to lift and move this equipment, or use an equipment cart. There is a risk of back injury, if this equipment is lifted by one person.

Table 2-1. ANRITSU *Service Centers*

UNITED STATES
ANRITSU COMPANY
685 Jarvis Drive
Morgan Hill, CA 95037-2809
Telephone: (408) 776-8300
FAX: 408-776-1744

ANRITSU COMPANY
10 Kingsbridge Road
Fairfield, NJ 07004
Telephone: (201) 227-8999
FAX: 201-575-0092

AUSTRALIA
ANRITSU PTY. LTD.
Unit 3, 170 Foster Road
Mt Waverley, VIC 3149
Australia
Telephone: 03-9558-8177
Fax: 03-9558-8255

BRAZIL
ANRITSU ELECTRONICA LTDA.
Praia de Botafogo, 440, Sala 2401
CEP22250-040, Rio de Janeiro, RJ, Brasil
Telephone: 021-28-69-141
Fax: 021-53-71-456

CANADA
ANRITSU INSTRUMENTS LTD.
215 Stafford Road, Unit 102
Nepean, Ontario K2H 9C1
Telephone: (613) 828-4090
FAX: (613) 828-5400

CHINA
ANRITSU BEIJING SERVICE
CENTER
Beijing Fortune Building
416W, 5 Dong San Huan Bei Lu
Chaoyang qu
Beijing 100004, China
Telephone: 010-501-7559
FAX: 010-501-7558

FRANCE
ANRITSU S.A
9 Avenue du Quebec
Zone de Courtaboeuf
91951 Les Ulis Cedex
Telephone: 016-44-66-546
FAX: 016-44-61-065

GERMANY
ANRITSU GmbH
Grafenberger Allee 54-56
D-40237 Dusseldorf
Germany
Telephone: 0211-67 97 60
FAX: 0211-68 33 53

INDIA
MEERA AGENCIES (P) LTD.
A-23 Hauz Khas
New Delhi 110 016
Telephone: 011-685-3959
FAX: 011-686-6720

ISRAEL
TECH-CENT, LTD
Haarad St. No. 7, Ramat Haahayal
Tel-Aviv 69701
Telephone: (03) 64-78-563
FAX: (03) 64-78-334

ITALY
ANRITSU Sp.A
Roma Office
Via E. Vittorini, 129
00144 Roma EUR
Telephone: (06) 50-22-666
FAX: (06) 50-22-4252

JAPAN
ANRITSU CORPORATION
1800 Onna Atsugi-shi
Kanagawa-Prf. 243 Japan
Telephone: 0462-23-1111
FAX: 0462-25-8379

KOREA
ANRITSU KOREA (AWK)
#901 Daeo Bldg. 26-5
Yeoido Dong, Youngdeungpo
Seoul Korea 150 010
Telephone: 02-782-7156
FAX: 02-782-4590

SINGAPORE
ANRITSU (SINGAPORE) PTE LTD
3 Shenton Way #24-03
Shenton House
Singapore 0106
Telephone: 2265206
FAX: 2265207

SOUTH AFRICA
ETESCSA
1st Floor Montrose Place
Waterfall Park
Becker Road
MIDRAND
SOUTH AFRICA
Telephone: 011-315-1366
Fax: 011-315-2175

SWEDEN
ANRITSU AB
Box 247
S-127 25 Skarholmen
Telephone: (08) 74-05-840
FAX: (08) 71-09-960

TAIWAN
ANRITSU CO., LTD.
8F, No. 96, Section 3
Chien Kuo N. Road
Taipei, Taiwan, R.O.C.
Telephone: (02) 515-6050
FAX: (02) 509-5519

UNITED KINGDOM
ANRITSU LTD.
200 Capability Green
Luton, Bedfordshire
LU1 3LU, England
Telephone: 015-82-41-88-53

Chapter 3
Front Panel Operation

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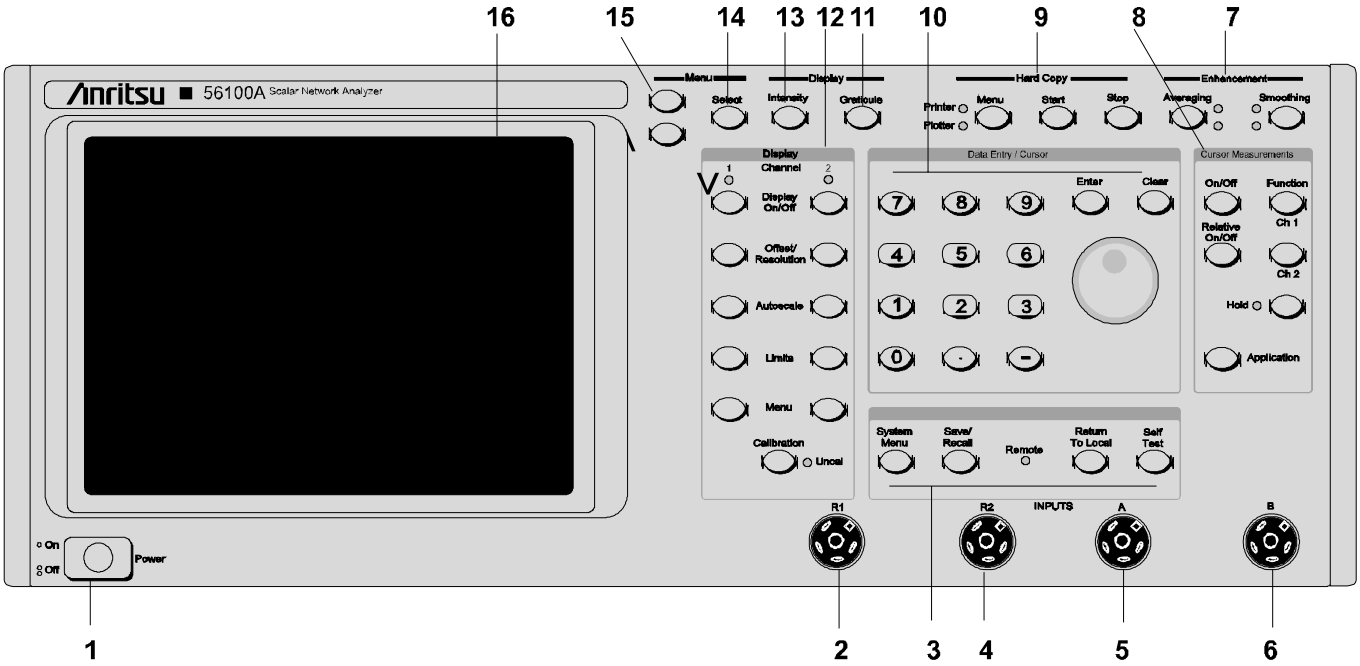


Figure 3-1. *Model 56100A Scalar Network Analyzer Front Panel Controls*

1. Power On/Off: Turns the instrument on and off. When pressed to ON, it initiates an instrument self test.

2. R1 Connector: Provides input for Channel R1.

3. System Functions Keys: Save and recall front panel setups, self test the analyzer, reset the front panel to factory selected settings, set the number of data points, set autozero mode, set GPIB addresses for source and plotter, choose applications-oriented functions. Also allows setting of other configurations such as labelling and ramp output, when not connected to an intelligent sweeper. Also provides Remote indicator and Return to Local GPIB functions.

4. R2 Connector: Provides input for Channel R2.

5. A Connector: Provides input for Channel A.

6. B Connector: Provides input for Channel B.

7. Enhancement Keys and Indicators: Allows for data averaging, and smoothing.

8. Cursor Keys And Indicators: Selection and movement of the Cursor and Relative cursor line on the display and selects the measurement channel.

9. Hard Copy Keys: Initiates a hard-copy printout of measurement results to a printer or plotter in either graphic or tabular form. The MENU switch displays the available options on the CRT.

10. Data Entry Keys and Knob: Enter numerical data. When Cursor is on, knob moves the cursor.

11. Graticule: Turns the display graticule on and off. Tick marks showing where the graticule lines would be are displayed when the graticule is off.

12. Intensity: Adjusts the intensity of the display.

13. Display Keys and Indicators: Control network analzyer and displayed trace functions.

14. Select: Implements the menu option illuminated by the MENU up and down keys.

15. Menu Up and Down Keys: Moves the menu cursor up or down to indicate menu options on the CRT.

16. CRT: Displays Channel A, B, R1, or R2 analyzer parameters, and control and calibration menus.

Chapter 3
Front Panel Operation

3-1 INTRODUCTION

This section describes:

- The operation of the 56100A Scalar Network Analyzer using the control panel controls.
- The controls and rear panel connectors.
- How to make transmission, return loss, and power measurements.
- How to check that the instrument is operating properly.

3-2 CRT DISPLAY

The CRT Display (Figure 3-2) displays the measurement traces, the present settings for the 56100A, cursors, markers, limit lines, menu options, and the frequency source parameters.

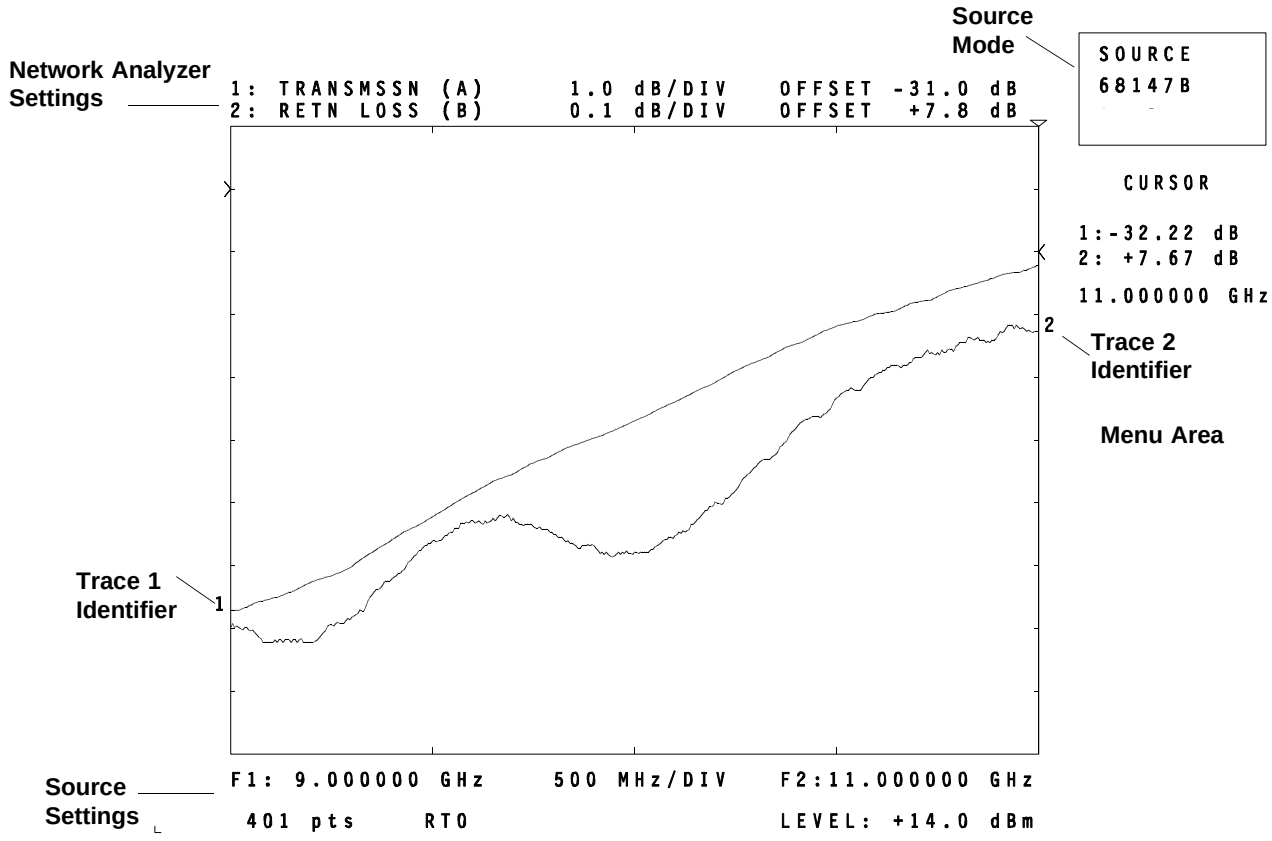


Figure 3-2. *Typical Model 56100A CRT Display*

- *CRT Screen* — Displays Channels 1 and 2 traces as set up in the display channel menu. If the source is alternating settings or frequencies, then trace 1 displays the main setting and trace 2 displays the alternative settings.
- *Network Analyzer Settings* — The two lines labeled "1" and "2" across the top of the screen display the type of measurement selected and the offset and vertical resolution values set for traces 1, 2, or both.
- *Source Information* — The box in the top right side of the screen displays source information. This box displays the source model number, or "ALTERNATE SETUP" when an alternating setup has been selected, or "HOLD" when the instrument is in the HOLD mode.
- *Source Frequency And Power And Horizontal Resolution (graticule) Settings* — The three lines along the bottom of the screen display (1) the source start/stop frequencies; (2) the alternate setup start/stop frequencies (see Table 3-3) or power sweep values if power sweep is selected; and (3) the RF power setting and horizontal resolution (Graticule) of the displayed traces.

  In the normal-sweep mode, the 56100A chooses horizontal resolution and intelligent-graticule divisions for optimum display of the selected frequency-sweep width. In the alternate-setup mode, the graticule is fixed at ten vertical and ten horizontal divisions.

3-3 SYSTEM FUNCTION KEYS AND MENUS

The System Function keys are shown in Figure 3-3. The keys and associated menus are described in the paragraphs 3-4 through 3-7.

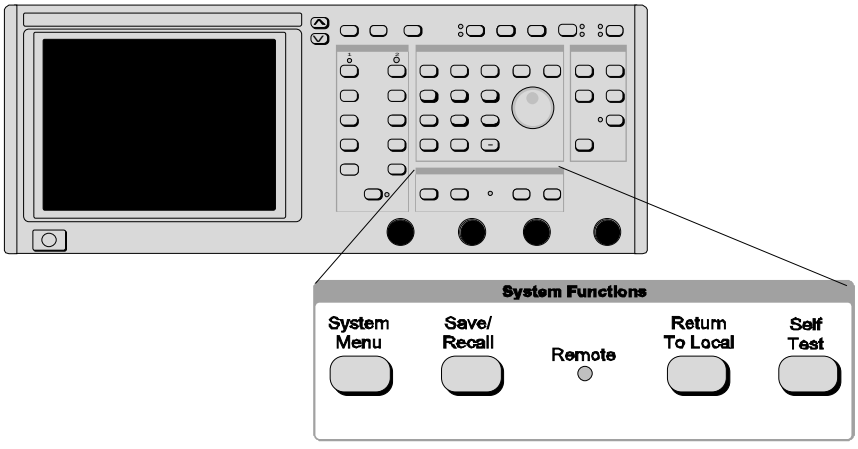


Figure 3-3. System Function *Keys*

3-4 SAVE/RECALL KEY AND MENUS

Pressing this key initiates a series of menus (Figure 3-4) that let you do various save and recall functions. Use the Menu Up/Down switches (Figure 3-1) with the Menu Select switch to make the selection. If you press this key and then decide it is not the key you wanted, use the Data Entry Clear (Figure 3-11) key to cancel the key action. Menu options are described below.

Recall or Save. Either menu option calls up a second menu providing two options.

- FRONT PANEL SETUP ONLY (1 to 9). Recalls a previously stored control panel setting from memory locations 1 thru 9. Or, this option lets you save the current front panel setup into a memory location.

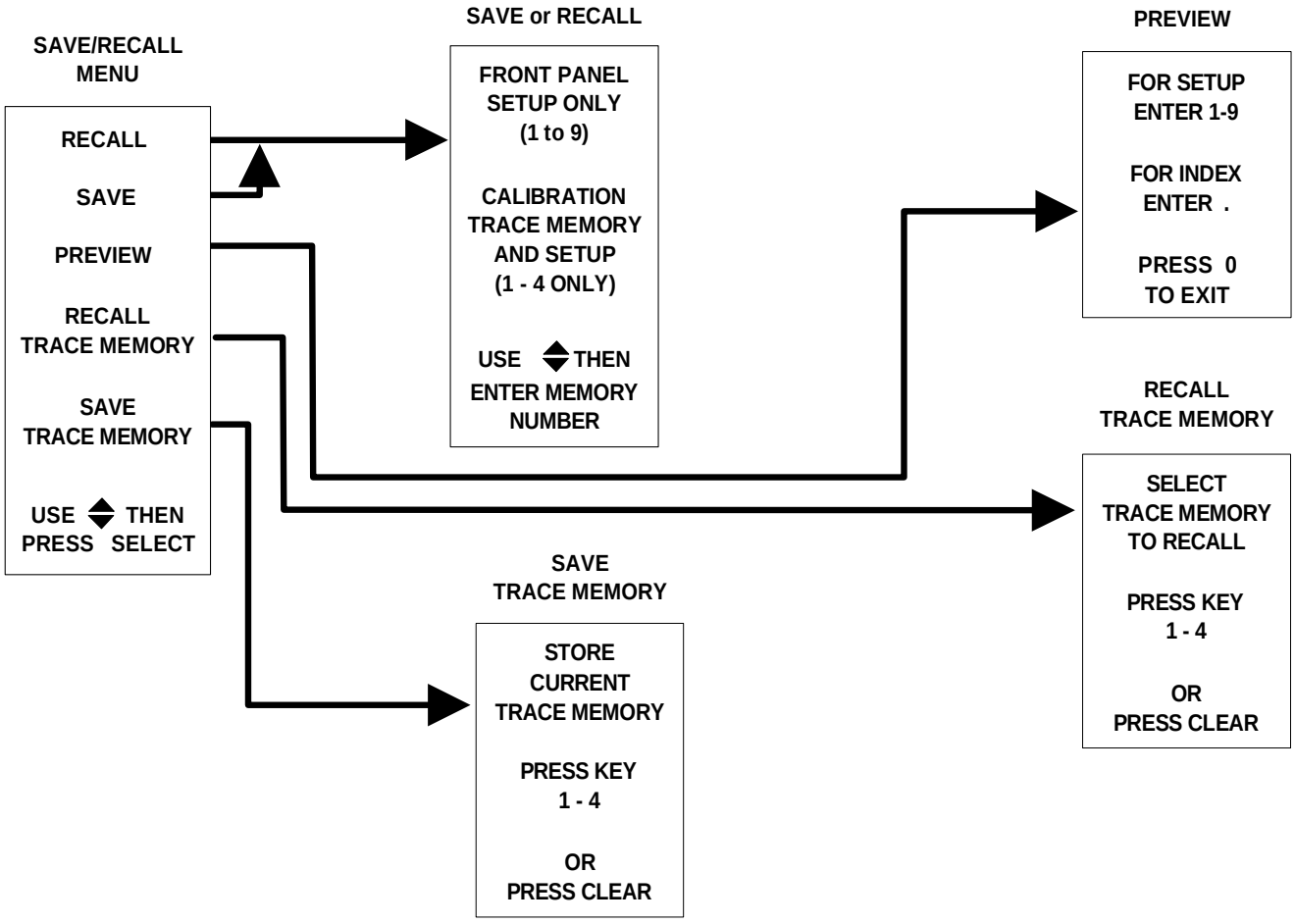


Figure 3-4. *SAVE/RECALL Key Menus*

- CALIBRATION TRACE MEMORY AND SETUP (1 - 4 ONLY). Recalls a previously saved calibration, trace, and setup from memory locations 1-4. Or, the option lets you save the current calibration, trace, and front panel setup into a memory location.

Preview Previews the setups stored in memory locations 1 through 9. With a source connected to the GPIB, this menu selection will also preview the source setup stored in memory locations 1 through 9

Recall Trace Memory Recalls a trace stored using the SAVE TRACE MEMORY option.

Save Trace Memory Saves a trace—such as, Power, Transmission, Return Loss, SWR, or Complex Limits—into a storage array. The storage area used here is separate from that used for the CALIBRATION TRACE MEMORY AND SETUP option discussed above.

3-5 REMOTE INDICATOR AND RETURN TO LOCAL KEY

The GPIB indicator, and key are described below.

Remote *Indicator* Lights when in the remote (GPIB) mode. When lit, a menu providing GPIB status appears at the bottom right side of the screen.

Return To Local *Key* If pressed while in the GPIB mode, the analyzer returns to the local mode. This occurs unless the local lockout (LLO) message has been programmed, in which case the key causes no action. If pressed while in the local mode, the analyzer's GPIB address displays in the MENU area of the screen. It can be altered by entering a new value from the numeric keypad and pressing Enter. The new address is saved on power down and reset.

3-6 SELF TEST KEY

This key initiates a self test of the analyzer and the source, if the latter is connected to the GPIB. If the analyzer functions properly, the screen displays "ALL TESTS PASSED." If the self test reveals a problem, the screen displays a failure message.

3-7 SYSTEM MENU KEY AND MENUS

This key initiates a series of menus (Figure 3-5 and 3-6) that provides various options, as described below.

System Interface. Displays a menu providing three options.

- ON. Turns the dedicated system interface on.
- OFF. Turns the dedicated system interface off.
- ADDRESSES. Displays the current address of the source and plotter or lets you change the address of either.

Configure When not connected to the dedicated (intelligent) system bus, this option lets you control the CRT display to be consistent with frequency source settings.

- RF ON DURING RETRACE. Tells the 56100A that the RF is on or off during sweep retrace.
- YES. Tells the 56100A that the RF is on and displays "RT1" at the bottom of the CRT.
- NO. Tells the 56100A that the RF is off and displays "RT0" at the bottom of the CRT.
- SWEEP MODE. Sets the display for the sweep mode of the frequency source. The source sweep mode (AUTO, CW, MANUAL) has to be selected using the source front panel controls.

NOTE

The setting chosen here must be the same as that chosen for the source; otherwise, the display will not function correctly.

- NORMAL. Sets display for the normal (AUTO) sweep mode.
- CW. Sets display for the non-sweeping CW mode. The displayed trace(s) is updated with no synchronization sent to the source.
- MANUAL. Sets the display for the source MANUAL SWEEP mode. The displayed trace(s) is a frequency sweep on which a cursor moves horizontally coincident with source power level changes.

56100A RAMP OUTPUT. Turns on the 56100A HORIZONTAL (SWEEP RAMP) OUTPUT signal (Index 12, Figure 3-24, page 3-31) and allows control and end-point labeling using the "RAMP OUTPUT CONTROL" option in the "APPLICATIONS" menu (Figure 3-6).

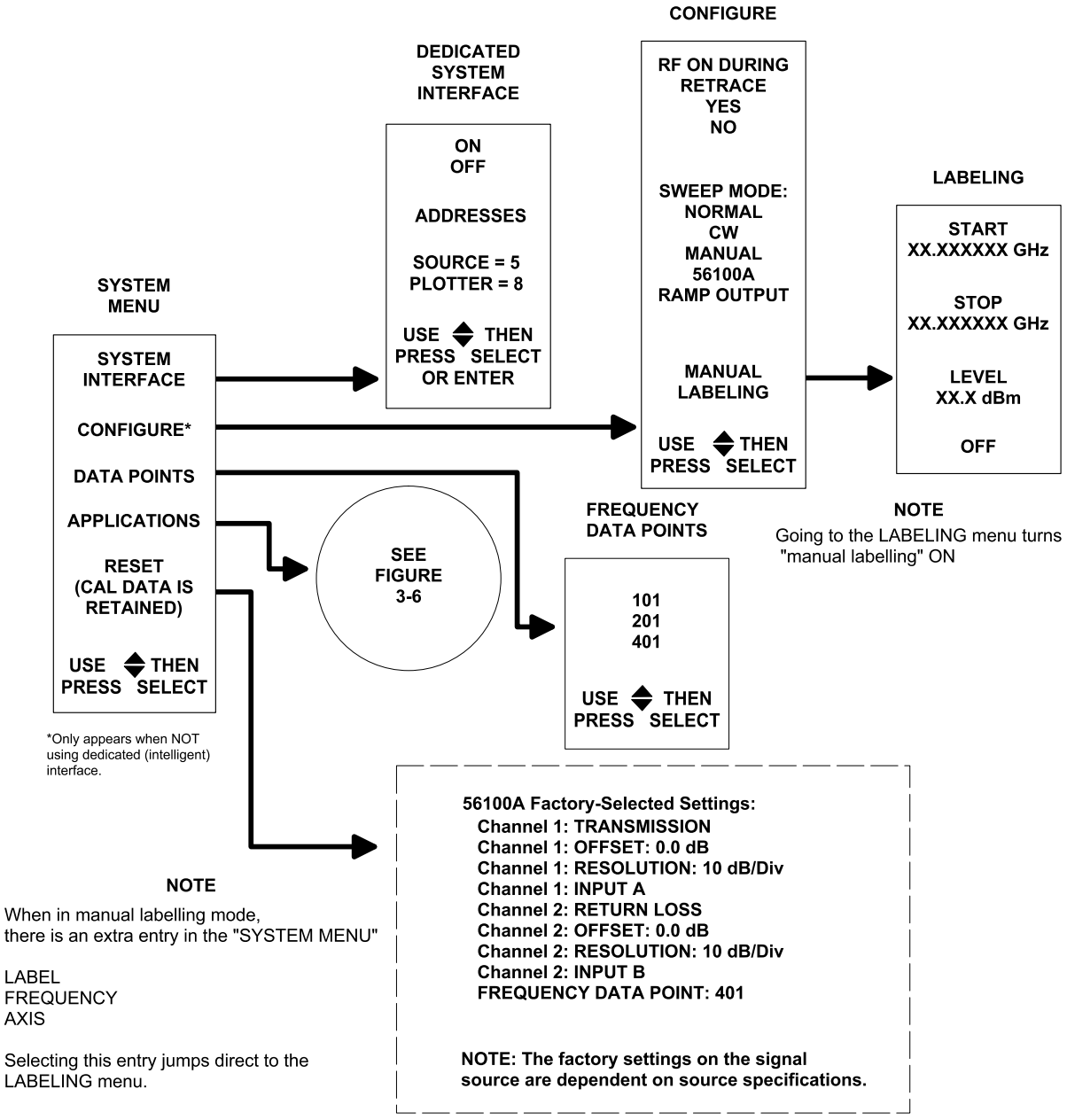


Figure 3-5. System Menu *and Factory-Select Settings*

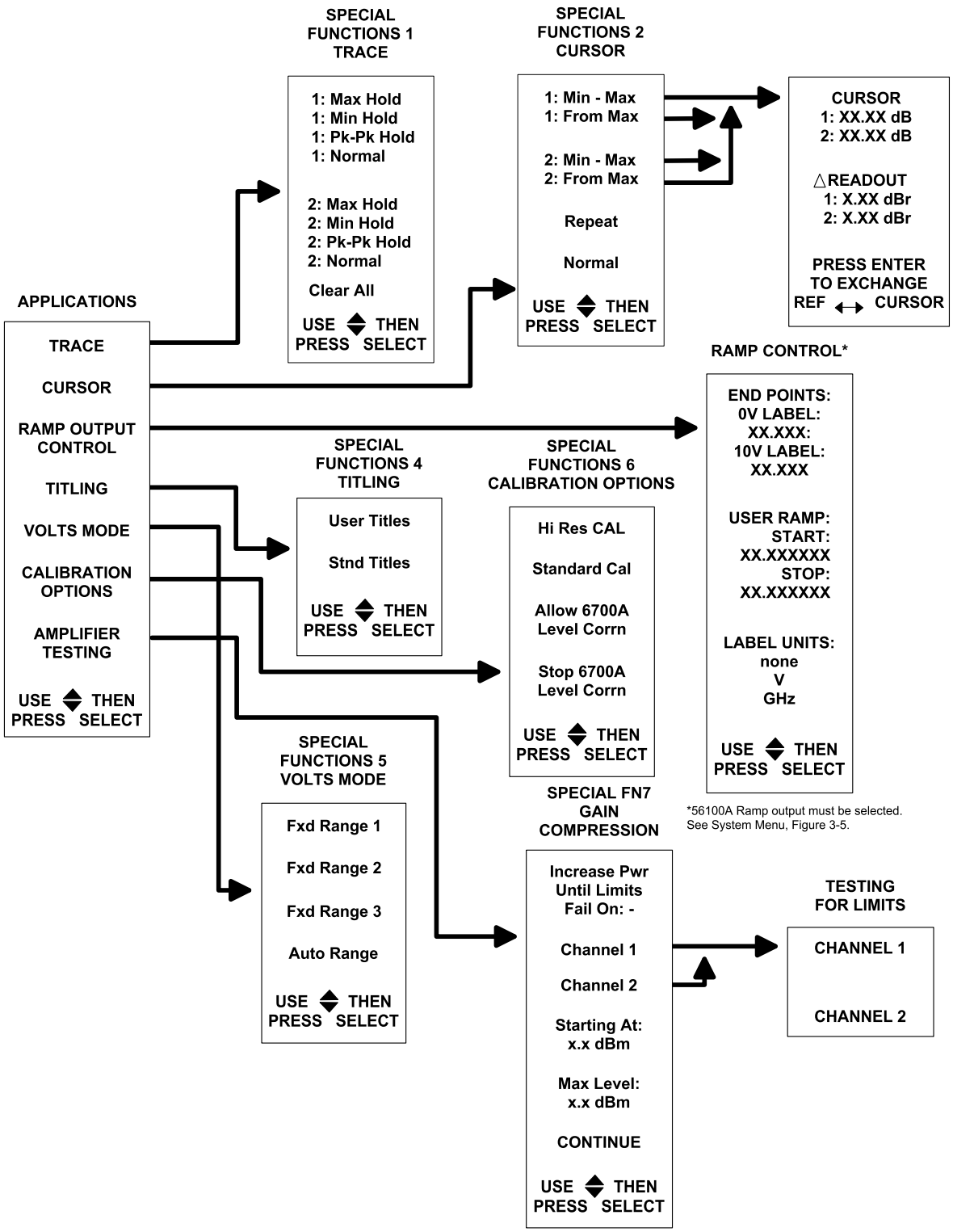


Figure 3-6. APPLICATION *Menu-Option Menus*

- MANUAL LABELING. Displays a menu that lets you apply labels to the display.
- START. Enter the sweep-start frequency.
- STOP. Enter the sweep-stop frequency.
- LEVEL. Enter the power level.
- OFF. Turns off sweep-ramp labeling.

Data Points Displays a menu that lets you select the number of points over which trace data is to be plotted.

Applications. Initiates a series of menus (Figure 3-6) that provides various applications-oriented functions.

TRACE. Displays a menu that provides the following trace-control options.

- 1: OR 2: MAX HOLD. Capture the peak values of trace 1 or 2, and causes "H" to appear at the bottom of the CRT.
- 1: OR 2: MIN HOLD. Capture the minimum values of trace 1 or 2, and causes "H" to appear at the bottom of the CRT.
- 1: OR 2: PK-PK HOLD. Capture the trace 1 or 2 minimum and maximum values from successive sweeps, and causes "H" to appear at the bottom of the CRT.

NOTE
This mode can be used only with a setting of 401 points.

- 1: OR 2: NORMAL. Turns off the capture modes on trace 1 or 2.
- CLEAR ALL. Turns off the capture mode on traces 1 and 2.

CURSOR. Displays a menu that provides cursor-control options.

- 1: OR 2: MIN.-MAX. Cause the cursor on trace 1 or 2 to search for the maximum trace value, and the Relative Cursor on trace 1 or 2 to search for the minimum value.
- 1: OR 2: FROM MAX. Cause the selected search to be made from the maximum value of trace 1 or 2 (for example bandwidth relative to peak).
- REPEAT. Repeats the search.

- NORMAL. Returns 56100A to the single-search mode.

RAMP OUTPUT CONTROL. Displays a menu that lets you control the 56100A sweep ramp signal (Index 12, Figure 3-24, page 3-32).

- END POINTS. Lets you label the display with end-point values (V, GHz, or none, as selected in the LABEL UNITS options).

NOTE

Ramp output mode (Figure 3-5) must be active for this function to work.

- 0V LABEL. Assigns a label to the left side of the display.
- 10V LABEL. Assigns a label to the right side of the display.
- USER RAMP. Lets you control the voltage output of the 56100A sweep ramp. The full range is from 0V to 10V. The settings chosen here interact with those chosen using the END POINTS options. The end points define the labels for the 0V and 10V ends of the user ramp. The user ramp is a portion of this ramp up to and including a full 0V to 10V sweep. For example, with end points of 2 to 12 and a user ramp of from 2 to 7, the 56100A sweep ramp goes from 0V to 5V. Units can be none, V, or GHz, as selected using the LABEL UNITS options.
- START. Sets the starting voltage of the 56100A sweep ramp (between 0V and 10V).
- STOP. Sets the stopping voltage of the 56100A sweep ramp (between 0V and 10V, but must be higher than the start voltage).
- LABEL UNITS. Assigns unit-labels to both END POINTS and USER RAMP options, above.
- NONE. Assigns no unit-labels.
- V. Assigns V (voltage) as unit-labels.
- GHz. Assigns GHz (frequency) as unit-labels.

TITLING. Displays a menu that lets you choose titles for displayed traces.

- User Titles. Changes the measurement name (type) as required by the user. For example, the titles could read “amp. gain,” or “bias volt.” The

titles "IDENTIFY" and "TEST DEVICE," as entered from the Hard Copy menu, apply to Channels 1 and 2 respectively.

- Stnd Titles. Cause trace to revert to standard title names (Transmission, Return Loss, Power, etc).

VOLTS MODE. Displays a menu that lets you define an approximate measurement range.

- Fxd Range 1. Selects the 0 - 10 volt range.
- Fxd Range 2. Selects the 0 - 1 volt range.
- Fxd Range 3. Selects the 0 - 100 mV range.
- Auto Range. Selects the normal autorange operation.

CALIBRATION OPTIONS. Displays a menu that provides special functions that will be of use to the programmable system user.

- HI RES CAL. Enables a facility that provides up to 2000 points of calibration memory.
- STANDARD CAL. Selects the standard calibration mode.
- ALLOW 6700A LEVEL CORRN. Enables 67XXA/B level correction.
- STOP 6700A LEVEL CORRN. Disables digital Level Correction on 67XXA/B.

AMPLIFIER TESTING. Displays a menu providing several options useful in amplifier testing.

- INCREASE POWER UNTIL LIMITS FAIL ON CHANNEL 1. Uses Channel 1 as reference power until limits fail.
- INCREASE POWER UNTIL LIMITS FAIL ON CHANNEL 2. Uses Channel 2 as reference power until limits fail.
- STARTING At. Enter the power level from which the test will start. Usually this is just below the expected compression point. The test restarts at this point each time that the function is used.
- MAX LEVEL. Sets the 56100A to the maximum allowable power level.
- CONTINUE. Overrides limit-failure and sets the power level to the "Max Level" point, as described above.

Reset (Cal Data Is Retained) Restores the factory-selected control panel settings (Figure 3-5). If the 56100A is connected to the source via the dedicated system bus, selecting this option resets the source control settings also.

3-8 DISPLAY KEYS, INDICATORS, AND MENUS

The Display keys and indicator (Figure 3-7) described below are the same for both channels. Generally, with the exception of Display On/Off and Autoscale, should one of these keys be pressed and then not wanted, the Clear (Figure 3-12) key can be used to cancel the key action.

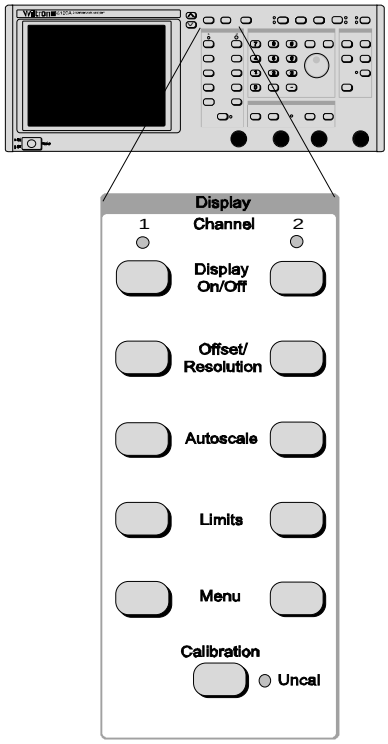


Figure 3-7. Display *Keys and Menus*

Display On/Off Key and Indicator Key turns its associated trace and reference line indicator on or off. The associated indicator is lit when the trace is on.

Offset/Resolution Key and Menus Displays a menu (Figure 3-8) that lets you select OFFSET or RESOLUTION.

Autoscale Key Sets the associated trace at optimum offset and resolution values for viewing the measured data.

Limits Key Access limit lines that may be used to establish go/no-go data limits (Figure 3-9). Limit lines may be either single lines or complex. Complex limits allow for setting up to ten different values for both the upper and lower limit lines.

Menu Key Initiates a series of menus that provide various trace display and input options. The Menu key menus are described in paragraph 3-9

3-9 MENU KEY MENUS

The Menu key menus (Figure 3-10) are described below.

Transmission Configures the trace for a transmission measurement.

Return Loss Configures the trace for a return loss measurement.

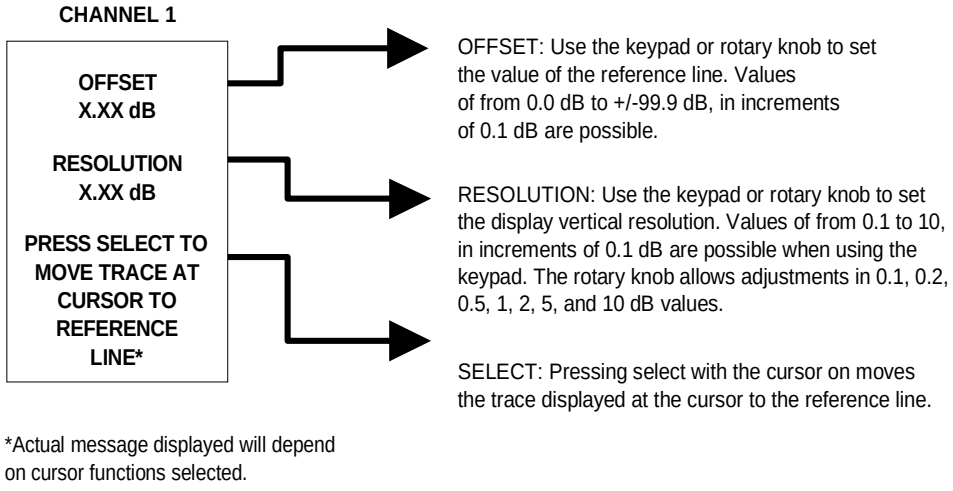


Figure 3-8. Offset/Resolution *Key Menu*

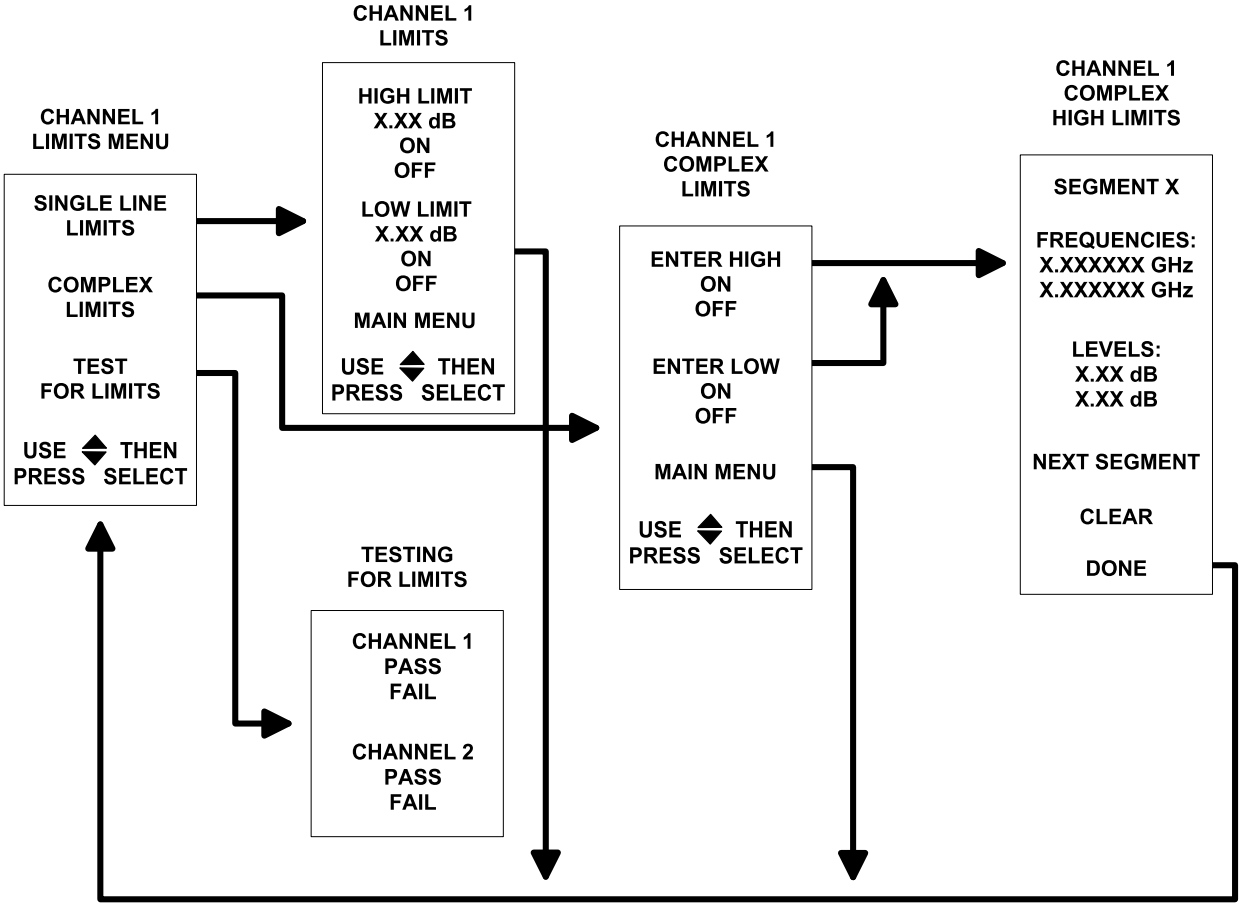


Figure 3-9. Limits Menus

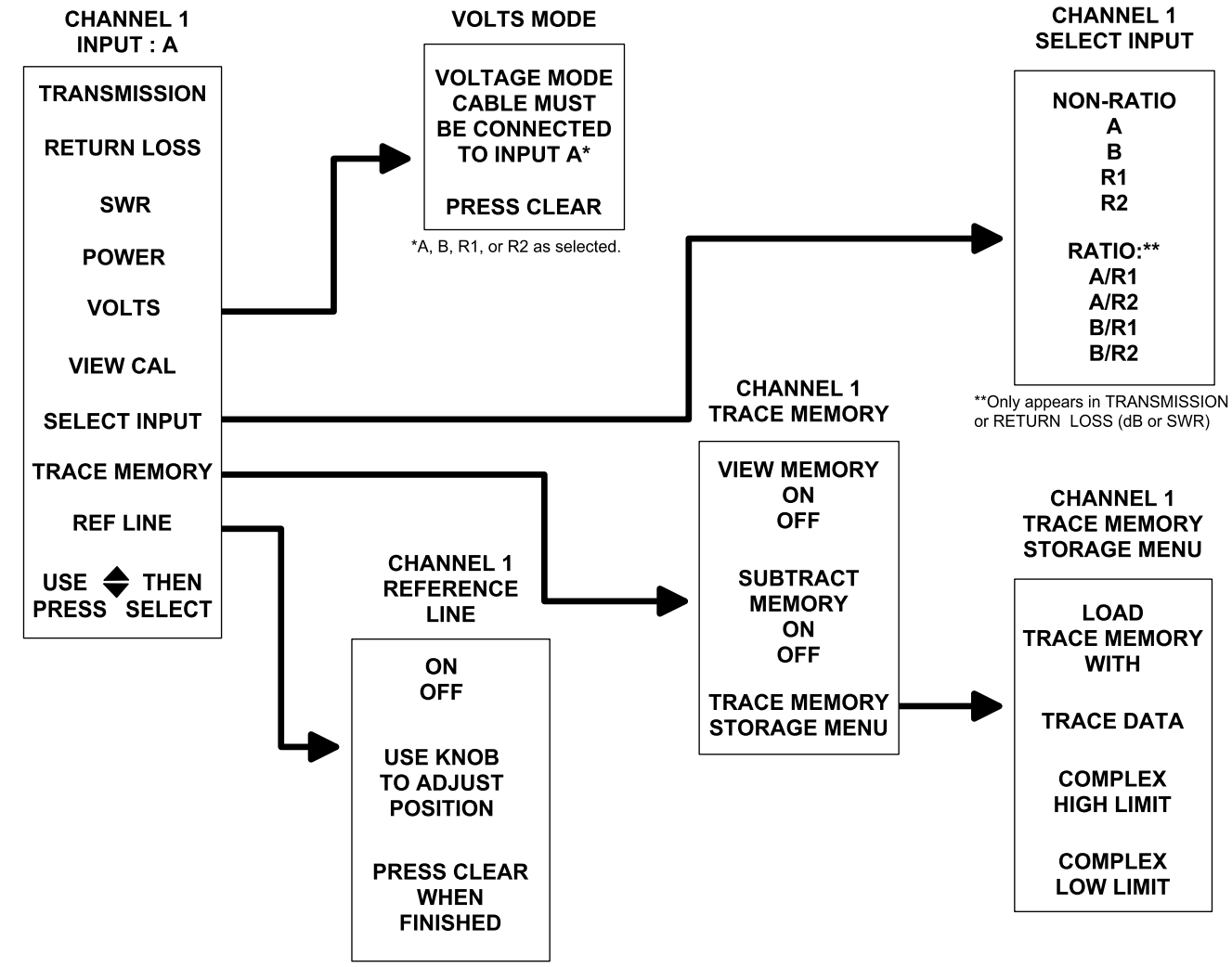


Figure 3-10. Display Menu *Key Menu*

SWR	Configures the trace for an SWR (standing-wave ratio) measurement.
Power	Configures the trace for a power measurement.
Volts	Configures the trace for a voltage measurement. In this measurement, the input RF Detector is replaced with a length of BNC-BNC cable.
View Cal	View stored calibration data.
Select Input	Displays a menu providing the following input selection.

- NON RATIO A. Connects the output of the input A amplifier to Channel 1 or 2.
- NON RATIO B. Connects the output of the input B amplifier to Channel 1 or 2.
- NON RATIO R1. Connects the output of the input R1 amplifier to Channel 1 or 2.
- NON RATIO R2. Connects the output of the input R2 amplifier to Channel 1 or 2.
- RATIO A/R1. Connects the ratio of input A subtracted by input R1 to Channel 1 or 2. This ratio is the difference signal that results from the logarithm of the signal on input A being subtracted by the logarithm of the signal on input R1.
- RATIO A/R2. Same as described for RATIO A/R1, except substitute input R2 for input R1.
- RATIO B/R1. Same as described for RATIO A/R1, except substitute input B for input A.
- RATIO B/R2. Same as described for RATIO A/R1, except substitute inputs B and R2 for A and R1.

Trace Memory Displays a menu providing options for controlling trace memory.

- VIEW MEMORY ON/OFF. View stored data for this trace.

NOTE

The data accessed here is from a different storage location than those trace memories accessed using SAVE/RECALL key menus (Figure 3-4).

- SUBTRACT MEMORY ON/OFF. Subtracts the trace stored in this memory from the displayed trace.

TRACE MEMORY STORAGE MENU. Displays a menu providing storage options.

- LOAD TRACE MEMORY WITH TRACE DATA. Loads this memory with data from the displayed trace.
- LOAD TRACE MEMORY WITH COMPLEX HIGH LIMIT. Loads this memory with complex-high-limit data.

- LOAD TRACE MEMORY WITH COMPLEX LOW LIMIT. Loads this memory with complex-low-limit data.

Ref Line Displays options for controlling the reference line.

NOTE

Use the Data Entry/Cursor rotary knob to reset the REFERENCE LINE to another graticule line. The reference line is the point about which the trace expands vertically with different resolution values; it can be set to any graticule line. Press Data Entry Clear to return to the measurement mode.

- ON. Turns the reference line on.
- OFF. Turns the reference line off.
- ADJUST POSITION. Lets you position the reference line using the DISPLAY ENTRY/ CURSOR knob.

3-10 CALIBRATION KEY AND MENUS

Displays a series of instructions (Figure 3-11) that guide you through the calibration cycle. The calibration sequence is determined by the measurements chosen. This key also allows low level trim to be performed (when required), and allows entry of detector offsets. Low level trim optimizes the 56100A for measurements of -45 dBm and below. It's use is required when retrace RF is ON or VOLTS mode is selected.

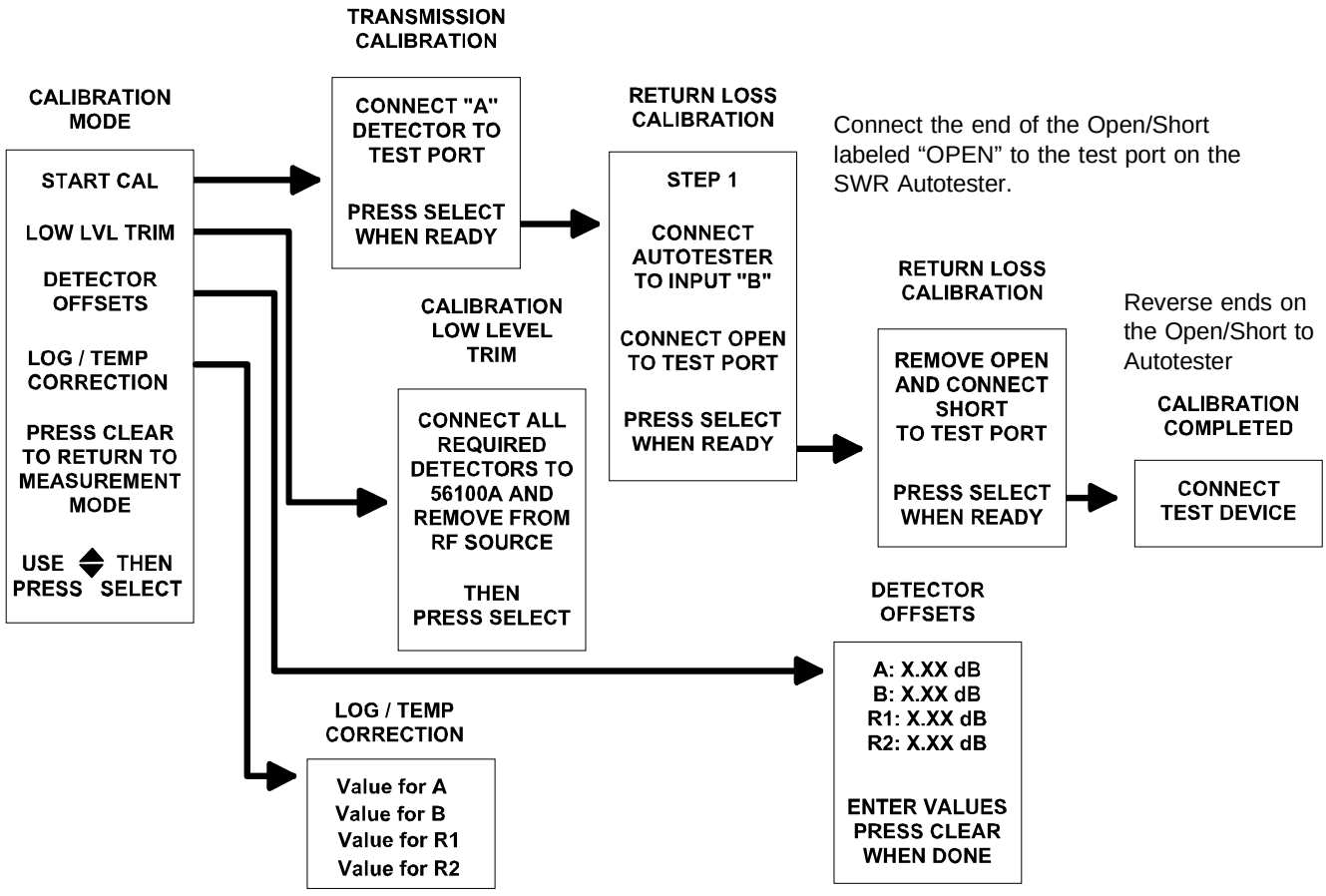
Detector offsets allow a dB offset to be set for any of the A, B, R1,or R2 detectors. These values remain in memory, even after the 56100A is reset and powered down. The offsets are only cleared by entering "0 dB". If any detector offset is active, a status message displays at the bottom of the screen.

UNCAL Indicator Lights when either measurement trace is uncalibrated.

CALIBRATION is the process whereby losses inherent in a transmission or return loss measurement system are measured, stored in internal memory, and later subtracted so that the results displayed are those of the test device, minus residual losses. Pressing the CALIBRATION key initiates the following sequence of menus when the Channel 1 trace has been selected to display transmission loss or gain from input A and the Channel 2 trace return loss from input B.
***Important*:** Set output power for the desired level before beginning the calibration sequence.

- Connect the RF Input port on the SWR Autotester to the RF OUTPUT port on the sweep generator. An adapter may be needed.
- Connect the RF detector between input A of the Network Analyzer and the Test Port on the SWR Autotester.

When only transmission loss is being measured and the SWR Autotester is not being used, the test port called out in the menu is the port to which the test device connects. In most cases, it will be the RF OUTPUT port on the sweep generator.



When the calibration cycle is complete, the losses inherent in the SWR Autotester, Adapter, and RF detector have been measured and stored. In all future measurements (in this configuration) of test devices *at this level* of output power, these losses will be subtracted from measured losses; consequently, the results displayed will be those of the test device minus residuals.

Figure 3-11. CALIBRATION *Key Menu Sequence*

3-11 DATA ENTRY/CURSOR KEYS AND KNOB

The Data Entry keys and knob (Figure 3-12) are described below.

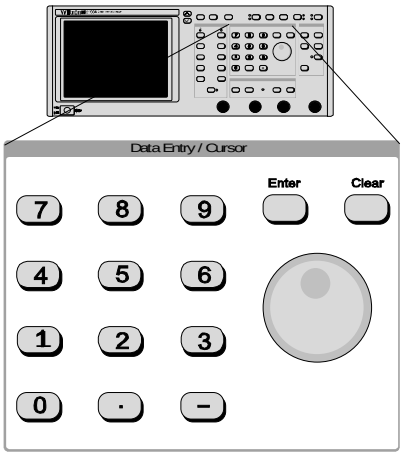


Figure 3-12. DATA ENTRY *Keys and Knob*

Knob Enters variably adjusted measurement values (cursor position, offset, resolution, etc.).

Keypad Enters discrete measurement values.

Enter Key Terminates data entries made from the keypad.

Clear Key Clears entered value, if pressed before the Enter key. Also clears a displayed menu, entry errors, complex limit segment identifiers, and cursor NOT FOUND message.

3-12 HARD COPY KEYS

The Hard Copy keys (Figure 3-13) are described in the following paragraphs.

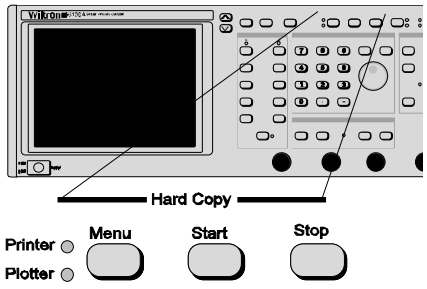


Figure 3-13. HARD COPY *Keys*

Hard Copy Menu Key Displays a menu (Figure 3-14) that provides print options. These menus are described in paragraph 3-13.

Start Key Freezes the displayed data and starts printing it. The type of printout then obtained, graphic or tabulated, is based on the last Display Menu key item selected.

Stop Key Stops printing the data immediately. In the case of plotting, the end of a data string is finished and the plotter left in a reset state.

3-13 HARD COPY KEY MENUS

Pressing the Hard Copy Menu key will display the menu for the currently selected hard-copy device (such as, printer or plotter). If the Hard Copy Menu is already displayed, the hard-copy type will toggle to the other device and its relevant menu will display.The Hard Copy Key menus provide for any of the following:

- The graphic display.
- A tabulation of the measured values to a printer.
- The graphic values to a plotter.
- Complex limit values in tabulated form.

Figure 3-15 provides examples of a hard copy plot. The Menu key menu selections are shown below.

Printer Selected:

Print Graph Prints the on-screen graphic.

Enter Titles Displays a menus providing options for entitling the test (Selected Titles to Enter menu).

- IDENTIFY. Selects an up-to-four character identification for the type of test (such as, TNSM for transmission, RL for return loss, PWR for power). Selecting this entry brings-up the "TITLE ENTRY" menu. To operate this menu, use the DISPLAY ENTRY/CURSOR knob highlight the desired alpha or numeric character. Then, press the ENTER key to select the highlighted entry. When your entry is complete, highlight DONE and press the ENTER key. Entries can contain up to 12 characters, which can also be entered from the numeric keypad.
- DATE. Enter the date in the format shown. Date can be entered as dd-mm-yy or mm-dd-yy, where m is the month, d is the day, and y is the year. Selecting this entry also brings up the "TITLE ENTRY" menu that was described above. Entries can contain up to 12 characters, which can also be entered from the numeric keypad.
- TEST DEVICE. Lets you enter an up-to-four character name for your test device. Selecting this entry also brings up the "TITLE ENTRY" menu that was described above. Entries can contain up to 12 characters, which can also be entered from the numeric keypad.

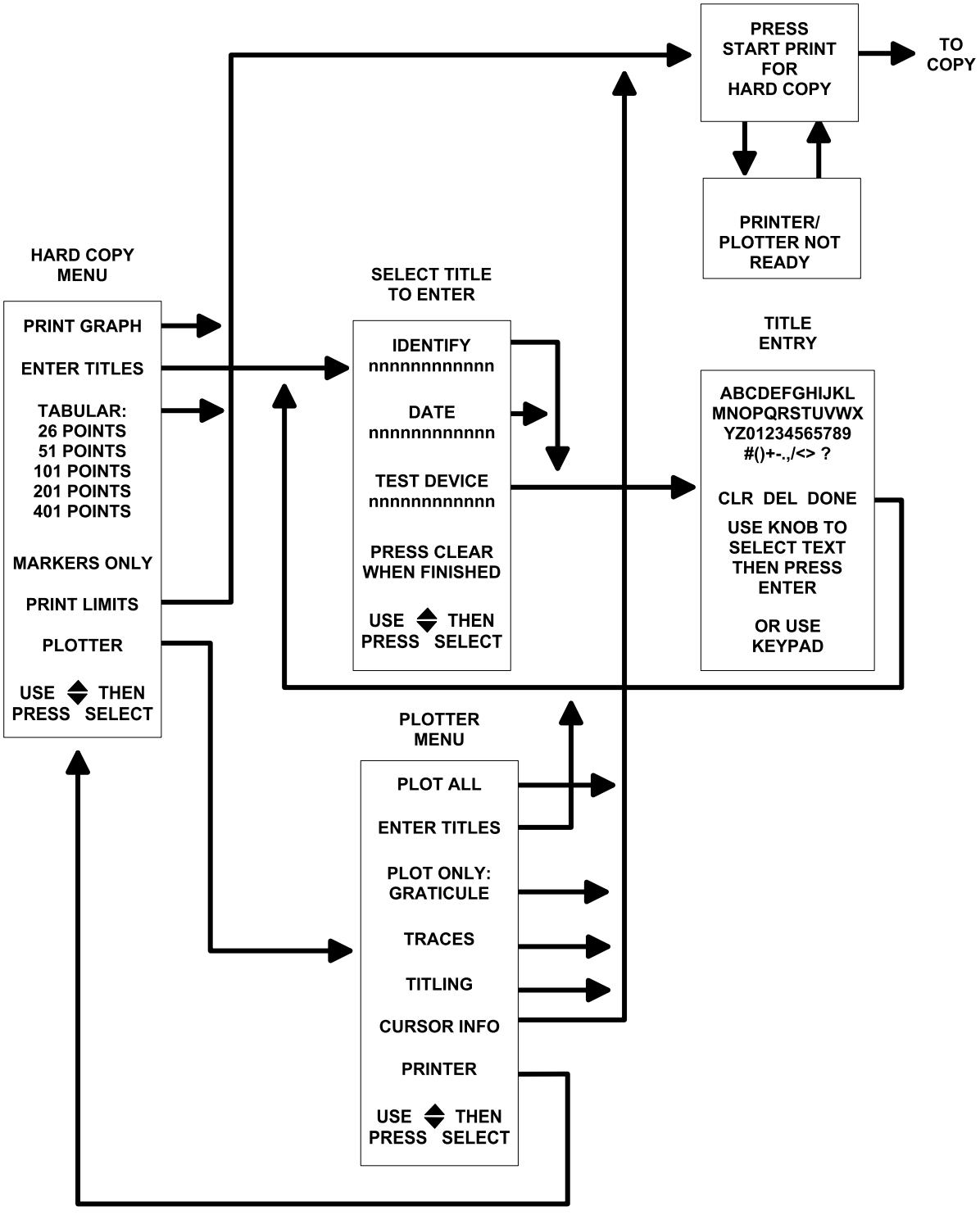


Figure 3-14. HARD COPY *Menu*

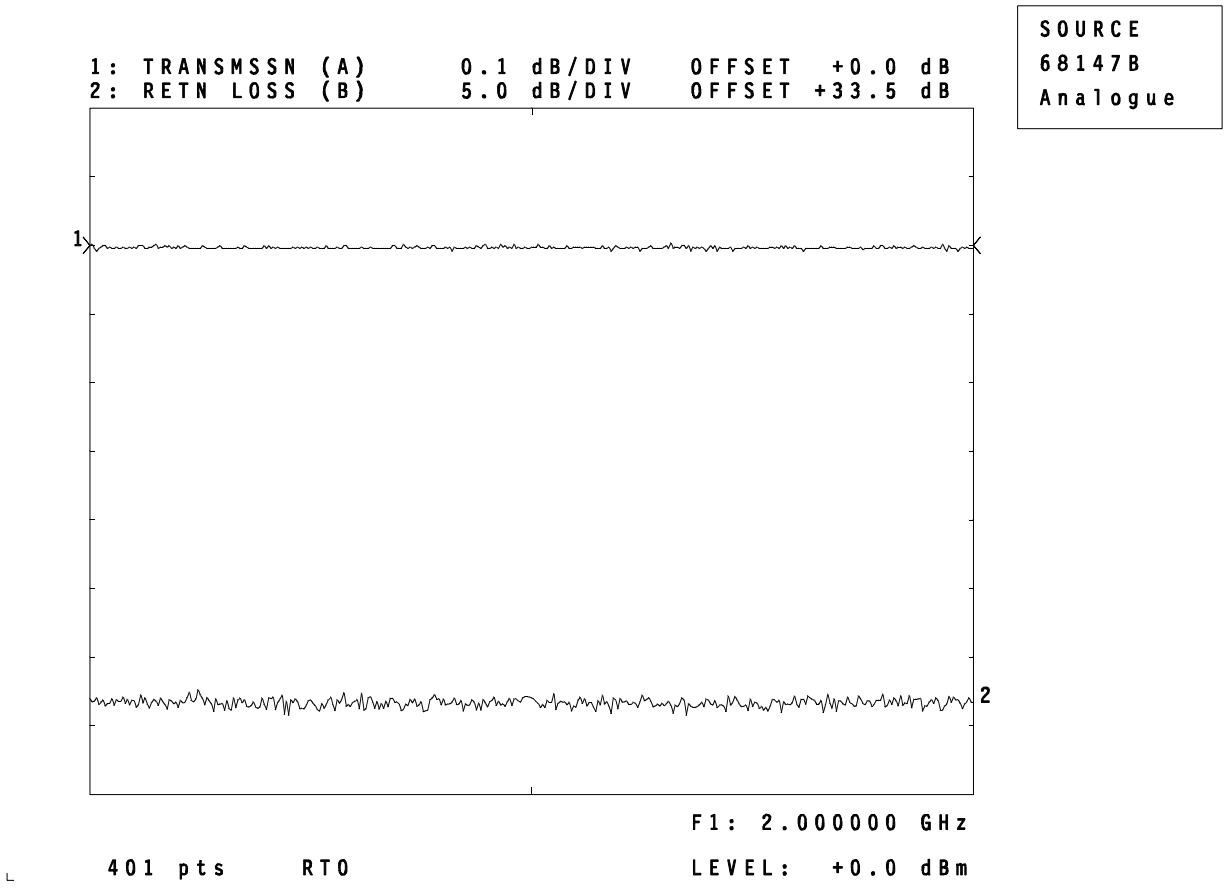


Figure 3-15. *Hard Copy Plotter Example*

Tabular Selects the print resolution in data points— 26, 51, 101, 201, or 401.

Markers Only Displays data only at the frequency-marker points.

Print Limits Prints limit data.

Plotter Displays a menu providing plotter options.

Plotter Selected:

- PLOT ALL. Plots all displayed data.
- ENTER TITLES. Displays the "SELECT TITLE TO ENTER" menu described above.
- PLOT ONLY GRATICULES. Plots only the graticule data.
- PLOT ONLY TRACES. Plots only the trace 1 or 2 data.
- PLOT ONLY TITLING. Plots only the titling data.
- PLOT ONLY CURSOR INFO. Plots only the cursor data.
- PRINTER. Returns you to the "HARD-COPY MENU," which provides you with printer options.

NOTE ABOUT PLOTTING

P1 and P2 are the X/Y coordinates that determine the size of the plot. These two coordinates, which were formerly preset by firmware, may now be adjusted manually at the plotter or remotely via GPIB programming (see the RDR command in Section 4).

3-14 CURSOR MEASUREMENT KEYS, INDICATORS, AND MENUS

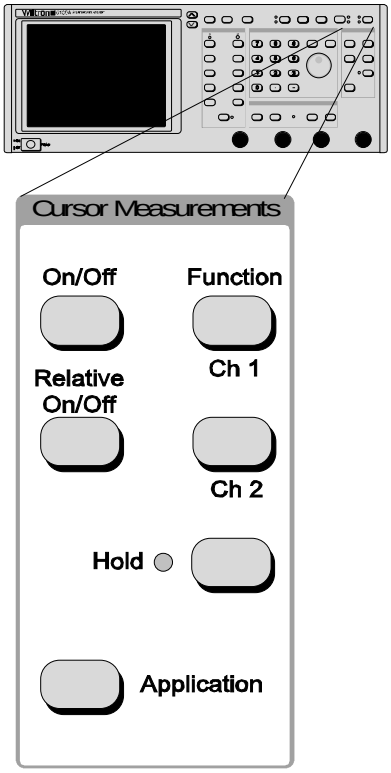


Figure 3-16. Cursor Measurement Keys and Indicators

The Cursor Measurement keys and indicators (Figure 3-16) are shown and described below.

On/Off Key Positions the main cursor to the frequency point it was at when the function was last used. Thereafter, it is continuously variable with the tuning knob, or it may be positioned at the next marker by pressing the Select key if this option was last selected from a Cursor Measurement menu. The frequency and amplitude of the test data at the cursor on both traces are digitally displayed.

Relative Cursor On/Off Key Positions a relative cursor on the screen. The main cursor will then move as the tuning knob is varied, or it will advance to the next marker if the Select key is pressed. To establish a new reference, the main and reference positions may be reversed by pressing the Enter key. The difference in amplitude and frequency between the reference cursor and the main cursor positions on the test data are displayed for both traces.

Hold Key and Indicator Key freezes the data, which can then be manipulated (1) by adding or changing limit or marker values or (2) by changing offset or resolution values. Indicator is lit while the data are frozen, which occurs when the Hold or Hard Copy Start keys are activated.

Application Provides a direct link into the applications menu shown in Figure 3-6.

Function– Ch1 and Ch2 Keys Display menus (Figures 3-17 and 3-18) that let you quickly move the Ch1 or Ch2 cursor to any one of the points indicated.

Menu Selections:

- MOVE CURSOR TO MAXIMUM. Moves the cursor to the maximum value of the test data and displays the amplitude and frequency.
- MOVE CURSOR TO MINIMUM. Same as described above, except for the minimum trace value.
- NEXT MARKER. Moves the cursor to the next frequency marker and displays the amplitude and frequency.

- ACTIVE MARKER. Moves the cursor to the active frequency marker and displays the amplitude and frequency.
- DB SEARCH. Moves the cursor in accordance with instructions set in the "SET SEARCH PARAMETERS" menu described below.

Set Search Parameters Menu:

- SEARCH VALUE. Enter the amplitude value that you want to search for.
- SEARCH TYPE LEFT. Directs the "dB SEARCH" mode cursor to search to the left of its current position for the value set using the "SEARCH VALUE" option.
- SEARCH TYPE RIGHT. Same as above, except the search is to the right.
- SEARCH TYPE BANDWIDTH. If the cursor is positioned within the +/– search range of the "SEARCH VALUE" entry, two cursors will diverge to indicate bandwidth (Figure 3-19).

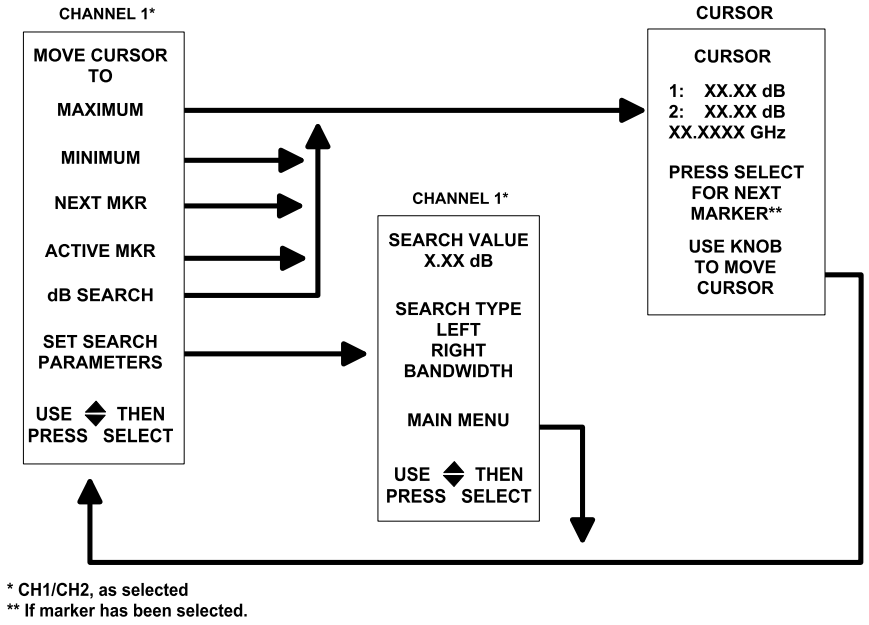


Figure 3-17. Cursor Measurements *Menus (With* Relative Cursor*Off)*

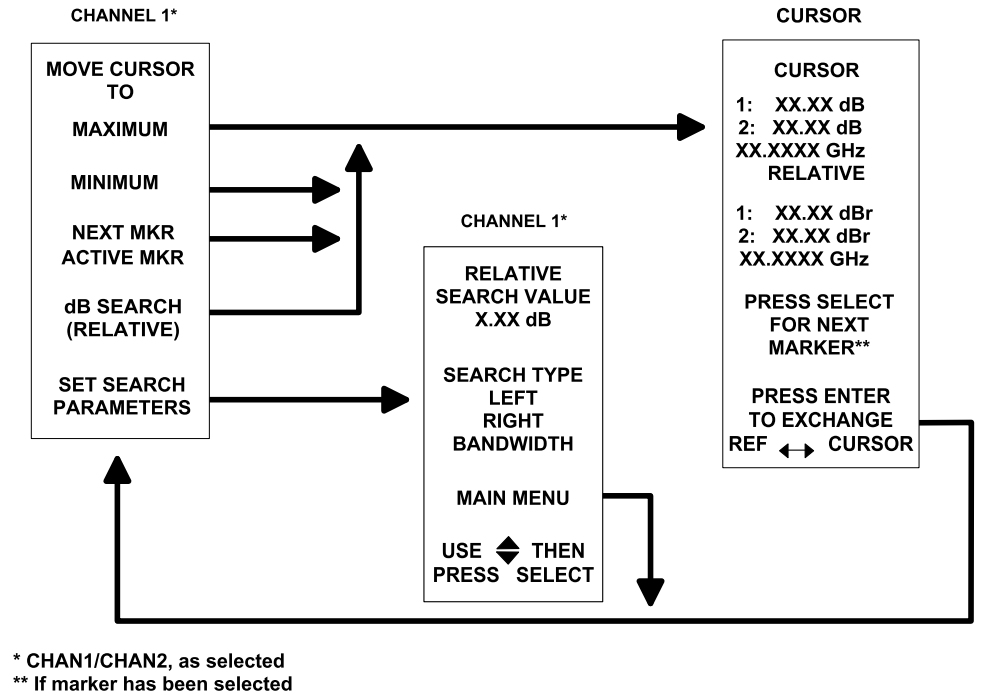
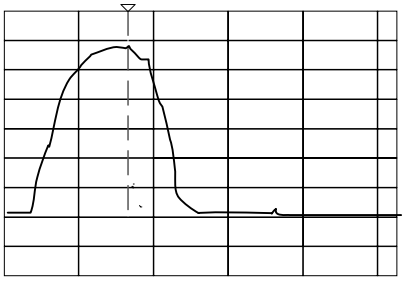
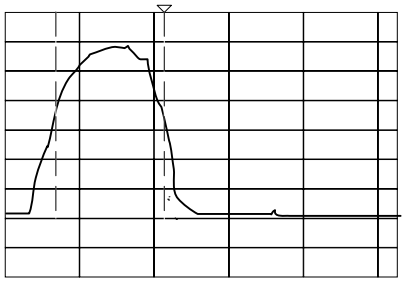


Figure 3-18. Cursor Measurements *Menus (With* Relative Cursor *On)*



Set cursor within the search range of the "SEARCH VALUE" range.



Two cursors diverge to indicate the bandwidth.

NOTE

When Relative Cursor is on, all cursor searches are performed relative to the value at the current main cursor position

Figure 3-19. *dB Search Mode Cursor, Bandwidth*

3-15 ENHANCEMENT KEYS, INDICATORS, AND MENUS

The Enhancement keys and indicators (Figure 3-20) are described below.

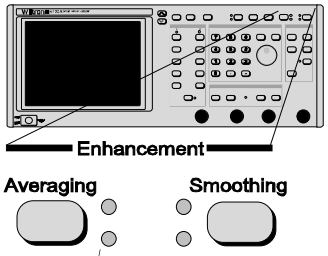


Figure 3-20. ENHANCEMENT *Keys*

NOTE
When Averaging is enabled, both LEDs to the right of the key are lit.

Smoothing Key and Indicators Key provides two levels of filtering, MIN and MAX, that improve the display at low-signal levels. Smoothing is indicated as follows: Both LEDs lit, maximum smoothing; top LED lit, minimum smoothing; no LEDs lit, no smoothing.

Averaging Key, Indicator and Menu When you select averaging, 2 to 256 successive sweeps can be averaged to smooth the trace display. The Averaging Key menu is shown in Figure 3-21).

AVERAGING

AVERAGE OVER
2 SWEEPS
4 SWEEPS
8 SWEEPS
16 SWEEPS
32 SWEEPS
64 SWEEPS
128 SWEEPS
256 SWEEPS

Figure 3-21. Averaging *Key Menu*

3-16 OPERATIONAL CHECKOUT

The 56100A Scalar Network Analyzer undergoes a comprehensive self test when turned on or when Self Test is selected. If the CRT displays "ALL TESTS PASSED," the internal circuits are operating properly. How to perform an operational check is described Table 3-1.

3-17 REAR PANEL CONNECTORS

The rear panel contains multipin GPIB and printer connectors, the line voltage module, and additional input/output connections. The line voltage module and GPIB connector are described in Chapter 2; the printer interface and the additional input/output connections are described in Figure 3-24.

3-18 ERROR MESSAGES

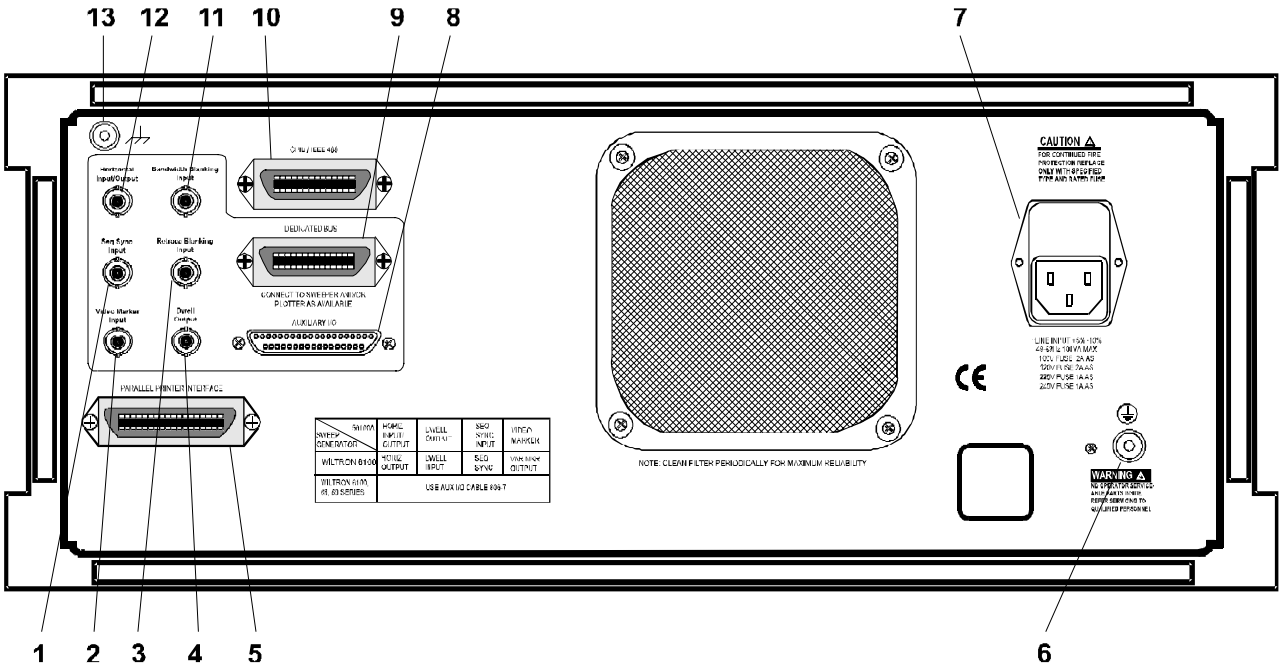
Upon turning on the equipment or selecting Self Test or Reset, the analyzer undergoes a comprehensive self test. If the self test passes, the message "ALL TESTS PASSED" displays; however, if any part of the self test fails, an error message displays. Additionally, a control panel LED flashes. A different LED flashes for each fault. The LED coding for fault detection is shown in Table 3-2. This coding makes it possible to locate a fault even if the CRT has failed or is switched off.

If an intelligent source is used, the 56100A directs it to perform a self test as well.

When memory has been tested, front panel LEDs light to show memory test is finished and any failures.

3-19 56100A ANALYZER CONNECTIONS TO ANRITSU SWEEP GENERATORS

The 56100A Scalar Network Analyzer may be used with various ANRITSU and other sweep generators. Tables 3-4 and 3-5 lists many of the models that may be used with the 56100A and the interconnections required.

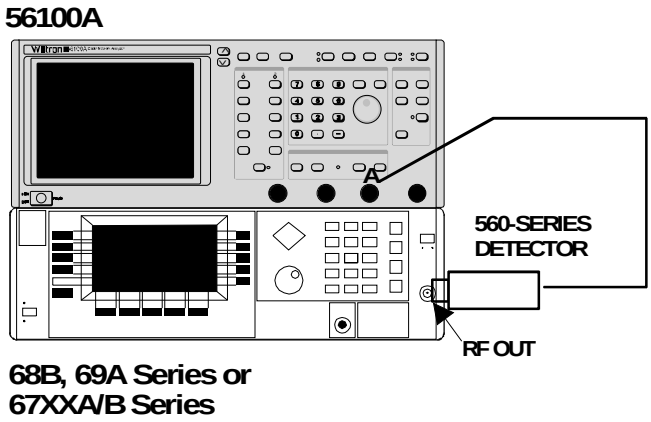


1. **Seq Sync Input:** +3.5V to +10V blanks trace during retrace or bandswitching. –3.5V to –10V defines a marker which, when in the range of –8V to –10V, is an active marker. BNC connector, 10 kΩ impedance.
2. **Video Marker Input**: +2V to +10V peak input. BNC connector.
3. **Retrace Blanking Input:** ±5V causes retrace to occur. BNC connector.
4. **Dwell Output:** TTL-Low signal stops sweep. Sweep continues when signal is removed. BNC connector.
5. **Parallel Printer Interface:** Provides standard Centronics parallel interface with a printer.
6. **Protective Conductor Terminal.**
7. **Line Voltage Module:** Provides an input for 100, 120, 220 or 240 Vac line power. Contains 100/120 1A and 220/240 2A anitsurge fuse. Refer to Chapter 2, page 2-4 for part numbers.
8. **Aux I/O:** Connects 56100A to ANRITSU 67XXA/B, 68XXXA/B, or 69XXXA Synthesizers, HP 8350B Sweeper, and HP 8340A/8341A Synthesizers.
9. **Dedicated GPIB:** Connects 56100A to signal source and plotter.
10. **GPIB Connector**: See Figure 2-2, page 2-5.
11. **Bandswitch Blanking Input:** Accepts ±5V signal coincident with bandswitching points. BNC connector.
12. **Horizontal (Sweep Ramp) Input/Output**: 0 to +10V nominal, +12V maximum input. BNC connector, 100 kΩ impedance. When selected, can also provide a 0-10 V output.
13. **Earth Chassis Ground Terminal**: May be used to connect the 56100A to the source.

Figure 3-22. *Location of Rear Panel Connectors*

Table 3-1. Operational Checkout

Step 1 Connect the RF detector between Channel A of the analyzer and the RF output of the source as shown below.



Step 2. Press Power on the analyzer to on. At the conclusion of the built-in self test, the screen displays "ALL TESTS PASSED." Press the System Menu key and select the RESET option with the Menu Select switch (returns the system to the factory settings). Observe that the 56100A screen is properly annotated for frequency and level.

Step 3. Press the Graticule key to turn the graticule on.

Step 4. Press the Channel 2 Display On/Off key to off.

Step 5. Press the Channel 1 Menu key.

Step 6. When the menu appears, select the POWER option using the Menu Up/Down switch and SELECT key.

Step 7. Press the Channel 1 Offset/Resolution key.

Step 8. When the menu appears, select the OFFSET option and enter 10 dB via the Data Entry keypad and the Enter key.

Step 9. Observe that the trace deflects downward by 1 division.

Step 10. Select the RESOLUTION option and enter 2 dB using the Data Entry keypad or rotary knob.

Step 11. On the power source, select a level of 2 dBm.

Step 12. Observe that the trace deflects downward by 4 divisions.

Table 3-2. *Control Panel LED Error Codes*

Flashing Led*	Fault	Fault Location
Top Averaging	Ramp Not Calibrated	A4, or Sweep Ramp Too Slow
Top Smoothing	CPU EPROM Checksum	A7 CPU (Observe Initial Test To Identify)
Bottom Averaging	CPU RAM Failure	A7 CPU
Bottom Smoothing	Front Panel Keyboard Interface Failure	Front Panel
Hold	7210 GPIB Interface Failure	A7 CPU
Plotter	ADC Converter	A3 PCB
Remote	Channel R1/R2 PCB Not Detected	A1 (A3) PCB
Printer	Channel A/B PCB Not Detected	A2 (A3) PCB
Uncal	Channel R1/R2 PCB Null/Zero Failure	A1 (A3) PCB
Display CH1	Channel A/B PCB Null/Zero Failure	A2 (A3) PCB

***** After a period of flashing, the option is given, at the users discretion, to continue to attempt operation by pressing SELECT.

Table 3-3. *Memory Test LED Error Codes*

Flashing Led*	Fault	Fault Location
Hold and Plotter	Memory Test Result	N/A
Top Averaging	U36 RAM Failure	A7 CPU PCB
Bottom Averaging	U30 EPROM Checksum	A7 CPU PCB
Top Smoothing	U31 EPROM Checksum	A7 CPU PCB
Bottom Smoothing	U32 EPROM Checksum	A7 CPU PCB

Table 3-4. *Interconnections, 56100A to Sweep Generators Using 806 Series Interconnect Cable*

56100 Connector	ANRITSU 6600/6700/68000/69000 Series	Hewlett-Packard 8340/8350 Series
Dedicated GPIB	GPIB	GPIB
Auxiliary I/O	AUX I/O (Using WPN 806-7 Interconnect Cable)	##PROGRAMMING (Using WPN 806-13 Interconnect Cable)

Table 3-5. *Interconnections, 56100A to Sweep Generators Using BNC Cable Connections*

56100 Connector	ANRITSU 6600A/B	ANRITSU 6700A/B, 68000A/B, 69000A	Hewlett-Packard 8340/8350 Series
Dedicated GPIB	GPIB	GPIB	GPIB
Horizontal Input/Output	HORIZ OUT	HORIZ OUT	SWEEP OUT
Seq Sync Input	SEQ SYNC	SEQ SYNC	POSZ BLANK
Video Marker Input	MARKERS OUTPUT	MARKERS OUTPUT	No Connection
Retrace Blanking Input	RETRACE BLANKING OUT	No Connection	No Connection
Dwell Output	SWEEP DWELL INPUT	SWEEP DWELL INPUT	STOP SWEEP

Chapter 4
Measurements

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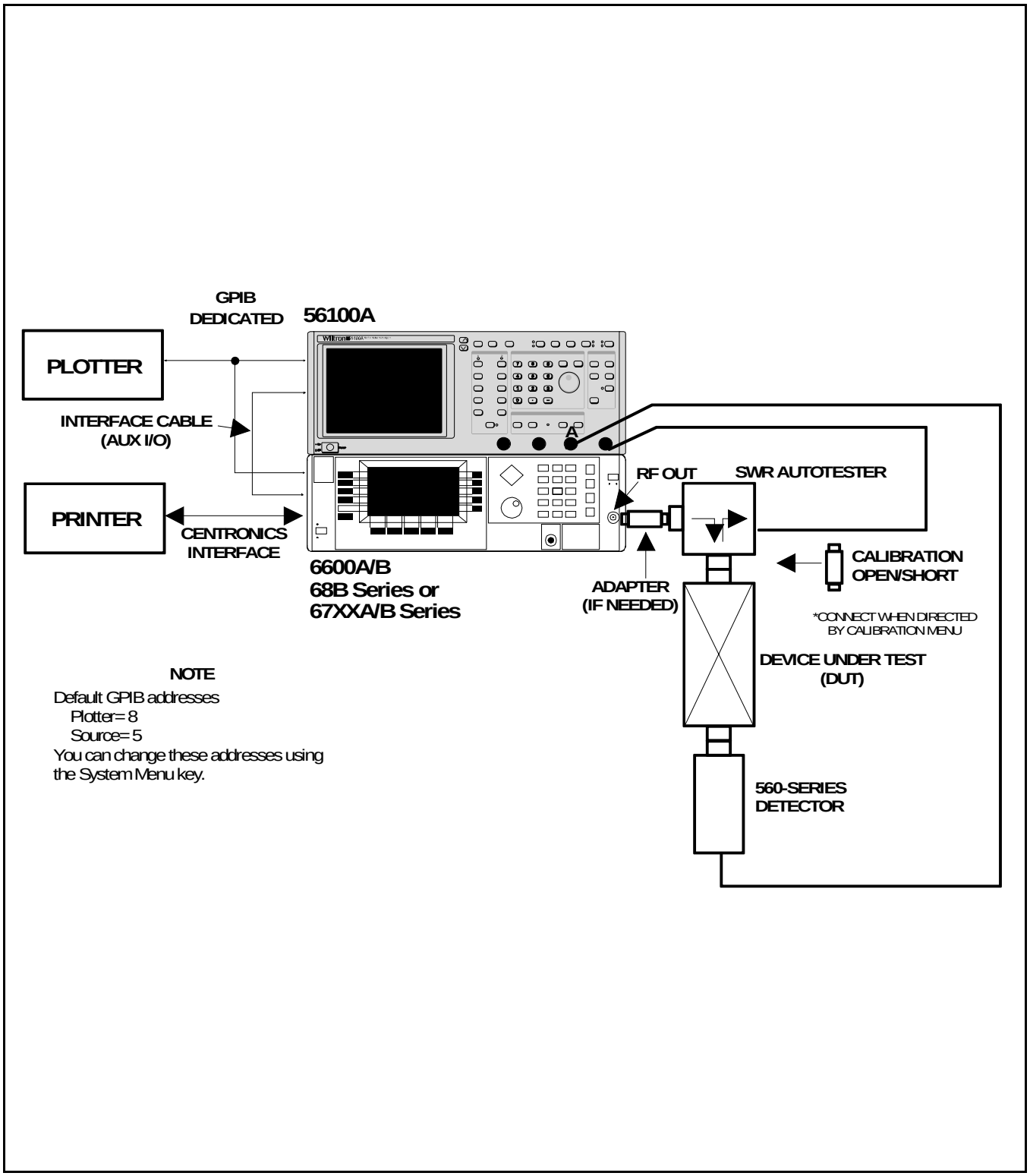


Figure 4-1. *Measurements Test Setup*

Chapter 4
Measurements

4-1 INTRODUCTION

This chapter provides detailed procedures for performing the following measurement types:

- Transmission and Return Loss
- Absolute Power
- Alternate Setup
- Ratio Mode

4-2 MEASUREMENTS WITH THE 56100A SCALAR NETWORK ANALYZER

The 56100A Scalar Network Analyzer can be used to make transmission loss or gain, return loss, absolute power, SWR, volts, alternating setup measurements, or special custom measurements using TRACE MEMORY.

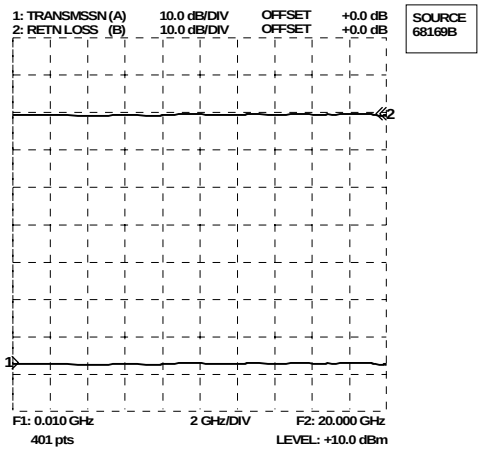
4-3 TRANSMISSION AND RETURN LOSS MEASUREMENTS

How to make a transmission and return loss measurement is described below; a test setup is shown in Figure 4-1.

Step 1 Connect test equipment per Figure 4-1, except do not connect the test device. Turn the printer on.

Step 2 Turn on the synthesizer, then press Power on the 56100A to ON. At the conclusion of the built-in self test, the screen displays "ALL TESTS PASSED," and the CRT resembles that shown below.

Control settings may be different from those shown, which are the Reset *control settings*. The instrument comes on line with the same control settings it had when last turned off.*



Step 3 Ensure that both channels are On and that Channel 1 is set for Transmission and Channel 2 for Return Loss.

Step 4 Press the Calibration key and follow the directions given in the calibration-cycle sequence of menus. If necessary, refer to Figure 3-11 for an explanation of the menus. After finishing the calibration, connect the test device and RF detector as shown in Figure 4-1.

Transmission Loss Measurement

Step 5 Press the Channel 2 Display On/Off key to Off.

Step 6 Press the Channel 1 Autoscale key. This gives an optimum vertical display of the test data.

Step 7 Read the transmission loss by interpolating the displayed graphic, or read it directly using the main and/or relative cursors with the readout function as described in step 8. The transmission loss is approximately 0 dB in the pass band and 66 dB at the bottom of the skirt for the 2 GHz LPF shown on the following page.

Step 8 To use the main cursor and delta cursor to read the results of the above measurement directly, proceed as follows:

- ☐ For an absolute measurement press the Cursor Measurements On/Off to On, then position the cursor using the rotary knob or the Cursor Measurements—Ch1 key in conjunction with the Menu Select key to the required measurement point.
- ☐ If a relative measurement is required, first turn on the relative cursor, then once the cursor has been positioned, press the Cursor Measurements—Ch1 key, then select the desired parameter from the menu .
- ☐ Read the resultant cursor delta position data from the menu screen.

Step 9 Make a hard copy printout of the transmission loss as follows:

- ☐ Press the Hard Copy Menu key.
- ☐ If device identify, date, and test device information is required, then select "ENTER TITLES."
- ☐ Select PRINT GRAPH to print the displayed graphic, or select 26, 51, 101, 201, or 401 to print a tabulation at the selected number of frequency points. You could also choose to print out a tabulation at only the marker frequencies, if any markers were on.
- ☐ When using a Canon BJ-20SX or Epson FX compatible printer, verify that the rear switch settings are as shown in Figure 4-1. Also verify that the power indicator is on and that the reset indicator is not flashing. If it is, press the Reset switch.
- ☐ Press Hard Copy Start to print out the data.
- ☐ If a plotter is connected, by selecting the hard-copy menu you could choose to plot either graticules, traces, titling, cursor information or all of these items if the "PLOT ALL" function is selected.

Return Loss Measurement

Step 10 Press Channel 1 Display On/off key to Off.

Step 11 Press Channel 2 Display On/Off key to On.

Step 12 Press Channel 2 Autoscale key.

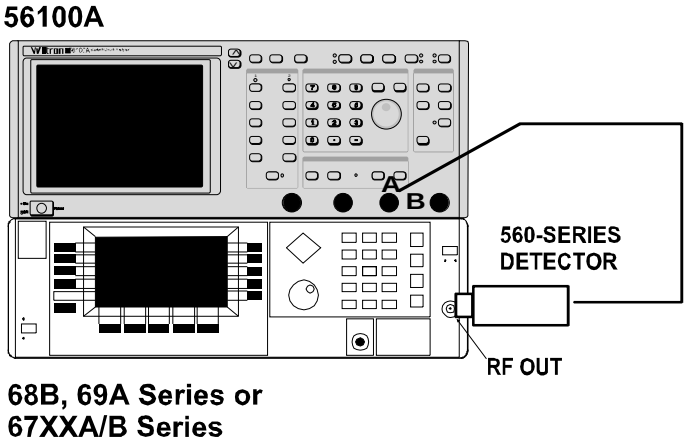
Step 13 To use the cursor function to read the results of the return loss measurement directly, repeat step 8 above.

Step 14 Print out the return loss as described in step 9 above.

4-4 ABSOLUTE POWER MEASUREMENT

How to make an absolute power measurement is described below.

Step 1 Connect the RF detector between Connector A and the RF Out connector as shown below.



Step 2 Press Power, on the analyzer, to On.

At the conclusion of the built-in self test the screen displays "ALL TESTS PASSED." Control settings may be different from those shown, which are the factory reset control settings. The instrument comes on line with the same control setting it had when last turned off.

Step 3 Press System Menu key, then select "RESET," when the menu appears.

Step 4 Press the channel 2 Display On/Off key to off.

Step 5 Press the Channel 1 Menu key.

Step 6 When the menu appears, select the "POWER" option using the Menu and Select keys.

Step 7 Press the Channel 1 Autoscale key. This gives an optimum vertical display of the test data.

Step 8 Press the Cursor Measurements On/Off key to On.

Step 9 Using the Data Entry rotary knob and/or the Cursor Measurements-Ch1 key in conjunction with the Menu Select switch, move the cursor from the low to the high ends of the trace and read the source output power, in dBm, at the frequencies of interest.

4-5 ALTERNATE SETUP MEASUREMENTS

How to make an alternate setup measurement is described below. The alternate setup mode is controlled thru the frequency source control panel.

Step 1 Connect test equipment per Figure 4-1, except do not connect the test device. Turn the printer on.

Step 2 Turn on the frequency source and 56100A.

At the conclusion of the built-in self test, the screen displays "ALL TESTS PASSED." Control settings may be different from those shown, which are the reset control setting. The instrument comes on line with the same control settings it had when last turned off.

Step 3 Set Channels 1 and 2 to display transmission using input A, as follows:

☐ Press the Ch1 Menu key.

☐ Move the cursor to highlight Transmission and press the Select key.

☐ Move the cursor to highlight "SELECT INPUT" and press the Select key.

☐ Move the cursor to highlight A and press the Select key.

☐ Repeat steps a thru d for channel 2.

☐ Press the Alt Setup and "5" keys.

Step 4 For the 67XXA/B, select an alternating setup as follows:

☐ Press the F1-F2 key.

☐ Press the Shift key.

☐ Press the F3-F4 key.

Step 5 For the 68XXXB or 69XXXA, select an alternating setup as follows:

☐ Press CW Sweep Select.

☐ Select the Analog soft key.

☐ Select the Alternate Swp Menu soft key.

☐ At the Alternate Menu display, select the Alt Sweep soft key.

Step 6 On the 56100A, press the Calibration key and follow the directions given in the calibration-cycle sequence of menus.

If necessary, refer to Figure 3-11 for an explanation of the menus.

- ☐ After finishing the calibration, press the Save/Recall key.
- ☐ Select menu option "SAVE," then highlight the "CALIBRATION TRACE MEMORY AND SETUP (1-4 ONLY)" option on the SAVE menu.
- ☐ Use keypad to select storage location 1 thru 4.

Step 7 Connect the test device and RF detector as shown in Figure 4-1.

Step 8 On the 56100A, measure the transmission loss in the Alternating Sweep mode as follows:

- ☐ Press Channel 1 Autoscale key. This gives an optimum vertical display of the test data.
- ☐ Read transmission loss by interpolating the displayed graphic, or read it directly using main and delta cursors and the readout function. This is the transmission loss for the normal source input.
- ☐ Repeat steps the above two bulleted steps for Channel 2. This is the transmission loss for the alternate source input. If different alternative measurements are needed, then new calibration may be required.

Step 9 Make a hard copy printout of the transmission loss as follows:

- ☐ Press the Hard Copy Menu key.
- ☐ If device identify, date, and test device information are required to be annotated on hard copy, these can be entered by selecting "TITLES."
- ☐ Select "PRINT GRAPH" to print the displayed graphic, or select 26, 51,101, 201, or 401 to print a tabulation at the selected number of frequency points. You could also choose to print out a tabulation at only the marker frequencies, if any markers were on.
- ☐ When using a Canon BJ-20SX or Epson FX compatible printer, verify that its rear switch settings are as shown in Figure 4-1. Also verify that the power indicator is on and that its reset indicator is not flashing. If it is, press the reset switch.
- ☐ Press Hard Copy Start to print out the data.

Step 10 Measure the return loss of the device under test as follows:

- ☐ Repeat steps 3, except choose Return Loss instead of Transmission.
- ☐ Repeat step 8 for a return loss measurement.
- ☐ Print out the return loss as directed in step 9 above.

4-6 RATIO-MODE MEASUREMENTS

Ratio-mode measurements in which the A or B input is subtracted by the R1 or R2 input are described below. A test setup is shown in Figure 4-2. Ratio mode is beneficial in compensating for the effects of a long length of transmission, when making measurement where the device-under-test is located some distance away from the 56100A.

Step 1 Connect test equipment per Figure 4-2, except do not connect the test device. Turn the printer (or plotter) on.

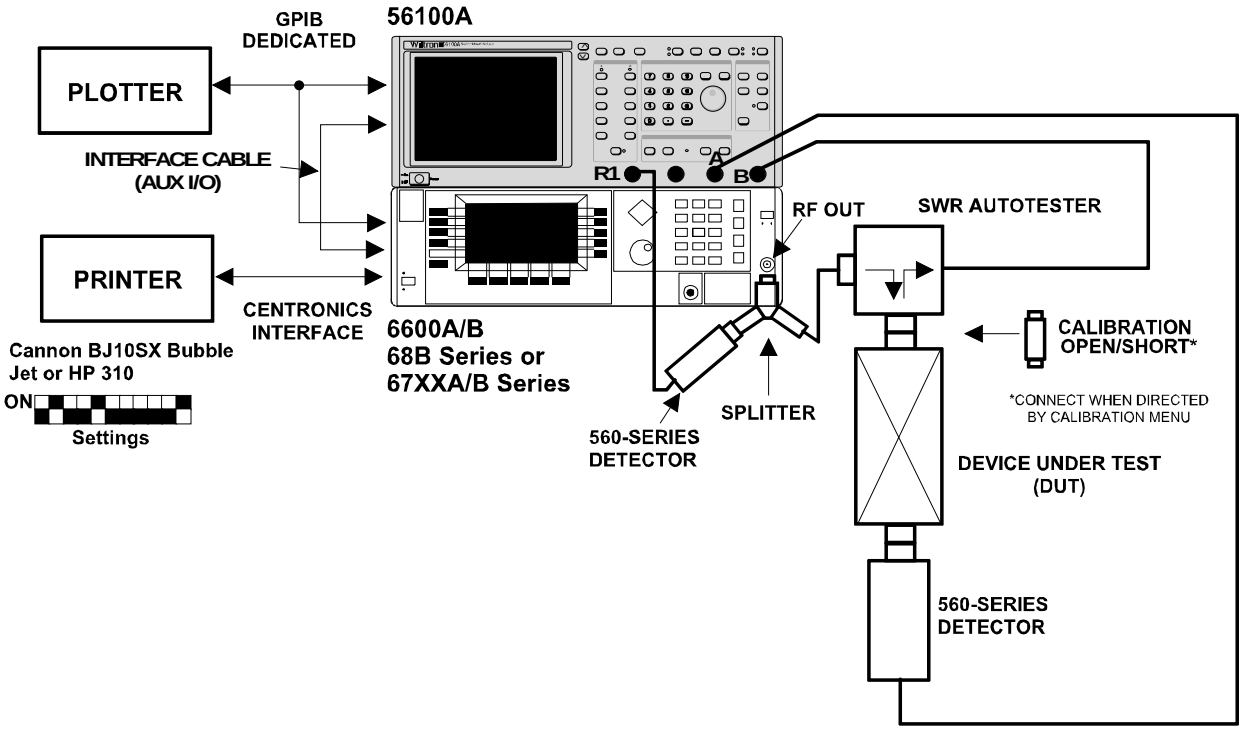


Figure 4-2. *Test Setup for Ratio Mode Setup*

Step 2 Turn on the frequency source and 56100A. At the conclusion of self test, the screen displays "ALL TESTS PASSED."

Select transmission mode and ratio input A/R1 for channel 1, and return loss and ratio input B/R1 for channel

Step 3 On the 56100A, press the Calibration key and follow the directions given in the calibration-cycle sequence of menus.

If necessary, refer to Figure 3-11 for an explanation of the menus. After finishing the calibration, connect the test device and RF detector as shown in Figure 4-2.

Step 4 On the 56100A, measure the transmission loss in the ratio mode as follows:

☐ Press the channel 1 Autoscale key. This gives an optimum vertical display of the test data.

☐ Read the transmission loss. This is the transmission loss for the A/R1 ratio mode input.

Step 5 To use the main cursor and relative cursor to read the results of the above measurement directly, proceed as follows:

☐ Press the Cursor Measurements On/Off to On, then position the cursor using the rotary knob or the Cursor Measurements—Ch1 key in conjunction with the Menu Select switch.

☐ Turn the relative cursor on and the Cursor Measurements—Ch1 key to On, then select the desired parameter from the menu.

Chapter 5
GPIB Programming

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Chapter 5
GPIB Programming

5-1. INTRODUCTION

This User's Guide provides descriptions and listings of the command mnemonics used to control the 56100A over the IEEE 488 Bus. It also contains general descriptions of the IEEE 488 Bus.

5-2. IEEE 488.1 BUS OVERVIEW

The IEEE-488 General Purpose Interface Bus (GPIB) is an instrumentation interface for integrating instruments, computers, printers, plotters, and other measurement devices into systems. The GPIB uses 16 signal lines to effect transfer of information between all devices connected on the bus.

The following requirements and restrictions apply to the GPIB.

- No more than 15 devices can be interconnected by one contiguous bus; however, an instrumentation system may contain more than one interface bus.
- The maximum total cumulative cable length for one interface bus may not exceed twice the number of devices connected (in meters) , or 20 meters whichever is less.
- A maximum data rate of 1 Mb/s across the interface on any signal line.
- Each device on the interface bus must have a unique address, ranging from 00 to 30.

The devices on the GPIB are connected in parallel, as shown in Figure 5-1, page 6. The interface consists of 16 signal lines and 8 ground lines in a shielded cable. Eight of the signal lines are the data lines, DIO 1 through DIO 8. These data lines carry messages (data and commands), one byte at a time, among the GPIB devices. Three of the remaining lines are the handshake lines that control the transfer of message bytes between devices. The five remaining signal lines are referred to as interface management lines.

The following paragraphs provide an overview of the GPIB including a description of the functional elements, bus structure, bus data transfer process, interface management bus, device interface function requirements, and message types.

5-3. IEEE 488 BUS FUNCTIONAL ELEMENTS

Effective communications between devices on the GPIB requires three functional elements; a talker, a listener, and a controller. Each device on the GPIB is categorized as one of these elements depending on its current interface function and capabilities.

Talker A talker is a device capable of sending device-dependent data to another device on the bus when addressed to talk. Only one GPIB device at a time can be an active talker.

Listener A listener is a device capable of receiving device-dependent data from another device on the bus when addressed to listen. Any number of GPIB devices can be listeners simultaneously.

Controller A controller is a device, usually a computer, capable of managing the operation of the GPIB. Only one GPIB device at a time can be an active controller. The active controller manages the transfer of device-dependent data between GPIB devices by designating who will talk and who will listen.

System Controller The system controller is the device that always retains ultimate control of the GPIB. When the system is first powered-up, the system controller is the active controller and manages the GPIB. The system controller can pass control to a device, making it the new active controller. The new active controller, in turn, may pass control on to yet another device. Even if it is not the active controller, the system controller maintains control of the Interface Clear (IFC) and Remote Enable (REN) interface management lines and can thus take control of the GPIB at anytime.

5-4. IEEE 488 BUS STRUCTURE

The GPIB uses 16 signal lines to carry data and commands between the devices connected to the bus. The interface signal lines are organized into three functional groups.

- Data Bus (8 lines)
- Data Byte Transfer Control Bus (3 lines)
- General Interface Management Bus (5 lines)

The signal lines in each of the three groups are designated according to function. Table 5-1 lists these designations.

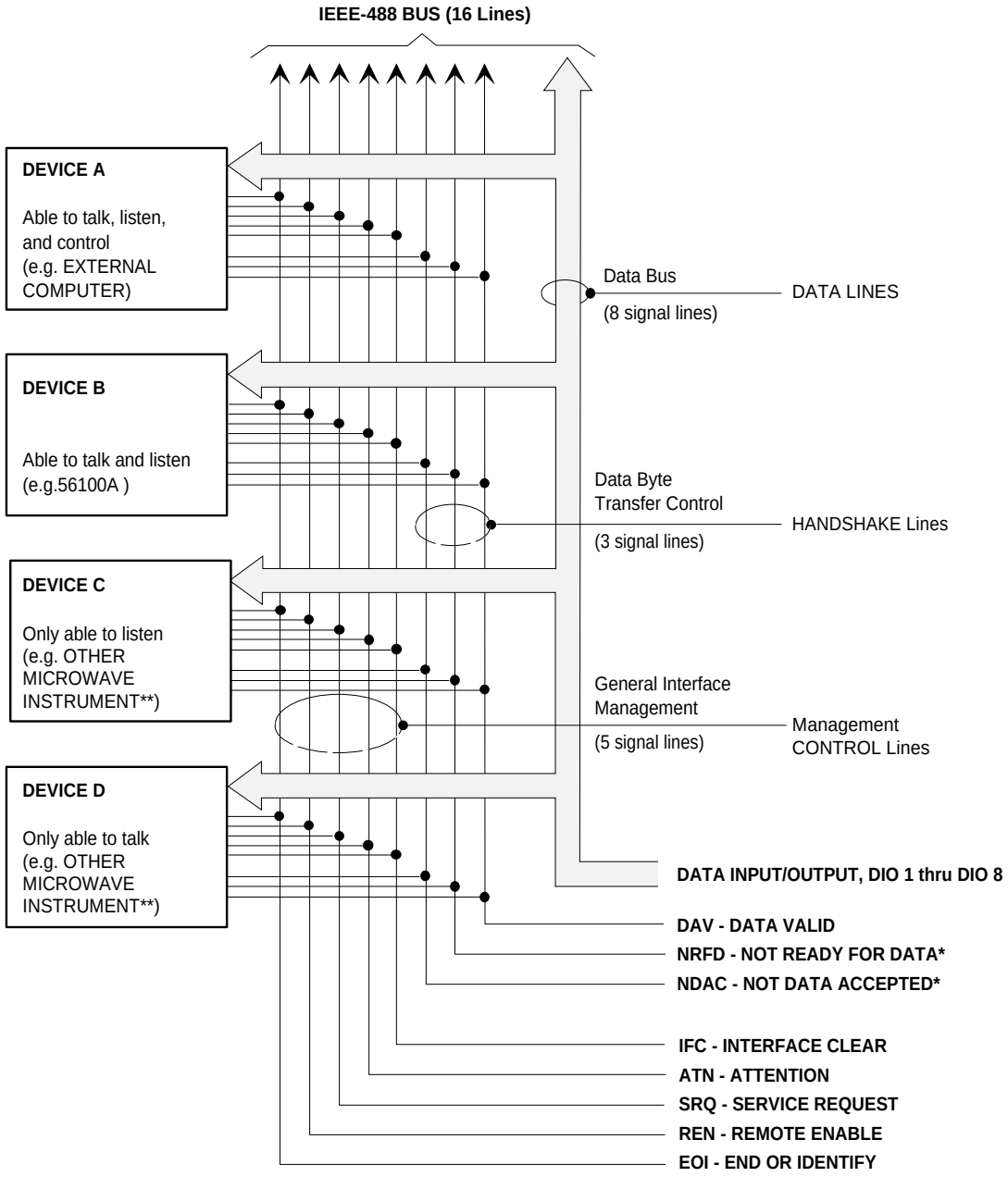
Table 5-1. *Interface Bus Signal Line Designations*

BUS TYPE	SIGNAL LINE	
	Name	Function
Data Bus	DIO 1– DIO 8	Data Input/Output, 1 thru 8
Data Byte Transfer and Control	DAV NRFD NDAC	Data Available Not Ready For Data Not Data Accepted
General Interface Control	ATN IFC SRQ REN EOI	Attention Interface Clear Service Request Remote Enable End Or Identify

5-5. IEEE 488 DATA BUS DESCRIPTION

The data bus is the conduit for the transfer of data and commands between the devices on the GPIB. It contains eight bi-directional, active-low signal lines—DIO 1 through DIO 8. Data and commands are transferred over the data bus in byte-serial, bit-parallel form. This means that one byte of data (eight bits) is transferred over the bus at a time. DIO 1 represents the least-significant bit (LSB) in this byte and DIO 8 represents the most-significant bit (MSB). Bytes of data are normally formatted in seven-bit ASCII (American Standard Code for Information Interchange) code. The eighth (parity) bit is not used.

Each byte placed on the data bus represents either a command or a data byte. If the Attention (ATN) interface management line is TRUE while the data is transferred, then the data bus is carrying a bus command which is to be received by every GPIB device. If ATN is FALSE, then a data byte is being transferred and only the active listeners will receive that byte.



* Negation is represented by low state on these two lines
** The configuration shown in this diagram depicts an external computer connected via GPIB to a 56100A Network Analyzer and other microwave instruments (if used).

Figure 5-1. *Interface Connections and Bus Structure*

5-6. DATA BYTE TRANSFER CONTROL BUS DESCRIPTION

Control of the transfer of each byte of data on the data bus is accomplished by a technique called the three-wire handshake, which involves the three signal lines of the Data Byte Transfer Control Bus. This technique forces data transfers at the speed of the slowest listener, which ensures data integrity in multiple listener transfers. One line (DAV) is controlled by the talker, while the other two (NRFD and NDAC) are wired-OR lines shared by all active listeners. The handshake lines, like the other GPIB lines, are active low. The technique is described briefly in the following paragraphs and is depicted in Figure 5-2. For further information, refer to ANSI/IEEE Std 488.1.

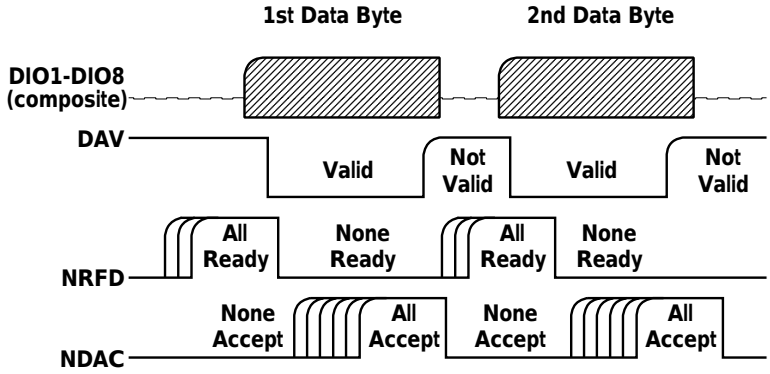


Figure 5-2. *Typical GPIB Handshake Operation*

DAV *Data Valid*

This line is controlled by the active talker. Before sending any data, the talker verifies that NDAC is TRUE (active low) which indicates that all listeners have accepted the previous data byte. The talker then places a byte on the data lines and waits until NRFD is FALSE (high), which indicates that all addressed listeners are ready to accept the information. When both NRFD and NDAC are in the proper state, the talker sets the DAV line TRUE (active low) to indicate that the data on the bus is valid (stable).

NRFD *Not Ready For Data*

This line is used by the listeners to inform the talker when they are ready to accept new data. The talker must wait for each listener to set the NRFD line FALSE (high), which they will do at their own rate. This assures that all devices that are to accept the data are ready to receive it.

NDAC *Not Data Accepted*
This line is also controlled by the listeners and is used to inform the talker that each device addressed to listen has accepted the data. Each device releases NDAC at its own rate, but NDAC will not go FALSE (high) until the slowest listener has accepted the data byte.

5-7. GENERAL INTERFACE MANAGEMENT BUS DESCRIPTION

The general interface management bus is a group of five signal lines used to manage the flow of information across the GPIB. A description of the function of each of the individual control lines is provided below.

ATN *Attention*
The active controller uses the ATN line to define whether the information on the data bus is a command or is data. When ATN is TRUE (low), the bus is in the command mode and the data lines carry bus commands. When ATN is FALSE (high), the bus is in the data mode and the data lines carry device-dependent instructions or data.

EOI *End or Identify*
The EOI line is used to indicate the last byte of a multibyte data transfer. The talker sets the EOI line TRUE during the last data byte.

The active controller also uses the EOI line in conjunction with the ATN line to initiate a parallel poll sequence.

IFC *Interface Clear*
Only the system controller uses this line. When IFC is TRUE (low), all devices on the bus are placed in a known, quiescent state (unaddressed to talk, unaddressed to listen, and service request idle).

REN *Remote Enable*
Only the system controller uses this line. When REN is set TRUE (low), the bus is in the remote mode and devices are addressed either to listen or to talk. When the bus is in remote and a device is addressed, it receives instructions from the GPIB rather than from its front panel. When REN is set FALSE (high), the bus and all devices return to local operation.

SRQ *Service Request*
The SRQ line is set TRUE (low) by any device requesting service by the active controller.

5-8. IEEE-488 INTERFACE FUNCTIONS AND PROTOCOLS

The IEEE-488 standard document describes a total of 11 different possible interface functions. Each of these interface functions acts in accordance with a specific protocol defined in the standard. This set of functions and protocols define every possible manner that information and control can be passed between devices connected to the GPIB.

Specific instruments, such as the 56100A, are implemented using only a portion, or subset, of the total set of interface functions defined by the standard. Table 5-2 lists the functional subset supported by the 56100A.

Table 5-2. *56100A GPIB Interface Function Subset Capability*

GPIB SUBSET	FUNCTION	DESCRIPTION
AH1	Acceptor Handshake	Complete Capability
SH1	Source Handshake	Complete Capability
T6	Talker	No Talk Only (TON)
TE0	Talker With Address Extension	No Capability
L4	Listener	No Listen Only (LON)
LE0	Listener With Address Extension	No Capability
SR1	Service Request	Complete Capability
RL1	Remote Local	Complete Capability
PP1	Parallel Poll	Complete Capability
DC1	Device Clear	Complete Capability
DT0	Device Trigger	No Capability
C0, C2, CF3, C28	Controller	No Capability

5-9. IEEE-488-1 MESSAGE TYPES

There are three types of information transmitted over the GPIB:

IEEE Interface Function Messages

These messages are sent on the data lines and interface management lines to control the state of the interface and the manner in which it responds to commands. These messages are used to maintain control of the interface. The user generally has control over these signals; however, the extent of user control is implementation-dependent and varies with the specific hardware and software used with the external controller.

Product-Specific Commands

These commands are mnemonic codes sent by the external computer to the 56100A to control the setup and measurement operations of the 56100A. The function and contents of these commands are not specified by the IEEE-488 standard. They are unique and specific to the ANRITSU 56100A. These commands (also referred to as "56100A GPIB commands") are transmitted over the data bus of the GPIB interface to the 56100A in the form of ASCII strings containing one or more codes. They are decoded by the *internal 56100A controller* and cause the various measurement functions of the system to be performed. (The 56100A GPIB interface does not decode these commands; it only acts as the transmission channel to the internal controller.)

Data and Instrument Status Messages

These messages are sent by the 56100A to the external computer via the GPIB. They contain measurement data, setup information, or system status information that the 56100A transmits over the data bus in response to specific commands from the external computer requesting the data. The contents of these messages are specific to the 56100A. They may be in the form of ASCII strings, or binary data.

In some cases data messages will be transmitted from the external computer to the 56100A. For example, messages to load calibration data.

An SRQ (service request) is an interface function message sent *from the 56100A* to the external computer to request service from the computer, usually due to some predetermined system condition or error. To send this message, the 56100A sets the SRQ

bit of the General Interface Management Bus true and then sends a status byte on the data bus lines.

An SRQ interface function message is also sent by the 56100A in response to a serial poll message from the computer, or upon receiving either an OEB or OPB command from the computer. The protocols associated with the SRQ functions are defined in the ANSI/IEEE Std 488-1978 document.

The 56100A GPIB commands for these functions along with the SRQ status byte format information is contained in Figure 5-6 and Table 5-14 of this user's guide.

The manner in which Interface Function Messages and Product-Specific Commands are invoked in programs is implementation specific for the GPIB interface used with the external computer. Even though both message types are represented by mnemonics, they are implemented and used in different ways.

The Interface Function Messages normally are sent automatically by the GPIB driver software in response to invocation of a software function. For example, to send the SDC interface function message, one would call the ibclr function of the National Instruments software driver. On the other hand, the 56100A GPIB command RST is sent in a string message to the addressed device (e.g. 56100A). In the case of the National Instruments example, this would be done by using the ibwrt function call.

5-10. IEEE 488. MESSAGES AND THE 56100A RESPONSE

Table 5-3 provides a listing of the IEEE 488.1 messages--Bus Messages--and the 56100A's response to each.

5-11. 56100A GPIB OPERATION, FUNCTIONAL GROUPS

The various GPIB commands used to control the 56100A are organized in functional groups and described in Tables 5-4 through 5-17, which start on page 5-13. All GPIB commands are listed alphabetically in Table 5-18, on page 5-58.

Table 5-3. *IEEE-488 Interface Function Messages Recognized by the 56100A*

Interface Function Message*	Message Function	Addressed Command	56100A Response
DCL	Device Clear	No	Resets the 56100A to its default state. Sending this message is equivalent to sending the RST command.
GTL	Go to Local	Yes	Returns the instrument to local (front panel) control. (See LLO below.)
GET	Group Execute	Yes	No action.
IFC	Interface Clear	No	Stops the 56100A GPIB interface from listening or talking. (The front panel controls are not cleared.)
LLO	Local Lockout	No	Prevents the front panel Return To Local key (or RTL GPIB command) from returning the instrument to local (front panel) control. Local control may be enabled using GTL message; however, any subsequent GPIB command (except DCL) will return to Local Lockout condition. The Local Lockout condition is cleared by DCL message.
REN**	Remote Enable	No	Places the instrument under remote (GPIB) if the 56100A has been addressed to listen.
SPE#	Serial-Poll Enable	No	Requests 56100A to output status byte to external computer.
SPD#	Serial Poll Disable	No	Disables the serial-poll function.
	Parallel-Poll Operation When queried by a parallel-poll message (PPOLL), the 56100A (if configured for parallel-poll operation) responds by setting its assigned data bus line to the logical state (1, 0) that indicates its correct SRQ status. To configure a bus device that is (1) built for parallel-poll operation and (2) designed to be remotely configured via the bus, the controller sends a two-byte parallel-poll configures and enable (PPC and PPE) message.		
PPC	Parallel-Poll Configure	No	The PPC byte configures the device to respond to a parallel-poll message, such as PPOLL.
PPE	Parallel-Poll Enable	No	The PPE byte assigns the logical sense (1,0) that the parallel-Enable (PPE) poll response will take.
PPU PPD	Parallel-Poll Unconfigure, Disable	No	When the network analyzer receives the PPC/PPE message, it configures itself to properly respond to the parallel-poll message. The PPU or PPD message is sent by the controller when a parallel-poll response is no longer needed. The message disable causes the network analyzer to become unconfigured for a parallel-poll response.

* These are *not* Device Specific Commands. These messages are implementation dependent — refer to the documentation included with the GPIB Interface for the external computer used.

** If the instrument is placed in remote and not supplied with program data, its operation is determined by the positions in which the front panel controls were set immediately prior to going remote.

For information about serial-poll operation, refer to the ANSI/IEEE Std 488-1978 document or to the documentation included with the GPIB Interface for the external computer used.

Table 5-4. Network Analyzer Display and Trace Memory Commands (1 of 4)

The following is a list of Mnemonic parameters as indicated within parenthesis:

N = 1 or 2 for channel selection
n = a number within range ±99.99
F = a frequency within range 0 to 999.9999 GHz or 0 to 9999.99 MHz. If units are omitted, GHz is assumed.
S = 0 or 1 for ON/OFF indication (1 = ON, 0 = OFF)
o = ∗ or / for ON/OFF indication (∗ = ON, / = OFF)
M = 1 to 9, Marker numbers, used for SAVE, RECALL, STORE Marker#, etc.
P = 0 to 400, to select pixel position
X = a variable that is defined in the descriptive text

Parameters (n) and (F) may use 'Scientific ('E') Notation,
examples: 123.4E-3 = 0.123; 6.2e1 = 62.00
Where alternative Mnemonics exist for a function, the double equals ('==') is used to indicate exactly equivalent commands.

MNEMONIC CODE	FUNCTION	DESCRIPTION
	COMMANDS FOR DISPLAY FUNCTIONS	
SI (N)(X)	Set Input For Channel N	Selects input to be displayed on selected display channel, where X is the selected input connector (or combination): A, B, R1, R2, A/R1, A/R2, B/R1, BR2. EXAMPLE: "**SI2 B/R2**" sets the signal ratio of (input B/ input R2). This input is displayed as the Channel 2 trace.
SM (N)(X)	Set Channel N Display	Sets measurement type to be displayed on selected display channel. X is selected measurement type: P (Power), R (Return loss), S (SWR), T (Transmission), C (Calibration data), M (trace Memory), V (volts), or 0 (turn channel off). EXAMPLES: "**SM2R**" sets channel 2 to display the return loss of the device under test from the selected input (see SI(N)(X)); "**SM 1 P**" sets channel 1 to display a measure of absolute power in dBm.
CH (N)(S)	Set Channel N On/Off	Turns the selected channel on or off. S=1 for ON, S=0 for OFF.
RON (N) ROF (N)	Reference Line On Reference Line Off	Selects the style of the reference line indicator for channel N,(1 or 2). Following RON, the position is displayed by a chevron "<" ">" and a broken line drawn across the screen display. The default display is ROF which displays the reference line position using only the chevron "<" or ">".

Table 5-4. Network Analyzer Display and Trace Memory Commands (2 of 4)

MNEMONIC CODE	FUNCTION	DESCRIPTION
SIF (S)	User Reference On/Off	Used to disable (S=0) or enable (S=1) the dedicated GPIB interface. NOTE: After a system reset, the 56100A defaults to the last user interface status selected.
REF(N)(X_{0-10})	Reference Line Position	Sets reference line to position "X" on selected channel (N), where X = 0 to 10. The top of screen is 0, bottom of screen is 10, default is 2. EXAMPLE: "**REF 1 9**" places the reference line for trace 1 at the ninth line from the top (i.e. almost at the bottom).
OFF (N)(n)	Offset (dB)	Sets the Offset (n) on the selected channel (N). Valid range for (n) depends on current measurement type: SWR: 1.00 to 60.00 dB or dBm: +/–99.99 Volts: –10.000 to +20.000 EXAMPLE: "**OFF 2 -10.5 dB**" sets the trace offset on channel 2 to –10.5 dB.
SCL (N)(X)	Resolution (scale)	Sets the Resolution Scaling for the selected channel (N), appropriate to the selected measurement type: dB or dBm: XdB / division; X = 0.1 to 10.0 in any 0.1 increment. SWR: XSWR / division; X = 0.01 to 10 in 0.01 increments. Volts: XVolts / division; X = 0.001 to 5 in 0.001 increments. EXAMPLE: "**SCL 1 .5**" sets channel 1 to 0.5 dB/Div (assuming dB mode) The signal trace is scaled about the Reference line.
TCR (N)	Trace At Cursor to Reference Line	Automatically adjusts the offset such that the trace at the cursor is placed on the reference line for channel N. The Resolution (scale) if not changed. Valid for all measurement modes providing the cursor is on.
ASC (N)	Autoscale	Automatically adjusts the resolution and offset for channel (N) to fit the signal trace on the screen. Resolution is set to the most appropriate value on a '1,2,5' sequence. Offset will be a multiple of the selected resolution.
ARF (S)	Autozero	Autozero occurs every retrace. This establishes if the 56100A is to expect the RF to still be on (in which case zeroing is performed using dummy loads) or off (zeroing is performed at the detectors).

Table 5-4. Network Analyzer Display and Trace Memory Commands (3 of 4)

MNEMONIC CODE	FUNCTION	DESCRIPTION
	LIMITS SETUP COMMANDS	
	Output Limits Functions Data Commands (OLT, OCH, and OCL) located in Table 5-15 can be used with the commands below to output limits data to the external computer.	
LHI (N)(n) or LLO (N)(n)	High Limit On Low Limit On	Sets straight line limit to (n) dB for the selected channel (N). These limits can be used as a guide to test signal trace response. Setting these limits suspends the application of any complex limits previously sent for that channel. EXAMPLE: "**LHI 2 10 dB**" Will set the high limit for channel 2 to 10 dB. The limits can be used as a guide to test signal trace response. For example, by setting Low and High limits to suitable values on channel 1, it would be easy to see if the signal trace (displayed on channel 1) of a device under test falls outside this defined range. The result (pass/fail) of these limit tests may be shown on screen (DLT), or sent to the controller (OLT).
LHF (N)	High Limit Off	Turns High Limit off for selected channel (N).
LLF (N)	Low Limit Off	Turns Low Limit off for selected channel (N).
CLH (N)(L) and CLL (N)(L)	Enter Complex Limits High Enter Complex Limits Low	These commands set the complex limits for channel (N). The format for the limits string (L) is shown in Figure 5-3. For these commands, a space *must* be used as a delimiter between parameters (N) and (L).
CHI (N)(S)	Complex High Limit ON/OFF	Displays (S = 1) or turns off (S = 0) the High Complex Limits for channel N
CLO (N)(S)	Complex LowLimit ON/OFF	Displays (S = 1) or turns off (S = 0) the Low Complex Limits for channel N
DSI (S)	Display Segment Identifiers	If enabled (S = 1), a numeric identifier is displayed to identify each segment of complex limit lines; Disabling (S = 0) removes the identifiers.
DLT	Display Limits Test	Displays a menu that performs pass/fail testing on every sweep for pre-entered limits.

Table 5-4. Network Analyzer Display and Trace Memory Commands (4 of 4)

MNEMONIC CODE	FUNCTION	DESCRIPTION
		TRACE MEMORY COMMANDS
SVT (X_{1-4})	Save Trace Memories	Argument (X) is a number from 1 to 4 that specifies the trace memory location to which data is to be saved. Saves Trace Memories for both channels. See also setup and calibration save/ recall commands in Table 5-9.
RCT (X_{1-4})	Recall Trace Memories	Argument (X) is a number from 1 to 4 that specifies the Trace Memory location from which data is to be recalled. Restores both Trace Memories to current memory. This command does not cause them to be applied (see command TM). See other save/recall commands in Table 5-9.
TMD (N)	Load Trace Memory with signal trace data	Stores current signal trace data for channel (N) to that channel's Trace Memory.
TMH (N)	Load Trace Memory with complex high limits	Stores current Complex High Limits data for channel (N) to that channel's Trace Memory
TML (N)	Load Trace Memory with complex low limits	Stores current Complex Low Limits data for channel (N) to that channel's Trace Memory A zero value will be stored in Trace Memory for any frequency range for which a complex limit has not been defined. Where there is a gap, no change will occur when Trace Memory is subsequently applied.
TM (N)(S)	Apply /Remove Trace Memory	S = 1: Apply Trace Memory subtraction to selected channel (N) trace display. S = 0: Do not apply Trace Memory subtraction for selected channel (N) trace display. Trace memory subtrac-

Commands: CLH, CLL, OCH, OCL.

Bus Command: **CLH 1 1 900MHz 4GHZ -3DB 7 DB D 2 4GHZ 6.2 7 -20.03dB d**

The command example above sets the high values of complex limits for channel 1. Two limit segments are shown in this example. The second segment is defined but turned off. The order in which data for each segment is entered is as follows:

- Segment Number {1,10}
- Start Frequency
- Stop Frequency
- Limit Value at Start Frequency
- Limit Value at Stop Frequency
- Segment status, {D|d|S|s} D = dB or dBm, segment on; d = segment off; S = SWR, segment on; s = segment off.

The command example illustrates setting the complex limits for segments 1 and 2. For the frequency parameters, “GHz” is assumed.

The “dB” mnemonic as used in the string is optional and may be used to improve readability. The command mnemonics may be in either upper or lower case, or mixed; *however, the segment status character is case-sensitive*.

Up to ten segments (1 – 10) may be specified, a complete set of segment values may be entered using a single command, or each segment may be entered individually.

The segment definitions are checked by the instrument and any overlap, where a single frequency has two different values specified by different segments, is treated as a command syntax error. (refer to paragraph 3.7).

The data is entered in an ASCII format.

Bus Command : **OCH 1**

EXAMPLE INSTRUMENT OUTPUT:

1	8.0000	10.0000	0.00	+15.00 D	2	10.0000	12.0000	+15.00	0.00 D
3	0.0000	0.0000	0.00	0.00 d	4	0.0000	0.0000	0.00	0.00 d
5	0.0000	0.0000	0.00	0.00 d	6	0.0000	0.0000	0.00	0.00 d
7	0.0000	0.0000	0.00	0.00 d	8	0.0000	0.0000	0.00	0.00 d
9	0.0000	0.0000	0.00	0.00 d	10	0.0000	0.0000	0.00	0.00 d

In this example, just the first two segments have been defined. The default frequency for undefined segments is 0.0000 GHz.

Commands **OCH** and **OCL** return definitions for all 10 possible segments irrespective of how many have been explicitly defined. Undefined segments have default values and lowercase Segment Status character.

If a limit is requested with **OCH** or **OCL** when that limit is off or a Single Line Limit is currently used, the last known data or default values will be returned but all segment status characters will be lowercase (d or s).

Figure 5-3. Programming Example: Complex Limits

Table 5-5. Calibration Sequence Commands (1 of 1)

The following is a list of Mnemonic parameters as indicated within parenthesis:

N = 1 or 2 for channel selection

n = a number within range ±99.99

F = a frequency within range 0 to 999.9999 GHz or 0 to 9999.99 MHz. If units are omitted, GHz is assumed.

S = 0 or 1 for ON/OFF indication (1 = ON, 0 = OFF)

o = ∗ or / for ON/OFF indication (∗ = ON, / = OFF)

M = 1 to 9, Marker numbers, used for SAVE, RECALL, STORE Marker#, etc.

P = 0 to 400, to select pixel position

X = a variable that is defined in the descriptive text

L = limit values - see Figure 5-3

Parameters (n) and (F) may use 'Scientific ('E') Notation, examples: 123.4E-3 = 0.123; 6.2e1 = 62.00

Where alternative Mnemonics exist for a function, the double equals ('==') is used to indicate exactly equivalent commands.

MNEMONIC CODE	FUNCTION	DESCRIPTION
CAL	Perform 56100A Calibration	Initiates the prompted calibration sequence for the 56100A. When a step has been completed the instrument will display a message prompting the user to set up the equipment ready for the next calibration step. It will also issue an SRQ (if SRQ is enabled and bit 2 is unmasked, i.e., 'SQ 1, PM 4'). Also, bit 2 in the Primary Status Byte will be set, indicating to the controller that the instrument is ready for a "continue" instruction (CTN).
CTN	Continue Calibration	Performs sweeps as necessary to take the data for the prompted conditions and continues to the next step. Also performs an equivalent function during instrument self test.
DOA (n)	Detector Offset A	Offsets the measurement data by (n) dB for input A measurements without affecting the calibration data. The allowed offset range is +/– 99.9 dB. This offset is cleared by re-entering a zero value for "n". This applies to the individual input detector so it applies whether db, dBm or SWR is being measured. Note: This offset is not cleared by Reset.
DOB (n)	Detector Offset B	Same as DOA for input B.
DO1 (n)	Detector Offset R1	Same as DOA for input R1.
DO2 (n)	Detector Offset R2	Same as DOA for input R2.
NUL	Low Level Null	Low level null is only usd in Autozero. RF Mode on establishes an equality between dummy loads and RF off concitions (only used when no RF is present).

Table 5-6. Cursor Control, Search, and Trace Value Hold Commands (1 of 3)

The following is a list of Mnemonic parameters as indicated within parenthesis:

N = 1 or 2 for channel selection
n = a number within range ±99.99
F = a frequency within range 0 to 999.9999 GHz or 0 to 9999.99 MHz. If units are omitted, GHz is assumed.
S = 0 or 1 for ON/OFF indication (1 = ON, 0 = OFF)
o = ∗ or / for ON/OFF indication (∗ = ON, / = OFF)
M = 1 to 9, Marker numbers, used for SAVE, RECALL, STORE Marker#, etc.
P = 0 to 400, to select pixel position
X = a variable that is defined in the descriptive text
L = limit values - see Figure 5-3

Parameters (n) and (F) may use 'Scientific ('E') Notation,
examples: 123.4E-3 = 0.123; 6.2e1 = 62.00
Where alternative Mnemonics exist for a function, the double equals ('==') is used to indicate exactly equivalent commands.

MNEMONIC CODE	FUNCTION	DESCRIPTION
	CURSOR CONTROL COMMANDS	
	Output Cursor Readout Data Commands (OCF, OCR, etc.) located in Table 5-17 can be used with the commands below to output cursor readout data to the external computer.	
COF	Cursor Off	Turn cursor off (see DON and DOF).
CON	Cursor On	Turn cursor on (see DON and DOF).
CRP (P)	Move Cursor to Position P	Move cursor to position (P) on measurement trace. Range of "P" is 0 to 400, where 0 is maximum left screen position and 400 is maximum right, irrespective of number of data points currently in use. CRP 201 will place cursor one pixel (dot) right of middle.
RCP (P)	Move Reference Cursor to Position P.	Same as CRP, but for reference cursor. This is a Relative Cursor operation and requires that Relative Mode has been selected. (see "DON")
CRF (N)(F)	Move Cursor to Frequency F	Move cursor to position corresponding to frequency (F) on measurement trace (N). The cursor data readout is interpolated between actual data points, as necessary. Frequency is assumed to be in GHz, unless otherwise designated. EXAMPLE: "**CRF 1 12000 MHz**" Will move the cursor to Frequency 12.0GHz on the signal trace for channel 1.

Table 5-6. Cursor Control, Search, and Trace Value Hold Commands (2 of 3)

MNEMONIC CODE	FUNCTION	DESCRIPTION
RCF(N)(F)	Move Reference Cursor to Frequency F	Same as CRF, but for reference cursor. EXAMPLE: "**RCF 1 10**" Will move the reference cursor to Frequency 10.0 GHz on the signal trace for channel 1. This is a Relative Cursor operation and requires that this mode has been selected. (see command "DON")
XCG	Exchange Cursors	Exchanges positions of Cursor and Reference cursor.
DON	Relative Mode On	Turn relative cursor mode on. This will not override a previous COF command; if COF has been sent, cursors will not be displayed by DON until CON is sent. In Relative Cursor mode, the difference value between the Main and Reference cursors is displayed in addition to the Main cursor value. If the Main cursor is placed at a greater value than the Reference cursor, the difference value will be positive. The pseudo-unit dBr is used to designate "Relative dB". EXAMPLE: if the Reference cursor is at 10 GHz with a value of –3 dB and the Main cursor is at 12 GHz with a value of –5 dB, then the relative readings will be 2 GHz and –2 dB.
DOF	Relative Mode Off	Turn relative cursor mode off.
	CURSOR SEARCH COMMANDS	
CMX(N)	Move Cursor to Max	Cursor will move to *maximum* trace value on designated measurement trace (N).
CMN(N)	Move Cursor to Minimum	Cursor will move to *minimum* trace value on designated measurement trace (N).
CMK(M_{1-9})	Move Cursor to Marker M	Move cursor to frequency marker 1 – 9, as specified. EXAMPLE: "**CMK 4**" will move the cursor to the same frequency as marker 4. Markers do not apply to the alternate frequency sweep. If the reference cursor is to be moved to marker 3, use "XCG CMK 3 XCG" to exchange cursors before and after the move.
CAM	Move Cursor to Active Marker	Move cursor to the active (last selected) frequency marker.

Table 5-6. Cursor Control, Search, and Trace Value Hold Commands (3 of 3)

MNEMONIC CODE	FUNCTION	DESCRIPTION
CLT(N)(n)	Move Cursor Left to n dB or SWR	Move cursor left of the present position on trace (N) to nearest data point that corresponds to (n) dB (or SWR). If the relative cursor is off, the search will be for an absolute value left of the cursor position. If the relative cursor is on, the search will be for a value relative to the reference cursor value. If the trace does not attain the specified search value, the cursor stays where it is and "NOT FOUND" is displayed in the Error Box (bottom right of screen). EXAMPLE: "**CLT 1 12.0**" If in SWR mode, this will move the cursor left to the nearest frequency at which channel 1 measures 12 SWR. (or 12.0 dB if in dB mode). If the instrument is in Relative cursor mode and the reference cursor is at a point where the level is 4 SWR (or dB), the cursor will be moved left to a point where the level is 16 SWR (or dB).
CRT(N)(n)	Move Cursor Right to n dB	Same as CLT, but search is to right of cursor position.
CBW(N)(n)	Cursor Bandwidth Search using (n) dB Reference	Displays the bandwidth value using dB reference (n) on trace (N). The reference cursor is positioned at the lower frequency [(n) dB point] and the main cursor at the higher frequency [(n) dB point]. The method of search is as described above (refer also to the manual mode of operation described in Chapter 3). The frequency data can be returned to the external computer using commands ORF, OCF and ODF (Table 5-16).

Table 5-7. Data Smoothing and Frequency Resolution Control Commands (1 of 1)

The following is a list of Mnemonic parameters as indicated within parenthesis:

N = 1 or 2 for channel selection
n = a number within range ±99.99
F = a frequency within range 0 to 999.9999 GHz or 0 to 9999.99 MHz. If units are omitted, GHz is assumed.
S = 0 or 1 for ON/OFF indication (1 = ON, 0 = OFF)
o = * or / for ON/OFF indication (* = ON, / = OFF)
M = 1 to 9, Marker numbers, used for SAVE, RECALL, STORE Marker#, etc.
P = 0 to 400, to select pixel position
X = a variable that is defined in the descriptive text
L = limit values - see Figure 5-3

Parameters (n) and (F) may use 'Scientific ('E') Notation, examples: 123.4E-3 = 0.123; 6.2e1 = 62.00
Where alternative Mnemonics exist for a function, the double equals ('==') is used to indicate exactly equivalent commands.

MNEMONIC CODE	FUNCTION	DESCRIPTION
	DATA SMOOTHING COMMANDS	
SON (X)	Trace Smoothing On	Sets smoothing to minimum, maximum, or off depending on the value of X. When: X = 0, smoothing off; X = 1, minimum smoothing; X = 2, maximum smoothing.
SOF	Trace Smoothing Off	Turns trace smoothing off.
SMO (X)	Set Smoothing Value	Alternative mnemonic for SON (X).
	AVERAGING COMMANDS	
AOF	Averaging Off	Turn on signal averaging.
AVG (X)	Averaging On	Turns measurement averaging function on. The number of sweeps averaged is equal to 2 raised to the power (X), where X = 1 to 8.
AVE (X)	Set Averaging	Turns measurement averaging function on. Number of averaged sweeps = (X). Valid values for X are 2, 4, 8, 16, 32, 64, 128, and 256; other values will be rounded down. This command applies to both channels. EXAMPLE: "**AVE 16**" (== AVG 4) Each display point will be the average of the last 16 measurement sweeps. This command may be followed with 'SQS 16' which will cause SRQ after 16 sweeps, when averaged data as required will be available.
	DATA POINT AND FREQUENCY RESOLUTION COMMANDS	
DP (X)	Set Number of Data Points	Sets the *screen display* resolution in terms of number of data points: X=1, 101 points; X=2, 201 points; X=4, 401 points.

Table 5-8. System Functions Control Commands (1 of 2)

The following is a list of Mnemonic parameters as indicated within parenthesis:

N = 1 or 2 for channel selection
n = a number within range ±99.99
F = a frequency within range 0 to 999.9999 GHz or 0 to 9999.99 MHz. If units are omitted, GHz is assumed.
S = 0 or 1 for ON/OFF indication (1 = ON, 0 = OFF)
o = ∗ or / for ON/OFF indication (∗ = ON, / = OFF)
M = 1 to 9, Marker numbers, used for SAVE, RECALL, STORE Marker#, etc.
P = 0 to 400, to select pixel position
X = a variable that is defined in the descriptive text
L = limit values - see Figure 5-3

Parameters (n) and (F) may use 'Scientific ('E') Notation,
examples: 123.4E-3 = 0.123; 6.2e1 = 62.00
Where alternative Mnemonics exist for a function, the double equals ('==') is used to indicate exactly equivalent commands.

MNEMONIC CODE	FUNCTION	DESCRIPTION
ASW	Auto Sweep	Only available on non-intelligent sweepers.
MSW	Manual Sweep	Only available on non-intelligent sweepers.
NSW	Normal Sweep	Set sweeper to normal. Only available on non-intelligent sweepers.
CN	Configure Normal	Resets the hardware link between 56100A and source for normal operation..
CNR	CW No Ramp	Only available on non-intelligent sweepers.
CRO	Configure Ramp Output	Provides 0–10V ramp output from 56100A via the RAMP INPUT/OUTPUT BNC connector..
CML (data)	Configure Manual Labeling	Allows 56100A display to be annotated when using a non-intelligent source, e.g., "2 GHz 8 GHz 10 dBm."
GON	Turn Graticule On	Turns the graticule grid display on. Lines are spaced at intervals in a sequence of 1, 2, 5, or 10 frequency units/division so that there are always between 3 and 10 vertical graticule lines on the screen.
GOF	Turn Graticule Off	Turns the graticule grid display off. Residual tick marks are displayed for reference.
SVC(X)	Save Setup with Calibration Data	Saves the current control panel setup together with all relevant calibration data to memory (M), where: M = 1 to 4. Saves a Store Title if one has been previosly sent with TSS (Table 11)
SVS(M)	Save Front Panel Setup	Saves the current control panel setup to setup memory location (M), where M = 1 to 9. Saves a Store Title if one has been previously sent with TSS (Table 11)
RCC(X)	Recall with Calibration Data	Recalls the control panel setup from memory location (X), together with calibration data (X = 1 to 4).

Table 5-8. System Functions Control Commands (2 of 2)

MNEMONIC CODE	FUNCTION	DESCRIPTION
RCS(M)	Recall Setup	Recalls the control panel setup from setup memory location (M).
PRV(X)	Preview	Looks at control panel setup X (X=1 to 9) from memory without recall. If an intelligent sweeper is connected, its setup is also displayed. When Preview mode is selected, only the following functions are allowed: other Preview setups, stop print function, and print graph function. Command “PRV 0” deselects the Preview mode; “PRV I” displays stored setup index.
		NOTE A summary of the GPIB commands for setup and trace data save, recall and preview functions is contained in Table 5-9.
TM0	Turn off manual labeling	Turns of all label information sets using the CML mnemonic.
GSN	GPIB Status Indication On	Turns the GPIB Status Indication display on. This is the default while in Remote operation. The Status Indication uses the error/warning box at lower right of screen.
GSF	GPIB Status Indication Off	Turns the GPIB status indication display off. This restores normal display of error/warning messages, if selected, in the box at bottom right of screen during remote operation.
HON	Hold Trace.	Holds the current data being displayed on the screen. Displayed traces may be re-scaled but no new data is taken.
HOF	Release Hold	Releases hold mode (resume measurements).
BC(S)	Blank CRT	Blanks or unblanks display screen: S = 1 blanks CRT; S = 0 restores display.
RTL	Return To Local	Returns the analyzer from the GPIB mode to the local mode.
TST	Self-Test Instrument	Runs the instrument self test routine. The result of the test is available in the extended status byte.
RST	Reset Instrument	Resets the instrument to factory default control panel settings. If an intelligent sweeper is connected to the 56100A, this too will be reset. The 56100A sends the Ramp On signal after RST, to ensure that the sweeper has an active sweep.
CTN	Continue	Continue after self test finished.

Table 5-9. Summary of Commands for Setup and Trace Memory Data Save, Recall and Preview Functions

Command	Function	From	To	Data	Refer to Table
SVC	Save	Current	Stores 1-4	Setup + Cal data + trace memories (both channels)	5-8
SVS	Save	Current	Stores 1-9	Setup	5-8
SVT	Save	Current	Stores 1-4	Trace memories (both channels)	5-4
RCC	Recall	Stores 1-4	Current	Setup + Cal data + trace memories (both channels)	5-8
RCS	Recall	Stores 1-9	Current	Setup	5-8
RCT	Recall	Stores 1-4	Current	Trace memories (both channels)	5-4
PRV	Preview	Stores 1-9	Screen	Summary/titles	5-8
OSS	Output	Stores 1-9	Controller	Setup	5-16
OCD	Output	Current	Controller	Cal data (one channel)	5-16
OTM	Output	Current	Controller	Trace memory (one channel)	5-16
LSS	Input	Controller	Stores 1-9	Setup	5-16
LCD	Input	Controller	Current	Cal data (one channel)	5-16
LTM	Input	Controller	Current	Trace memory (one channel)	5-16

NOTE: Calibration Data and Trace Memories held in store locations 1-4 cannot be transferred directly to the external controller. They must first be moved from the store locations to “current” using the RCC command. Then the data for each required channel must be transferred to the external controller using OCD or OTM commands. To transfer from the external controller to store locations, use the LCD or LTM commands, followed by the SVC command.

Table 5-10. Pass Through Codes (1 of 1)

The following is a list of Mnemonic parameters as indicated within parenthesis:
N = 1 or 2 for channel selection
n = a number within range +/–99.99
F = a frequency within range 0 to 999.9999 GHz or 0 to 9999.99 MHz.
If units are omitted, GHz is assumed.
S = 0 or 1 for ON/OFF indication (1 = ON, 0 = OFF)
M = 1 to 9, Marker numbers, used for SAVE, RECALL, STORE Marker#, etc.
P = 0 to 400, to select pixel position
X = a variable that will be defined next to the instruction or Mnemonic

MNEMONIC CODE	FUNCTION	DESCRIPTION
RDB (X)	Pass Through Command for Binary Data	Redirects binary data to an instrument on the dedicated bus.
RDR(X)	Pass Through Command for ASCII Data	Addresses and programs instruments connected to the dedicated GPIB interface, where X is the address of the instrument receiving the data. For example, RDR 5 COMMAND STRING would pass the command string data to any instrument on the dedicated GPIB having address 5. “CR LF” at the end of the pass through command string terminates the data transmission. See Figure 5-4 for a sample program that uses this command. This command can be used to change an attached plotter’s X/Y coordinates, which determine the size of a plot. To do this, send this command followed by the plotter’s address and its GPIB command for changing P1 and P2. (Refer to the plotter’s documentation for the P1 and P2 commands.)
SDP(X) SDS(X) SDX(X)	Set Plotter Address Set Sweeper Address Set 56100A Address	Sets the plotter, sweeper, or 56100A address where X= the new address of the instrument. Valid instrument addresses for X are 0 to 30.
FRD (X) (data)	Fast Redirection	High speed data communications with device at address X. This command is used in place of the RDR command when high speed data transfer is required.
FRE	Fast Redirection Ends	This command terminates the Fast Redirection (FRD) command.

Sweeper Setup Data Transfer Example Program

EQUIPMENT:
56100A Scalar Network Analyzer
68147B Sweep Generator (connected to 56100A via the *Dedicated* GPIB)
Controller (connected to 56100A via the *Main* GPIB)

The example program below loads the contents of the 68147B sweep generator setup memories 1, 2, & 3 into the Controller (via the 56100 A). It then sends this data back to the 68147B (via the 56100A) and loads it into setup memories 4, 5, & 6.

```
10 DIM A$[500]                    |
20 DIM B$[500]                    |  Dimension controller memory
30 DIM C$[500]                    |

40 ASSIGN @Sna to 706             |
50 OUTPUT @Sna; "RST"             |  Reset 56100A to factory settings

60 WAIT 5                         |  Wait for Reset to finish

70 OUTPUT @Sna; "RDR 5 RCS1 SAV"  |  Send 68147B Setup Memory 1 data
                                  |  to 56100A
90 OUTPUT @Sna; "ORD"             |  Send data from 56100A to contoller

100 ENTER @Sna;A$                 |  Enter data into cont'lr memory

110 OUTPUT @Sna; "RDR 5 RCS2 SAV"|
120 ENTER @Sna;B$                 |  Same as statm'ts 70 & 100 above,
130 OUTPUT @Sna; "RDR 5 RCS3 SAV"|  but for setup memories 2 and 3
140 ENTER @Sna;C$                 |

150 OUTPUT @Sna; "RDR 5 RCL";A$   |  Send data for setup memory 4 from
                                  |  controller to 68147B
160 OUTPUT @Sna; "RDR 5 SVS4"     |  Save data into 68147B setup memory 4

170 OUTPUT @Sna; "RDR 5 RCL";B$   |
180 OUTPUT @Sna; "RDR 5 SVS5"     |  Same as statm'ts 150 & 160 above,
190 OUTPUT @Sna; "RDR 5 RCL";C$   |  but for setup memories 5 and 6
200 OUTPUT @Sna; "RDR 5 SVS6"     |

210 LOCAL 706                     |
220 END                           |   End of program
```

PROGRAM APPLICATION — The example program above illustrates how the sweep generator setup memory data can be expanded by transferring it to the controller. Note that the data is transferred via the 56100A to the controller (and back again to the sweep generator) without having to change the system cable configuration. This program can be used to store sweep generator setup data in controller memory to be recalled and down loaded at a future time. This is useful when saving unique Test System setups.

Figure 5-4. Example Program Showing Usage of RDR and ORD Commands

Table 5-11. Hard Copy Output Commands (1 of 2)

The following is a list of Mnemonic parameters as indicated within parenthesis:

N = 1 or 2 for channel selection
n = a number within range ±99.99
F = a frequency within range 0 to 999.9999 GHz or 0 to 9999.99 MHz. If units are omitted, GHz is assumed.
S = 0 or 1 for ON/OFF indication (1 = ON, 0 = OFF)
o = ∗ or / for ON/OFF indication (∗ = ON, / = OFF)
M = 1 to 9, Marker numbers, used for SAVE, RECALL, STORE Marker#, etc.
P = 0 to 400, to select pixel position
X = a variable that is defined in the descriptive text

Parameters (n) and (F) may use 'Scientific ('E') Notation,
examples: 123.4E-3 = 0.123; 6.2e1 = 62.00
Where alternative Mnemonics exist for a function, the double equals ('==') is used to indicate exactly equivalent commands.

MNEMONIC CODE	FUNCTION	DESCRIPTION
	PRINT COMMANDS, PGR, PT, PTL, TMO, PST.	
	The data is temporarily stored in an internal buffer, and the unit is ready for a new instruction after approximately 1-12 seconds. If the buffer cannot store the amount of data requested or if the printer is not ready, the 56100A indicates an error by setting bit 2 of extended status byte and sending a SRQ (if enabled). Bit 0 of the Extended Status Byte indicates that a print is in progress. The printer is connected to the rear panel PARALLEL PRINTER INTERFACE connector.	
PGR	Print Graph	A pixel (dot-by-dot) plot of the measurement screen display is sent to the external printer.
PT(X)	Print Tabular Data	Sends tabular measurement data to external printer, as follows: X = 0 401 data points are sent; X = 1 201 data points are sent; X = 2 101 data points are sent; X = 3 51 data points are sent; X = 4 26 data points are sent; X = 5 data at current markers only is sent Where there is currently a marker at a data point frequency, it is identified and emphasized in the table.
PTL	Print Complex Limits	Provides a hardcopy printout of Complex Limits data.
PST	Stop Print/Plot	Stops any printing of hard copy currently in progress.
	IDENTIFICATION STRING DEFINITIONS:	
	These text strings are reproduced verbatim on hardcopy outputs where used. Suggested use is as fixed labels; however, they may be used as text strings for other annotation, as needed. Maximum length of string is 12 characters (including spaces). String must be enclosed by 'single quote marks'.	

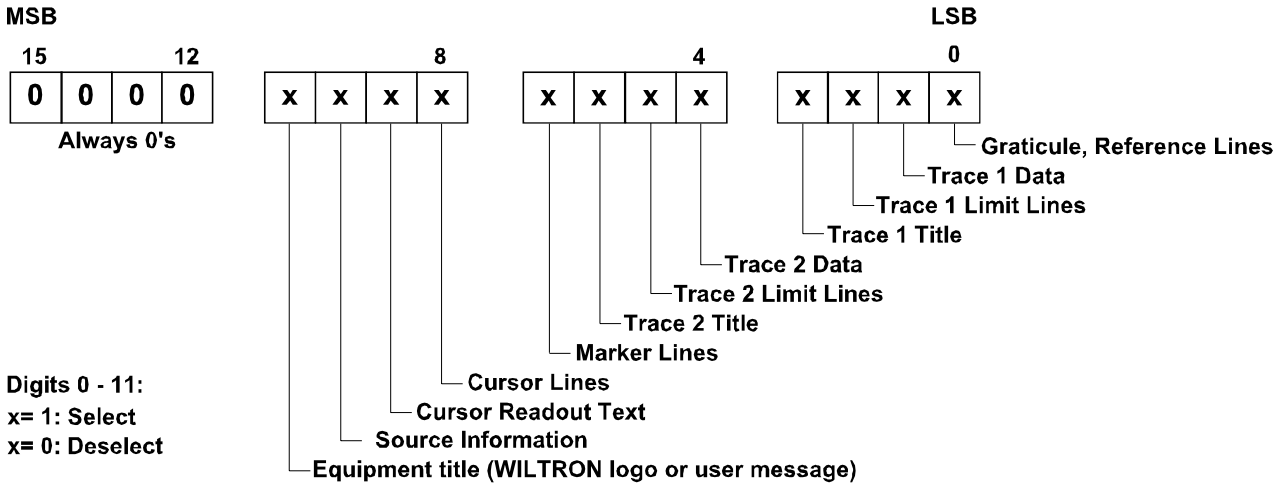
Table 5-11. Hard Copy Output Commands (2 of 2)

MNEMONIC CODE	FUNCTION	DESCRIPTION
LID 'Ident'	Load Identification Label	Sets up an ASCII string that is used as an 'Identify' label for printer or plotter output containing header or title information. Typically it will include the name of the operator or test device serial number. EXAMPLE: **LID 'A. Wilkinson'** causes the operator's name, to be included on external printer or plotter output.
LDE 'Device'	Load Test Device Label	Same as LID, but the string forms the 'Test Device' label.
LDA 'Date'	Load Date Label	Same as LID, but the string forms the 'Date' label.
TSS 'Title'	Set Title String for Stored Setups	Same as LID, but the string is used as a DESCRIPTION in the Preview Index for stored front panel setups. For this to be used, it must be sent to the instrument before a setup is saved. EXAMPLE: **TSS 'Attenuators'** Assign title to current setup **SVS 5** Save current front panel setup in store 5
PLT	Plot Titles	Plots the current titles displayed to indicate the measurement and test being performed.
SCP (bit mask)	Specify Custom Plot	The bit mask (Figure 5-5) is a string of ASCII 0's and 1's that indicate the user's requirements for a plot (e.g., ti-tle, strings, markers, traces, graticules, etc.)
PLA	Plot All	Provides a screen plot containing trace, graticule, cursor, and titles.
PLR	Plot Trace	Provides a screen plot of the signal trace(s).
PLG	Plot Graticules	Provides a screen plot of the graticule and reference lines.
PLC	Plot Cursor	Provides a plot of the current cursor position.
PC	Output Custom Plot	Always plots the user specified plot. If PC is used and not defined, the 56100A defaults to "Plot All."

Bus Command: SCP (Argument)

The mask that follows the SCP command mnemonic is a 16 digit ASCII string that defines which plot elements will be active in the custom plot being setup. The first three digits of this string are always zero. The remaining 13 digits turn various plot characteristics on/off, as shown below. As shown in the example, note that spaces may be inserted at any place in the string to improve program readablility.

The SCP command does not actually produce the defined plot; the next PLT command encountered in the program will produce the defined plot. The plot elements activated by the SCP command will be produced in the subsequent plot only if they are currently displayed on the 56100A. Also, if measurement limits are activated by the SCP command, but have not been specified (or are not active), they will not be plotted. The SCP and PLT command mnemonics are described in Table 5-11.



EXAMPLE: **SCP (0000 0000 0010 0001)**
[or: **SCP(0000000000100001)]**

This example will setup a custom plot that will contain only a graticule, reference lines and Trace 2 limit lines.

Figure 5-5. SCP Command Mask Bit Assignments

Table 5-12. Command Codes: Special Functions (1 of 3)

The following is a list of Mnemonic parameters as indicated within parenthesis:

N = 1 or 2 for channel selection
n = a number within range ±99.99
F = a frequency within range 0 to 999.9999 GHz or 0 to 9999.99 MHz. If units are omitted, GHz is assumed.
S = 0 or 1 for ON/OFF indication (1 = ON, 0 = OFF)
o = ∗ or / for ON/OFF indication (∗ = ON, / = OFF)
M = 1 to 9, Marker numbers, used for SAVE, RECALL, STORE Marker#, etc.
P = 0 to 400, to select pixel position
X = a variable that is defined in the descriptive text
L = limit values - see Figure 5-3

Parameters (n) and (F) may use 'Scientific ('E') Notation, examples: 123.4E-3 = 0.123; 6.2e1 = 62.00
Where alternative Mnemonics exist for a function, the double equals ('==') is used to indicate exactly equivalent commands.

MNEMONIC CODE	FUNCTION	DESCRIPTION
	SPECIAL FUNCTIONS 1, TRACE	
SF10	1: Max Hold.	Capture the peak values of trace 1.
SF11	1: Min Hold.	Capture the minimum values of trace 1.
SF12	1: Pk-Pk Hold.	Capture the trace 1 minimum and maximum values from successive sweeps.
	NOTE This mode can be used only with a setting of 401 points.	
SF13	1: Normal.	Turns off the capture modes on trace 1.
SF14	2: Max Hold.	Capture the peak values of trace 2.
SF15	2: Min Hold.	Capture the minimum values of trace 2.
SF16	2: Pk-Pk Hold.	Capture the trace 2 minimum and maximum values from successive sweeps.
	NOTE This mode can be used only with a setting of 401 points.	
SF17	2: Normal.	Turns off the capture modes on trace 2.
	SPECIAL FUNCTIONS 2, CURSOR	
SF20	1: Min.-Max.	Cause the cursor on trace 1 to search for the maximum trace value, and the Relative Cursor on trace 1 or 2 to search for the minimum value.
SF21	1: From Max.	Cause the selected search to be made from the maximum value of trace 1 (for example bandwidth relative to peak).

Table 5-12. Command Codes: Special Functions (2 of 3)

MNEMONIC CODE	FUNCTION	DESCRIPTION
SF22	2: Min.-Max.	Cause the cursor on trace 2 to search for the maximum trace value, and the Relative Cursor on trace 2 to search for the minimum value.
SF23	2: From Max.	Cause the selected search to be made from the maximum value of trace 1 or 2 (for example bandwidth relative to peak).
SF24	Repeat.	Repeats the search.
SF25	Normal.	Returns 56100A to the single-search mode.
SF40	User Titles.	Changes the measurement name (type) as required by the user. For example, the titles could read “amp. gain,” or “bias volt.” The titles “IDENTIFY” and “TEST DEVICE” apply to channel 1 and 2 respectively, as set using the LID and LDE commands.
SF41	Stnd Titles.	Cause trace to revert to standard title names (Transmission, Return Loss, Power, etc).
	SPECIAL FUNCTIONS 5, VOLTS MODE	
SF50	Fxd Range 1.	Selects the 0 - 10 volt range.
SF51	Fxd Range 2.	Selects the 0 - 1 volt range.
SF52	Fxd Range 3.	Selects the 0 - 100 mV range.
SF53	Auto Range.	Selects the normal autorange operation.
	SPECIAL FUNCTIONS 6, CALIBRATION OPTIONS	
SF60	Hi Res CAL.	Enables a feature that provides up to 2000 points of calibration memory (typically used in special applications, like Distance-to-Fault, Option P2).
SF61	Standard Cal.	Selects the standard calibration mode.
SF62	Allow 6700A Level Corrn.	Enables 67XXA level correction.
SF63	Stop 6700A Level Corrn.	Disables digital Level Correction on 67XXA. (This may be needed in some system applications).
	SPECIAL FUNCTIONS 7, GAIN COMPRESSION	
SF70	Channel 1	Increment power on Channel 1 until limits fail.
SF71	Channel 2	Increment power on Channel 2 until limits fail.

Table 5-12. Command Codes: Special Functions (3 of 3)

MNEMONIC CODE	FUNCTION	DESCRIPTION
SSL(X)	Starting At	Enter the power level from which the test will start. Usually this is just below the expected compression point. The test restarts at this point each time that the function is used. Enter the level value the same as for complex limits. The argument (X) is a number from –120 to +30 dBm, based on the desired power level.
SML(X)	Max Level	Tells the 56100A the maximum power level value that should be sent to the source.The argument (X) is a number from –120 to +30 dBm, based on the desired power level.
SF74	Continue	Overrides limit-failure and sets the power level to the “Max Level” point, as described above.

Table 5-13. SRQ Generation and Status Commands (1 of 1)

The following is a list of Mnemonic parameters as indicated within parenthesis:

N = 1 or 2 for channel selection
n = a number within range ±99.99
F = a frequency within range 0 to 999.9999 GHz or 0 to 9999.99 MHz. If units are omitted, GHz is assumed.
S = 0 or 1 for ON/OFF indication (1 = ON, 0 = OFF)
o = ∗ or / for ON/OFF indication (∗ = ON, / = OFF)
M = 1 to 9, Marker numbers, used for SAVE, RECALL, STORE Marker#, etc.
P = 0 to 400, to select pixel position
X = a variable that is defined in the descriptive text

Parameters (n) and (F) may use 'Scientific ('E') Notation,
examples: 123.4E-3 = 0.123; 6.2e1 = 62.00
Where alternative Mnemonics exist for a function, the double equals ('==') is used to indicate exactly equivalent commands.

MNEMONIC CODE	FUNCTION	DESCRIPTION
SQ(S)	Enable/Disable SRQ	Enables or disables the SRQ generation function for the instrument: S = 0 disables SRQ function (default); S = 1 enables function.
SQS(S)	Set Number of Sweeps for SRQ	After (X) number of frequency sweeps are completed by the instrument, an SRQ will be generated.
IPM($X_{0\text{-}255}$)	Input Mask for Primary Status Byte	Specifies an 8-bit data mask that is used to enable specified bits of the primary status byte, which is returned to the controller. The mask argument (X) is a number from 0 to 255. Figure 5-6 shows the mask argument decoding, the function of each bit of the status byte and the default value.
IEM($X_{0\text{-}255}$)	Input Mask for Extended Status Byte	Same as IPM, but for the extended status byte. See Figure 5-6.
CSB	Clear Primary Status Byte	Clears the primary status byte.

See related commands **OEB, OPB, OSB, OID**, in Table 5-14.

Service Request (SRQ) Generation Function

The 56100A generates GPIB service requests (SRQs) to report instrument status and syntax errors, etc, to the external controller. When a SRQ is generated, the GPIB SRQ control line is set true (low) and the Primary Status Byte is returned to the controller on the GPIB data lines, DIO 1 thru DIO 8.

The 56100A will generate a SRQ if:

Primary Status Byte

Bit Assignment:	7	6	5	4	3	2	1	0

Status Reporting Function	Status Byte Bit
Programmed number of sweeps have been completed	0
Syntax error encountered	1
Calibration sweep finished	2
Low level trim required	3
Redirection mode failure. Sets for any error associated with attempting to program an instrument on the dedicated GPIB.	4
Extended Status Byte contains valid information (see below)	5
Service request bit (this bit is unmaskable)	6
Redirected SRQ. Set when any instrument on the dedicated GPIB has requrested service.	7

Figure a

1. The SRQ generation function has been enabled using the SQ 1 command and,
2. One (or more) of the status reporting functions listed below in Figure **a** is true and,
3. The Primary Status Byte bit associated with the true status reporting function has been *enabled* by the Primary Status Mask function (command IPM — see Figure **b**).

Bit 6 of the Primary Status Byte (SRQ bit) is not maskable. It will be true for the status byte returned to the controller for all internally generated SRQ's and in response to a serial poll request.

When an SRQ is serviced by the controller, the Primary Status Byte bit(s) that caused the SRQ generation will automatically be reset. (The corresponding Primary Status *Mask* bit(s) will not.) The Primary Status Byte may be cleared at any time via the CSB command.

The contents of the Primary Status byte will also be returned to the controller in response to the OPB and OSB commands.

If the SRQ generation function is not used, the instrument status can still be be checked using the IPM, OPB, OSB and CSB commands.

Figure 5-6. SRQ Generation, Primary & Extended Status Byte Structures, and Masking (1 of 3)

Primary Status Mask Function

Primary Status Mask Byte

Bit Assignment:	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Binary Bit Weight:	**128**	**64**	**32**	**16**	**8**	**4**	**2**	**1**

Figure b

The IPM command sets the bits in the Primary Status Mask Byte. A true bit in this byte will enable the corresponding status reporting function in the Primary Status Byte. A false bit will disable the function. The value assigned with the IPM command designates the binary weight of all true bits. EXAMPLE:

IPM 3 enables bits 0 and 1 (binary weight 1+2) in the Primary Status Byte

Extended Status Byte

Bit Assignment:	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**

Status Reporting Function	**Ext'd Status Byte Bit**
NOTE: Bits 0, 1, and 2 contain status information and also generate a service request. The remaining bits are status bits only.	
Print finished = 0(will generate an SRQ) Print failed = 1	0
Plot Failed = 0 (will generate an SRQ Plot failed = 1	1
Last print request failed (generates an SRQ)	2
56100A is uncalibrated	3
56100A is in Calibration mode	4
56100A is in Secure mode	5
56100A failed Self Test	6
56100A is in Preview mode	7

Figure c

Extended Status Byte StExtended Status Byte Structure

The Extended Status Byte bits always reflect the status of the instrument functions listed in Figure **c**. These bits are enabled/disabled in the same manner as the Primary Status Byte bits by the Extended Status Byte Mask command, IEM. When one (or more) of the status conditions listed below are true and the associated status bit is enabled, bit 5 of the Primary Status Byte is set true (if enabled). If SRQ's are enabled, a SRQ will be generated in the normal manner. The Extended Status Byte can then be read by the controller via the OEB command.

Figure 5-6. SRQ Generation, Primary & Extended Status Byte Structures, and Masking (2 of 3)

Redirected Status Byte Structure

When an instrument on the dedicated GPIB requests service, bit 7 in the primary status byte is set. This generates an SRQ. Two data bytes are available to be read. They will indicate which instrument on the dedicated GPIB has requested service and its status. The first byte contains the status information. The second byte contains the address of the instrument requesting service (below).

Byte 1:	**7**	**6**	**5**	**4**	**3**	**2**	**1**
Byte 2:	**Address of the instrument**						

Figure 5-6. SRQ Generation, Primary & Extended Status Byte Structures, and Masking (3 of 3)

Example Usage of SRQ Commands

Before enabling the SRQ generation function, it is necessary to set the Primary Status Mask first so that the appropriate status bits will be enabled in the Primary and Extended Status Bytes. A typical sequence of commands to perform these steps is shown in the following example:

IPM 103 103 = 01100111 binary (Enable bits 0,1,2,5 and 6 of the Primary Status Byte)
IEM 255 255 = 11111111 binary (Enabled all bits of the Extended Status Byte)
CSB (Clear all existing status bits)
SQ 1 (Enable SRQ's)

EXAMPLE USE OF OSB COMMAND: If a syntax error occurs when bit 1 of the Primary Status mask has been set (IPM 2) but before the SRQ function has been enabled ('**SQ 1**'), it is possible to check the status byte with the **OSB** command, which will return the value '2' if a syntax error has ocurred since the last time the Status Byte was cleared (**CSB**).

If the SRQ function has been enabled and the external controller has been set to respond to them, a controller response to a SRQ from the 56100A will clear the status byte. Therefore, there is no point in using **OSB** (or **CSB)** if SRQ's are enabled.

In the above example, if the **CSB** command is omitted before the **SQ 1** command, the next occurence of an SRQ may deliver the previous status information along with current status that shows the cause of the SRQ.

Figure 5-7. Example Usage of SRQ Function

Table 5-14. Status Byte Output Commands (1 of 1)

The following is a list of Mnemonic parameters as indicated within parenthesis:

N = 1 or 2 for channel selection
n = a number within range ±99.99
F = a frequency within range 0 to 999.9999 GHz or 0 to 9999.99 MHz. If units are omitted, GHz is assumed.
S = 0 or 1 for ON/OFF indication (1 = ON, 0 = OFF)
o = ∗ or / for ON/OFF indication (∗ = ON, / = OFF)
M = 1 to 9, Marker numbers, used for SAVE, RECALL, STORE Marker#, etc.
P = 0 to 400, to select pixel position
X = a variable that is defined in the descriptive text
L = limit values - see Figure 5-3

Parameters (n) and (F) may use 'Scientific ('E') Notation,
examples: 123.4E-3 = 0.123; 6.2e1 = 62.00
Where alternative Mnemonics exist for a function, the double equals ('==') is used to indicate exactly equivalent commands.

MNEMONIC CODE	FUNCTION	DESCRIPTION
	STATUS BYTES	
OEB	Output Extended Status Byte (ASCII)	Returns an ASCII representation of the extended status byte to the controller. The returned data will be a numeric string 0 – 255. see Figure 5-6 (page 36) for an explanation of bit assignments.
OPB	Output Primary Status Byte	Returns the primary status byte to the controller; see Figure 5-6 for explanation of bit assignments.
OSB	Output Primary Status Byte	Alternative for command OPB. OSB == OPB
OID	Output Identify	Returns identity string to controller, which includes model number and software version number. Output format is: "56100A, nn.nn", where "n" designates software version number Total string length is 12 characters. (Version field is padded with spaces.)
OPM(X)	Output Parameter X	Returns parameter X to the controller. Parameter X is defined in Figure 5-8.
ORB	Output Redirected Status Bytes	Bytes Returns an SRQ generated on the dedicated GPIB (sweeper, plotter, etc.) along with the address of the instrument that caused it, when next addressed to talk.
ORD	Output Redirected Data	Returns the last data that was requested from an instrument on the dedicated bus by an RDR command (Table 5-10). See example program shown in Figure 5-4.

1	Offset Channel 1 (dB)
2	Offset Channel 2 (dB)
3	Resolution Channel 1 (dB/Div)
4	Resolution Channel 2 (dB/Div)
5	High Limit Channel 1 (dB)
6	Low Limit Channel 1 (dB)
7	High Limit Channel 2 (dB)
8	Low Limit Channel 2 (dB)
9	Sweeper Start Frequency (GHz)
10	Sweeper Stop Frequency (GHz)
11	562 GPIB Address
12	Sweeper GPIB Address
13	Reserved
14	Marker M1 Frequency (GHz)
15	Marker M2 Frequency (GHz)
16	Marker M3 Frequency (GHz)
17	Marker M4 Frequency (GHz)
18	Marker M5 Frequency (GHz)
19	Marker M6 Frequency (GHz)
20	Marker M7 Frequency (GHz)
21	Marker M8 Frequency (GHz)
22	Marker M9 Frequency (GHz)
23	Power Level From Sweeper (dBm)
24	Reserved
25	Reserved
26	dB/Sweep Value (dB)
27	Cursor Position
28	Reference Cursor Position
29	Plotter Address Parameter
30	Reserved
31	Graticule Spacing (GHz/Div)
32	Reserved
33	Reading At Cursor for Channel 1
34	Reading At Cursor for Channel 2
35	Alternate Start Frequency (GHz)
36	Alternate Stop Frequency (GHz)
37	Alternate Power Sweep Level (dB)
38	Alternate Power Level (dBm)
39	Reserved

Figure 5-8. Available Parameters, OPM(X)

Table 5-15. ASCII Trace Data Save, Recall, and Learn Commands (1 of 4)

The following is a list of Mnemonic parameters as indicated within parenthesis:

N = 1 or 2 for channel selection
n = a number within range ±99.99
F = a frequency within range 0 to 999.9999 GHz or 0 to 9999.99 MHz. If units are omitted, GHz is assumed.
S = 0 or 1 for ON/OFF indication (1 = ON, 0 = OFF)
o = * or / for ON/OFF indication (* = ON, / = OFF)
M = 1 to 9, Marker numbers, used for SAVE, RECALL, STORE Marker#, etc.
P = 0 to 400, to select pixel position
X = a variable that is defined in the descriptive text
L = limit values - see Figure 5-3

Parameters (n) and (F) may use 'Scientific ('E') Notation,
examples: 123.4E-3 = 0.123; 6.2e1 = 62.00
Where alternative Mnemonics exist for a function, the double equals ('==') is used to indicate exactly equivalent commands.

MNEMONIC CODE	FUNCTION	DESCRIPTION
	ASCII TRACE DATA FUNCTIONS	
		Commands requesting ASCII or binary data output from the instrument return the (ASCII) message "error" in addition to the usual SRQ response if a syntax error is detected or if the requested data is not available for some reason. (Example: if the channel for which data is requested is not switched on at the time.) The exact conditions are given with each relevant command in this table. The data formats used with these commands is shown in Figure 5-9 (page 5-44). A summary of the GPIB commands for setup and trace data save, recall and output functions (OSS, OCD, OTM, LSS, LCD and LTM) is contained in Table 5-9 (page 5-25).
OAT (N)	Output ASCII Trace Data	Returns an ASCII representation of the measurement trace data for display channel (N). Returns 101, 201, or 401 data points, according to current measurement setting. See the data format for this command shown in Figure 5-9 (page 5-44). EXCEPTION: Returns the ASCII string "error" if N is invalid or missing. If channel N is off, returns last set of measured data for channel..
LAT (N)(data string)	Learn ASCII Trace Data	The instrument receives ASCII measurement trace data string sent from the controller for channel (N). 'Data String' format is the same as for command OAT; see Figure 5-9 (page 5-44). The number of data points sent (101, 201, 401) and measurement type (T, P, R, S) should correspond to the current instrument setting; otherwise, the data will be unusable. The instrument should be placed in HOLD (mnemonic HON) before this command is used, otherwise the restored (learned) data will be immediately overwritten with new data.

Table 5-15. ASCII Trace Data Save, Recall, and Learn Commands (2 of 4)

MNEMONIC CODE	FUNCTION	DESCRIPTION
	OUTPUT CURSOR READOUT DATA COMMANDS	
	The following commands are used to return cursor readout data from the 56100A to the external computer/controller. (Refer to the Cursor Control Commands in Table 5-6.)	
OCF (N)	Output Cursor Frequency	Returns the frequency at the current cursor position for display channel (N). The (ASCII) output format is "12.3456." Frequency information is in GHz. EXCEPTION: Returns "error" if N is invalid or missing. If channel (N) is off or cursor is off, returns last known frequency value for cursor. When the 56100A is operated in the Secure Mode, the string containing frequency information that is returned by command OCF is replaced by the string " – – – – – – – – –".
OCR (N)	Output Cursor Readout	Returns the scalar value at the current cursor position for display channel (N). The returned (ASCII) value format is "+/–12.34" or "+/–1.23" and will be in dB's, volts, or SWR, depending on the measurement mode currently selected. EXCEPTION: Returns "error" if N is invalid or missing. If channel (N) is off or cursor is off, returns last known value for cursor.
OCP	Output Cursor Position	Returns the current cursor pixel position (0 – 400). Position is defined as 0 at left edge, 400 at right edge, irrespective of current number of data points. EXCEPTION: If cursor is off, returns last known position for cursor.
ODF (N)	Output Relative Cursor Frequency	Returns the frequency difference between the reference cursor and the main cursor for display channel (N). Data format same as OCF, except that data value will be preceded by "–" if reference cursor is at higher frequency than main cursor. EXCEPTION: Returns "error" if N is invalid or missing, or if the instrument is not in relative cursor mode. If channel (N) is off or cursor is off, returns last known frequency value for cursor. When the 56100A is operated in the Secure Mode, the string containing frequency information that is returned

Table 5-15. ASCII Trace Data Save, Recall, and Learn Commands (3 of 4)

MNEMONIC CODE	FUNCTION	DESCRIPTION
		by command ODF is replaced by the string " – – – – – – – – –".
ODR (N)	Output Relative Cursor Readout	Returns the difference value between the reference cursor scalar value and the main cursor scalar value for display channel (N). Data format similar to OCR, but in dBr (see description of dBr associated with command DON in Table 5-6). EXCEPTION: Returns "error" if N is invalid or missing, or if the instrument is not in relative cursor mode. If channel (N) is off or instrument is not in relative cursor mode, returns last known value for relative cursor.
ORF (N)	Output Reference Cursor Frequency	Returns the frequency at the current reference cursor position for display channel (N). Data format as OCF. EXCEPTION: Returns "error" if N is invalid or missing. If channel (N) is off or instrument is not in relative cursor mode, returns last known frequency value for relative cursor. When the 56100A is operated in the Secure Mode, the string containing frequency information that is returned by command ORF is replaced by the string " – – – – – – – – – ".
ORP	Output Reference Cursor Position	Same as OCP but for the reference cursor.
ORR (N)	Output Reference Cursor Readout	Returns the scalar value at the current reference cursor position for display channel (N). Data format as OCR. EXCEPTION: Returns "error" if N is invalid or missing. If channel (N) is off or instrument is not in relative cursor mode, returns last known value for relative cursor.

OUTPUT LIMITS FUNCTIONS DATA COMMANDS

The following commands are used to return limits setup data from the 56100A to the external computer/controller. (Refer to the Limits Setup Commands in Table 5-4.)

OLT (N)	Output Limits Test Result	Returns a pass/fail indication to the controller. "PASS" is sent for pass and "FAIL" for fail; "NOT SET" is sent if no limits set. If fail, the first frequency at which failed test occurred is returned immediately following "FAIL" in the format used for OCF. EXCEPTION: Returns "error" if N is invalid or missing or channel N is off.

Table 5-15. ASCII Trace Data Save, Recall, and Learn Commands (4 of 4)

MNEMONIC CODE	FUNCTION	DESCRIPTION
OCH (N)	Output Complex Limits High	Returns ASCII data string for complete complex high limit for display channel (N) to the controller. The data format used with this command is the same as used with the CLH and CLL commands (refer to Table 5-4 and Figure 5-3). EXCEPTION: Returns "error" if N is invalid or missing.
OCL (N)	Output Complex Limits Low	Same as OCH, but for complex low limit for channel (N).

NOTE

When the 56100A is operated in the Secure Mode, the strings containing frequency information that are returned by commands OCH and OCL are replaced by the string " – – – – – – – –".

Example (for a two-segment complex limit):

1 – – – – – – – – – – – – – – – – – x.x x.x D
2 – – – – – – – – – – – – – – – – – x.x x.x D

Where "x.x x.x D" is amplitude limit data (refer to to Figure5-9).

The rest of the segments are as follows:

3 – – – – – – – – – – – – – – – – x.x x x d

●

●

●

10 – – – – – – – – – – – – – – – – x.x x.x d

Data Formats For: ASCII Data Streams Output Commands: OAT, RAT, RBT and ASCII Data Learn (Input) Command: LAT

Data Format for OAT(N) - *Output Ascii Trace Command.*

The format for the ASCII data string returned by this command (for channel N) is as follows:

n VAL1 VAL2 VAL3 VAL4 . . . . . VAL$_P$ <CR> <LF> [EOI]

Where: n = Start Character. This character specifies the number of data points contained in measurement trace as follows:
- n = O4H for 401 data points;
- n = O2M for 201 data points;
- n = O1M for 101 data points.

VAL$_P$ = last data value, where P equals maximum number of data points.

The data format (ASCII) of each value, **VAL$_P$**, is: **S X X . D D**

Where: S = sign (also used as delimiter between values);
XX = integer portion of data;
. = decimal point;
DD = decimal portion of data

The individual values are delimited (separated) by O3H. The end of the ASCII data string is designated by a <CR> <LF> and EOI true sent with LF character (0Ah).

Data Format for* LAT(N) *, Learn Ascii Trace Command.

The data format of the ASCII string used with this command is identical to that for command OAT.

Figure 5-9. Data Formats for ASCII Output Data and Learn Commands (1 of 1)

Table 5-16. Binary Trace Data Save, Recall, Output, and Learn Commands (1 of 3)

The following is a list of Mnemonic parameters as indicated within parenthesis:

N = 1 or 2 for channel selection
n = a number within range ±99.99
F = a frequency within range 0 to 999.9999 GHz or 0 to 9999.99 MHz. If units are omitted, GHz is assumed.
S = 0 or 1 for ON/OFF indication (1 = ON, 0 = OFF)
o = ∗ or / for ON/OFF indication (∗ = ON, / = OFF)
M = 1 to 9, Marker numbers, used for SAVE, RECALL, STORE Marker#, etc.
P = 0 to 400, to select pixel position
X = a variable that is defined in the descriptive text
L = limit values - see Figure 5-3

Parameters (n) and (F) may use 'Scientific ('E') Notation,
examples: 123.4E-3 = 0.123; 6.2e1 = 62.00
Where alternative Mnemonics exist for a function, the double equals ('==') is used to indicate exactly equivalent commands.

MNEMONIC CODE	FUNCTION	DESCRIPTION
	BINARY TRACE DATA COMMANDS	
	If the controller is expecting Binary data to be returned (OBT, OCD, OTM, etc), and an error condition is detected and reported by the 56100A, the controller's received message buffer may be expected to include the (error) ASCII string termination characters (**0Dh,0Ah**).	
	The binary data "Learn Commands", LBT, LCC, LCD , LTM, and LSS, *must* be terminated using a LF or CR, LF or EOI terminator *before* the transfer of binary data is started. Any occurrence of ASCII data bytes **0Dh,0Ah** within the binary data will be ignored by these commands.	
	A summary of the GPIB commands for setup and trace data save, recall and output functions (OSS, OCD, OTM, LSS, LCD and LTM) is contained in Table 5-9 (page 5-25).	
OBT (N)	Output Binary Trace Data	The 56100A sends a binary representation of the measurement trace data for display channel (N) to the controller. Returns 101, 201, or 401 data points, according to the current 56100A measurement setting. The data format for this command is shown in Figure 5-10 (page 5-48). EXCEPTION: Returns the ASCII string "error" instead of the normal data stream if N is invalid or missing, or if channel N is off.
LBT (N) (bin. data stream)	Learn Binary Trace Data	The 56100A receives the binary trace data steam sent from the controller. The data stream contains a binary representation of the measurement trace data for display channel (N) previously received by the controller (using command OBT). The Binary Data Stream format is the same as for command OBT (Figure 10). As with command LAT, the number of data points sent and the measurement type should correspond to the current 56100A settings.

Table 5-16. Binary Trace Data Save, Recall, Output, and Learn Commands (2 of 3)

MNEMONIC CODE	FUNCTION	DESCRIPTION
		NOTE
		The 56100A must be put in the HOLD mode (using the HON command) before receipt of the LBT command; otherwise, the restored (learned) data will be overwritten with new data. Use care when manipulating this data as it is in minimal binary form; the 56100A is therefore unable to check it for errors or inconsistencies.
OTM (N)	Output Trace Memory	Returns contents of Trace Memory for selected channel (N) to the controller. This data may be a stored measurement trace, or a trace representation of a complex limit line. Returns 101, 201, or 401 data points, according to the current instrument measurement setting. The data format used with this command is the same as that for the OCD command. EXCEPTION: Returns the ASCII string “error” if N is invalid or missing or channel N is off.
LTM (N)(binary data)	Learn Trace Memory	The 56100A receives Trace Memory data stream sent from the controller for channel (N). Data format is same as for command OTM. As with LAT, the number of data points sent should equal the current instrument setting.
		NOTE
		Refer to Figure 5-10 (page 5-48) for descriptions of the data formats used with the commands described above.
OCD (N)	Output Calibration Data	Returns calibration trace data for the selected channel (N) and data describing calibration conditions to the controller. This is the data taken during the most recent calibration of that channel. The data returned will relate directly to current trace data *ONLY* if instrument settings (Start/Stop Frequencies, Output Power, Data Points, Input(s), etc) have not been changed since calibration. Data output produced by the OCD command may be restored with the LCD command. EXCEPTION: Returns the ASCII string “error” if N is invalid or missing or channel N is off.
LCD (N)(binary data)	Learn Calibration Data	The 56100A receives the calibration data stream sent from the controller for channel (N). The Binary Data format used with this command is the same as for command OCD. Care must be exercised when manipulating this data as it is in minimal binary form; the 56100A is therefore unable to check it for errors or inconsistencies. ADDITIONAL DATA TERMINATION REQUIREMENTS: as with other binary data “Learn Commands”, this com-

Table 5-16. Binary Trace Data Save, Recall, Output, and Learn Commands (3 of 3)

MNEMONIC CODE	FUNCTION	DESCRIPTION
		mand *must* be terminated using a LF or CR, LF or EOI terminator *before* the transfer of binary data is started; refer to the LCC command.

NOTE

Refer to Figure 5-10 (page 5-48) for descriptions of the data formats used with the commands described above.

BINARY SETUP & LIMITS DATA FUNCTIONS

OSS (M_{1-9})	Output Stored Front Panel Setup	Returns stored front panel setup (M) to the controller. The binary data format used with this command is shown in Figure 10 (page 51). This command is suitable ONLY for providing external storage for additional setups. It should NOT be used for amending them as this may result in unpredictable instrument operation and is not supported by ANRITSU. The value of any element of this data may be established through the use of other commands. EXCEPTION: Returns “error” if M is invalid or missing.
LSS (M_{1-9})(binary data)	Learn Stored Front Panel Setup	The instrument receives data stream for stored front panel setup (M) sent from controller. Data format is the same as for command OSS. ADDITIONAL DATA TERMINATION REQUIREMENTS: as with other binary data “Learn Commands”, this command *must* be terminated using a LF or CR, LF or EOI terminator *before* the transfer of binary data is started; refer to the LCC command.

NOTE

The OSS and LSS commands are intended as a means of providing external storage of front panel setups. They are not intended for amending setup data strings stored in external memory. Any attempt to do so may result in unpredictable 56100A operation. It is possible to correctly establish any front panel setup operation by first setting it (using appropriate GPIB commands), then outputting the complete stored setup.

Refer to Figure 5-10 (page 5-48) for descriptions of the data formats used with the commands described above.

Data Formats For:
Binary Data Streams Output Commands: OBT, OCD, OTM, OSS and Binary Data Learn (Input) Commands: LBT, LCD, LTM, LSS

Data Format for* OBT(N), *Output Binary Trace Command:

The format for the binary data stream returned by this command for channel (N) is described below. Refer also to Note 1 at the end of this figure for additional information concerning the data streams used with these commands.

n BW1 BW2 BW3 BW4 • • • • • • • • • • • BW$_P$ **[EOI]**

Where: n = Start Character. This character specifies the number of data points contained in measurement trace as follows:

n = O4H for 401 data points;
n = O2H for 201 data points;
n = 01H for 101 data points. The exact message length can be deduced from the value of n.
BW$_P$ = last data value, where P equals maximum number of data points.

BW1 to BW$_P$ are individual binary data signed words.

The end of the binary data stream used with this command is designated by EOI true.

Data Format for* LBT(N)*, Learn Binary Trace Command:

The data format of the binary data stream used with this command is identical to that for command OBT.

Data Format for Data Output Commands:
OCD(N), Output Calibration Data
OTM(N), Output Trace Memory Data

The format for the binary data stream returned by these commands for channel (N) is as follows:

D BW1 BW2 BW3 BW4 • • • • • • • • • • • BW$_P$ **[EOI]**

BW1 to BW$_P$ are individual binary data signed words.

Configuration data is included with the calibration and trace memory data port values.

D is Data Type (ASCII) character:
'C' identifies data as Calibration Data
'T' identifies data as Trace Memory data.

BW$_1$ to BW$_N$ are individual binary data signed words, using the same format and data weighting as for command OBT, above.

The end of the binary data stream used with this command is designated by EOI true.

Figure 5-10. Data Formats for Binary Output Data and Learn Commands (1 of 3)

Data Format for Data Learn Commands:

LCD(N), ***Learn Calibration Data, and***
LTM(N), ***Learn Trace Memory Data Command***

The data format of the binary data stream used with these commands is identical to that for commands OCD, OTM.

Data Format for OSS(M), ***Output Stored Front Panel Setup Command:***

The format for the binary data stream returned by this command for stored front panel setup (M) is as follows:

B1 B2 B3 B4 • • • • B_P **[EOI]**

Where: P = maximum number of data bytes.

B1 to B_P are individual data bytes which make up the overall structure of a stored setup. The maximum stream size is 2045 bytes (P = 2045); See Note 3 at the end of this figure. No details of the internal structure of the data bytes is provided (see note below).

NOTE

The OSS and LSS commands are intended as a means of providing external storage of front panel setups. They are not intended for amending setup data streams stored in external memory. Any attempt to do so may result in unpredictable 56100A operation.

The end of the (binary) stored setup data stream is designated by EOI true.

Data Format for* LSS(M)*, Learn Stored Front Panel Setup Command:

The data format of the binary data stream used with this command is identical to that for command OSS.

NOTES:

1. For OBT and OCD commands, all values are sent across the GPIB as binary integers. If a data type is intrinsically a fractional quantity (e.g., 1.24 dB) it is first multiplied by a stated weighting factor (in this case 250) to convert it to an integer, e.g., 1.24 * 250 = 310.

   The data is transferred across the GPIB interface in Bytes. Each byte consists of eight binary digits (bits) of data. These may be represented using Hexadecimal (Hex) notation (base 16). (The set of Hex digits is: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E and F; e.g., number 13 decimal is represented as '0D h' —where 'h' is the Hex base indicator). Any 8-bit byte can be represented as a 'hex pair': e.g., 3 decimal is 03h; 109 decimal is 6Dh. A single byte transfer can therefore pass any value between 00h and FFh (0 - 255 decimal).

Figure 5-10. Data Formats for Binary Output Data and Learn Commands (2 of 3)

EXAMPLES:

Data Type	Value	Hex Value	Bytes Sent
unsigned byte	+1	01h	01h
signed byte	+123	7Bh	7Bh
signed byte	–1	–01h	FFh
unsigned word	23456	5BA0h	A0h,5Bh
signed word	–8765	–223Dh = DDC3h	C3h,DDh
unsigned dword	100000	186A0h	A0h,86h,01h,00h
signed dword	–62	–3Eh = FFFFFFC2h	C2h,FFh,FFh,FFh

NOTES (Continued):

Most data values to be sent require more than 8 bits (data values greater than 255). For such data, **Words** which are 16 bits or **Dwords** (double words) which are 32 bits are used. These data words are sent over GPIB as a sequence of 2 or 4 bytes respectively. In each case the bytes making up a word or dword value are sent with the Least Significant Byte (LSB) first and the Most Significant Byte (MSB) last. If the data type is **signed** and if the value is negative, the Most Significant Bit (bit 15 or bit 31) is set to a logic 1 (see Note 2).

The binary data may include the value '0Ah' (ASCII Linefeed); therefore, it is not possible to use that character as an end-of-message character. The last character of the binary data stream is therefore always marked by signal EOI 'true'. The GPIB controller software must handle this situation. Normally, a convention exists for receiving such binary data transfers.

EXAMPLE:

Using an HP-85 system controller, the program routine to place the binary data in R$ from a GPIB device at address 5 is:

```
DIM R$[1000]                    Set up receive buffer
     (code):
    (code):
ENTER 705 USING "#%,#%K" ; R$   Terminate on EOI only; ignore linefeed char.
```

The program routine to transmit data (from T$) is:

```
DIM T$[1000]                    Set up transmit buffer
 IOBUFFER T$                    Required for TRANSFER
     (code):
    (code):
CONTROL 7,16 ; 128              Terminate  with EOI only
TRANSFER T$ TO 705 FHS          Use 'Fast Hand Shake'
CONTROL 7,16 ; 2,13,10          Restore normal handshake  (CR, LF)
```

2. All data formats in this figure are shown using the conventional (default) mode for byte-order transfer. This byte-order transfer is used for both transmitting data and for receiving data. This order is: Low Byte first, High Byte last.

   Commands HBF 1 and HBF 0 are provided for use with controller GPIB software that uses the reverse byte-order transfer mode.

Figure 5-10. Data Formats for Binary Output Data and Learn Commands (3 of 3)

Table 5-17. Miscellaneous Commands (1 of 1)

The following is a list of Mnemonic parameters as indicated within parenthesis:

N = 1 or 2 for channel selection
n = a number within range ±99.99
F = a frequency within range 0 to 999.9999 GHz or 0 to 9999.99 MHz. If units are omitted, GHz is assumed.
S = 0 or 1 for ON/OFF indication (1 = ON, 0 = OFF)
o = ∗ or / for ON/OFF indication (∗ = ON, / = OFF)
M = 1 to 9, Marker numbers, used for SAVE, RECALL, STORE Marker#, etc.
P = 0 to 400, to select pixel position
X = a variable that is defined in the descriptive text
L = limit values - see Figure 5-3

Parameters (n) and (F) may use 'Scientific ('E') Notation, examples: 123.4E-3 = 0.123; 6.2e1 = 62.00
Where alternative Mnemonics exist for a function, the double equals ('==') is used to indicate exactly equivalent commands.

MNEMONIC CODE	FUNCTION	DESCRIPTION
FCW(S)	Turn Fast CW ON/OFF	Allows fast signal channel processing when the analyzer is operating in CW sweep mode. Each measurement cycle is approximately 25 ms, which— when combined with a GPIB transfer time of 25 ms or less—gives a total update time of 50 ms. *Operation:* One measurement channel on only, with width equal to 0 MHz. Connect a detector to the active input before the mode is turned on. The mode will be disabled if, 1. The unit is returned to local, 2. A channel is turned on or off, 3. The GPIB command "FCW0" is sent, 4. Or if the unit is reset. Best results will be obtained if the unit is allowed to warm up before the mode is used. Note zeroing and locking are not active when the mode is operating. "FCW0" — Turn off Fast CW "FCW1" — Turn on Fast CW See Figure 5-12 (page 5-59) for a BASIC language example of FCW programming.

56100A GPIB SETUP/UTILITY SUBROUTINE

The programming example shown below is a subroutine written in QuickBASIC that sets up and initializes the 56100A GPIB interface. It also displays the SRQ type for any service requests (SRQ's) on the display screen of the external computer/controller.

```
SUB SetupGPIB0

    board% = ILFIND("GPIB")                                  Find the Controller Board
    IF board% < 0 THEN PRINT "Cannot find."
    ELSE PRINT USING "#####"; board%

    DUT% = ILFIND("DEV6")                                    Find the 56100A
    IF DUT% < 0 THEN PRINT "Cannot find."
    ELSE PRINT USING "#####"; DUT%

    PRINT "SIC – Set Interface Clear . . . . . ";            Clear the Controller Board
    IF ILSIC(board%) <0 THEN CALL GPIBError(IBSTA%)

    IF ILCLR(DUT%) <0 THEN CALL GPIBError(IBSTA%)            Clear (Reset) Instrument
    PRINT "ON PEN....";
    ON PEN GOSUB SRQresponse                                 Set up Response Vector
    PEN ON                                                   Enable SRQ's
    PRINT "Set up done."
    PRINT
END SUB

SRQresponse                                                  This routine displays the SRQ type
                                                             on the controller display.
    SPR% = 32
    CALL IBRSP(DUT%, SPR%)
    IF SPR% > 0 THEN
       PRINT ">>> SRQ <<<";
       PRINT "code: ";SPR%
       IF SPR% > 127 THEN PRINT "– Redirected SRQ "; : SPR% = SPR% – 128
       IF SPR% > 63 THEN  SPR% = SPR% – 64
       IF SPR% > 31 THEN PRINT "– Extended status byte contains info "; : SPR% = SPR% – 32
       IF SPR% > 15 THEN PRINT "– Redirection mode failure "; : SPR% = SPR% – 16
       IF SPR% > 7 THEN PRINT "– Low level trim required "; : SPR% = SPR% – 8
       IF SPR% > 3 THEN PRINT "– Calibration sweep finished "; : SPR% = SPR% – 4
       IF SPR% > 1 THEN PRINT "– Syntax Error. "; : SPR% = SPR% – 2
       IF SPR% > 0 THEN PRINT "– Required Sweeps Completed. "; : SPR% = SPR% – 1
       CALL hesitate
       PRINT
    END IF
    RETURN
```

Figure 5-11. Example GPIB Setup and Utility Subroutine

Table 5-18. Alphabetical Index to 56100A Commands (1 of 3)

The following is a list of mnemonic parameters as indicated within parentheses:

N = 1 or 2 for channel selection
n = a number within range +/–99.99
F = a frequency within range 0 to 999.9999 GHz.
S = 0 or 1 for ON/OFF indication (1 = ON, 0 = OFF)
M= 1 to 9, Marker numbers, used for SAVE, RECALL, STORE Marker #, etc.
P = 0 to 400, to select pixel position
X = a variable that will be defined next to the instruction or Mnemonic
L = Limit Values

MNEMONIC CODE	FUNCTION	PAGE NUMBER
AOF	Averaging Off	5-22
ARF(S)	Autozero RF On/Off	5-14
ASC(N)	Autoscale	5-14
ASW	Autosweep	5-23
AVE (X)	Set Averaging	5-22
AVG(X)	Averaging On	5-22
BC(S)	Blank CRT	5-24
CAL (X)	Calibrate the 56100A	5-18
CAM	Move Cursor To Active Marker	5-20
CBW(N)(n)	Move Cursor To Show Bandwidth	5-21
CH(N)(S)	Set Channel N On/Off	5-13
CHI (N) (S)	Complex High Limit On/Off	5-15
CLH(N) (L)	Enter High Complex Limits	5-15
CLL(N) (L)	Enter Low Complex Limits	5-15
CLO (N) (S)	Complex Low Limit On/Off	5-15
CLT(N)(n)	Move Cursor Left To n dB	5-21
CMK(M)	Move Cursor To Marker M	5-20
CML (data)	Configure Manual Labelling	5-23
CMN(N)	Move Cursor To Min	5-20
CMX(N)	Move Cursor To Max	5-20
CN	Configure Normal	5-23
CNR	CW No Ramp	5-23
COF	Cursor Off	5-19
CON	Cursor On	5-19
CRF(N)(F)	Move Cursor To Frequency F On Channel N	5-19
CRO	Configure 0-10v Ramp Output	5-23
CRP(P)	Move Cursor To Position P	5-19
CRT(N)(n)	Move Cursor Right To n dB	5-21
CSB	Clear Primary Status Byte	5-34
CTN	Continue to Next Calibration Step, or Continue after Self Test Failed	5-18, 5-24
dB	Reserved Mnemonic	
dBm	Reserved Mnemonic	
DLT	Display Limits Test	5-15
DO1 (n)	Detector Offset R1	5-18
DO2 (n)	Detector Offset R2	5-18
DOA (n)	Detector Offset A	5-18
DOB (n)	Detector Offset B	5-18
DOF	Relative Mode Off	5-20
DON	Relative Mode On	5-20
DP(X)	Set Number of Data Points Points	5-22
DSI (S)	Display Segment Identifiers	5-15
FCW (S)	Turn Fast CW On/Off	5-51
FRD	Fast Redirection	5-26
FRE	Fast Redirection Ends	5-26
GHz	Reserved Mnemonic	
GOF	Turn Off Graticule Display	5-23
GON	Display Graticule	5-23
GSF	GPIB Status Indication Off	5-24
GSN	GPIB Status Indication On	5-24
HOF	Hold Off	5-24
HON	Hold On	5-24
IEM(X)	Input Extended Mask	5-34
IPM(X)	Input Primary Mask	5-34
LAT(N)	Learn ASCII Trace	5-40
LBT(N)	Learn Binary Trace	5-45
LCD(N)	Learn Calibration Data	5-46
LDA “date”	Label For Date	5-29
LDE “device”	Label For Test Device	5-29
LHF(N)	High Limit (Off)	5-15
LHI(N)(n)	High Limit (On)	5-15
LID “ident”	Label For Identification	5-29
LLF(N)	Low Limit (Off)	5-15
LLO(N)(n)	Low Limit (On)	5-15

Table 5-18. Alphabetical Index to 56100A GPIB Commands (2 of 3)

MNEMONIC CODE	FUNCTION	PAGE NUMBER
LSS	Learn Stored Setup	5-47
LTM (N)	Learn Trace Memory	5-46
MHz	Reserved Mnemonic	
MSW	Manual Sweep	5-23
NSW	Normal Sweep	5-23
NUL	Low Level Null	5-18
OAT(N)	Output ASCII Trace Data	5-40
OBT(N)	Output Binary Trace Data	5-45
OCD(N)	Output Calibration Data	5-46
OCF(N)	Output Cursor Frequency	5-41
OCH (N)	Output Complex Limits High	5-43
OCL (N)	Output Complex Limits Low	5-43
OCP	Output Cursor Position	5-41
OCR(N)	Output Cursor Readout	5-41
ODF(N)	Output Relative Cursor Frequency	5-41
ODR(N)	Output Relative Cursor Readout	5-42
OEB	Output Extended Status Byte	5-38
OFF(N)(n)	Set Channel Offset (dB)	5-14
OID	Output Identify	5-38
OLT(N)	Output Limits Test Result	5-42
OPB	Output Primary Status Byte	5-38
OPM(X)	Output Parameter X	5-38
ORB	Output Redirected Status Bytes	5-38
ORD	Output Redirected Data	5-38
ORF(N)	Output Ref. Cursor Frequency	5-42
ORP	Output Reference Cursor Position	5-42
ORR (N)	Output Ref. Cursor Readout	5-42
OSB	Output Status Byte	5-38
OSS (M)	Output Stored Setup	5-47
OTM (N)	Output Trace Memory	5-46
PC	Output Custom Plot	5-29
PGR	Print Graph	5-28
PLA	Plot All	5-29
PLC	Plot Cursor	5-29
PLG	Plot Graticule	5-29
PLR	Plot Trace	5-29
PLT	Plot Titles	5-29
PRV(X)	Preview	5-24
PST	Stop Print/Plot	5-28
PT(X)	Print Tab Data	5-28
PTL	Print Complex Limits	5-28
RCC(X)	Recall with Calibration Data	5-23
RCF(X)(F)	Move Reference Cursor to Frequency F	5-20
RCP(P)	Move Reference Cursor to Postion P	5-19
RCS(M)	Recall Setup	5-24
RCT(X)	Recall Trace Memories	5-16
RDB(X)	Pass Through Command for Binary Data	5-26
RDR(X)	Pass Through Command for ASCII Data	5-26
REF(N)	Reference Line Position	5-14
ROF(N)	Reference Line Off	5-13
RON(N)	Reference Line On	5-13
RST	Reset Instrument	5-24
RTL	Return to Local	5-24
SCL(N)(X)	Resolution (scale)	5-14
SCP(bit mask)	Specify Custom Plot	5-29
SDP(X)	Set Plotter Address	5-26
SDS(X)	Set Sweeper Address	5-26
SDX(X)	Set 56100A GPIB Address	5-26
SF10	1: Max Hold	5-31
SF11	1: Min Hold	5-31
SF12	1: Pk-Pk Hold	5-31
SF13	1: Normal	5-31
SF14	2: Max Hold	5-31
SF15	2: Min Hold	5-31
SF16	2: Pk-Pk Hold	5-31
SF17	2: Normal	5-31
SF20	1: Min-Max	5-31
SF21	1: From Max	5-31
SF22	2: Min-Max	5-32
SF23	2: From Max	5-32
SF24	Repeat	5-32
SF25	Normal	5-32
SF40	User Tables	5-32
SF41	Stnd Titles	5-32
SF50	Fixed Range 1	5-32
SF51	Fixed Range 2	5-32
SF52	Fixed Range 3	5-32
SF53	Auto Range	5-32

Table 5-18. Alphabetical Index to 56100A GPIB Commands (3 of 3)

MNEMONIC CODE	FUNCTION	PAGE NUMBER
SF60	Hi Res Cal	5-32
SF61	Standard Cal	5-32
SF62	Allow 6700A Corrn.	5-32
SF63	Stop 6700A Corrn.	5-32
SF70	Channel 1	5-32
SF71	Channel 2	5-32
SF74	Continue	5-33
SI(N)(X)	Set input for Channel N	5-13
SIF(S)	User Interface On/Off	5-14
SM(N)(X)	Set Channel N Measurement Display	5-13
SML(X)	Set maximum Power Level; X= –120 to +30 dBm	5-33
SMO (X)	Set Smoothing	5-22
SOF	Smoothing Off	5-22
SON(X)	Smoothing On	5-22
SQ(S)	Enable/Disable SRQs	5-34
SQS(X)	Program Number of Sweeps	5-34
SSL(X)	Set Start Power Level; X= –120 to +30 dBm	5-33
SVC(X)	Save Setup With Calibration Data	5-23
SVS(M)	Save Front Panel Setup	5-23
SVT(X)	Save Trace Memory; X=1 to 4	5-16
TCR(N)	Adjust Offset so that Trace at Cursor Moves To Ref. Line	5-14
TMD (N)	Load Trace Memory With Signal Trace Data	5-16
TMH (N)	Load Trace Memory With Complex High Limits	5-16
TML (N)	Load Trace Memory With Complex Low Limits	5-16
TM(N)(S	Apply/remove trace memory	5-16
TM0	Turn Off Manual Labelling	5-24
TSS “title”	Title Stored Setups	5-29
TST	Run Instrument Test Routine	5-24
XCG	Exchange Cursor and Reference Cursor	5-20

Appendix A
Performance Specifications

This appendix contains the ANRITSU 56100A Scalar Network Analyzer Technical Data Sheet, ANRITSU Part Number 11410-00171.

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