MODEL 562
SCALAR NETWORK ANALYZER

OPERATION MANUAL

For “Model 562 Version 3-7 Firmware”

(Software version number appears
on the CRT display when the 562
undergoes a self test.)

Wiltron

490 JARVIS DRIVE ● MORGAN HILL, CA 95037-2809

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SECTION I
GENERAL INFORMATION

1-1 SCOPE OF THE MANUAL

This manual provides general, installation, and operation information for the Model 562 Scalar Network Analyzer (Figure 1-1).

1-2 INTRODUCTION

This section of the manual provides information about the equipment identification number, performance specifications, and options.

1-3 IDENTIFICATION NUMBER

All WILTRON instruments are assigned a unique numeric six-digit ID number, such as 201001. (Some models also include an alphabetic prefix, for example: K202222.) The 562 ID number is affixed to the outside of the rear panel. Please use the complete ID number when ordering parts or corresponding with WILTRON 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 WILTRON part number for the Maintenance Manual is 10410-00048.

1-5 NETWORK ANALYSIS DESCRIPTION

Network analysis consists of the characterization of microwave devices 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.

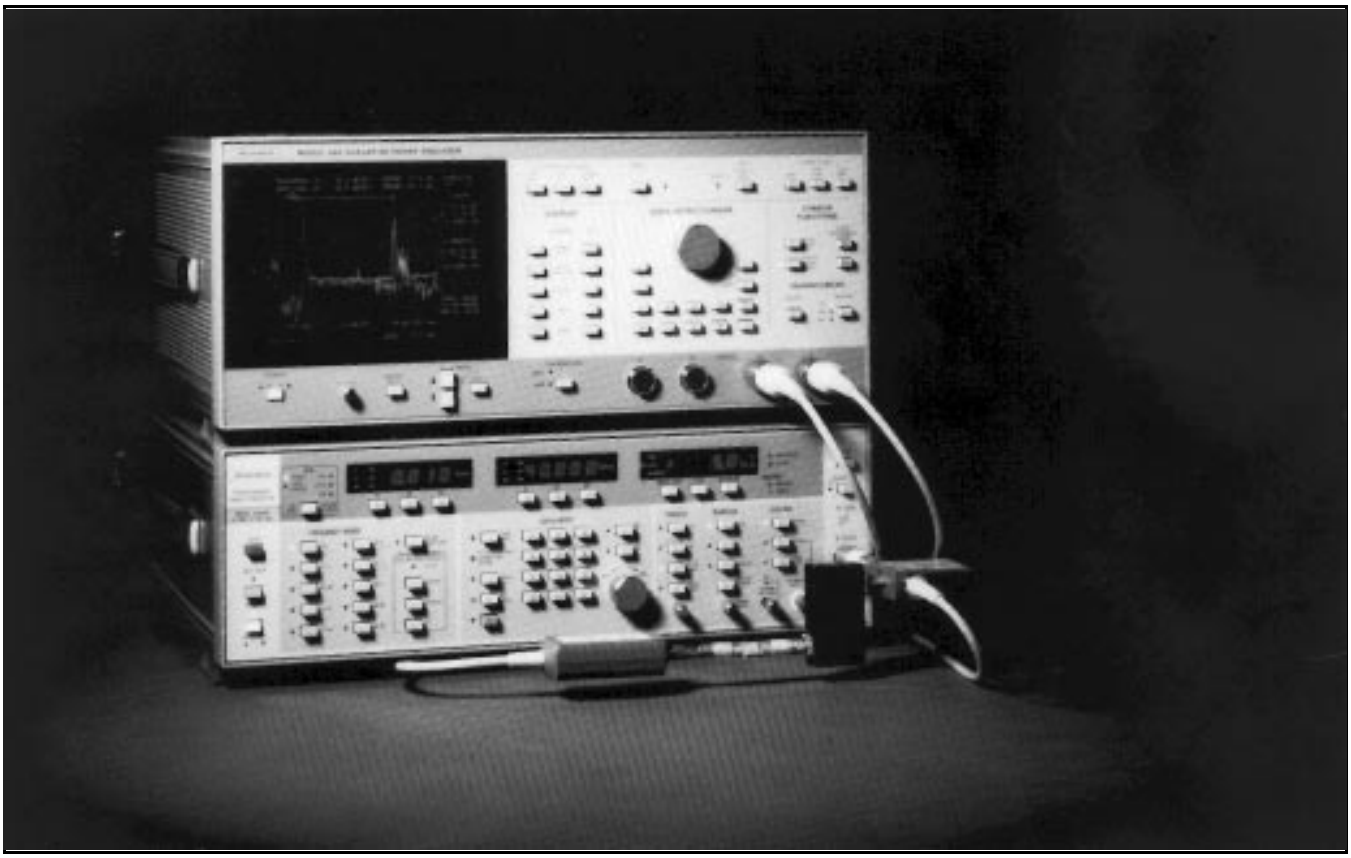


Figure 1-1. Model 562 Scalar Network Analyzer Shown With a WILTRON Model 6669B Sweep Generator

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 562 is of the scalar network analyzer type.

1-6 562 SCALAR NETWORK ANALYZER DESCRIPTION

The Model 562, 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 also normally required for operation of this unit. The Model 562 is ideal for both production and R&D applications.

1-6.1 Measurement System Overview

With the addition of a programmable signal source, the 562 becomes an automated transmission, return loss (SWR), and power measurement system. For example, with the appropriate test components and a WILTRON 6669B frequency source, the 562 will operate over the 10 MHz to 40 GHz range from a single coaxial test port. The 562 provides fully annotated displays of test data and measurement parameters as shown in Figure 1-2.

Under internal microprocessor control (no external controller required), the 562 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 562 features include:

- Automatic measurements and hard copy output without a controller.
- Accurate coaxial measurements from 10 MHz to 40 GHz.
- Nine stored setups to eliminate set-up time.
- Cursors, markers, and limit lines to improve productivity.

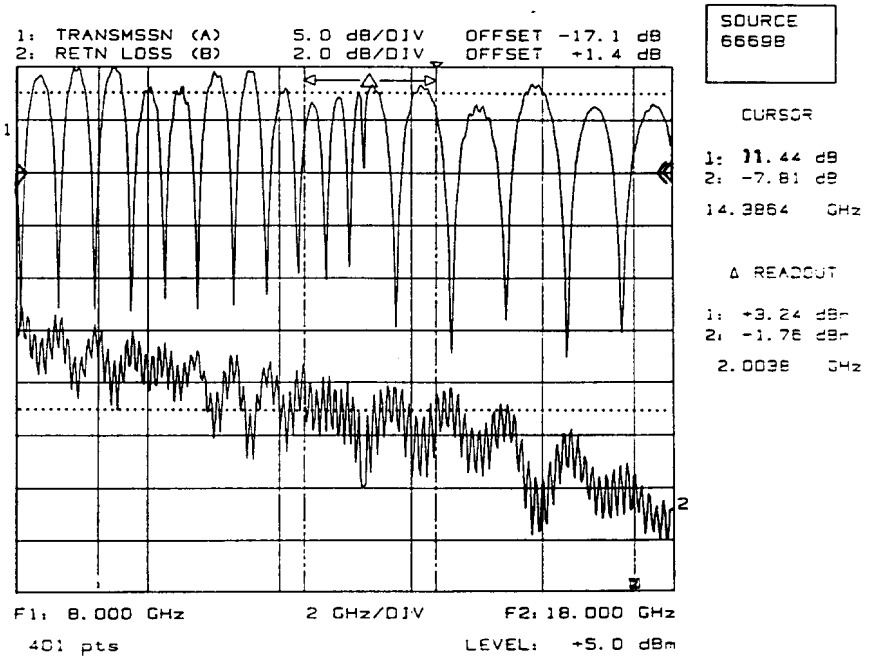


Figure 1-2. Typical 562 Annotated Display

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

1-6.2 Normalization and Measurement

In a typical 562 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.

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 562 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. A permanent record of the test data – with or without the test, marker, or stored setup parameters – is made automatically using an HP 7440A, 7470A, or 7475A plotter. Most dot-matrix printers may also be used, including the Epson FX and the optional WILTRON 2225C Ink Jet Printer. Since the 562 requires only about 10 seconds for print formatting, a new test can be conducted while the previously taken data is being printed out.

The 562 is equally effective when used for waveguide reflectometer setups, where ratio measurements may be preferred. The 560-10BX-1 Adapter Cables provide the interface between the instrument and waveguide detectors.

1-6.3 Cursors, Markers, and Limit Lines

The 562 has an extensive number of cursor functions available. These cursor functions are in addition to the eight markers available when a WILTRON 6600B, 6700A/B, or 68000A/B series signal generator is used as the system signal source. The 562 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.

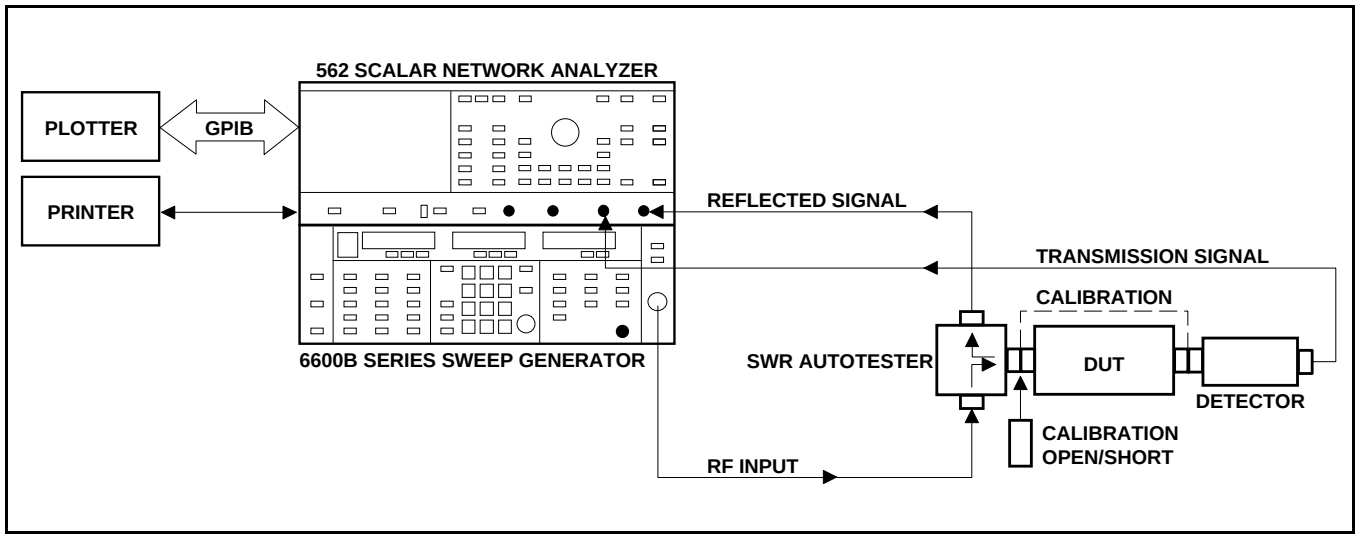


Figure 1-3. Typical 562 Test Setup

1-6.4 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, 4 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.

1-6.5 Measurement Accuracy

The return-loss accuracy of the 562 is largely attributable to the high directivity of the WILTRON 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, SWR autotesters are available with either male or female test ports in Type N, WSMA, or K connectors. All have high directivity. 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 WILTRON SWR autotesters and detectors.

Zero-biased Schottky diodes are used in all 560-7xxx series detectors to minimize drift and circuit complexity. With the exception of the 560-7K50, the diode modules of these units are field-replaceable. This eliminates the expense and inconvenience of returning the detectors to a service center for repair.

The accuracy of the 562 is high also because modulation of the input signal is not required. The need for modulation is avoided by using self-balancing amplifiers, which are stable at low signal levels. As a result, errors from modulation asymmetry and modulation-sensitive test devices are nonexistent. Without the insertion loss of a modulator, measurements can be made at higher input levels. This increases the measurement dynamic range.

1-6.6 Recommended Signal Sources

There are many advantages in selecting a WILTRON 6600B, 6700B, or 68000B series signal source for use with the 562. 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 562 can display frequency response over different frequency ranges and/or power levels.

Another advantage of using a WILTRON signal source is that the 6600B and 6700B series use fundamental oscillators from 2 to 26.5 GHz, thus avoiding the serious errors introduced by the subharmonics of frequency multipliers.

1-6.7 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.

1-6.8 GPIB Compatibility

The implementation of the IEEE-488 General Purpose Interface Bus (GPIB) is standard on the 562 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 Section — 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.

The 562 GPIB controller operates with any IBM XT, AT, or PS/2 compatible computer/controller equipped with a National Instruments GPIB-PCII/IIA interface card and NI-488 MS-DOS Handler Software. The procedures for installing this hardware and software in your computer is contained in Appendix A at the rear of this manual.

1-7 OPTIONS

Option 1, Rack Mount — This option to the 562 includes mounting brackets, mounting ears and a chassis track slide that provides a full 90° tilt capability.

1-8 ADDITIONAL EQUIPMENT REQUIRED

Transmission measurements require a suitable RF Detector for use with the 562. Reflection measurements require a WILTRON SWR Autotester.

1-8.1 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 WILTRON 560 series SWR Autotesters are listed in Table 1- 3.

1-8.2 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, field-replaceable Schottky diodes provide –60 dBm sensitivity. Optional extender cables can be used without degradation in performance. Part numbers and specifications for WILTRON 560 series RF Detectors are listed in Table 1-4.

1-9 ACCESSORIES

RF Components, cables and other accessories used with the 562 are available from WILTRON. 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 562 are contained in the WILTRON catalog. These components are available with the connector types listed below. Contact your WILTRON representative for further information.

- GPC-7
- K Male
- K Female
- N Male
- N Female
- WSMA Male
- WSMA Female

1-9.1 Extender Cables

Extender cables can be used between the SWR Autotester or detector and the 562. Use of these cables allows measurements to be made up to 200 feet from the 562. Cable part numbers and lengths are:

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)

1-9.2 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 562. The 560-10BX-1 Adapter cable is used to connect the 562 to waveguide detectors with SMA female output connectors. The 560-15BX Adapter cable is used with the 562 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
560-15BX	BNC Male

The 806 series adapter cables are used to connect the 562 to various sweep generators. The 806-7 cable is provided with the 562 and is used to connect to WILTRON 6600B, 6700B, and 68000B signal sources. Other cables available are:

Model	Usage
806-13	WILTRON 562 to HP 8350B, 8340B
806-14	WILTRON 562 to HP 8620C

1-9.3 GPIB Cables

GPIB cables are used to interconnect the 562 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)

1-9.4 Other Accessories

Other accessories for the 562 include:

- A carrying case for the RF components
- A transit case for the 562
- A 260 mm (10.25 in.) diagonal screen external monitor
- An ink jet printer, including a 2225-1 Interface Cable, 1 ink cartridge, and 50 sheets of Ink Jet paper.

1-10 RECOMMENDED TEST EQUIPMENT

Table 1-1 is a list of recommended test equipment required for performance verification and calibration procedures and for troubleshooting the 562. 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

1-11 PERFORMANCE SPECIFICATIONS

Performance specifications for the 562 are listed in Table 1-2 (page 1-10). Specifications for SWR Autotesters and RF Detectors normally used with the 562 are listed in Tables 1- 3 and 1-4.

Table 1-1. Recommended Test Equipment

INSTRUMENT	CRITICAL SPECIFICATION	RECOMMENDED MANUFACTURER/MODEL	USE
Adaptor Cable	Simulates 560-7 Series detectors	WILTRON Model 560-10BX	P
Computer/Controller	Personal computer, equipped with National PCIIA GPIB interface card	Any IBM compatible (or WILTRON Model 85, or HP Model 200)	P
RF Detector	1. 0.010 to 18.5 GHz 2. 0.010 to 26.5 GHz	WILTRON Model 560-7N50 WILTRON Model 560-7K50	P
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) AC Input Impedance: 1 MΩ	John Fluke Mfg Co. Inc., Model 8840A, with Option 8840A-09, True RMS AC	T
Oscilloscope	*Bandwidth*: DC to 150 MHz *Sensitivity:* 2 mV *Horiz. Sensitivity:* 50 ns/division	Tektronix, Inc. Model 2445	C, T
Power Meter, with:	*Power Range:* +10 to –55 dBm *Other:* 50 MHz Calibrated Output	Anritsu Corp., Model ML4803A	P, T
Power Sensor 50Ω input	Frequency Range: 1.0 MHz to 2.0 GHz *Power Range:* –30 to +20 dBm	Anritsu Corp., Model MA4601A	
Power Sensor	Frequency Range: 0.10 to 18.0 GHz *Power Range:* –30 to +20 dBm *Power Range:* –70 to –20 dBm	Anritsu Corp., Model MA4701A Anritsu Corp., Model MA4702A	
Power Sensor#	Frequency Range: 0.05 to 26.5 GHz *Power Range:* –30 to +20 dBm *Power Range:* –70 to –20 dBm	Anritsu Corp., Model MA4703A Anritsu Corp., Model MA4704A	
Atten, Calibration	Atten: 30 dB, used with MA4702A/04A	Anritsu Corp., Model MP47A	
Printer	Parallel Interface operation	WILTRON, Model 2225C Ink Jet Printer, or equivalent	P
Spectrum Analyzer	*Frequency Range:* 0.01 to 26.5 GHz *Power Range: +10 dB to –60 dBm*	Anritsu Corp., Model MS2802	P, T
Step Attenuator	*Attenuation Range:* 60 dB, 10 dB/step 0.000 to 18.0 GHz 0.000 to 26.5 GHz	 Hewlett-Packard, Model 8495B Hewlett-Packard, Model 8495D	P, C
Voltage Standard	Range: –1.462V to –1.313 mV Accuracy: 0.002% of set value.	John Fluke Mfg Co. Inc., Model 335D	P, C, T

Table 1-2. Specifications (1 of

MEASUREMENTS

Measurement Modes: Transmission, Power, Return Loss, SWR, Voltage.

Frequency Range: 10 MHz to 50 GHz in coax using WILTRON 560 Series Detectors and SWR Autotesters. Measurements can be made at higher frequencies with waveguide detectors and WILTRON 560-10BX or 560-10BX-1 Adapter Cables.

Inputs: Four inputs, A, B, R1, and R2 accept detected outputs from WILTRON 560 Series Detectors and SWR Autotesters.

Dynamic Range: 76 dB (–60 dBm to +16 dBm) on all channels, usable to –65 dBm.

Data Correction: System residuals, including the average of open and short reflections, are stored during calibration for automatic subtraction from test data.

Calibration: During the calibration sequence, the number of data points used for each trace are stored with 0.002 dB resolution over any user-selected frequency range. Calibration data are automatically interpolated for ranges less than the original normalized range.

Trace Memory: For both channels, any trace, measurement, or complex limit line may be subtracted from any subsequent measurement.

Save/Recall: Nine sets of front-panel settings (four sets include calibration data and trace memories) can be stored for later recall. All stored data can be previewed on the CRT or printer output prior to selection.

DISPLAY

Channels: Two channels are used to select and simultaneously display any two inputs from A, B, R1, or R2. The same inputs can be displayed as ratios of A/R1, A/R2, B/R1, or B/R2.

Alternate Sweep: Displays alternate sweeps between the current front-panel setup and any of nine stored setups when used in conjunction with any of the sweepers using dedicated GPIB, as indicated in Table 3-7.

Graticule: Ten vertical divisions. Horizontal divisions are set automatically in frequency increments of a 1, 2, 5 sequence. The graticule On/Off control turns all graticule lines off. Tick marks remain on each axis to indicate graticule position.

Display Resolution:
Horizontal: 101, 201, or 401 points per trace over the selected frequency range.
Vertical: 0.005 dB

Limit Lines: Two lines, either straight or complex, for each trace. Complex lines may be made from up to 10 segments. Measurement data can be compared with limit lines for Pass/Fail testing.

SCALING

Resolution: 0.1 dB to 10 dB per division in 0.1 dB steps with independent control for each channel.
Offset Range: –99 .9 dB to +99.9 dB in 0.1 dB steps.

Autoscale: Automatically selects offset and resolution to provide optimum display of test data.

Trace Update Time: Typically less than 100 ms, varying with frequency range, averaging and smoothing settings, and number of data points selected.

Smoothing: Off, Minimum, and Maximum selections use analog techniques to reduce noise on low-level traces. Trace update time is automatically adjusted for any combination of averaging and smoothing.

Averaging: 2, 4, 8, 16, 32, 64, 128, or 256 successive traces can be averaged to smooth the trace display.

CRT Intensity: Variably adjustable from off to bright.

MARKERS AND CURSORS

Markers: Up to eight numerically identified markers generated by the 6600B Series Sweep Generator and nine with the 6700B and 68000B Series Synthesizers may be displayed on the 562. Marker frequency and type are selected on the sweeper. A marker is designated as “Active” if it is open to DATA ENTRY.

Cursor: Position is selectable via tuning knob. Amplitude at the cursor frequency is displayed for both traces.

Cursor Delta: Displays the frequency and amplitude difference between the main Cursor and Relative Cursor for both traces. A menu selection reverses the position of the two cursors.

Table 1-2. Specifications (2 of

Cursor Min/Max: Moves the cursor to the minimum or maximum point on the trace as selected.

Cursor "X" dB: Moves cursor to "X" value on either trace.

Cursor Delta "X" dB: Moves the main Cursor to "X" value relative to Reference Cursor.

Cursor "X" dB Bandwidth: Moves both main Cursor and Reference Cursors to the first "X" dB down value from the initial reference position.

SIGNAL SOURCES

Recommended Signal Sources: The WILTRON 6600B Sweep Generators and 6700B and 68000B Synthesizers are directly compatible with the 562. A dedicated GPIB system interface supplies frequency annotation on the 562 display to form an intelligent link.

Compatibility: The 562 is compatible with any signal source that meets the following minimum requirements:

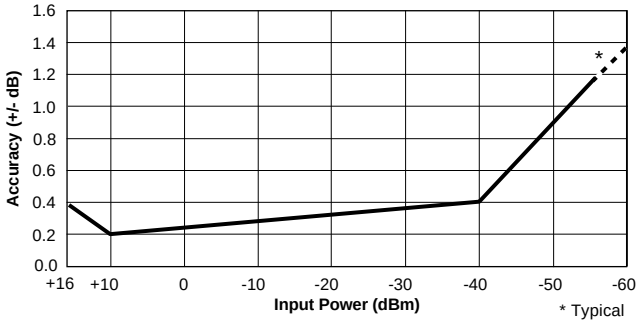
- **Horizontal Ramp:** Provides a 0V to +10V nominal ramp signal, +12 V maximum.
- **Blanking Signal:** Provides + 5V during retrace and bandswitching.
- **Dwell Signal:** Outputs TTL–Low signal to dwell sweep ramp.

ACCURACY

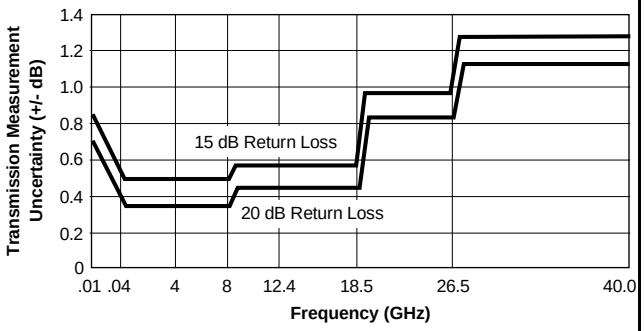
Transmission Loss or Gain Accuracy: Uncertainties due to the frequency response characteristics of components are automatically subtracted from the test data during the calibration procedure. The overall accuracy for this type of measurement is then:

Transmission Loss or Gain Accuracy = **Channel Accuracy** + **Mismatch Uncertainty**

Channel Accuracy (25°C)



Mismatch Uncertainty **



*** Based on worst-case analysis of uncertainties due to return loss of the detector, SWR Autotester, connecting cables, and the retrun loss of the measured reflection.*

Overall Coaxial Return Loss Measurement Accuracy: Uncertainties resulting from SWR Autotester and sweep generator frequency response characteristics and from system open and short characteristics are automatically subtracted from the test data.

The overall accuracy for this type of measurement is then:

Return Loss Accuracy = **Channel Accuracy** + **SWR Autotester Uncertainty**

SWR Autotester Accuracy: ‡

Model	Accuracy of Measured Reflection Coefficient (ρ)			
	10 MHz–8 GHz	8–18 GHz	18–26.5 GHz	26.5–40 GHz
560–97A50 560–97A50–1	$0.016 \pm 0.06\ \rho^2$ $0.010 \pm 0.06\ \rho^2$	$0.016 \pm 0.10\ \rho^2$ $0.010 \pm 0.10\ \rho^2$	N/A	N/A
560–97N50 560–97N50–1	$0.018 \pm 0.08\ \rho^2$ $0.013 \pm 0.08\ \rho^2$	$0.018 \pm 0.12\ \rho^2$ $0.013 \pm 0.12\ \rho^2$	N/A	N/A
560–97NF50 560–97NF50–1	$0.018 \pm 0.12\ \rho^2$ $0.013 \pm 0.12\ \rho^2$	$0.018 \pm 0.12\ \rho^2$ $0.013 \pm 0.12\ \rho^2$	N/A	N/A
560–98S50 560–98S50–1	$0.014 \pm 0.10\ \rho^2$ $0.010 \pm 0.10\ \rho^2$	$0.014 \pm 0.10\ \rho^2$ $0.010 \pm 0.10\ \rho^2$	$0.016 \pm 0.12\ \rho^2$ $0.013 \pm 0.12\ \rho^2$	N/A
560–98SF50 560–98SF50–1	$0.014 \pm 0.10\ \rho^2$ $0.010 \pm 0.10\ \rho^2$	$0.014 \pm 0.10\ \rho^2$ $0.010 \pm 0.10\ \rho^2$	$0.016 \pm 0.12\ \rho^2$ $0.013 \pm 0.12\ \rho^2$	N/A
560–98K50 560–98K50-1	$0.018 \pm 0.15\ \rho^2$	$0.018 \pm 0.15\ \rho^2$	$0.025 \pm 0.15\ \rho^2$	$0.032 \pm 0.18\ \rho^2$

‡ Accuracy includes the effects of directivity (first term) and test port reflection (second term) over the frequency range (ρ is the measured reflection coefficient.)

Table 1-2. Specifications (3 of

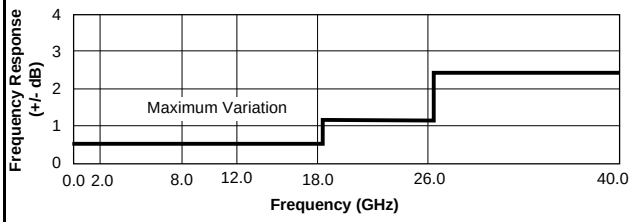
Overall Waveguide Return-Loss Measurement Accuracy: Mismatch uncertainties introduced by the detectors used in a waveguide reflectometer setup can be significant. The overall accuracy for this type of measurement is:

Return Loss Accuracy = **Channel Accuracy** + **User–Selected Coupler Accuracy**

Power Measurement Accuracy: Uncertainties introduced by the frequency response of the detectors used for power measurements can be significant. The overall accuracy for this type of measurement is:

Absolute Power Accuracy = **Channel Accuracy** + **Detector Frequency Response**

Detector Frequency Response:



GPIB

Interface: IEEE–488 interface is standard on all instruments. All front panel controls are GPIB controllable except power on/off and CRT intensity. A dedicated GPIB connects to WILTRON 6600B Series and HP 8350B Sweep Generators or WILTRON 6700B Series, WILTRON 68000B Series, and HP 8340/8341 Synthesizers. Pass-through commands allow control of the signal source through the 562 dedicated GPIB port.

Data Transfer: The 562 does not require an external controller for most measurements; nevertheless, it is capable of providing high speed transfer of test data and normalization data to and from an external GPIB controller.

PRINTER/PLOTTER

Printer: The parallel printer interface is compatible with most dot-matrix printers, including Epson FX and HP Thinkjet. Hard copy output in graphical or tabular format can be selected. Selections include graphics with measurement parameters, test data tabulated for 26, 51, 101, 201, or 401 points, marker parameters only, or stored setup parameters. Complex limit lines may also be printed.

Plotter: The dedicated system GPIB interface is compatible with HP Models 7440A, 7470A, and 7475A Plotters. Display traces, markers, cursor, and graticule information are copied. When overlay traces are desired, data traces only can be plotted**.**

Internal Print Buffer: After approximately 20 seconds of print formatting, a new test can be conducted while previously taken test data are being printed out from an internal printer buffer.

INPUT/OUTPUT CONNECTIONS

Horizontal Sweep Ramp Input: 0 to +10V nominal, +12V maximum. Rear panel BNC connector, 100 kΩ impedance.

Sequential 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. Rear panel BNC connector, 10 kΩ impedance.

Sweep Dwell Output: TTL-low signal stops sweep. Sweep continues when signal is removed. Rear panel BNC connector.

Bandswitch Blanking Input: Accepts ±5V signal coincident with bandswitching points. Rear panel BNC connector.

Retrace Blanking Input: ±5V input signal blanks traces during retrace. Rear panel BNC connector.

Video Marker Input: ±2V to ±10V peak input. Rear panel BNC connector.

GPIB IEEE 488: Connects 562 to GPIB or plotter. Rear panel GPIB connector.

Dedicated GPIB: Connects 562 to WILTRON or HP signal source and plotter. Rear panel GPIB connector.
Parallel Printer (Centronics): Connects 562 to printer. Rear panel connector.

AUX I/O: Connects 562 to WILTRON 6600B Series and HP8350B Sweep Generators and to WILTRON 6700B Series, WILTRON 68000B Series and HP8340/8341 Synthesizers. Rear panel connector.

GENERAL

Temperature Range:
Operating: 0°C to +50°C
Storage: –40°C to +70°C
Power: 100V/110V/220V/240V ±10%, 48–66 Hz, 130 VA maximum
Dimensions:
177H x 432W x 476D mm + 10mm for feet.
(7H x 17W x 18-3/4D in. + 3/8 in. for feet)
Weight: 16 kg (35 lb)

1-12 SYSTEM RF COMPONENTS

The Series 560-9XXXX SWR Autotesters and Series 560-7XXX RF Detectors are the measurement components most commonly used with the 562. The part numbers and specifications for these components are contained in paragraphs 1-12.1 and 1-12.2 below.

For measurements below 3.0 GHz, Series 5400-6XXXX SWR Autotesters and Series 5400-7XXX RF Detectors also may be used with the 562. The part numbers and specifications for these components are contained in the WILTRON Catalog (also in Chapter 1 of the 54XXA Scalar Measurement Systems Operation Manual).

1-12.1 560 Series SWR Autotesters (Specifications)

WILTRON 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 40 GHz (Table 1-3). The performance verification procedures for SWR Autotesters are contained in the Series 560 Autotesters Operation and Maintenance Manual (P/N 10100-00028).

Accuracy: See accuracy chart on page 1-11.
Maximum Input Power: 500 mW
Cable Length: 122 cm (4 ft)
Insertion Loss: 6.5 dB nominal from input port to test port.
Weight: 560-97XXXX Series: 340g (12 oz.)
560-98XXXX Series: 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

1-12.2 560 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 1-4). 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):

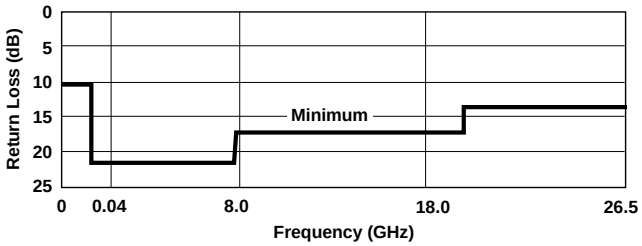


Table 1-4. 560 Series Detectors

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

1-13 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 WILTRON warranty).

a. 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. A WILTRON 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 Table 1-5). 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.

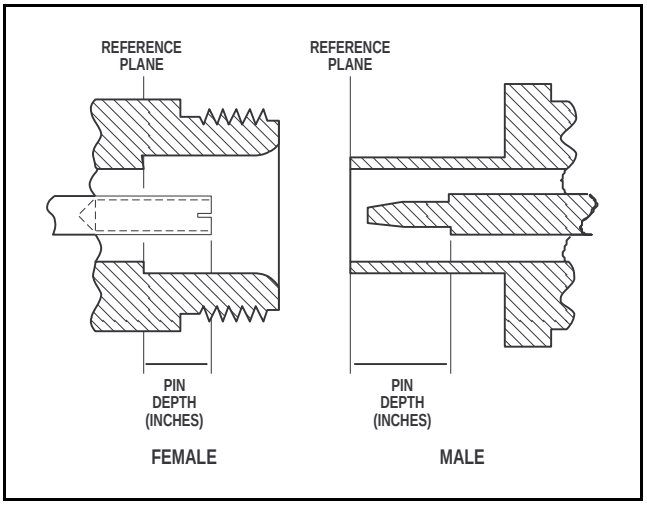


Figure 1-5. N Connector Pin Depth Definition

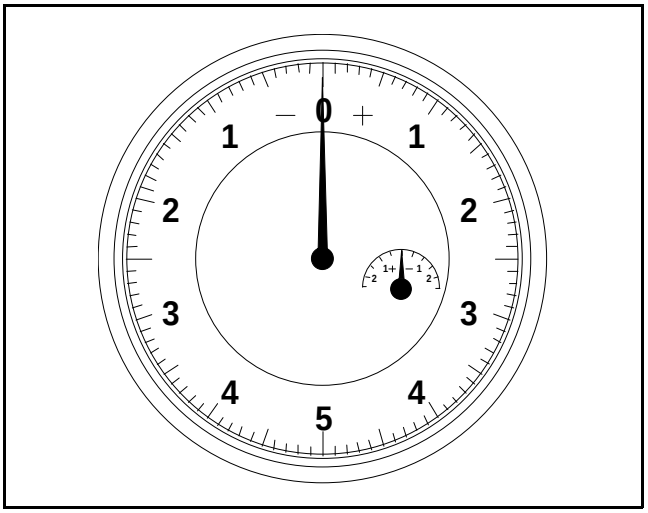


Figure 1-6. Pin Depth Gauge

Table 1-5. Allowable Mating Connector Pin Depth

Test Port Connector Type	Wiltron • Gauging Set Model	Pin Depth (Mils)	Pin Depth Gauge Reading
N-Male	01-163	207 −0.000 +0.003	207 +0.000 −0.003
N-Female		207 +0.000 −0.003	Same as Pin Depth
GPC-7	01-161	+0.000 −0.003	Same as Pin Depth
WSMA-Male	01-162	−0.0025 −0.0035	Same as Pin Depth
WSMA-Female		+0.003 −0.007	
K-Male, K-Female	01-162	+0.000 −0.005	Same as Pin Depth

b. 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.

c. Avoid Mechanical Shock

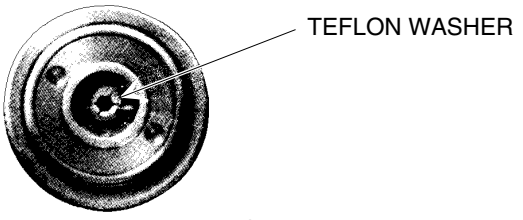
Do not drop or otherwise treat RF components roughly. These devices are designed to withstand years of normal bench handling. However, mechanical shock will significantly reduce their service life.

d. 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.

e. 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 WILTRON precision connector.

Figure 1-7. Typical Tuning Washer Usage

f. Compensation Washers (WSMA Connectors)

WSMA connectors are optimized for connection to standard SMA connectors. 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 54XXA and other WILTRON RF signal sources. Figure 1-8 shows a typical compensation washer installation.

g. 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.

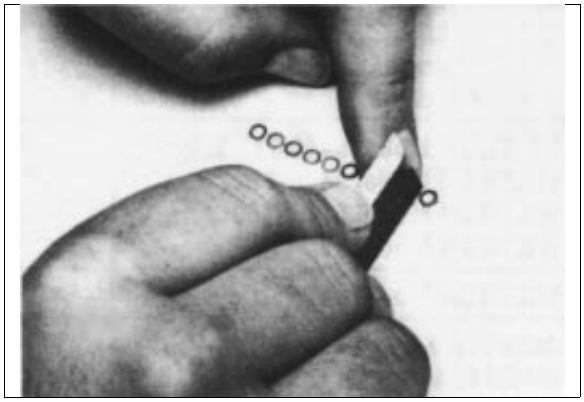
To clean the connector interfaces, use a clean cotton swab that has been *dampened* with denatured alcohol. Proper techniques for cleaning male and female GPC type connectors are as follows.

- 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

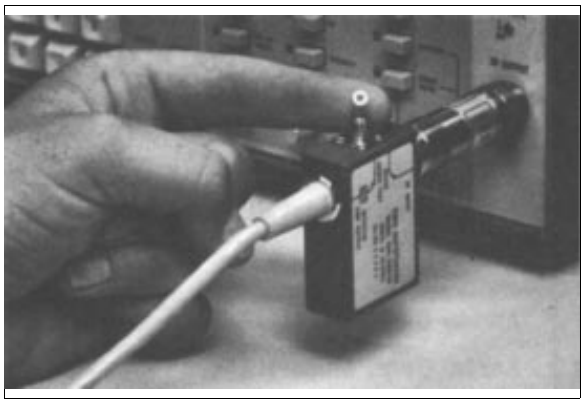
Most cotton swabs are too large to fit into the smaller connector types. In these cases it is necessary to peel off most of the cotton and then twist the remaining cotton tight. Be sure that the remaining cotton does not get stuck in the connector.

CONNECTING A 19SF50 AIR LINE TO A 560-98SF50 SWR AUTOTESTER (WSMA to WSMA Connection)



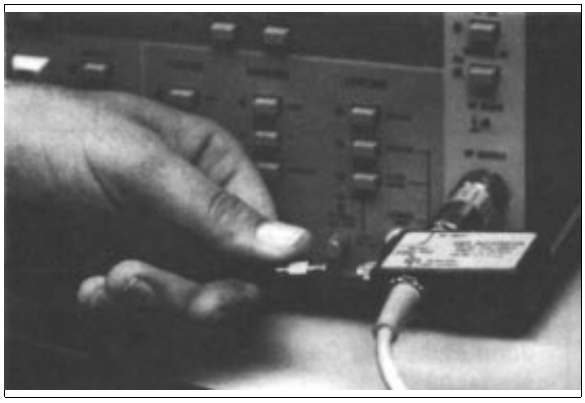
1. Separate a single WSMA connector compensation washer and trim away the interconnecting tabs.

2. Connect the 560-98SF50 SWR Autotester input port to the signal source RF output port, and loosely tighten connector. Orient the WSMA female connector (test port) up.



3. Insert the compensation washer into the opening of the WSMA female connector, as shown.

4. Connect beaded end of the air line per application. Tilt the air line horizontally. At unbeaded end, center the inner conductor with the center of the connector opening.



5. Loosen the SWR Autotester input port connector and rotate unit horizontally, as shown at left. Align unbeaded end of Air Line with test port connector and carefully mate connectors. Tighten all connectors carefully.

NOTE

For a 560-98S50 SWR Autotester (male WSMA test port) in combination with a 19SF50 Air Line, insert the compensation washer into the female WSMA connector of the air line (beaded end).

Figure 1-8. Example Use of Compensation Washer with WSMA Connectors

SECTION II
INSTALLATION

CONTENTS

SECTION II
INSTALLATION

2-1 INTRODUCTION

This section provides information for the initial inspection and preparation for use of the 562 Scalar Network Analyzer. It includes information for interfacing the 562 to the IEEE-488 General Purpose Interface Bus and for interconnecting to various sweep generators and and other signal sources. Reshipment and storage information for the 562 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 562 is damaged mechanically, notify your local sales representative or WILTRON Customer Service. If either the shipping container is damaged or the cushioning material shows signs of stress, notify the carrier as well as WILTRON. 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 100, 120, 220 or 240 Vac operation; see Figure 2-1. If the selector drum setting is incorrect for the line voltage available, set it to the correct setting and insert the correct line fuse as shown in the chart in Figure 2-1.

2-4 GPIB SETUP AND INTERCONNECTION

All functions of the 562 (except power on/off) can be controlled remotely by an external computer/controller via the IEEE-488 General Purpose Interface Bus (GPIB). The information in this section pertains to interface connections and cable requirements for the rear panel GPIB connector. For information about remote operation of the 562 using the GPIB, refer to Section IV — Remote (GPIB) Operation.

The 562 GPIB controller operates with any IBM XT, AT, or PS/2 compatible computer/controller equipped with a National Instruments GPIB-PCII/IIA interface card and NI-488 MS-DOS Handler Software. The procedures for installing this hardware and software in your computer is contained in Appendix A at the rear of this manual.

2-4.1 Interface Connector

Interface between the 562 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 2-2 (page 2-6).

2-4.2 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.

To change the line voltage from that shown on the Line Voltage Module selector drum, proceed as follows:

(a) Remove the power cord from the line voltage module.

(b) Insert the blade of a small screwdriver into the slot at the top-center of the module, and pry open the cover.

(c) Remove the voltage selector drum by pulling straight out.

(d) Rotate the drum so that the desired line voltage marking faces out, then reinstall the drum.

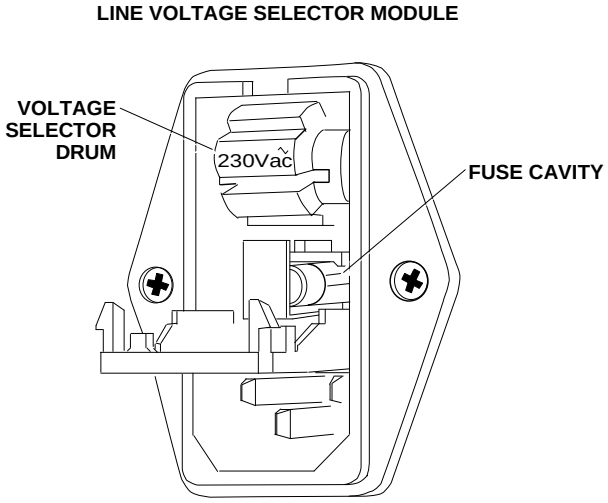
(e) Remove the fuse cartridge from the right-hand fuseholder. The fuse cartridge is identified with a white arrow and is located beneath the voltage selector drum.

(f) Check that the proper fuse is installed (see table).

(g) Change to the correct fuse, if necessary, and replace the fuse cartridge.

(h) Close the cover, and ensure that the desired line voltage value is displayed through the opening in the cover.

(i) Reinstall the line cord.



Fuse Sizes, Ratings, and Part Numbers

Line Voltage Setting	Area	Fuse Rating	Fuse Size	Wiltron P/N Fuse	Wiltron P/N Fuse Holder
100 Vac	Japan	2A, Antisurge	3 AG	631-4	553-221
120 Vac	USA	2A, Antisurge	3 AG	631-4	553-221
220 Vac	Europe	1A, Antisurge	5 x 20 mm	631-49	553-240
240 Vac	UK	1A, Antisurge	5 x 20 mm	631-49	553-240

Figure 2-1. Setting the Line Voltage Module Operating Voltage

2-4.3 System GPIB Interconnection

The rear panel GPIB IEEE-488 connector is used to interface the 562 to an external computer/ controller (or plotter) via a standard GPIB cable. The WILTRON Part numbers for standard GPIB cables of various lengths are listed in Section I.

2-4.4 Dedicated GPIB Interface

The 562 includes a second (dedicated) GPIB interface connector on the rear panel. This interface is used to control the GPIB compatible sweep generators and synthesizers used with the 562. (For use with non-GPIB compatible signal sources, this interface in not used.) This interface can also be used to control a suitable external plotter. Standard GPIB cables are used with this interface.

2-4.5 GPIB Addresses

The 562 leaves the factory with the default address for the system GPIB interface set to 6. This address can be changed using the menu from the GPIB RETURN TO LOCAL key. The default addresses for the dedicated GPIB interface are 5 for

the signal source and 8 for the plotter. These addresses can be changed using the menus invoked by the front panel SYSTEM MENU key. These procedures are explained in Section III.

2-5 SWEEP GENERATOR INTERCONNECTION

The following paragraphs provide instructions for connecting the 562 Network Analyzer to various sweep generators.

2-5.1 WILTRON Signal Sources

The 562 Analyzer is supplied with a dedicated GPIB bus cable (PN 2100-1) and auxiliary I/O cable (PN 806-7) for use with Series 6600B Sweep Generators and and other WILTRON signal sources. Proceed as follows:

- Remove power from the 562 and the signal source.
- Install the auxiliary I/O cable between the AUX I/O connectors of both instruments.
- Connect the GPIB cable between the dedicated GPIB connector of the analyzer and the IEEE-488 Interface connector of the sweep generator. The system is now ready for operation.

2-5.2 Other Sweep Generators

The sweep generator or other signal source used with the 562 Analyzer must provide the necessary horizontal, blanking, and dwell signals that are defined in Table 1-2 (page 1-11) under "SIGNAL SOURCE". Refer to Table 3-7 for information about interconnecting the 562 to various non-WILTRON sweep generators and other frequency sources.

2-6 PREPARATION FOR STORAGE AND/OR SHIPMENT

The following paragraphs describe the procedure for preparing the 562 for storage or shipment.

2-6.1 Preparation for Storage

Preparing the 562 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).

2-6.2 Preparation for Shipment

To provide maximum protection against damage in transit, the 562 should be repackaged in the original shipping container. If this container is no longer available and the 562 is being returned to WILTRON for repair, advise WILTRON 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.

a. 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.

b. Protect the Instrument

Surround the instrument with polyethylene sheeting to protect the finish.

c. 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.

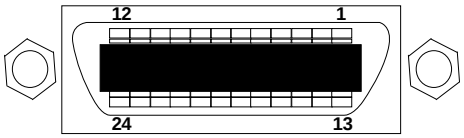
d. Seal the Container

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

e. Address the Container

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

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 2-2. Pinout for Rear Panel GPIB Connector

Table 2-1. WILTRON Service Centers

UNITED STATES

WILTRON COMPANY
490 Jarvis Drive
Morgan Hill, CA 95037-2809
Telephone: (408) 778-2000
Telex: 285227 WILTRON MH
FAX: 408-778-0239

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

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

AUSTRALIA

WILTRON PTY. LTD.
Level 2, 410 Church Street
North Parramatta
NSW 2151 Australia
Telephone: 026-30-81-66
Fax: 026-83-68-84

BRAZIL

ANRITSU ELECTRONICA LTDA.
Praia de Botafogo, 440-Sa;a 2.401-Botafogo
2225-Rio de Janeiro-RJ-Brasil
Telephone: 021-28-69-141
Fax: 021-53-71-456

CANADA

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

CHINA

WILTRON BEIJING SERVICE CENTER
416W Beijing Fortune Building
5 Dong San Huan Bei Lu
Chao Yang Qu, Beijing 100004, China
Telephone: 86-1-50-17-559
FAX: 86-1-50-17-558

FRANCE

ANRITSU WILTRON 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 WILTRON GmbH
Rudolf Diesel Strabe 17
8031 Gilching
Telephone: 08-10-58-055
Telex: (841) 528523
FAX: 08-10-51-700

INDIA

ACCUTROL SYSTEMS PRIVATE LIMITED
Nirmal, 15th Floor
Narimen Point
Bombay 400 021
Telephone: 011-91-22-202-2220
FAX: 011-91-22-202-9403

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 WILTRON 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

WILTRON CORPORATION
#2103 Korea World Trade Center
159-1 Samsung-Dong
Kangnam-ku, Seoul
Telephone: (02) 551-2250
FAX: (02) 551-4941

SWEDEN

WILTRON AB
Box 247
S-127 25 Skarholmen
Telephone: (08) 74-05-840
Telex: (854) 81-35-089
FAX: (08)71-09-960

TAIWAN

WILTRON 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 WILTRON LTD.
200 Capability Green
Luton, Bedfordshire
LU1 3LU, England
Telephone: 05-82-41-88-53
Telex: (851) 826750
FAX: 05-82-31-303

SECTION III
FRONT PANEL OPERATION

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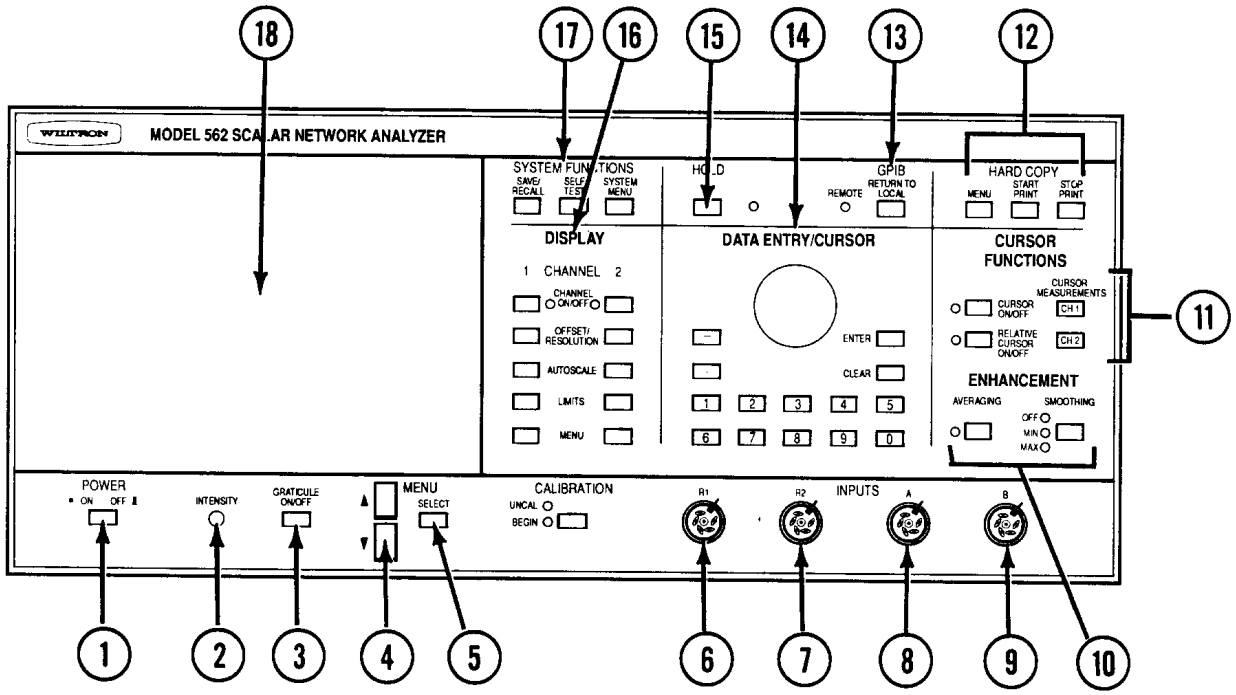


1. **POWER ON/OFF:** Turns the instrument on and off. When pressed to ON, it initiates an instrument self test.

2. **INTENSITY:** Adjusts the intensity of the display.

3. **GRATICULE ON/OFF:** Turns the display graticule on and off. Tick marks showing where the graticule lines would be are displayed when the graticule is off.

4. **MENU Up and Down Keys:** Moves the menu cursor up or down to indicate menu options on the CRT.

5. **SELECT:** Implements the menu option illuminated by the MENU up and down keys.

6. **R1 Connector:** Provides input for Channel R1.

7. **R2 Connector:** Provides input for Channel R2.

8. **A Connector:** Provides input for Channel A.

9. **B Connector:** Provides input for Channel B.

10. **ENHANCEMENT Keys and Indicators:** Allows for data averaging, and smoothing.

11. **CURSOR keys and Indicators:** Selection and movement of the Cursor and Relative cursor line on the display and selects the measurement channel.

12. **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.

13. **GPIB Indicator and Key:** Key returns the analyzer to local (control panel) operation and allows the GPIB address to be set. Indicator is lit when the analyzer is in the GPIB mode.

14. **DATA ENTRY Keys and Knob:** Enter numerical data. When Cursor is on, knob moves the cursor.

15. **HOLD:** 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 START PRINT keys are activated.

16. **DISPLAY Keys and Indicators:** Control network analzyer and displayed trace functions.

17. **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.

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

Figure 3-1. Model 562 Scalar Network Analyzer Front Panel Controls

SECTION III
FRONT PANEL OPERATION

3-1 INTRODUCTION

This section describes:

- The operation of the 562 Scalar Network Analyzer using the control panel controls.
- The controls and rear panel connectors.
- How to make transmission, return loss, power, and alternating setup 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 562, cursors, markers, limit lines, menu options, and the frequency source parameters.

- *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

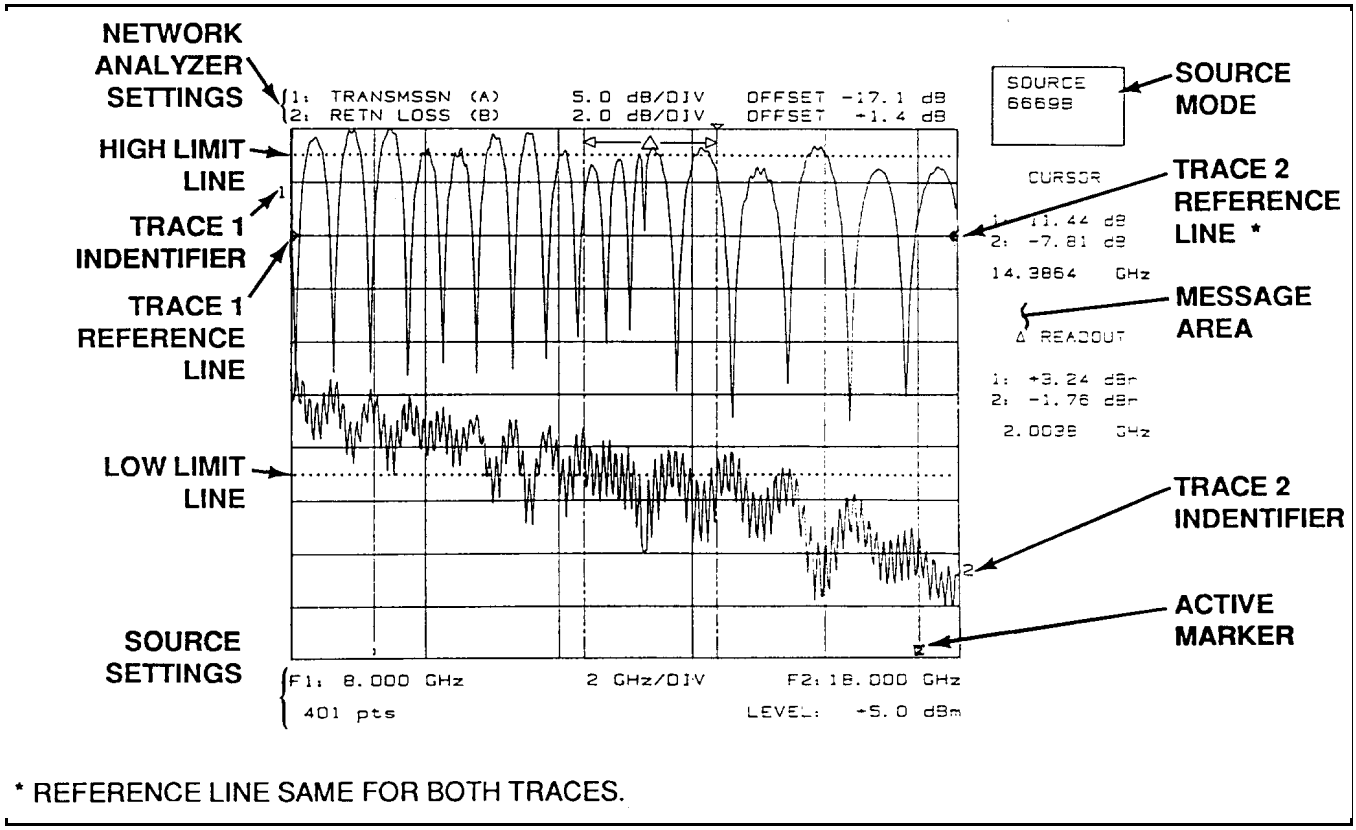


Figure 3-2. Typical Model 562 CRT Display

(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 562 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 paragraphs 3-3.1 thru 3-1.3.

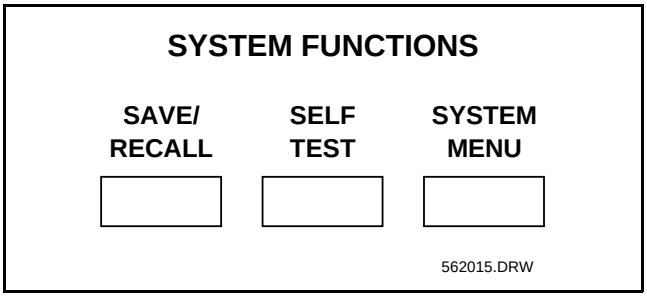


Figure 3-3. SYSTEM FUNCTION Keys

3-3.1 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.

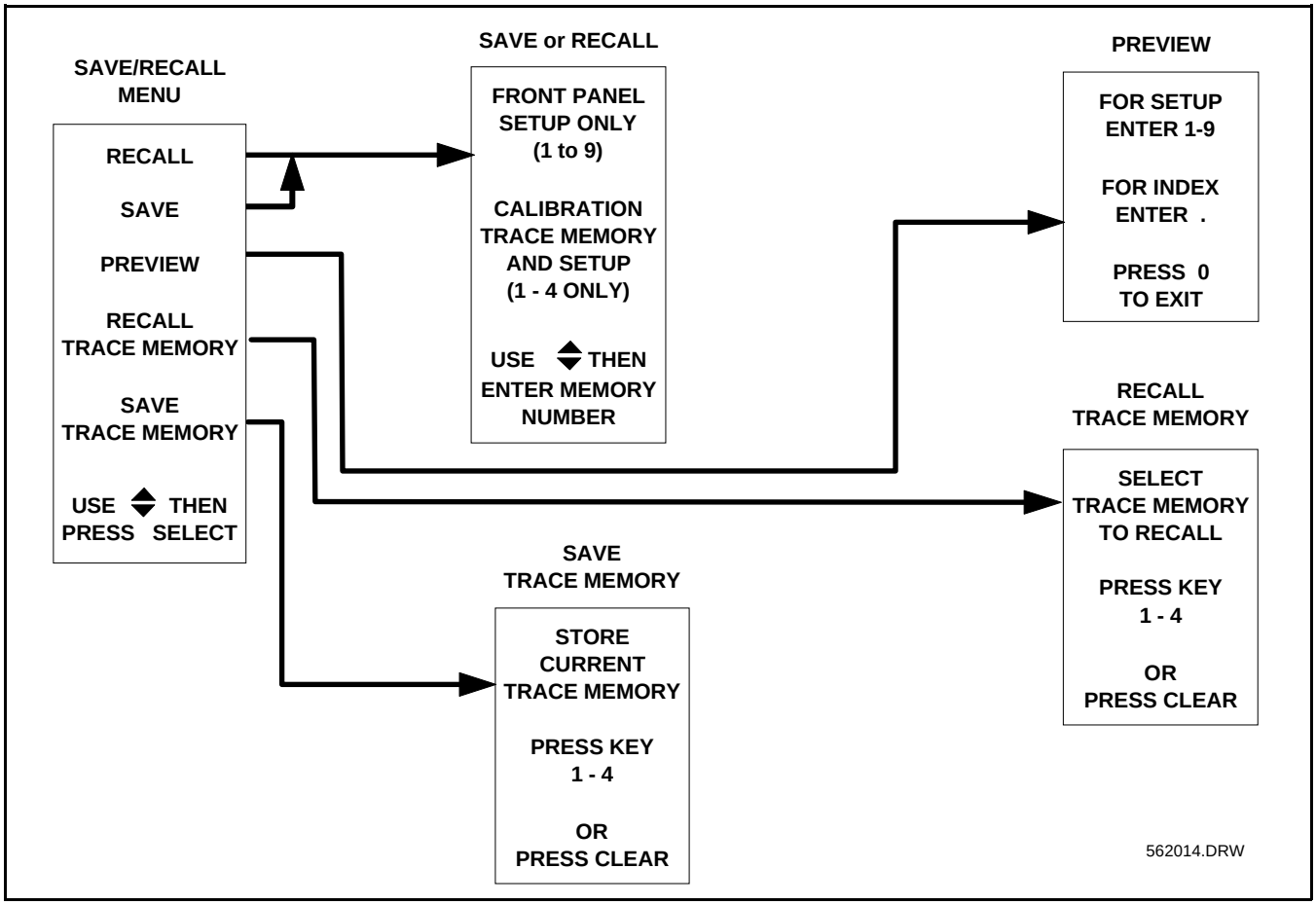


Figure 3-4. SAVE/RECALL Key Menus

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

1. 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.
2. 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.

b. Preview. Previews the setups stored in memory locations 1 thru 9.

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

d. 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.

3-3.2 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.

3-3.3 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.

a. System Interface. Displays a menu providing three options.

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

b. 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.

1. RF ON DURING RETRACE. Tells the 562 that the RF is on or off during sweep retrace.
   (a) YES. Tells the 562 that the RF is on and displays "RT1" at the bottom of the CRT.
   (b) NO. Tells the 562 that the RF is off and displays "RT0" at the bottom of the CRT.
2. 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.

   (a) NORMAL. Sets display for the normal (AUTO) sweep mode.
   (b) CW. Sets display for the non-sweeping CW mode. The displayed trace(s) is updated with no synchronization sent to the source.
   (c) 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.
   (d) 562 RAMP OUTPUT. Turns on the 562 HORIZONTAL (SWEEP RAMP) OUTPUT signal (Index 9, Figure 3-24) and allows control and end-point labeling using the "RAMP OUTPUT CONTROL" option in the "APPLICATIONS" menu (Figure 3-6).
3. MANUAL LABELING. Displays a menu that lets you apply labels to the display.
   (a) START. Enter the sweep-start frequency.
   (b) STOP. Enter the sweep-stop frequency.
   (c) LEVEL. Enter the power level.
   (d) OFF. Turns off sweep-ramp labeling.

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

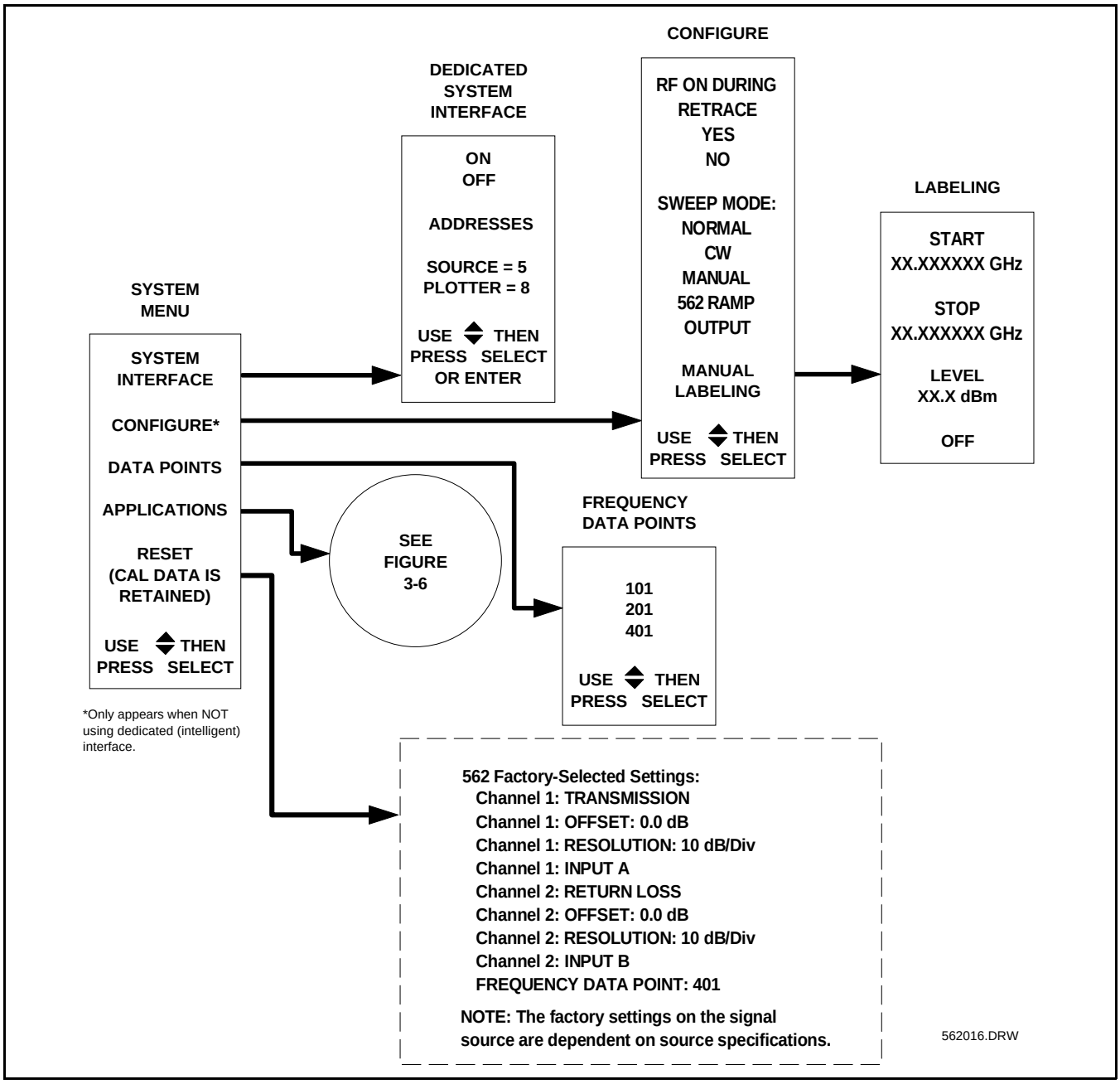


Figure 3-5. SYSTEM MENU and Factory-Select Settings

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

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

   (a) 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.

   (b) 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.

   (c) 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.

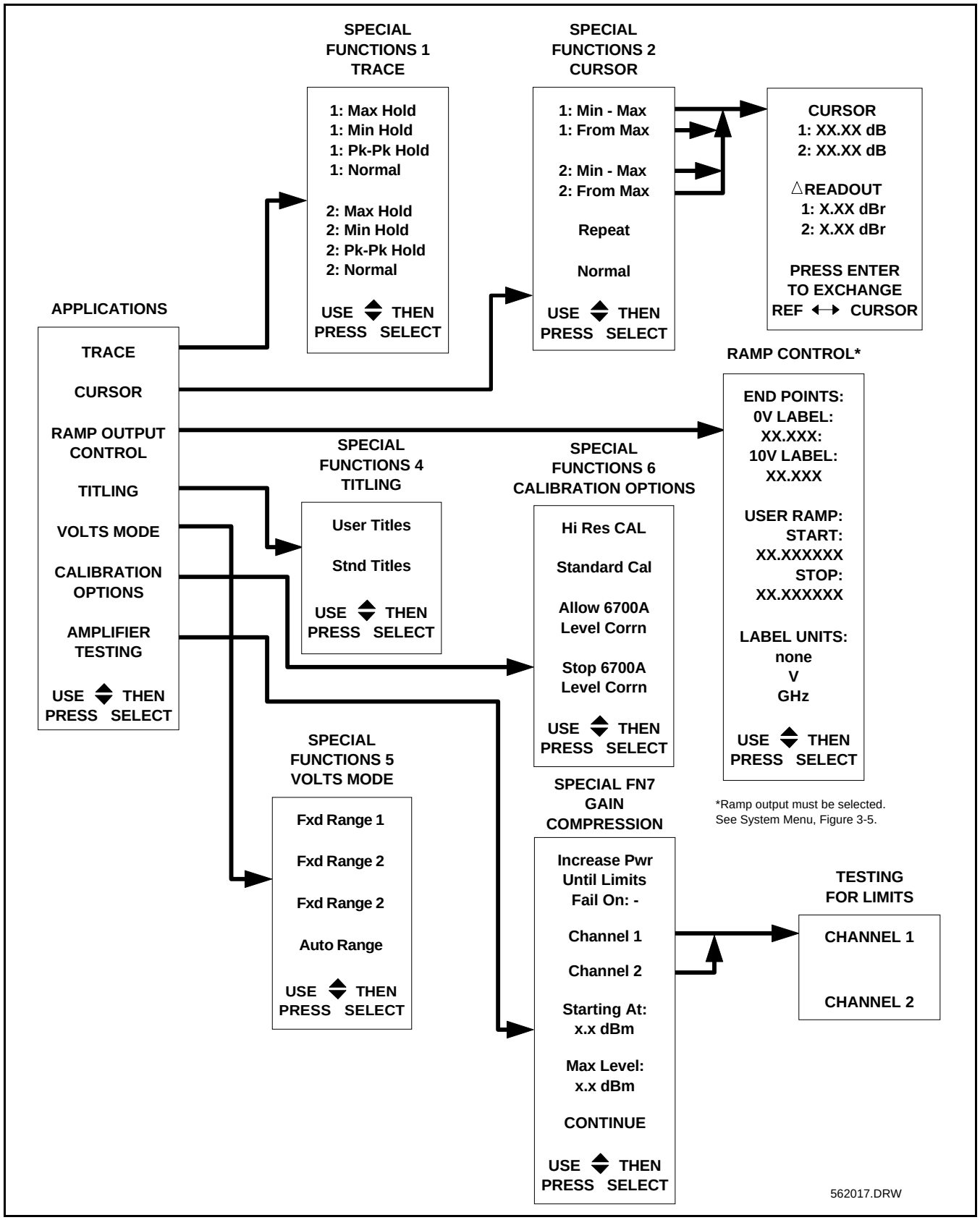


Figure 3-6. APPLICATION Menu-Option Menus

(d) 1: OR 2: NORMAL. Turns off the capture modes on trace 1 or 2.

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

(a) 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.

(b) 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).

(c) REPEAT. Repeats the search.

(d) NORMAL. Returns 562 to the single-search mode.

3. RAMP OUTPUT CONTROL. Displays a menu that lets you control the 562 sweep ramp signal (Index 9, Figure 3-24).

(a) 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.

(1) 0V LABEL. Assigns a label to the left side of the display.

(2) 10V LABEL. Assigns a label to the right side of the display.

(b) USER RAMP. Lets you control the voltage output of the 562 sweep ramp. The full range is from 0V to 10V. The settings chosen here interact with those chosen using the END POINTS options above. 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 from 2 to 12 and a user ramp of from 2 to 7, the 562 sweep ramp goes from 0V to 5V. Units can be none, V, or GHz, as selected using the LABEL UNITS options.

(1) START. Sets the starting voltage of the 562 sweep ramp (between 0V and 10V).

(2) STOP. Sets the stopping voltage of the 562 sweep ramp (between 0V and 10V, but must be higher than the start voltage).

(c) LABEL UNITS. Assigns unit-labels to both END POINTS and USER RAMP options, above.

(1) NONE. Assigns no unit-labels.

(2) V. Assigns V (voltage) as unit-labels.

(3) GHz. Assigns GHz (frequency) as unit-labels.

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

(a) 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 Channels 1 and 2 respectively.

(b) STND TITLEs. Cause trace to revert to standard title names (Transmission, Return Loss, Power, etc).

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

(a) FXD RANGE 1. Selects the 0 - 10 volt range.

(b) FXD RANGE 2. Selects the 0 - 1 volt range.

(c) FXD RANGE 3. Selects the 0 - 100 mV range.

(d) AUTO RANGE. Selects the normal autorange operation.

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

(a) HI RES CAL. Enables a facility that provides up to 2000 points of calibration memory.

(b) STANDARD CAL. Selects the standard calibration mode.

(c) ALLOW 6700A LEVEL CORRN. Enables 67XXA/B level correction.

(d) STOP 6700A LEVEL CORRN. Disables digital Level Correction on 67XXA/B.

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

   (a) INCREASE POWER UNTIL LIMITS FAIL ON CHANNEL 1. Uses Channel 1 as reference power until limits fail.

   (b) INCREASE POWER UNTIL LIMITS FAIL ON CHANNEL 2. Uses Channel 2 as reference power until limits fail.

   (c) 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.

   (d) MAX LEVEL. Sets the 562 to the maximum allowable power level.

   (e) CONTINUE. Overrides limit-failure and sets the power level to the "Max Level" point, as described above.

e. ***Reset (Cal Data Is Retained).*** Restores the factory-selected control panel settings (Figure 3-5). If the 562 is connected to the source via the dedicated system bus, selecting this option resets the source control settings also. If a 66XXB is on the dedicated bus, then the 562 is automatically configured to the 66XXB RF retrace setting to provide correct 562 autozeroing. (This function is not presented as a menu option.)

3-4 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 3-11) key can be used to cancel the key action.

3-4.1 CHANNEL ON/OFF Key and indicator

Key turns its associated trace and reference line indicator on or off (Figure 3-2). The associated indicator is lit when the trace is on.

3-4.2 OFFSET/RESOLUTION *Key* and Menus

Displays a menu (Figure 3-8) that lets you select OFFSET or RESOLUTION.

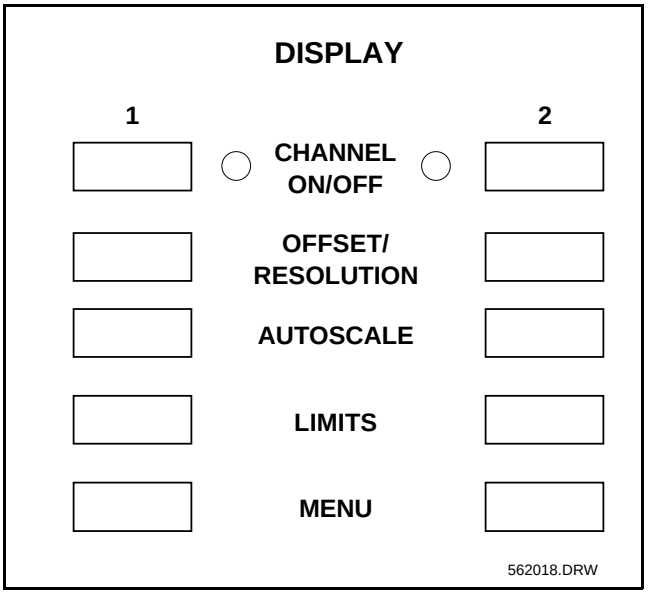


Figure 3-7. DISPLAY Keys and Indicators

3-4.3 AUTOSCALE Key

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

3-4.4 LIMITS Keys

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.

3-4.5 MENU Key and Menus

Initiates a series of menus (Figure 3-10) providing various trace display and input options, which are described below.

a. ***Transmission.*** Configures the trace for a transmission measurement.

b. ***Return Loss.*** Configures the trace for a return loss measurement.

c. ***Power.*** Configures the trace for a power measurement.

d. ***SWR.*** Configures the trace for an SWR (standing-wave ratio) measurement.

e. ***Volts.*** Configures the trace for a voltage measurement. In this measurement, the input RF Detector is replaced with a length of BNC-BNC cable.

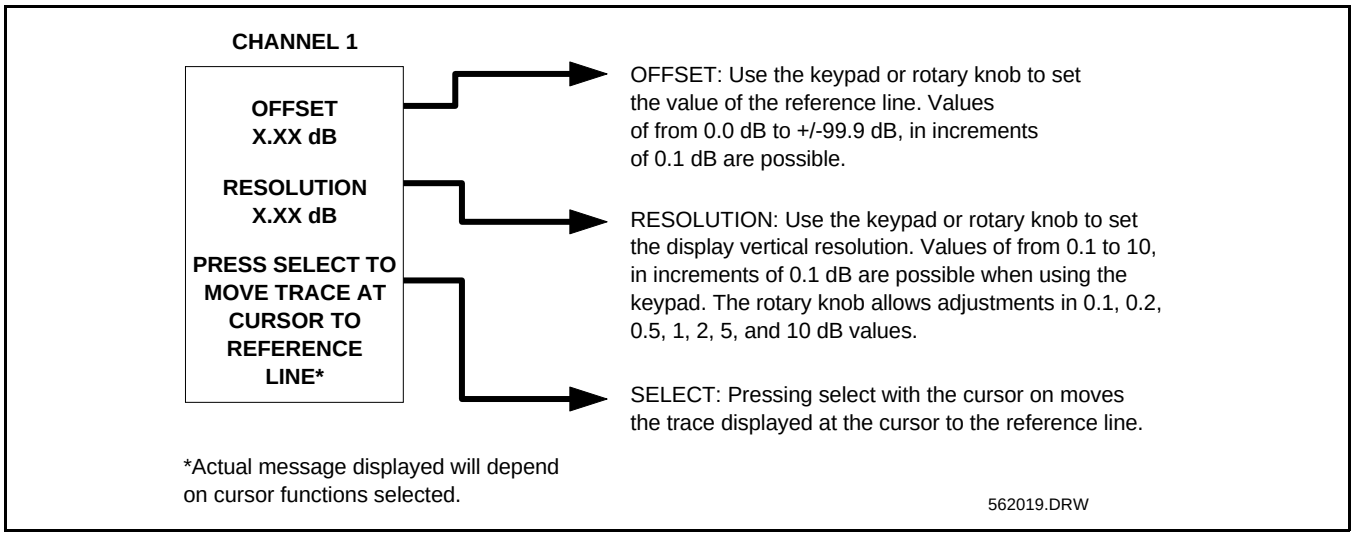


Figure 3-8. OFFSET/RESOLUTION Key Menu

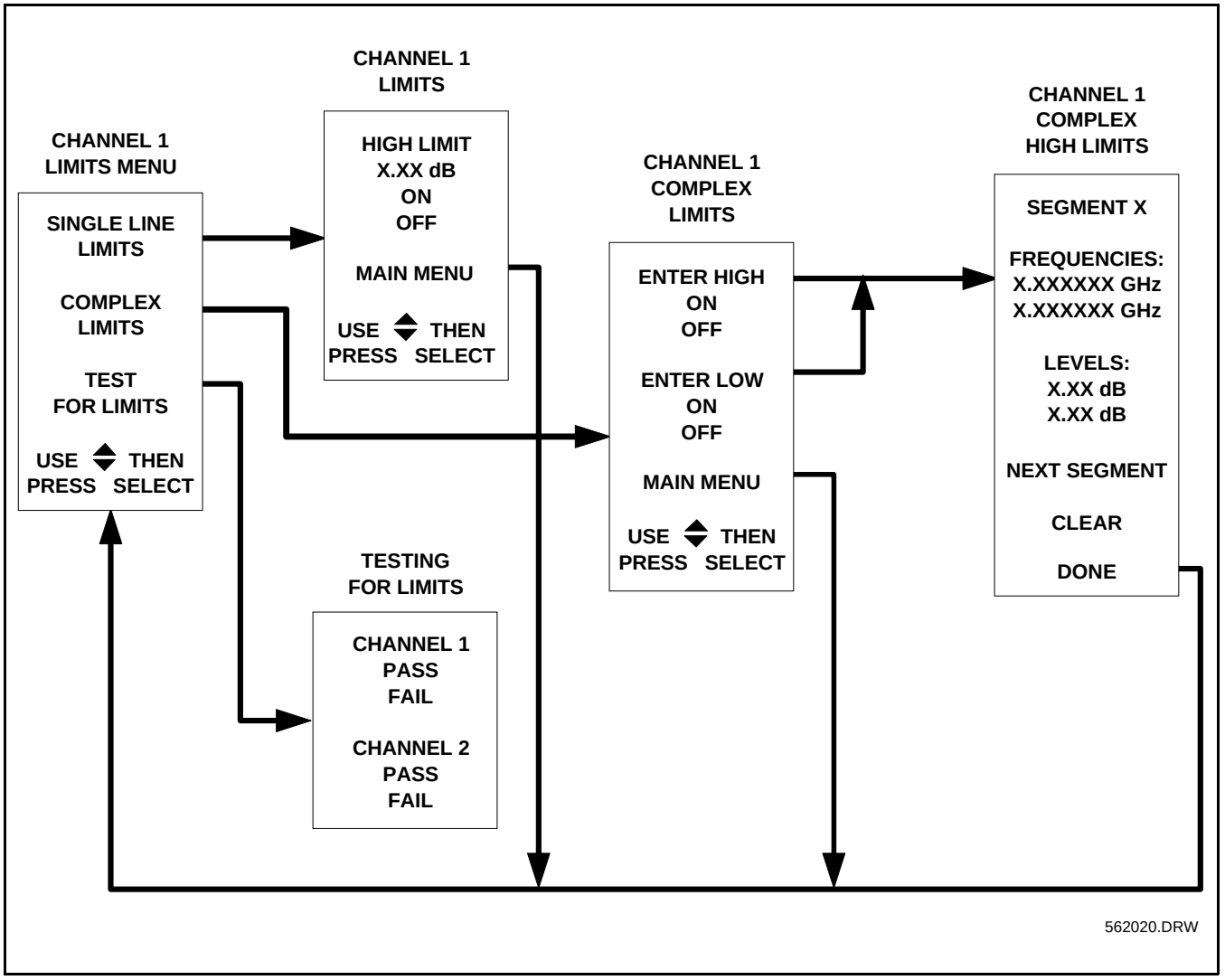


Figure 3-9. LIMITS Menus

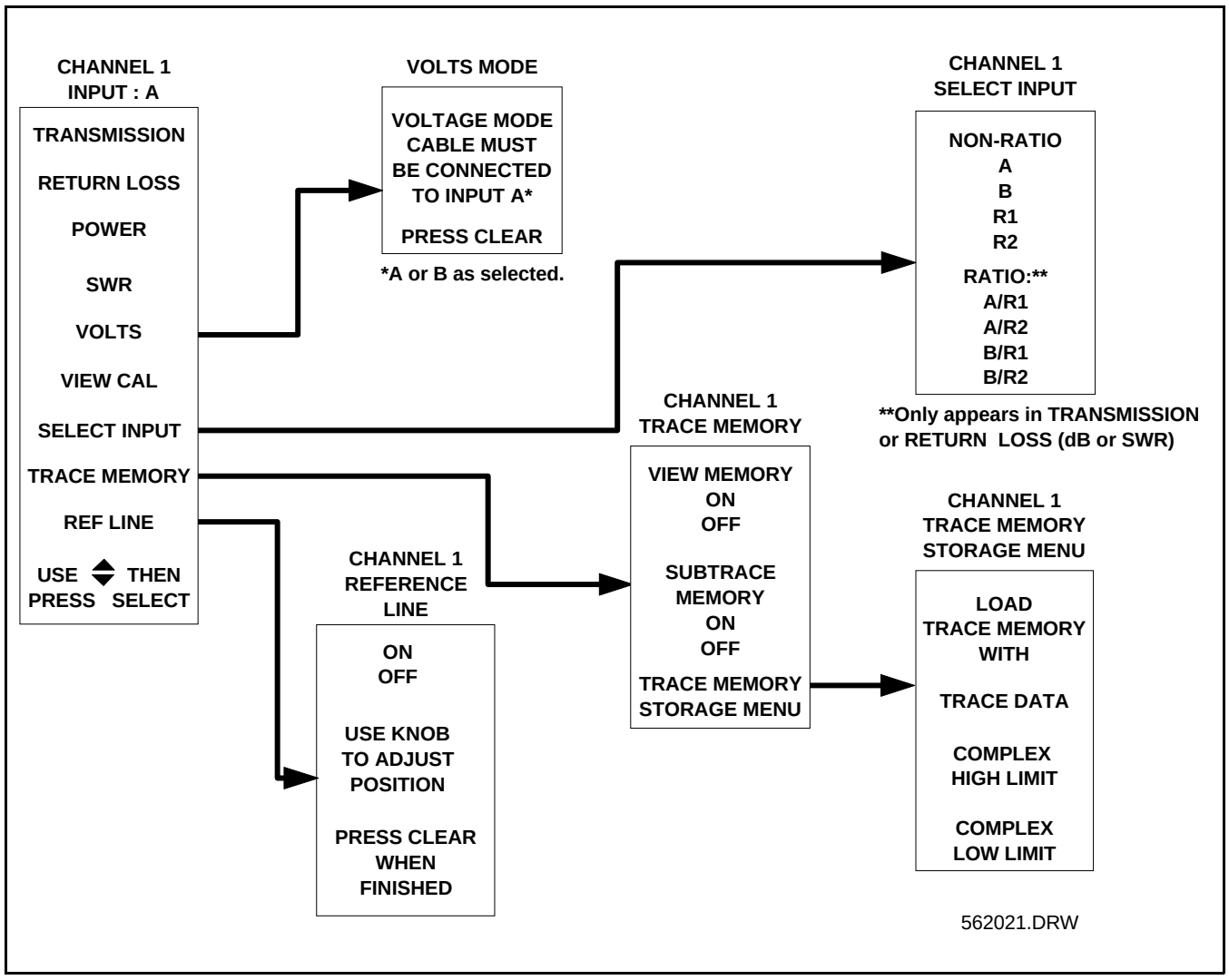


Figure 3-10. DISPLAY MENU Key Menu

f. View Cal. View stored calibration data.

g. Select Input. Displays a menu providing the following input selection.

1. NON RATIO A. Connects the output of the input A amplifier to Channel 1 or 2.
2. NON RATIO B. Connects the output of the input B amplifier to Channel 1 or 2.
3. NON RATIO R1. Connects the output of the input R1 amplifier to Channel 1 or 2.
4. NON RATIO R2. Connects the output of the input R2 amplifier to Channel 1 or 2.
5. 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.
6. RATIO A/R2. Same as described for RATIO A/R1, except substitute input R2 for input R1.
7. RATIO B/R1. Same as described for RATIO A/R1, except substitute input B for input A.
8. RATIO B/R2. Same as described for RATIO A/R1, except substitute inputs B and R2 for A and R1.

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

1. 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).

2. SUBTRACT MEMORY ON/OFF. Subtracts the trace stored in this memory from the displayed trace.
3. TRACE MEMORY STORAGE MENU. Displays a menu providing storage options.
   (a) LOAD TRACE MEMORY WITH TRACE DATA. Loads this memory with data from the displayed trace.
   (b) LOAD TRACE MEMORY WITH COMPLEX HIGH LIMIT. Loads this memory with complex-high-limit data.
   (c) LOAD TRACE MEMORY WITH COMPLEX LOW LIMIT. Loads this memory with complex-low-limit data.

i. 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.

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

3-4.6 CALIBRATION Key and Menus

Displays a series of instructions (Figure 3-12) 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 562 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 562 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.

3-4.7 UNCAL Indicator

Lights when either measurement trace is uncalibrated.

3-4.8 BEGIN Indicator

Lights at the beginning of the calibration cycle and remains lit until the cycle is completed.

3-5 DATA ENTRY/CURSOR KEYS AND KNOB

The DATA ENTRY keys and knob (Figure 3-11) are described below.

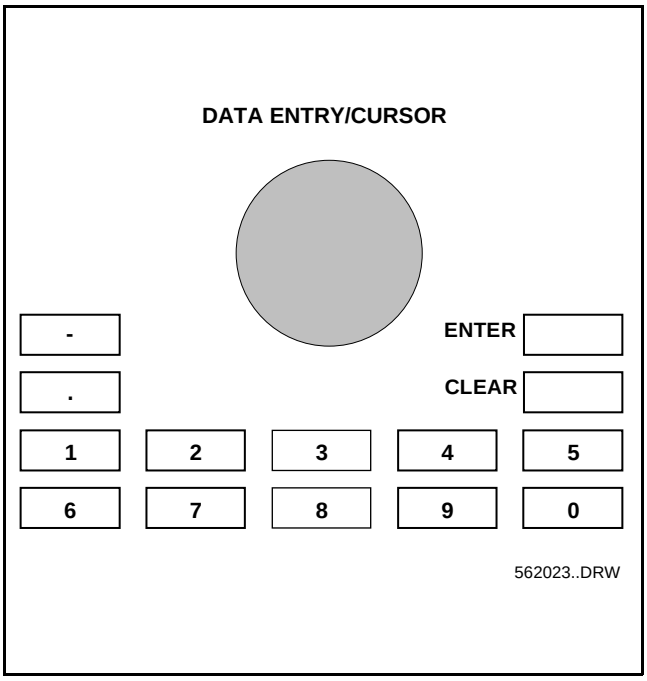


Figure 3-11. DATA ENTRY Keys and

3-5.1 Knob

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

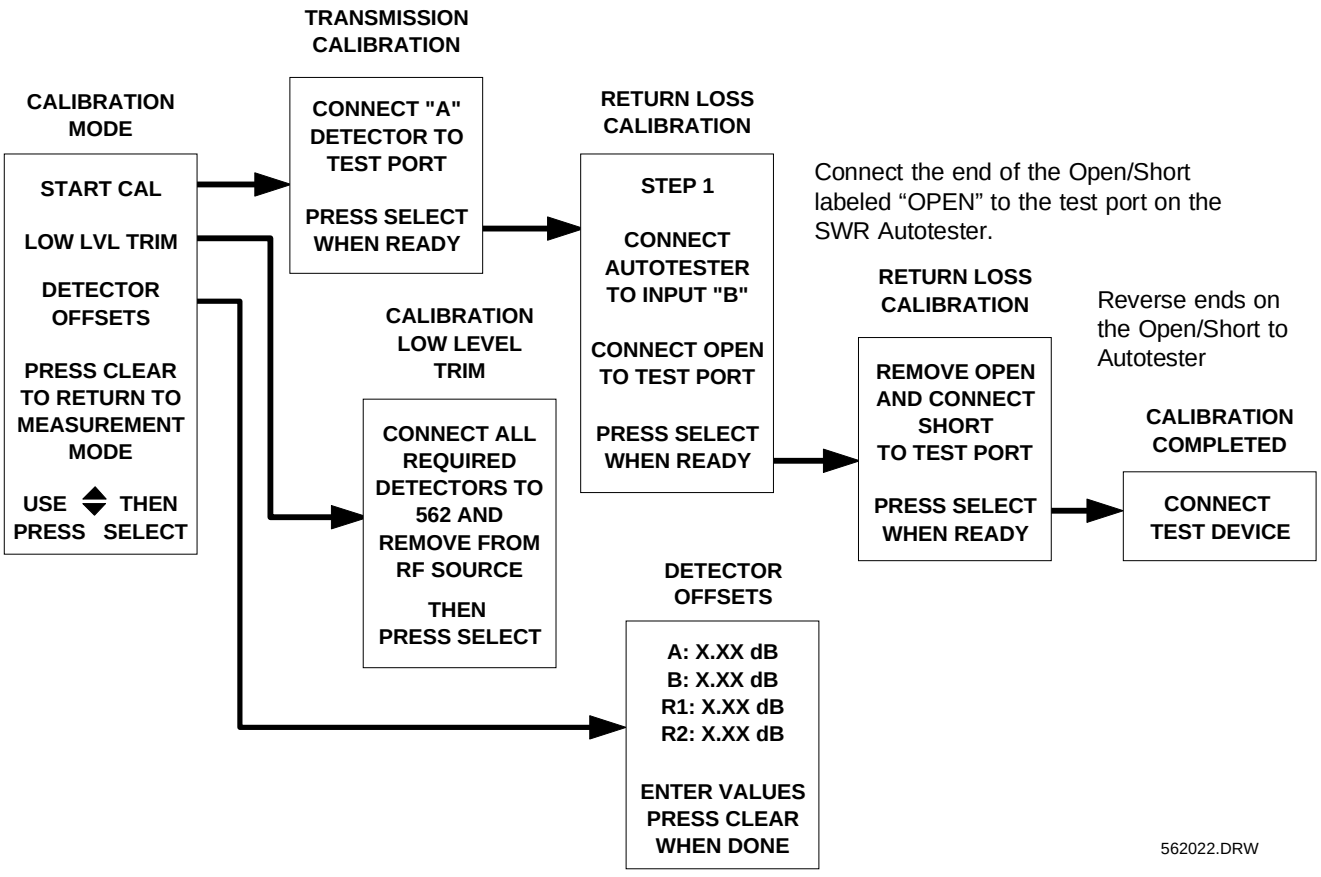
CALIBRATION is the process whereby losses inherent in a transmission or return loss measurement system are measured, stored in internal memory, and later subtracted so that the results displayed are those of the test device, minus residual losses. Pressing the CALIBRATION key initiates the following 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.

Refer to Figure 3-25 for a pictorial of the following test setup.

- 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 3-12. CALIBRATION Key Menu Sequence

3-5.2 Keypad

Enters discrete measurement values.

3-5.3 ENTER Key

Terminates data entries made from the keypad.

3-5.4 CLEAR Key

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

3-6 HARD COPY KEYS

The HARD COPY keys (Figure 3-13) are described below.

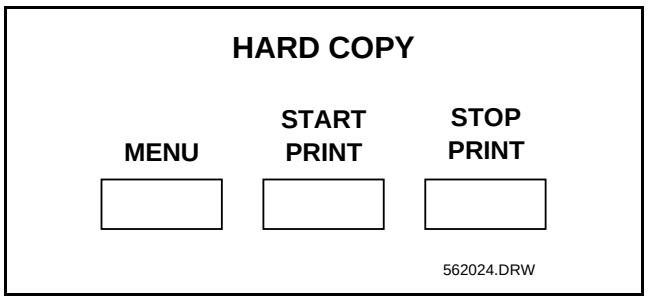


Figure 3-13. HARD COPY Keys

3-6.1 MENU Key

Displays a menu (Figure 3-14) providing print options 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 hard copy print outs. The MENU key menu selections are shown below.

a. Print Graph. Prints the on-screen graphic.

b. Enter Titles. Displays a menus providing options for entitling the test.

1. 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.
2. 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.
3. 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.

c. Tabular. Selects the print resolution in data points—25, 51, 101, 201, or 401.

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

e. Print Limits. Prints limit data.

f. Plotter. Displays a menu providing plotter options.

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

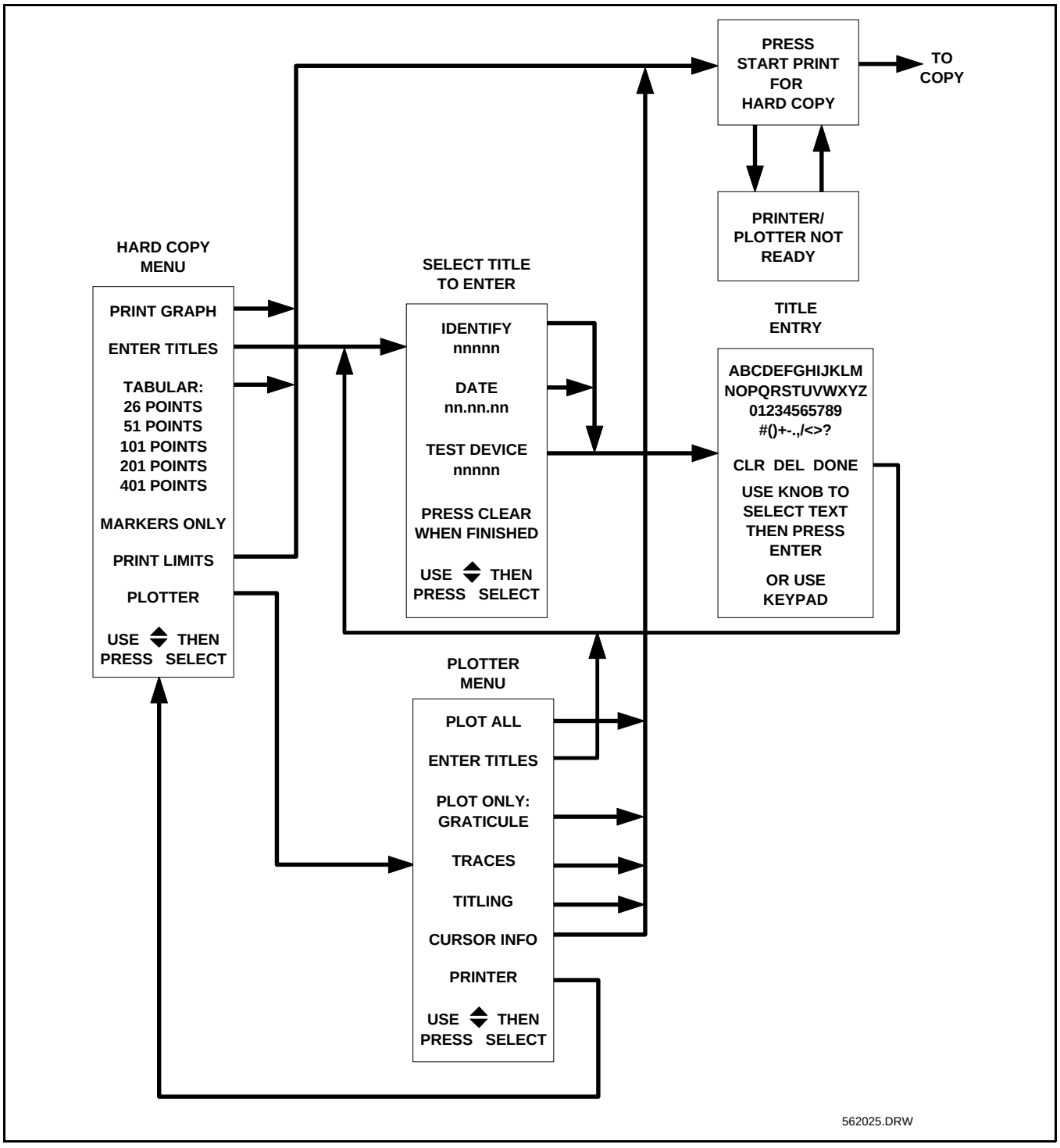
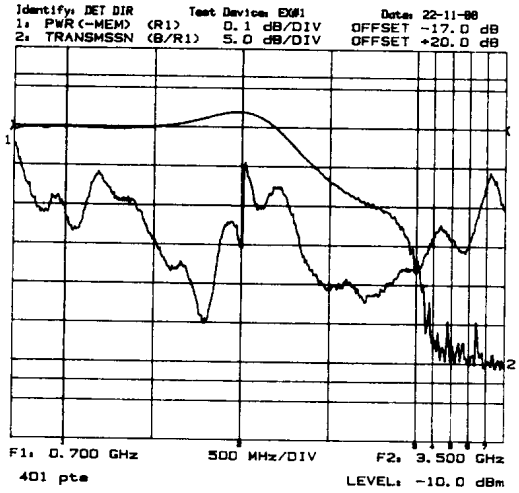


Figure 3-14. HARD COPY Menu

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).



SOURCE
66478

LIMIT TESTS
1: - Pass -

WILTRON 562 Scalar Network Analyzer

Identify : DET DIR
Test Device : EX#1

Date : 22-11-88
Source : 66478

	FREQUENCY	1:POWER (-MEM) (R1)	2:TRANSMISSION (B/R1)	
	0.7000 GHz	-17.03 dBm	+19.44 dB	
	0.8120 GHz	-17.18 dBm	+19.86 dB	
M1	**1.0000 GHz**	**-17.22 dBm**	**+19.84 dB**	.MARKER
	1.0360 GHz	-17.25 dBm	+19.84 dB	
	1.1480 GHz	-17.15 dBm	+19.76 dB	
	1.2600 GHz	-17.17 dBm	+19.70 dB	
	1.3720 GHz	-17.18 dBm	+19.79 dB	
	1.4840 GHz	-17.28 dBm	+19.87 dB	
	1.5960 GHz	-17.36 dBm	+20.19 dB	
	1.7080 GHz	-17.39 dBm	+20.65 dB	
	1.8200 GHz	-17.46 dBm	+21.32 dB	
M2	**2.0000 GHz**	**-17.30 dBm**	**+21.88 dB**	.MARKER
	2.0440 GHz	-17.14 dBm	+21.69 dB	
	2.1560 GHz	-17.16 dBm	+20.46 dB	
	2.2680 GHz	-17.20 dBm	+18.16 dB	
	2.3800 GHz	-17.34 dBm	+15.51 dB	
	2.4920 GHz	-17.40 dBm	+13.11 dB	
	2.6040 GHz	-17.38 dBm	+11.39 dB	
	2.7160 GHz	-17.43 dBm	+9.96 dB	
	2.8280 GHz	-17.40 dBm	+9.11 dB	
M3	**3.0000 GHz**	**-17.36 dBm**	**-0.08 dB**	.MARKER
M4	**3.1000 GHz**	**-17.26 dBm**	**-7.36 dB**	.MARKER
M5	**3.2000 GHz**	**-17.27 dBm**	**-8.72 dB**	.MARKER
M6	**3.3000 GHz**	**-17.28 dBm**	**-8.66 dB**	.MARKER
M7	**3.4000 GHz**	**-17.13 dBm**	**-10.98 dB**	.MARKER
[M8]	**3.5000 GHz**	**-17.20 dBm**	**-10.10 dB**	.ACTIVE

---------- System Conditions ----------

	Channel 1	Channel 2	Analyzer
High Limit :	-16.87 dB	-- off --	Smoothing : min
Low Limit :	-17.65 dB	-- off --	Averaging : off
Limit Testing:	- pass -	-- off --	Autozero : RF off
Cursor :	-- off --	-- off --	
at :	-- off --	-- off --	(-- off --) Bandwidth
Delta Readout:	-- off --	-- off --	F(min) : -- off --
at :	-- off --	-- off --	F(max) : -- off --

Detector offsets: A: +0.00 dB B: +0.00 dB R1: +0.00 dB R2: +0.00 dB

Page : 1

WILTRON 562 Scalar Network Analyzer

Identify : DET DIR
Test Device : EX#1

Date : 22-11-88
Source : 66478

	FREQUENCY	1:POWER (-MEM) (R1)	2:TRANSMISSION (B/R1)	
M1	1.0000 GHz	-17.23 dBm	+19.83 dB	.MARKER
M2	2.0000 GHz	-17.30 dBm	+21.92 dB	.MARKER
M3	3.0000 GHz	-17.36 dBm	+3.27 dB	.MARKER
M4	3.1000 GHz	-17.27 dBm	-5.44 dB	.MARKER
M5	3.2000 GHz	-17.27 dBm	-5.68 dB	.MARKER
M6	3.3000 GHz	-17.28 dBm	-7.98 dB	.MARKER
M7	3.4000 GHz	-17.13 dBm	-8.29 dB	.MARKER
[M8]	3.5000 GHz	-17.20 dBm	-7.77 dB	.ACTIVE

Figure 3-15. Hard Copy Examples

3-6.2 START PRINT 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.

3-6.3 STOP PRINT 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.

3-7 CURSOR FUNCTION KEYS, INDICATORS, AND MENUS

The CURSOR keys and indicators (Figure 3-16) are shown in the figure below. Keys and menus are described in paragraphs 3-7.1 thru 3-7.3.

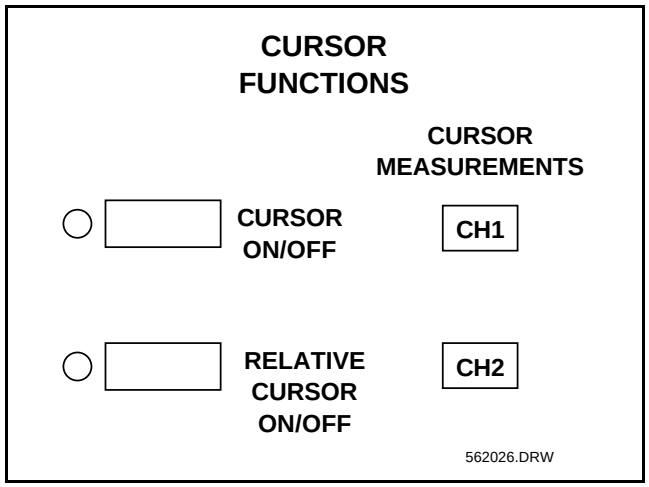


Figure 3-16. CURSOR Keys and Indicators

3-7.1 CURSOR 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.

3-7.2 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.

3-7.3 CURSOR MEASUREMENTS Keys and Menus

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.

a. ***Move Cursor To Maximum.*** Moves the cursor to the maximum value of the test data and displays the amplitude and frequency.

b. ***Move Cursor To Minimum.*** Same as described above, except for the minimum trace value.

c. ***Next Marker.*** Moves the cursor to the next frequency marker and displays the amplitude and frequency.

d. ***Active Marker.*** Moves the cursor to the active frequency marker and displays the amplitude and frequency.

e. ***dB Search.*** Moves the cursor in accordance with instructions set in the "SET SEARCH PARAMETERS" menu described below.

f. ***Set Search Parameters.*** Displays a menu providing control options for the "dB SEARCH" mode cursor.

1. SEARCH VALUE. Enter the amplitude value that you want to search for.
2. 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.
3. SEARCH TYPE RIGHT. Same as above, except the search is to the right.
4. 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).

3-8 ENHANCEMENT KEYS, INDICATORS, AND MENUS

The ENHANCEMENT keys and indicators (Figure 3-20) are described below. Keys and menus are described in paragraphs 3-8.1 and 3-8.2.

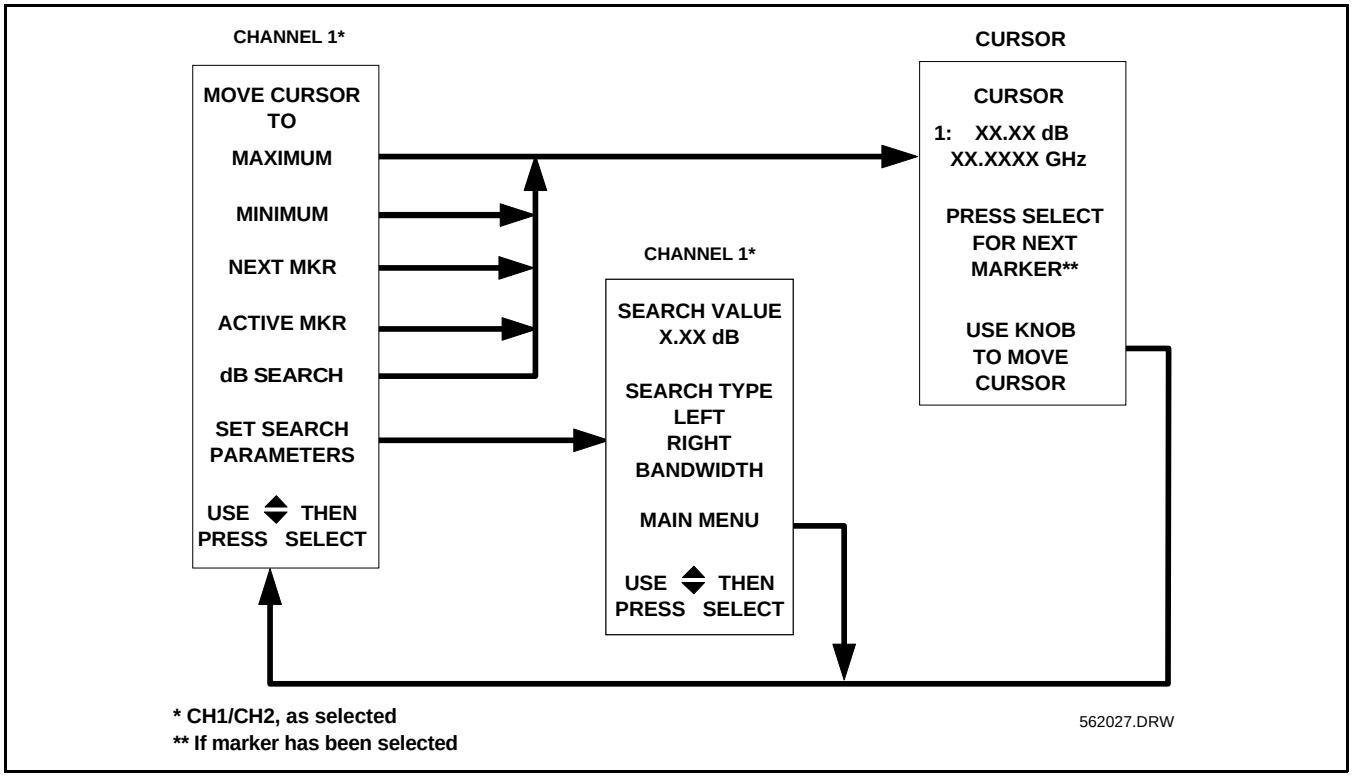


Figure 3-17. CURSOR MEASUREMENTS Menus (With RELATIVE CURSOROff)

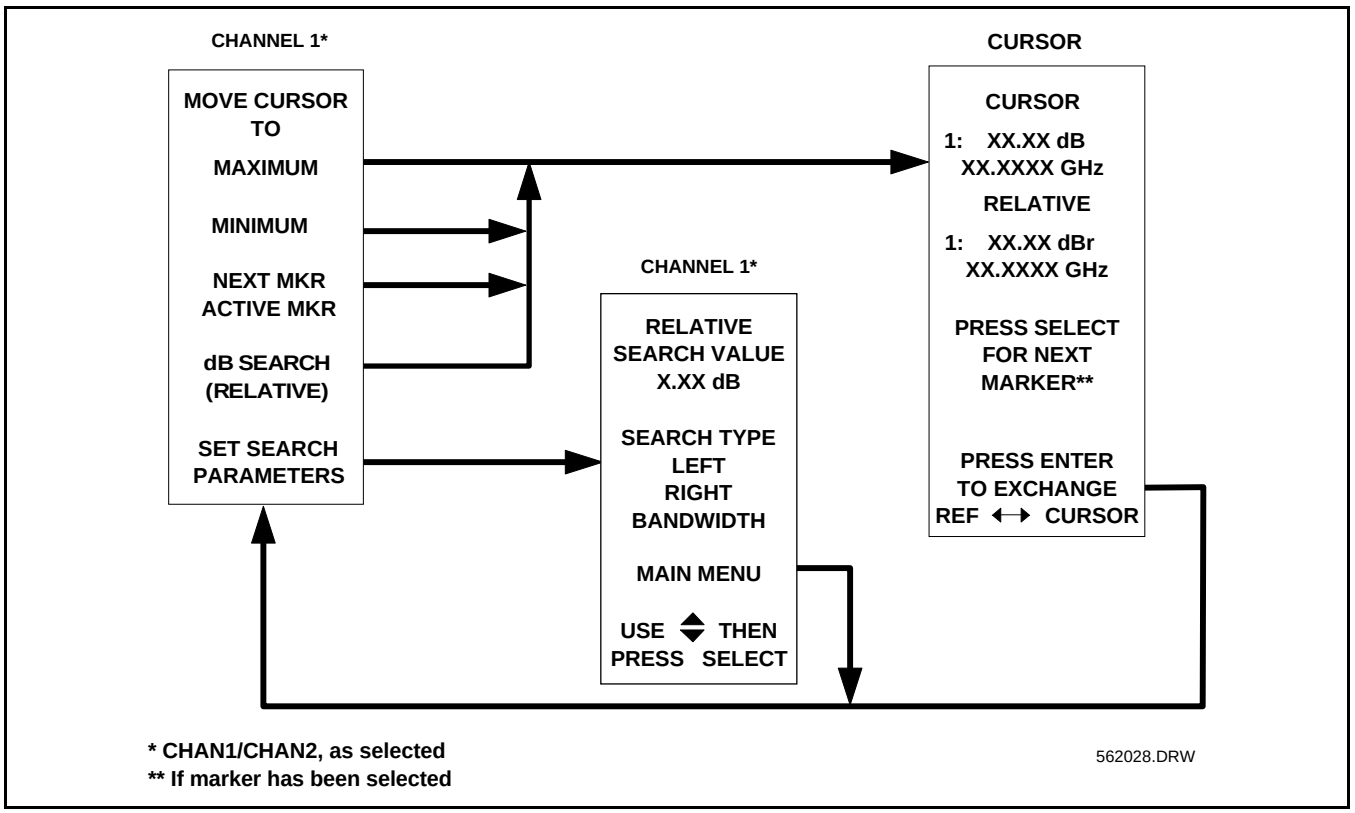


Figure 3-18. CURSOR MEASUREMENTS Menus (With RELATIVE CURSOR On)

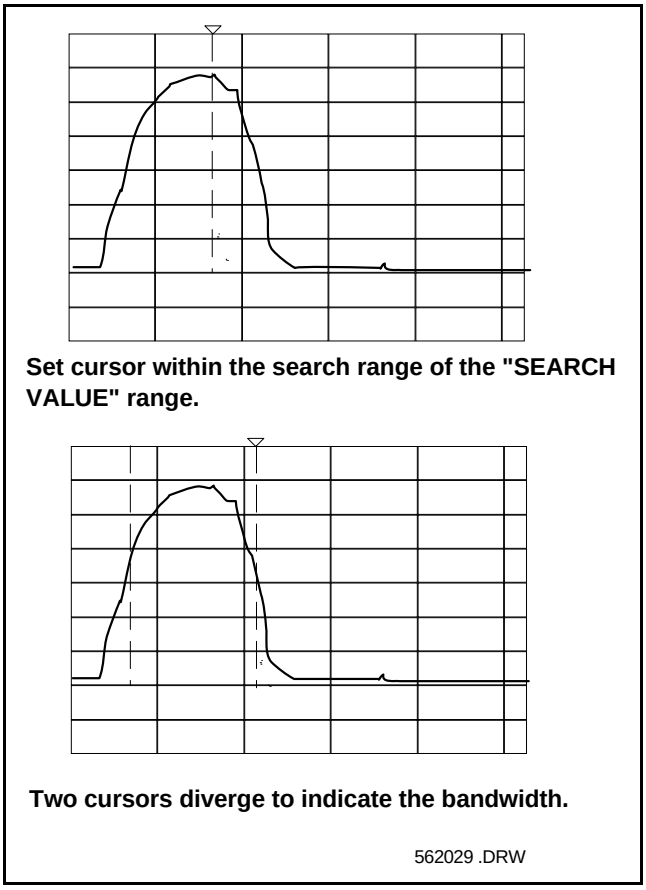


Figure 3-19. dB Search Mode Cursor, Bandwidth

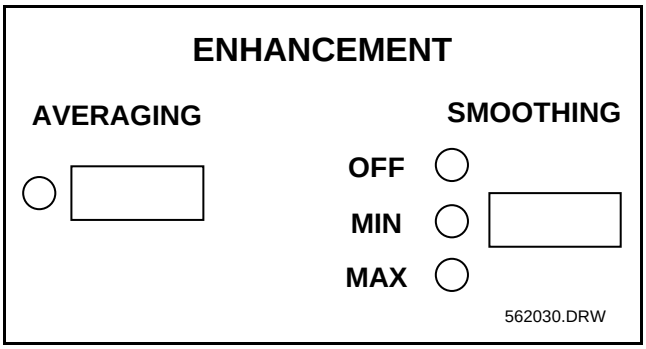


Figure 3-20. ENHANCEMENT Keys and Indicator

3-8.1 SMOOTHING Key and Indicators

Key provides two levels of filtering, MIN and MAX, that improve the display at low-signal levels. The OFF indicator lights when no smoothing (low-level filtering) is supplied.

3-8.2 AVERAGING Key, Indicator and Menu

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

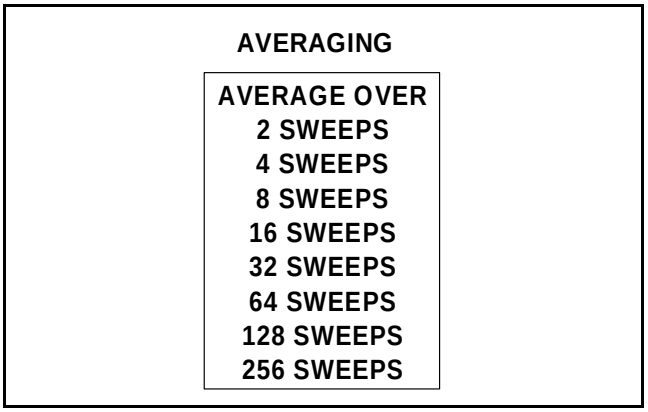


Figure 3-21. AVERAGING Menu

3-9 GPIB INDICATOR, KEY, AND STATUS DISPLAY

The GPIB indicator, and key (Figure 3-22) are described in paragraphs 3-9.1 and 3-9.2.

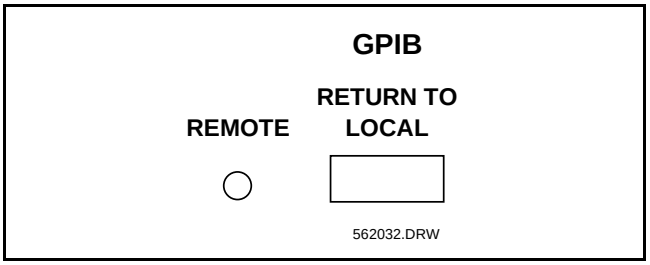


Figure 3-22. GPIB Indicator and Key

3-9.1 REMOTE Indicator

Lights when in the remote (GPIB) mode (Figure 3-23). When lit, a menu providing GPIB status appears at the bottom right side of the screen.

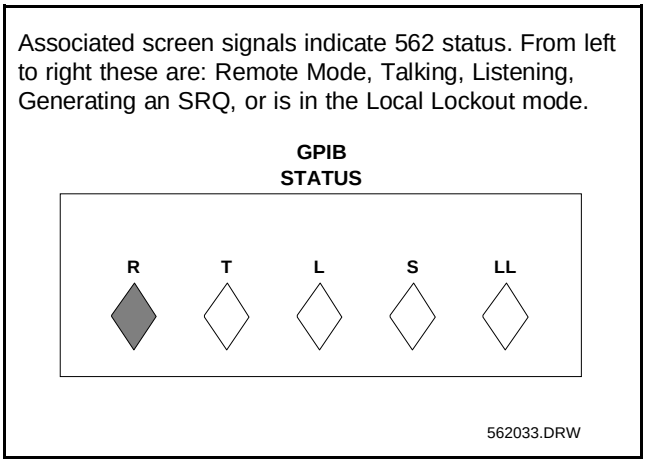


Figure 3-23. GPIB Status Display

3-9.2 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.

3-10 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 Section II; the printer interface and the additional input/output connections are described in Figure 3-24.

3-11 MEASUREMENTS WITH THE 562 SCALAR NETWORK ANALYZER

The 562 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.

3-11.1 Transmission And Return Loss Measurements

How to make a transmission and return loss measurement is described in Table 3-1; a test setup is shown in Figure 3-25.

3-11.2 Absolute Power Measurement

How to make an absolute power measurement is described in Table 3-2.

3-11.3 Alternate Setup Measurements

How to make an alternate setup measurement is described in Table 3-3. The alternate setup mode is controlled thru the frequency source control panel.

3-11.4 Operational Checkout

The 562 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 in Table 3-4.

3-11.5 Ratio-Mode Measurements

Ratio-mode measurements in which the A or B input is subtracted by the R1 or R2 input are described in Table 3-5. A test setup is shown in Figure 3-27. 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 562.

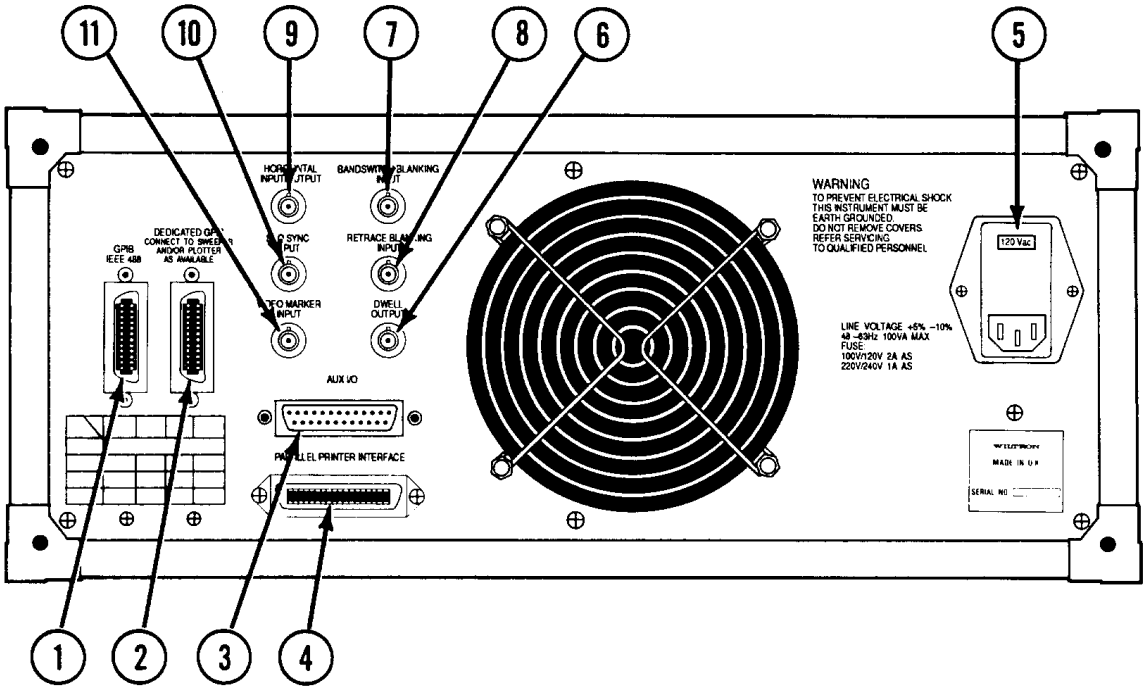
3-12 ERROR MESSAGES

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 3-6. 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 562 directs it to perform a self test as well.

3-13 562 ANALYZER CONNECTIONS TO WILTRON SWEEP GENERATORS

The 562 Scalar Network Analyzer may be used with various WILTRON and other sweep generators. Table 3-7 lists many of the models that may be used with the 562 and the interconnections required.



1. **GPIB CONNECTOR:** See Figure 2-2, page 2-4

2. **DEDICATED GPIB:** Connects 562 to signal source and plotter.

3. **AUX I/O:** Connects 562 to WILTRON 66XXA/B Sweep Generators, 67XXA/B or 68XXXA/B Synthesizers, HP 8350B Sweeper, and HP 8340A/8341A Synthesizers.

4. **PARALLEL PRINTER INTERFACE:** Provides standard Centronics parallel interface with a printer.

5. **LINE VOLTAGE MODULE:** See Figure 2-1, page 2-4.

6. **SWEEP DWELL OUTPUT:** TTL-Low signal stops sweep. Sweep continues when signal is removed. BNC connector.

7. **BANDSWITCH BLANKING INPUT:** Accepts ±5V signal coincident with bandswitching points. BNC connector.

8. **RETRACE BLANKING INPUT:** ±5V causes retrace to occur. BNC connector.

9. **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.

10. **SEQUENTIAL 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.

11. **VIDEO MARKER INPUT**: +2V to +10V peak input. BNC connector.

Figure 3-24. Location of Rear Panel Connectors

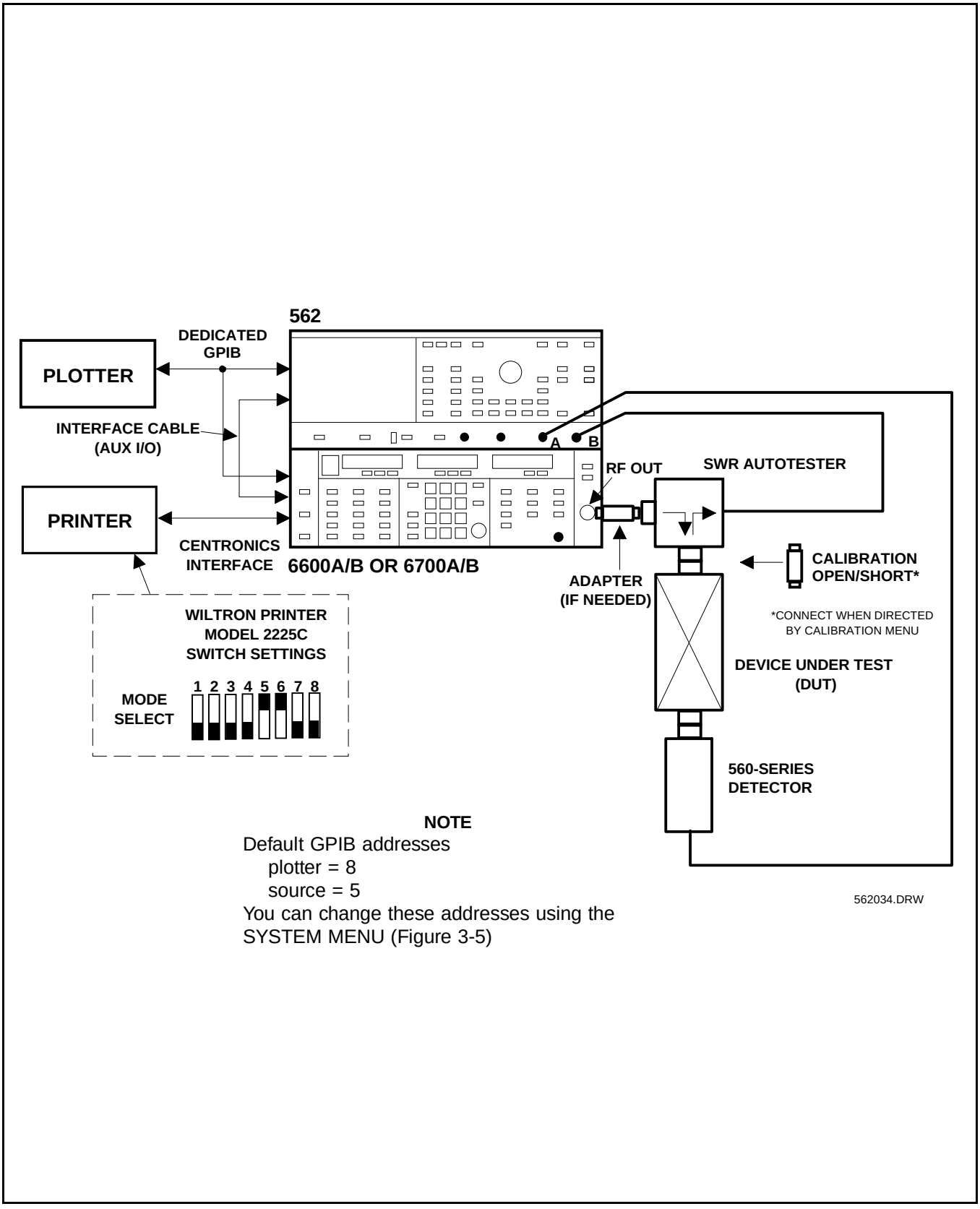
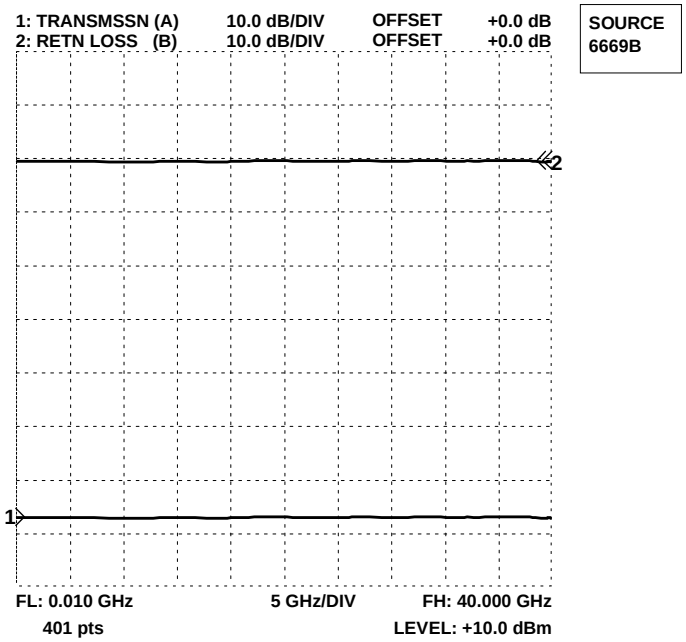


Figure 3-25. Measurements Test Setup

Table 3-1. Transmission and Return Loss Measurements

1. Connect test equipment per Figure 3-25, except do not connect the test device. Turn the printer on.
2. Turn on the 6600B sweep generator, then press POWER on the 562 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. Ensure that both channels are ON and that Channel 1 is set for TRANSMISSION and Channel 2 for RETURN LOSS.
3. 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 3-25.



Transmission Loss Measurement

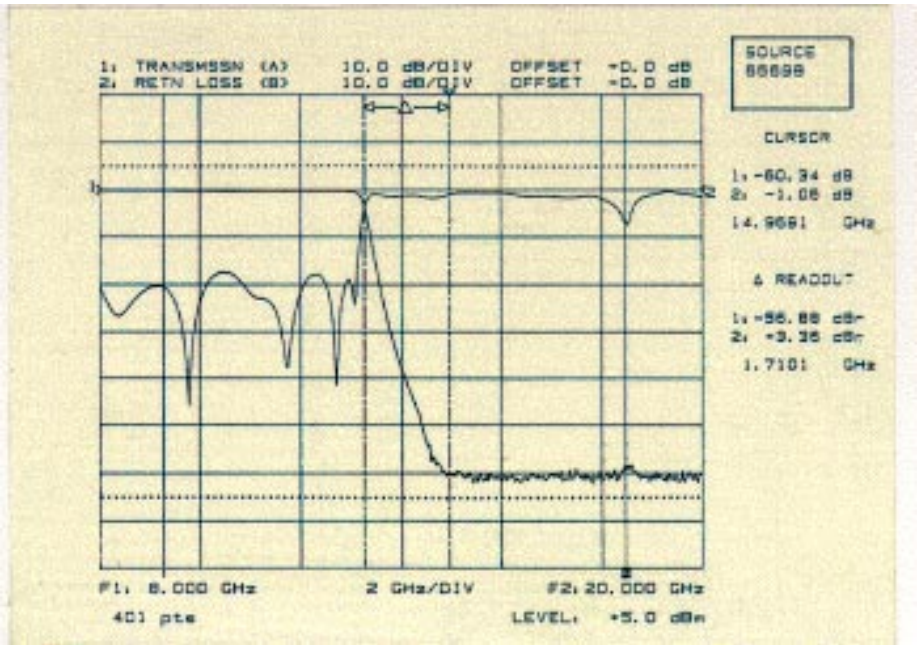
4. Measure the transmission loss as follows:
   a. Press the Channel 2 DISPLAY ON/OFF key to off.
   b. Press the Channel 1 AUTOSCALE key. This gives an optimum vertical display of the test data.
5. Read the transmission loss by interpolating the displayed graphic, or read it directly using the main and/or relative cursors with the readout function as described in step 6. 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.
6. To use the main cursor and delta cursor to read the results of the above measurement directly, proceed as follows:
   a. For an absolute measurement press the Cursor 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.
   b. 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 .

* Reset conditions depend upon the sweep generator.

Table 3-1. Transmission and Return Loss Measurements (Continued)

c. Read the resultant cursor delta position data from the menu screen.

7. Make a hard copy printout of the transmission loss as follows:
   a. Press the HARD COPY MENU key.
   b. If device identify, date, and test device information is required, then select “ENTER TITLES” (paragraph 3-2.5).
   c. 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.
   d. When using the Wiltron Model 2225C printer, verify that the rear switch settings are as shown in Figure 3-25. Also verify that the power indicator is on and that the reset indicator is not flashing. If it is, press the RESET switch.
   e. Press START PRINT to print out the data.
   f. The printout should resemble the one shown below. (Note: both transmission and return loss measurements are shown.)
8. If a plotter is connected, by selecting the hardcopy menu you could choose to plot either graticules, traces, titling, cursor information or all of these items if the “PLOT ALL” function is selected (see paragraph 3-2.5).

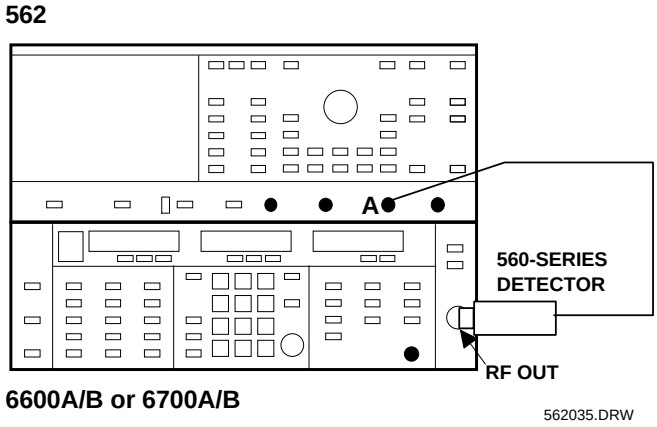


Return Loss Measurement

9. Measure the return loss of the device under test as follows:
   a. Press Channel 1 DISPLAY ON/OFF key to off.
   b. Press Channel 2 DISPLAY ON/OFF key to on.
   c. Press Channel 2 AUTOSCALE key.
10. To use the cursor function to read the results of the return loss measurement directly, repeat step 6 above.
11. Print out the return loss as described in step 7 above.

Table 3-2. Absolute Power Measurement

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



3. Press SYSTEM MENU key. Select RESET option, when menu appears.
4. Press the channel 2 DISPLAY ON/OFF key to off.
5. Press the channel 1 MENU key.
6. When the menu appears, select the POWER option using the MENU and SELECT keys.
7. Press the Channel 1 AUTOSCALE key. This gives an optimum vertical display of the test data.
8. Press the CURSOR ON/OFF key to on.
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.

Table 3-3. Alternate Setup Measurements

1. Connect test equipment per Figure 3-25, except do not connect the test device. Turn the printer on.
2. Turn on the frequency source and 562. 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.
3. Set Channels 1 and 2 to display transmission using input A, as follows:
   a. Press the CH1 MENU key.
   b. Move the cursor to highlight TRANSMISSION and press the SELECT key.
   c. Move the cursor to highlight SELECT INPUT and press the SELECT key.
   d. Move the cursor to highlight A and press the SELECT key.
   e. Repeat steps a thru d for channel 2.
4. For the 66XXB, select an alternating setup as follows:
   a. Press the FULL key.
   b. Press the SHIFT key.
   c. Press the SAVE key.
   d. Select “5” on the keypad.
   e. Press the ΔF CF key.
   f. Press the ALT SETUP and “5” keys.
4. For the 67XXA/B, select an alternating setup as follows:
   a. Press the F1-F2 key.
   b. Press the SHIFT key.
   c. Press the F3-F4 key.
5. On the 562, press the CALIBRATION key and follow the directions given in the calibration-cycle sequence of menus. If necessary, refer to Figure 3-12 for an explanation of the menus. After finishing the calibration:
   a. Press SAVE/RECALL key,
   b. Select menu option SAVE, then highlight CALIBRATION TRACE MEMORY AND SETUP (1-4 ONLY) option on SAVE menu.
   c. Use keypad to select storage location 1 thru 4.
6. Connect the test device and RF detector as shown in Figure 3-25.
7. On the 562, measure the transmission loss in the Alternating Sweep mode as follows:
   a. Press Channel 1 AUTOSCALE key. This gives an optimum vertical display of the test data.
   b. Read transmission loss by interpolating the displayed graphic, or read it directly using main and delta cursors and the readout function per step 7 below. This is the transmission loss for the normal source input.
   c. Repeat steps a and b 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 (see paragraph 3-2.2a).

Table 3-3. Alternate Setup Measurements (Continued)

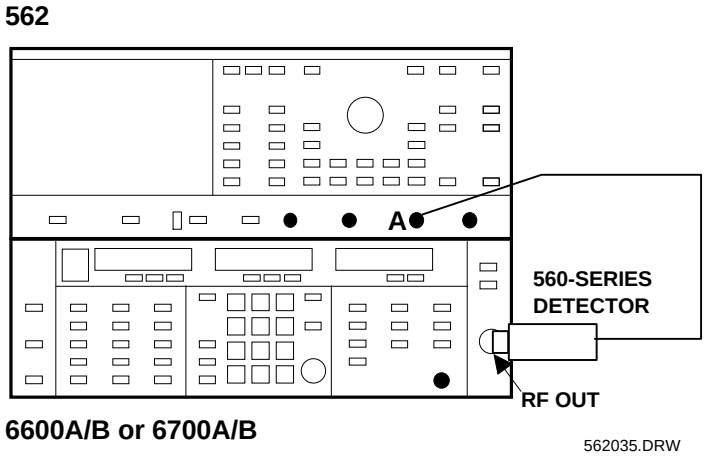
8. Make a hard copy printout of the transmission loss as follows:
   a. Press the HARD COPY Menu key.
   b. If device identify, date, and test device information are required to be annotated on hard copy, these can be entered by selecting TITLES (paragraph 3-2.5).
   c. Select PRINT GRAPH to print the 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.
   d. When using the Wiltron Model 2225C printer, verify that its rear switch settings are as shown in Figure 3-26. Also verify that the power indicator is on and that its reset indicator is not flashing. If it is, press the reset switch.
   e. Press START PRINT to print out the data.
   f. The printout should resemble the one shown in Figure 3-14.

9. Measure the return loss of the device under test as follows:
   a. Repeat steps 3 a thru d, except choose RETURN LOSS instead of TRANSMISSION.
   b. Repeat step 6 for a return loss measurement.

10. Print out the return loss as directed in step 7 above.

Table 3-4. Operational Checkout Procedure

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



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 562 screen is properly annotated for frequency and level.
3. Press the Graticule ON/OFF key.
4. Press the Channel 2 DISPLAY ON/OFF key to off.
5. Press the Channel 1 MENU key.
6. When the menu appears, select the POWER option using the MENU Up/Down switch and SELECT key.
7. Press the Channel 1 OFFSET/RESOLUTION key.
8. When the menu appears, select the OFFSET option and enter 10 dB via the DATA ENTRY keypad and the ENTER switch.
9. Observe that the trace deflects downward by 1 division.
10. Select the RESOLUTION option and enter 2 dB using the DATA ENTRY keypad or rotary knob.
11. On the power source, select a level of 2 dBm.
12. Observe that the trace deflects downward by 4 divisions.

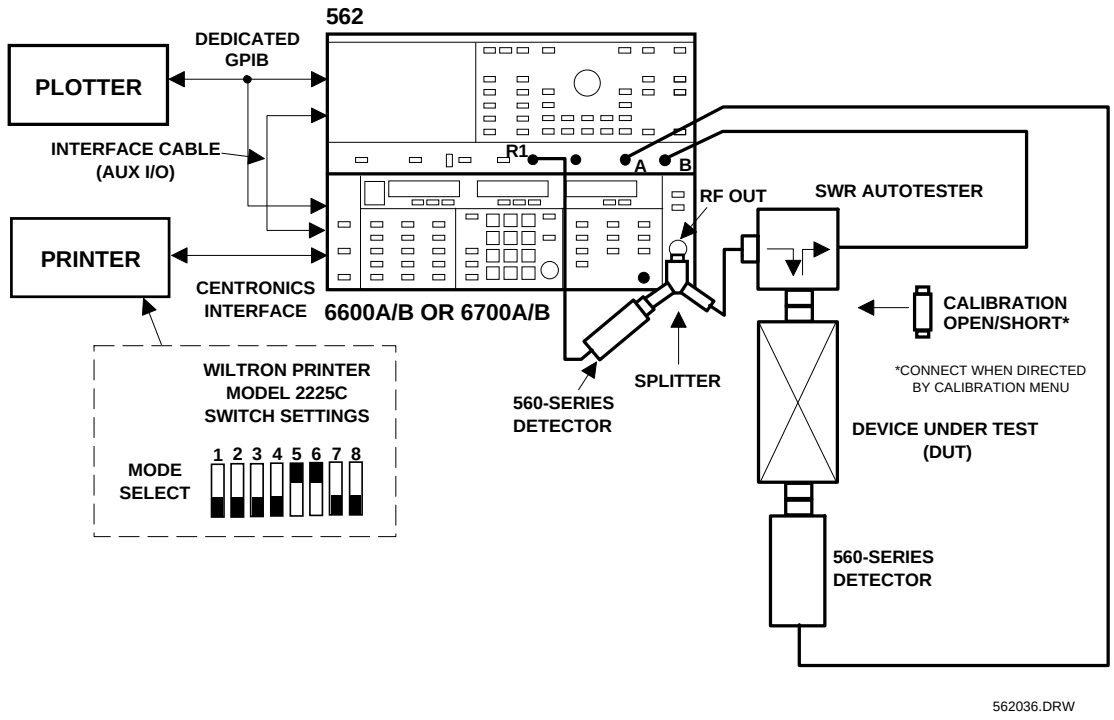


Figure 3-26. Test Setup for Ratio Mode Setup

Table 3-5. Ratio Mode Measurements

1. Connect test equipment per Figure 3-26, except do not connect the test device. Turn the printer (or plotter) on.
2. Turn on the frequency source and 562. At the conclusion of self test, the screen displays “ALL TESTS PASSED.”
3. Select transmission mode and ratio input A/R1 for channel 1, and return loss and ratio input B/R1 for channel 2 (section 3-2.3b).
4. On the 562, 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 3-26.
5. On the 562, measure the transmission loss in the ratio mode as follows:
   a. Press the channel 1 AUTOSCALE key. This gives an optimum vertical display of the test data.
   b. Read the transmission loss. This is the transmission loss for the A/R1 ratio mode input.
6. To use the main cursor and relative cursor to read the results of the above measurement directly, proceed as follows:
   a. Press the cursor 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.
   b. Turn the relative cursor on and the CURSOR MEASUREMENTS—CH1 key to ON, then select the desired parameter from the menu.

Table 3-5. Ratio Mode Measurements (Continued)

c. Read the resultant cursor position data from the menu screen.

7. Make a hard copy printout of the transmission loss as follows:
   a. Press the HARD COPY Menu key.
   b. Select PRINT GRAPH to print the displayed graphic, or select 26,51,101, 201, or 401 to print out 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.
   c. When using the WILTRON Model 2225C printer, verify that the rear switch settings are as shown in Figure 3-26. Also verify that the power indicator is on and that the reset indicator is not flashing. If it is, press the reset switch.
   d. Press START PRINT to print out the data.
   e. The printout should resemble the one of those shown in Figure 3-15.
8. On the 562, measure the return loss in the ratio mode as follows:
   a. Press the channel 2 AUTOSCALE key. This gives an optimum vertical display of the test data.
   b. Read the return loss by interpolating the displayed graphic, or read it directly by using main and relative cursors and the readout function per step 6 above. This is the return loss for the B/R1 ratio mode input.
9. Print out the return loss as directed in step 7 above.

Table 3-6. Control Panel LED Error Codes

FLASHING LED*	FAULT	FAULT LOCATION
HOLD (Initial Turn On)	No Communication With 2nd CPU	A6
CHANNEL 1 (Initial Turn On)	Unable To Send Self Test To Sweeper	
CURSOR ON/OFF (Initial Turn On)	Fatal Error While Attempting To Calibrate Ramp	A4
CHANNEL 2	Ramp Not Calibrated	A4, or Sweep Ramp Too Slow
CHANNEL 1	CPU EPROM Checksum	A5 (Observe Initial Test To Identify)
AVERAGING	U22 RAM or U23 RAM	A5
SMOOTHING MINIMUM	Front Panel Key Error	A13
SMOOTHING OFF	U24 RAM or U30 RAM	A5
SMOOTHING MAXIMUM	System GPIB	A8
CAL BEGIN	Dedicated GPIB	A10
UNCAL	ADC Converter	A3
CURSOR	Test Reading Failed	A3 (A1/A2)
RELATIVE CURSOR	Channel A/B Null/Zero Failure/PCB Not Detected	A2 (A3)
REMOTE	Channel R1/R2 Null/Zero Failure/PCB Not Detected	A1 (A3)
HOLD	Tick/Time Scheduling Failure	A9/A5

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

Table 3-7. Interconnections, 562 to WILTRON and Other Sweep Generators

562 to WILTRON 6600A*/B

562 CONNECTOR	6600A/B CONNECTOR
AUX I/O	AUX I/O
Dedicated GPIB	GPIB

* 66XXA with retrofit kit installed for operation with the 562.

562 to WILTRON 6600A*/B—Using Discrete Cables

562 CONNECTOR	6600A/B CONNECTOR
HORIZ IN/OUT	HORIZ OUT
SEQ SYNC	SEQ SYNC
VIDEO MARKER	MARKERS OUTPUT
RETRACE BLANKING	NO CONNECTION
BANDSWITCH BLANKING	NO CONNECTION
DWELL OUTPUT	SWEEP DWELL INPUT
Dedicated GPIB	GPIB

* 66XXA with retrofit kit installed for operation with the 562.

562 to WILTRON 6600

562 CONNECTOR	6600 CONNECTOR
HORIZ IN/OUT	HORIZ OUT
SEQ SYNC	SEQ SYNC
VIDEO MARKER	MARKERS OUTPUT
RETRACE BLANKING	RETRACE BLANKING OUTPUT (+)
BANDSWITCH BLANKING	NO CONNECTION
DWELL OUTPUT	SWEEP DWELL INPUT

562 to WILTRON 6700A/B and 68000A/B

562 CONNECTOR	6700A/B or 68000A/B CONNECTOR
AUX I/O	AUX I/O
Dedicated GPIB	GPIB

562 to WILTRON 6700A/B or 68100A/B Using Discrete Cables

562 CONNECTOR	6700A/B or 68100A/B CONNECTOR
HORIZ IN/OUT	HORIZ OUT
SEQ SYNC	SEQ SYNC
VIDEO MARKER	MARKERS OUTPUT
RETRACE BLANKING	NO CONNECTION
BANDSWITCH BLANKING	NO CONNECTION
DWELL OUTPUT	SWEEP DWELL INPUT
Dedicated GPIB	GPIB

562 to HP8340/8341A

562 CONNECTOR	HP 8340/8341a CONNECTOR
HORIZ IN/OUT	SWEEP OUTPUT
SEQ SYNC	Z-AXIS/BLANK/MKRS
VIDEO MARKER	NO CONNECTION
RETRACE BLANKING	NO CONNECTION
BANDSWITCH BLANKING	NO CONNECTION
DWELL OUTPUT	STOP SWEEP
Dedicated GPIB	GPIB

***** Use WILTRON cable P/N 806-13 (only necessary for Alternate Sweep Mode).

562 to WILTRON 610D

562 CONNECTOR	610D* CONNECTOR
HORIZ IN/OUT	HORIZ OUT
SEQ SYNC	SEQ SYNC
VIDEO MARKER	VARIABLE MARKER OUTPUT
RETRACE BLANKING	+6V DURING RETRACE
BANDSWITCH BLANKING	+10V DURING BAND-SWITCH

* 610D requires Option 8.

562 to HP 8350B

562 CONNECTOR	8350B CONNECTOR
HORIZ IN	SWEEP OUTPUT
SEQ SYNC	POSZ BLANK
VIDEO MARKER	NO CONNECTION
RETRACE BLANKING	NO CONNECTION
BANDSWITCH BLANKING	NO CONNECTION
DWELL OUTPUT	STOP SWEEP
Dedicated GPIB	GPIB
***** AUX I/O	8410 PROGRAMMING CONNECTOR

***** Use WILTRON cable P/N 806-13 (only necessary for Alternate Sweep Mode).

562 to HP 8620C

562 CONNECTOR	8620C CONNECTOR
HORIZ IN/OUT	SWEEP OUTPUT
SEQ SYNC	POSZ BLANK
VIDEO MARKER	NO CONNECTION
RETRACE BLANKING	NO CONNECTION
BANDSWITCH BLANKING	NO CONNECTION
* DWELL OUTPUT	STOP SWEEP (Pin 34 of the 50-pin connector)

***** Use WILTRON cable P/N 806-14.

SECTION IV
REMOTE (GPIB) OPERATION

CONTENTS

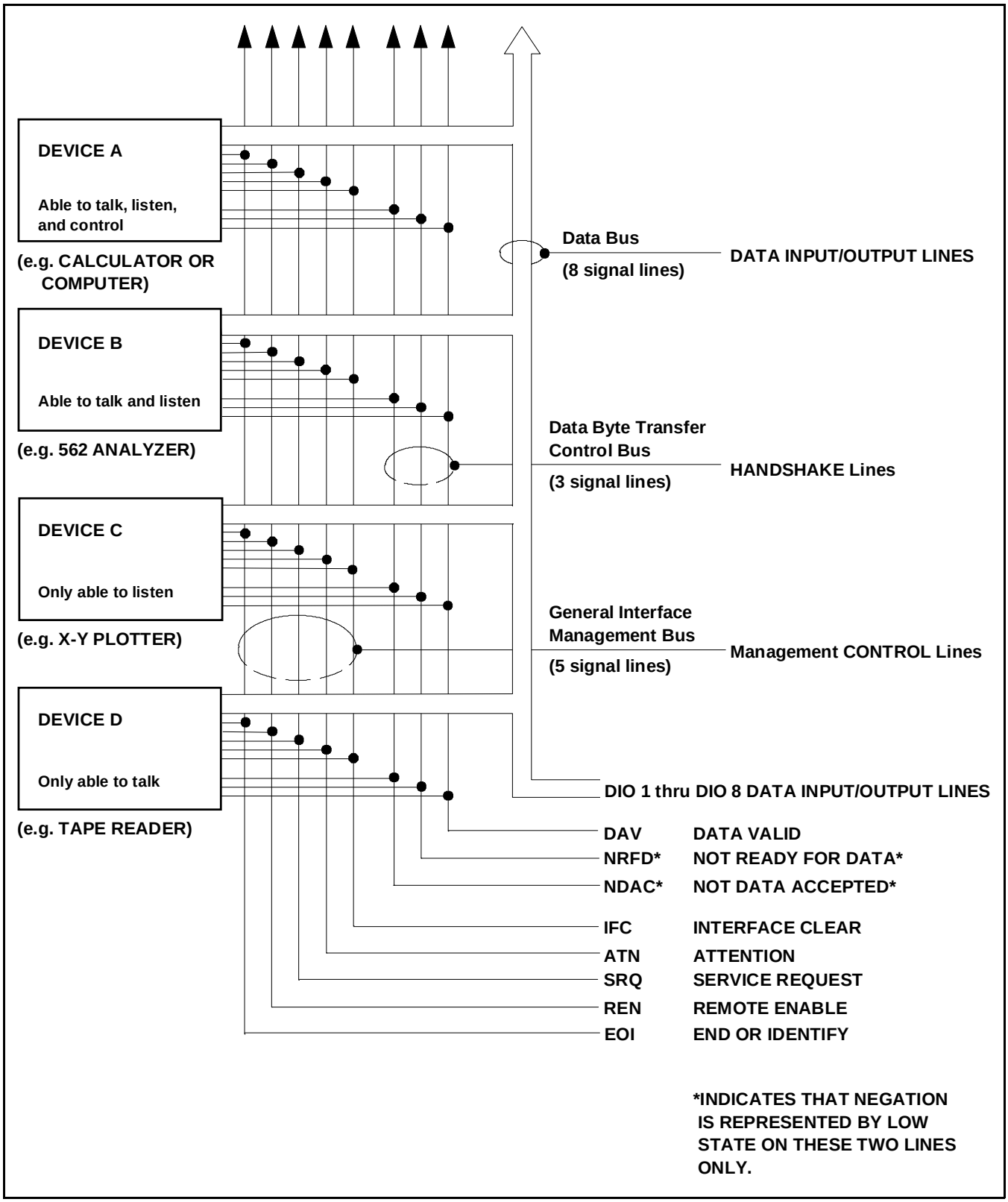


Figure 4-1. Interface Connections and Bus Structure

SECTION IV
REMOTE (GPIB) OPERATION

4-1 INTRODUCTION

This section provides a description of the GPIB and the analyzer command codes. It also provides several examples of bus programming.

4-2 DESCRIPTION OF THE IEEE-488 INTERFACE BUS

The IEEE-488 bus (General Purpose Interface Bus, or GPIB) is an instrumentation interface for integrating instruments, calculators, and computers into systems. The bus uses 16 signal lines to effect transfer of data and commands to as many as 15 instruments.

The instruments on the bus are connected in parallel, as shown in Figure 4-1 on the facing page. Eight of the signal lines (DIO 1 thru DIO 8) are used for the transfer of data and other messages in a byte-serial, bit-parallel form. The remaining eight lines are used for communications timing (handshake), control, and status information. Data is transmitted as eight-bit characters, referred to as bytes. Normally, a seven-bit ASCII (American Standard Code for Information Interchange) code is used. The eighth (parity) bit is not used. Data is transferred using an interlocked handshake technique.

This technique permits asynchronous communications over a wide range of data rates. The following paragraphs provide an overview of the data, management, and handshake buses, and describe how these buses interface with the analyzer.

4-2.1 Data Bus Description

The data bus is the conduit for transmitting control information and data between the controller and the analyzer. It contains eight bi-directional, active-low signal lines—DIO 1 thru DIO 8. One byte of information (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). Each byte represents a peripheral address (either primary or secondary), a control word, or a data byte. Data bytes are usually formatted in ASCII code, without parity.

4-2.2 Management Bus Description

The management bus is a group of five signal lines used to control the operation of the bus system. Functional information regarding the individual control lines is provided below.

a. ATN (Attention)
When TRUE, the analyzer responds to appropriate interface messages—such as, device clear and serial poll—and to its own listen/talk address.

b. EOI (End Or Identify)
When TRUE, the last byte of a multibyte message has been placed on the line. Also used in conjunction with ATN to indicate a parallel poll.

c. IFC (Interface Clear)
When TRUE, the analyzer interface functions are placed in a known state—such as, unaddressed to talk, unaddressed to listen, and service request idle.

d. REN (Remote Enable)
When TRUE, the analyzer is enabled—upon receipt of its listen address—for entry into the remote state. The mode is exited either when the REN line goes FALSE (high) or when the analyzer receives a go-to-local (GTL) message.

e. SRQ (Service Request)
This line is pulled LOW (true) by the analyzer to indicate that certain preprogrammed conditions exist.

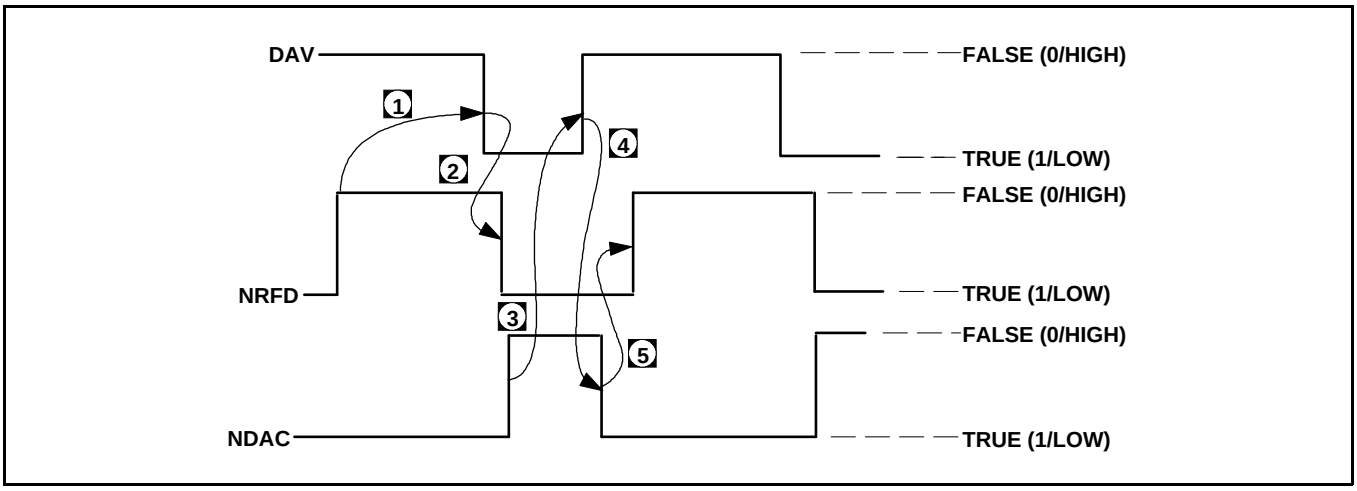


Figure 4-2. Typical Handshake Operation

4-2.3 Data Byte Transfer Control (Handshake) Bus Description

Information is transferred on the data lines by a technique called the three-wire handshake. The three handshake-bus signal lines (Figure 4-2) are described below.

a. DAV (Data Valid)
Goes TRUE (arrow 1) when the talker has (1) sensed that NRFD is FALSE, (2) placed a byte of data on the bus, and (3) waited an appropriate length of time for the data to settle.

b. NRFD (Not Ready For Data)
Goes TRUE (arrow 2) when a listener indicates that valid data has not yet been accepted. The time between the events shown by arrows 1 and 2 is variable and depends upon the speed with which a listener can accept the information.

c. NDAC (Not Data Accepted)
Goes FALSE to indicate that a listener has accepted the current data byte for internal processing. When the data byte has been accepted, the listener releases its hold on NDAC and allows the line to go FALSE. However, since the GPIB is constructed in a wired-OR configuration, NDAC will not go FALSE until all listeners participating in the interchange have also released the line. As shown by arrow 3, when NDAC goes FALSE, DAV follows suit a short time later. The FALSE state of DAV indicates that valid data has been removed; consequently, NDAC goes LOW in preparation for the next data interchange (arrow 4).
Arrow 5 shows the next action in time: NRFD going FALSE after NDAC has returned TRUE. The FALSE state of NRFD indicates that all listeners are ready for the next information interchange. The time between these last two events is variable and depends on how long it takes a listener to process the data byte. In summation, the wired-OR construction forces a talker to wait for the slowest instrument to accept the current data byte before placing a new data byte on the bus.

4-3 GPIB OPERATION

All front panel keys are bus controllable. When used on the GPIB, the analyzer functions as both a listener and a talker. Table 4-1 provides a listing of the GPIB subset functions.

NOTE

The 562 GPIB controller operates with any IBM XT, AT, or PS/2 compatible computer/controller equipped with a National Instruments GPIB-PCII/IIA interface card and NI-488 MS-DOS Handler Software. The procedures for installing this hardware and software in your computer is contained in Appendix A at the rear of this manual.

Table 4-1. 562 IEEE-488 Bus 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
DT1	Device Trigger	No Capability
C1, C2, C3, C28	Controller	No Capability

4-4 COMMAND CODES, DESCRIPTIONS

The command codes recognized by the 562 are listed in Tables 4-2 thru 4-11.

4-4.1 Inputting Restrictions and Notes

To initiate a GPIB command mnemonic, enter the command together with any required parameters. You may use a space to separate the command and parameter(s), but you do not have to. Also, you may enter several commands on the line; however, each must be separated by a valid delimiter. We recommend using a comma as the delimiter. Other valid delimiters are the colon (:), hyphen (-), asterisk (*), dollar sign ($), virgule (/), reverse virgule (\), space ( ), and semicolon (;). The following is an example of a valid command structure.

SI1 A, SM1 R, OFF 1 20 dB, GON, CRF 1 20GHz, OCF 1

The above command string would do the following:

1. Set the channel 1 signal trace to be from input A.
2. Set the measurement type to be displayed on channel 1 and to be the return loss of the test device.
3. Set the channel 1 offset to be 20 dB.
4. Turn on the graticule grid display.
5. Move the cursor to 20 GHz on the channel 1 trace.
6. Return to the controller the cursor frequency for channel 1.

4-4.2 Reserved Mnemonics

In writing command strings, the following mnemonics may be used for clarity, or they may be omitted for brevity: dB, dBm, GHz, MHz. If the units of frequency (MHz, GHz) are not specified, GHz is assumed.

4-5 BUS MESSAGES, ANALYZER RESPONSE TO

Table 4-12 (page 4-24) lists the bus messages responded to by the analyzer. Table 4-13 (page 4-24) lists programming statements showing how the WILTRON 85 and HP Series 200 bus controllers implement the recognized bus messages.

4-6 ALPHABETICAL INDEX TO ANALYZER COMMAND CODES

Table 4-14 (pages 4-26 thru 4-28) provides an alphabetical index to the analyzer command codes.

Table 4-2. Command Codes: Display Channel Control

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 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**
SI1(X) SI2(X)	Set Input For Channel 1 Set Input For Channel 2	Selects input to be displayed on selected channel, where X is the input combination: that is A, B, R1, R2, A/R1, B/R1, A/R2, or B/R2. For example, bus command “SI2 B/R2” sets the signal ratio of Input B/Input R2. This input is displayed as the Channel 2 trace signal.
SIF(S)	User Interface ON/OFF	Used to Disable (S=0), or Enable (S=1) the dedicated GPIB interface. Note: After a system reset, the 562 defaults to the last user User Interface status selected.
SM1(X) SM2(X)	Set Channel 1 Display Set Channel 2 Display	Sets measurement type to be displayed on selected channel. In this case X equals P (power), R (return loss), T (transmission), C(calibration data), V(volts), M(trace memory), or S(SWR). For example, bus command “SM2R” sets channel 2 to measure the return loss of the device under test. Bus command “SI1 A, SM1 P ” then sets channel 1 to display Input A, and sets the displayed signal to be a measure of absolute power in dBm.
TSS “title”	Title Stored Setups	Used to title the Preview Index for the Stored Setups. The title can be a maximum of 12 characters.
CH1(S) CH2(S)	Set Channel 1 On/Off Set Channel 2 On/Off	Turns the selected channel on or off. For example, bus command “CH1 1” turns channel 1 ON and allows it to display a signal trace.
RON(N) ROF(N)	Reference Display On Reference Display Off	Turns On/Off the reference line. The position is displayed by a chevron “<” “>” and a line drawn across the screen display. The default display is ROF which displays the reference line position using the chevron “< ” or “>”.
REF(N)(X)	Position	Sets reference line to position “X” on selected channel, where X= 0 to 10. In this case, the top of the screen equals 0, and the bottom of the screen equals 10. For example, bus command “REF 15” places the reference line for trace 1 at the fifth line from the top.
OFF(N)(n)	Offset (dB)	Sets the Offset on the selected channel. For example, bus command “OFF 2 10 dB” sets the trace offset on channel 2 to 10 dB.
SCL(N)(X)	Resolution (dB/div.)	Sets the Resolution of the selected channel to X dB/div, where X = 0.1 to 10 dB/div in any 0.1 dB increment.

Table 4-2. Command Codes: Display Channel Control (Continued)

MNEMONIC CODE	FUNCTION	DESCRIPTION
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.
LHI(N)(n) LHF(N) LLO(N)(n) LLF(N)	High Limit On High Limit Off Low Limit On Low Limit Off	Sets the straight line limits to n dB on the selected channel or turns off the limits. The limits can be used as a guide to test signal trace response. Setting these limits cancel any complex limits previously sent for that channel.
CLH(N)(limits) CLL(N)(limits) CHI (N) (S) CLO (N) (S)	Enter Complex Limits High Enter Complex Limits Low Complex High Limit ON/OFF Complex LowLimit ON/OFF	Sets the complex limits on the selected channel. See Figure 4-3 for a programming example. Displays or turns off the High Complex Limits for channel N. Displays or turns off the Low Complex Limits for channel N.
LTM (N)	Learn Trace Memory	562 Receives Trace Memory data sent from the controller for channel N
OCH (N) OCL (N)	Output Complex Limits High Output Complex Limits Low	Complex limits previously setup on the 562 may be returned to the controller. The data is returned in ASCII format.
DSI (S)	Display Segment Identifiers	If enabled, a numeric identifier is displayed to identify each segment of complex limit lines.
OLT(N)	Output Limits Test Result	Returns a pass/fail message to the controller. If the test fails, the failed frequency in GHz is returned with the fail message.
DLT	Display Limits Test	Displays a menu that performs pass/fail testing on every sweep for pre-entered limits.
ASC(N)	Autoscale	Automatically adjusts the resolution and offset to fit the signal trace for channel N on the screen.
GSN GSF	GPIB Status Indication On GPIB Status Indication Off	Turns the GPIB status indication display on. Turns the GPIB status indication display off
TM1(S) TM2(S)	Apply trace memory to Channel 1 Apply trace memory to Channel 2	Used to subtract Trace Memory from Signal Trace on the selected channel
TMD (N)	Load Trace Memory with signal trace data	Stores signal trace data for channel N to trace memory
TMH (N)	Load Trace Memory with complex high limits	Stores Complex High Limits for channel N to Trace Memory
TML (N)	Load Trace Memory with complex low limits	Stores Complex Low Limits for channel N to Trace Memory

Bus Command: **CLH 1 1 900MHz 4GHZ -3DB 7 DB**
2 4GHZ 6GHz 7DB -20.03DB

(Mnemonics may be in either upper or lower case, or mixed.)

The above command sets the high values of complex limits for channel 1. The order in which data is entered is as follows:

Segment Number
Start Frequency
Stop Frequency
Limit Value at Start Frequency
Limit Value at Stop Frequency

The above command illustrates setting the complex limits for segments 1 and 2. For the frequency parameter, if "GHz" or "MHz" is not entered, then the frequency defaults to GHz.

The "dB" mnemonic as used in the string is optional and may be used to improve readability.

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

The data is entered in an ASCII format.

Figure 4-3. Programming Example: Complex Limits

Table 4-3. Command Codes: Calibration, Graticule Display, System Functions, Diagnostic Facilities, Averaging, and Smoothing.

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
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
	CALIBRATION	
CAL (X)	Perform 562 calibration	Initiates the calibration sequence on the 562. If (X) is "N" or omitted, calibration data at the number of data points selected is stored. If (X) is "H", up to 2000 points are stored for a high resolution calibration.
CTN	Continue Calibration	Continues a paused calibration routine
NUL	Low Level Null	Low level null is only used in Autozero RF Mode ON Establishes an equality between dummy loads and RF OFF conditions (only used when no RF is present).
DOA (N)	Detector Offset A	Offsets the measurement for the selected input without affecting the calibration data
DOB (N)	Detector Offset B	
DO1 (N)	Detector Offset R1	
DO2 (N)	Detector Offset R2	
	GRATICULE DISPLAY	
GON	Turn Graticule On	Turns the graticule grid display on.
GOF	Turn Graticule Off	Turns the graticule grid display off leaving small tick marks.
	SYSTEM FUNCTIONS	
SVS(M)	Save Front Panel Setup	Saves the current control panel setup to memory M.
SVC(X)	Save Setup with Calibration Data	Saves the current control panel setup together with all relevant calibration data to memory X, where X = 1 to 4.
RCS(M)	Recall Setup	Recalls the control panel setup from memory M.
RCC(X)	Recall with Calibration Data	Recalls the control panel setup from memory X (X = 1 to 4), together with calibration data.
PRV(X)	Preview	Looks at control panel setup X (X=1 to 9) from memory without recall. If an intelligent sweeper is connected, it's 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. Mnemonic command "PRV 0 "deselects the Preview mode.
CN	Configure Normal	Resets the hardware link between 562 and source for normal operation
CNR	CW No Ramp	Only available with non-intelligent sweepers.
CRO	Configure Ramp Output	Provides 0-10v ramp output from 562 via the RAMP INPUT/OUTPUT BNC connector
CML (data)	Configure Manual Labelling	Allows monitor display to be annotated when using a non-intelligent source, e.g. "2 GHz 8 GHz 10 dBm".

Table 4-3. Command Codes: Calibration, Graticule Display, System Functions, Diagnostic Facilities, Averaging, and Smoothing (Continued)

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 sweep to normal. Only available on non-intelligent sweepers.
TMO	Turn Off Manual Labelling	Turn off all label information set using the CML mnemonic.
RCT(X)	Recall Trace Memory	The argument (X) is a number from 1 to 4, based on the trace memory location from which data is to be recalled.
SML(X)	Set Maximum Power Level	The argument (X) is a number from –120 to +30 dBm, based on the desired power level.
SSL(X)	Set Start Power Level	The argument (X) is a number from –120 to +30 dBm, based on the desired power level.
SVT(X)	Save Trace Memory	The argument (X) is a number from 1 to 4, based on the trace memory location to which data is to be saved.
	DIAGNOSTIC FACILITIES	
TST	Test	Runs the instrument self test routine. The result of the test is available in the extended status byte.
RST	Reset	Resets the instrument to factory default settings. If an intelligent sweeper is connected to the 562, this too will be reset. The 562 sends the Ramp On signal after RST, to ensure that the 6700A/B has an active sweep.
CTN	Continue	Continue after Self Test failed.
	FREQUENCY DATA POINTS	
DP1	Set Resolution to 101 Data Points	Sets the screen display resolution to 101, 201, or 401 data points. 101 and 201 are only valid when smoothing is off, else the DP instruction will only take effect when returning to smoothing off.
DP2	Set Resolution to 201 Data Points	
DP4	Set Resolution to 401 Data Points	
	AVERAGING	
AVG(X)	Averaging On	Turns the averaging function on or off. The number of sweeps averaged is equal to 2 raised to the power X, where X = 2 to 8.
AOF	Averaging Off	Turn off signal averaging.
AVE (X)	Set Averaging	Sets the number of averaging sweeps (X) valid values for X are 2, 4, 8, 16, 32, 64, 128, and 256.

Table 4-3. Command Codes: Calibration, Graticule Display, System Functions, Diagnostic Facilities, Averaging, and Smoothing. (Continued)

MNEMONIC CODE	FUNCTION	DESCRIPTION
	SMOOTHING	
SON(X)	Smoothing On	Controls the on/off and minimum/maximum states of the signal trace smoothing function where X = 0,1, or 2. When X is 0, smoothing is off; X = 1, minimum smoothing; X= 2, maximum smoothing.
SOF	Smoothing Off	Turns smoothing off.
SMO (X)	Set Smoothing	Sets smoothing to minimum, maximum, or off depending on the value of X. When X is 0, smoothing is off; X = 1, minimum smoothing; X= 2, maximum smoothing. NOTE: SMO (X) is an alternate mnemonic for SON (X).

Table 4-4. Command Codes: Service Request

MNEMONIC CODE	FUNCTION	DESCRIPTION
SQ1 SQ0	Enable SRQ Disables SRQ	The 562 defaults to SQ0, SRQ being disabled.
SQS(X)	Program Number of Sweeps	After X number of sweeps, an SRQ will be generated.
IPM(X)	Input Primary Mask	Provides an 8-bit mask (X) for the primary status byte. The mask argument (X) can be a number from 0 to 255. The default value is zero. See Figure 4-4 for an example of the status bytes and how they are used.
IEM(X)	Input Extended Mask	Provides an 8-bit mask (X) for the extended status byte. The mask argument (X) can be a number from 0 to 255. The default value is zero.
CSB	Clear Primary Status Byte	Clears the primary status byte.

Bus Command: IPM 135

The argument 135 sets the primary status mask to enable bits 0, 1, 2, and 7 in the primary status byte (see below).

NOTE

The Service Request bit (6) in the primary status byte is not maskable. Separate mnemonics exist for enabling and disabling the SRQs.

STATUS BYTE
Binary Byte Decoding

7	6	5	4	3	2	1	0
128	64	32	16	8	4	2	1

Primary Status Byte

7	6	5	4	3	2	1	0

All bits except 6 will generate an SRQ when set to a 1 (high).

Bit	Function
0	Provides an SRQ after a programmed number of sweeps have been completed.
1	Syntax error.
2	Calibration sweep finished.
3	Not used.
4	Redirection mode failure. Sets for any error associated with attempting to program an instrument on the dedicated GPIB.
5	Extended status byte contains valid information.
6	Service request bit.
7	Redirected SRQ. Set when any instrument on the dedicated GPIB has requested service. See Figure 4-5 for an explanation.

Extended Status Byte

7	6	5	4	3	2	1	0

Bits 0, 1, and 2 will contain status information and will also generate a service request. The remaining bits are status bits only.

Bit	Function
0	Print finished = 0 (will generate an SRQ.) Print failed = 1
1	Plot finished = 0 (will generate an SRQ.) Plot failed = 1
2	Last print request failed (will generate an SRQ).
3	562 is uncalibrated.
4	562 is in calibration mode.
5	562 is in secret mode.
6	562 self test failed.
7	Preview mode currently selected.

Figure 4-4. Programming Example: Service Request

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, see below.

Byte 1	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Byte 2	**Address of the instrument requesting service**							

Figure 4-5. Redirected Status Byte

Table 4-5. Command Codes: Cursor Control and Search Facility

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
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
	CURSOR CONTROL	
COF	Cursor Off	Controls the movement of the main or reference cursor,either by specifying position or frequency, and also the on/off states of the cursors. EXAMPLE: Bus command RCF 1 20 GHz will move the reference cursor to a frequency of 20 GHz on the channel 1 trace. This is the relative cursor operation. This is a Relative Cursor function and requires the Relative Mode to be selected.
CON	Cursor On	
CRP(P)	Move Cursor to Position P	
CRF(N)(F)	Move Cursor to Frequency F	
DON	Relative Mode On	
DOF	Relative Mode Off	
RCF(N)(F)	Move Reference Cursor to Frequency F	
RCP(P)	Move Reference Cursor to Position P	
	SEARCH FACILITY	
CMX(N)	Move Cursor to Max	General cursor search on channel N. The cursor will be moved to either the maximum or minimum trace position, a specific marker, or the active marker.
CMN(N)	Move Cursor to Min	
CMK(M)	Move Cursor to Marker M	
CAM	Move Cursor to Active Marker	
CLT(N)(n)	Move Cursor Left to n dB	If the relative cursor is off, then the search will be for an absolute value left or right of the cursor. If the relative cursor is on, the search will be for a value relative to the current reference cursor value.
CRT(N)(n)	Move Cursor Right to n dB	
CBW(N)(n)	Bandwidth	Displays the bandwidth of value n dB on channel N. The reference cursor is left at the lower frequency and the main cursor at the higher.
XCG	Exchange Cursor And Reference Cursor	Reverses the positions of the main cursor and the reference cursor.

Table 4-6. Command Codes: Hard Copy

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
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
PST	Stop Plot/Print	Stops the plotting/printing of hard copy.
PGR	Print Graph	Dumps the current graph displayed on the screen to the Centronics printer.
PT(X)	Print Tabular Data	Where X = 0 – 5. When X = 5 Tab data prints only at the markers. X = 0 Screen dumps 401 data points. X = 1 Screen dumps 201 data points. X = 2 Screen dumps 101 data points. X = 3 Screen dumps 51 data points. X = 4 Screen dumps 26 data points.
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 Graticule	Provides a screen plot of the graticule and reference lines.
PLC	Plot Cursor	Provides a plot of the current cursor position.
PLT	Plot Titles	Provides a plot of the current titles displayed to indicate the measurement and test being performed.
PC	Output Custom Plot	Always plots the user specified plot. If PC is used and not defined, the 562 defaults to “Plot All.”
SCP “bit mask”	Specify Custom Plot	The bit mask (Figure 4-6) is a string of ASCII 0’s and 1’s that indicate the user’s requirements for a plot (e.g., title strings, markers, traces, graticules, etc).
LID ’Ident’ LDE ’Device’ LDA ’Date’	Set Identification Set Test Device Label Set Date	The name of the operator or test device serial number, the test device used, and the date will be printed for all Centronics prints containing header or title information. EXAMPLE: LID ’A. WILKINS’, causes the operator’s name, to be printed on any printer using a Centronics interface.
PTL	Print Complex Limits	Provides a hardcopy printout of Complex Limits data.

Bus Command: **SCP (mask)**

The "mask" is a 16-bit ASCII string of 1's and 0's, where the first four characters are zeros. It must be set to select the desired plot function. Mask selections for plot functions are as follows:

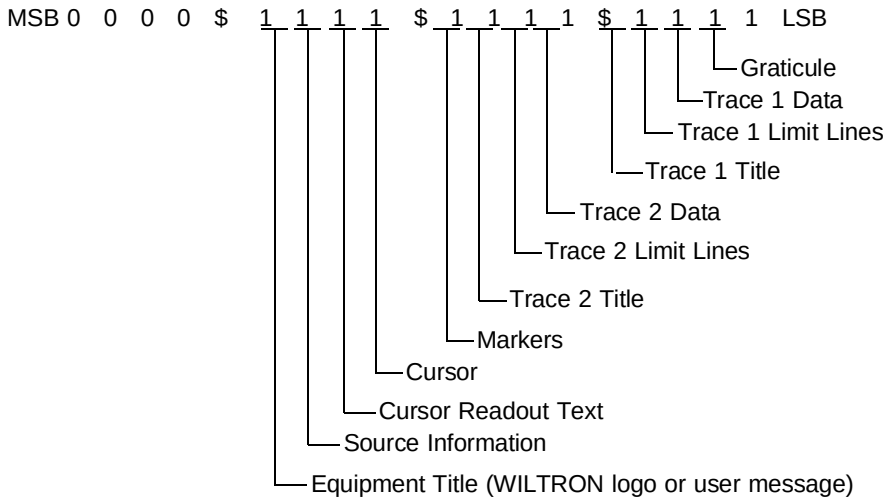


Figure 4-6. Programming Example: SCP (mask)

Table 4-7. Command Codes: Output Functions

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
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
OCF(N)	Output Cursor Frequency	Returns the cursor frequency from channel N.
OCR(N)	Output Cursor Readout	Returns the cursor value for the current cursor trace position.
OCP	Output Cursor Position	Returns the current cursor position.
ODF(N)	Output Relative Cursor Frequency	Returns the frequency difference between the reference cursor and the main cursor for channel N.
ODR(N)	Output Relative Cursor Readout	Returns the readout difference between the reference cursor value and the main cursor value for channel N.
OEB	Output Extended Status Byte	Returns an ASCII representation of the extended status byte to the controller.
OPM(X)	Output Parameter X	Returns parameter X to the controller. Parameter X is defined in Figure 4-7.
OID	Output Identify	Returns the 562's identity string.
OPB	Output Primary Status Byte	Returns the primary status byte to the controller.
ORB	Output Redirected Status 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 4-9). See example program shown in Figure 4-8.
ORF(N)	Output Reference Cursor Frequency	Returns reference cursor frequency for channel N .
ORP	Output Reference Cursor Postion	Causes the 562 to output the reference cursor position when next addressed to talk.
ORR(N)	Output Reference Cursor Readout	Returns the cursor value for the current reference cursor position. (The returned value will be in dB, mV, or SWR depending on the measurement mode currently selected.)

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 4-7. Available Parameters, OPM(X)

Table 4-8. Command Codes: Data Strings

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
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
OAT(N)	Output ASCII Trace	Returns an ASCII representation of the signal trace data for channel N.
OBT(N)	Output Binary Trace	Returns a binary representation of signal trace data for channel N.
OCD(N)	Output Calibration Data	Returns calibration data for the selected channel to the controller for channel N.
OSB	Output Status Byte Indication	Returns an Ascii representation of the Status Byte to the controller. The returned data will be a numeric string, 0 to 255.
OSS(M)	Output Stored Setup	Returns stored setup M to the controller.
LAT(N)	Learn ASCII Trace	The 562 receives ASCII signal trace data sent from the controller for channel N.
LBT(N)	Learn Binary Trace	The 562 receives binary signal trace data sent from the controller for channel N.
LCD(N)	Learn Calibration Data	The 562 receives calibration data sent from the controller for channel N.
LSS(M)	Learn Stored Setup	The 562 receives stored setup M sent from the controller.
OTM(N)	Output Trace Memory	Returns contents of Trace Memory for selected channel (N) to the controller. This data is in binary format.

Table 4-9. Command Codes: Pass Through Codes

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 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 4-8 for a sample program using 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 562 Address	Sets the plotter, sweeper, or 562 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:
562 Scalar Network Analyzer
6647B Sweep Generator (connected to 562 via the *Dedicated* GPIB)
HP 200 Series Controller (connected to 562 via the *Main* GPIB)

The example program below loads the contents of the 6647B sweep generator setup memories 1, 2, & 3 into the HP 200 controller (via the 562). It then sends this data back to the 6647B (via the 562) 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 562 to factory settings

60  WAIT 5               |  Wait for Reset to finish

70  OUTPUT @Sna; "RDR 5 RCS1 SAV"   |  Send 6647B Setup Memory 1 data
                                    |  to 562

90  OUTPUT @Sna; "ORD"              |  Send data from 562 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 6647B
160 OUTPUT @Sna; "RDR 5 SVS4"    |  Save data into 6647B 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 562 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 4-8. Example Program Showing Usage of RDR and ORD Commands

Table 4-10. Command Codes: General Functions

MNEMONIC CODE	FUNCTION	DESCRIPTION
ARF(S)	Autozero RF Mode On/Off	Autozero occurs every retrace. This establishes if the 562 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).
BC(S)	Blank CRT	Either blanks (BUS COMMAND = BC1), or unblanks (BUS COMMAND = BC0) the CRT display.
CTN	Continue	Continues to next calibration step, or continues after self test failed.
HON HOF	Hold Enable Release Hold	Holds the current data being displayed on the screen. Continue displaying measurement data.
NUL	Low Level Null	Used in conjunction with autozero RF mode on to establish an equality between dummy loads and actual RF off conditions (when no RF present). Used to calibrate the dummy load.
RTL	Return To Local	Returns the analyzer from the GPIB mode to the local mode.

Table 4-11. Command Codes: Special Functions

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.

Table 4-11. Command Codes: Special Functions (Continued)

MNEMONIC CODE	FUNCTION	DESCRIPTION
	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).
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 562 to the single-search mode.
	SPECIAL FUNCTIONS 4, TITLING	
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.
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).

Table 4-11. Command Codes: Special Functions (Continued)

MNEMONIC CODE	FUNCTION	DESCRIPTION
	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.
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 562 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 4-12. Bus Messages Recognized by the 562 Network Analyzer

BUS MESSAGES	HOW MESSAGE IS USED BY THE RF ANALYZER
Device Clear	Resets the network analyzer to its default state. Sending this message is equivalent to sending the RST command.
Go to Local	Returns the network analyzer to local (control panel) control.
Group Execute	No action.
Interface Clear	Stops the network analyzer GPIB interface from listening or talking. The front panel controls are not cleared, however.
Local Lockout	Prevents the front panel RETURN TO LOCAL key from returning the network analyzer to local (control panel) control.
Remote Enable	Places the network analyzer under remote (GPIB) control if the REM line is TRUE and the network analyzer has been addressed to listen. ***NOTE*** If the network analyzer 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.
Service Request Messages	The network analyzer has been equipped with an SRQ capability.It will respond to both serial- and parallel-poll messages. Responses to these messages are described below.
Serial-Poll (SPE)	The SPE message causes the network analyzer to respond with a Enable (SPE) decimally-coded status byte.
Serial-Poll Disable (SPD)	The SPD message, which the controller sends, terminates a serial poll operation.
Parallel Poll Operation	When queried by a parallel-poll message (PPOLL, Table 4-13), the network analyzer (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 configure and enable (PPC and PPE) message.
Parallel-Poll Configure (PPC)	The PPC byte configures the device to respond to a parallel- poll message, such as PPOLL.
Parallel-Poll ENABLE (PPE)	The PPE byte assigns the logical sense (1, 0) that the parallel- Enable (PPE) poll response will take.
Parallel-Poll Unconfigure (PPU), Disable (PPD)	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. This message disable causes the network analyzer to become unconfigured for a parallel-poll response.

Table 4-13. Methods of Generating Bus Commands

FUNCTION	METHOD OF EXECUTION	
	WILTRON 85	HP SERIES 200
Go to Local (GTL)	LOCAL 6 * LOCAL 706	LOCAL 6 LOCAL 706
Group Execute Trigger	TRIGGER 6 TRIGGER 706	TRIGGER 6 (GET) TRIGGER 706
Interface Clear (IFC)	ABORTIO 6	ABORT 6
Device Clear (DC) (SDC)	CLEAR 6 CLEAR 706	CLEAR 6 CLEAR 706
Local Lockout (LLO)	LOCAL LOCKOUT 6	LOCAL LOCKOUT 6
Remote Enable (REN)	REMOTE 6 REMOTE 706	REMOTE 6 REMOTE 706
Serial Poll	A=SPOLL (706)	A=SPOLL (706)
Parallel Poll Configure (PPC)	SEND 6; UNL LISTEN 6 CMD 3 SCG 6	PPOLL CONFIGURE 706;6
Parallel Poll	A=PPOLL (6)	A=PPOLL (6)
Parallel Poll Unconfigure (PPU)	SEND 6; CMD 21 SEND 6; UNL LISTEN 6 CMD 21	PPOL UNCONFIGURE 6 PPOL UNCONFIGURE 706

* Assumes GPIB address set to 6.

Table 4-14. Alphabetical Index to the Command Codes

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	NAME	PAGE NUMBER
AOF	Averaging Off	4-10
ARF(S)	Autozero RF On/Off	4-21
ASC(N)	Autoscale	4-7
ASW	Autosweep	4-10
AVE (X)	Set Averaging	4-10
AVG(X)	Averaging On	4-10
BC(S)	Blank CRT	4-21
CAL (X)	Calibrate the 562	4-9
CAM	Move Cursor To Active Marker	4-13
CBW(N)(n)	Move Cursor To Show Bandwidth	4-13
CH1(S)	Set Channel 1 On/Off	4-6
CH2(S)	Set Channel 2 On/Off	4-6
CHI (N) (S)	Complex High Limit On/Off	4-7
CLH(N) (L)	Enter High Complex Limits	4-7
CLL(N) (L)	Enter Low Complex Limits	4-7
CLO (N) (S)	Complex Low Limit On/Off	4-7
CLT(N)(n)	Move Cursor Left To n dB	4-13
CMK(M)	Move Cursor To Marker M	4-13
CML (data)	Configure Manual Labelling	4-9
CMN(N)	Move Cursor To Min	4-13
CMX(N)	Move Cursor To Max	4-13
CN	Configure Normal	4-9
CNR	CW No Ramp	4-9
COF	Cursor Off	4-13
CON	Cursor On	4-13
CRF(N)(F)	Move Cursor To Frequency F On Channel N	4-13
CRO	Configure 0-10v Ramp Output	4-9
CRP(P)	Move Cursor To Position P	4-11
CRT(N)(n)	Move Cursor Right To n dB	4-13
CSB	Clear Primary Status Byte	4-11
CTN	Continue to Next Calibration Step, or Continue after Self Test Failed	4-9
dB	Reserved Mnemonic	4-5
dBm	Reserved Mnemonic	4-5
DLT	Display Limits Test	4-7
DO1 (X)	Detector Offset R1	4-9
DO2 (X)	Detector Offset R2	4-9
DOA (X)	Detector Offset A	4-9
DOB (X)	Detector Offset B	4-9
DOF	Relative Mode Off	4-13
DON	Relative Mode On	4-13
DP1	Set Resolution To 101 Data Points	4-10
DP2	Set Resolution To 201 Data Points	4-10
DP4	Set Resolution To 401 Data Points	4-10
DSI (S)	Display Segment Identifiers	4-7
FRD	Fast Redirection	4-19
FRE	Fast Redirection Ends	4-19
GHz	Reserved Mnemonic	4-5
GOF	Turn Off Graticule Display	4-9
GON	Display Graticule	4-9
GSF	GPIB Status Indication Off	4-7
GSN	GPIB Status Indication On	4-7
HOF	Hold Off	4-21
HON	Hold On	4-21
IEM(X)	Input Extended Mask	4-11
IPM(X)	Input Primary Mask	4-11
LAT(N)	Learn ASCII Trace	4-18
LBT(N)	Learn Binary Trace	4-18
LCD(N)	Learn Calibration Data	4-18
LDA “date”	Label For Date	4-14
LDE “device”	Label For Test Device	4-14
LHF(N)	High Limit (Off)	4-7
LHI(N)(n)	High Limit (On)	4-7
LLF(N)	Low Limit (Off)	4-7
LLO(N)(n)	Low Limit (On)	4-7
LID “ident”	Label For Identification	4-14
LSS	Learn Stored Setup	4-18
LTM (N)	Learn Trace Memory	4-7
MHz	Reserved Mnemonic	4-12
MSW	Manual Sweep	4-10
NSW	Normal Sweep	4-10
NUL	Low Level Null	4-9
OAT(N)	Output ASCII Trace Data	4-18
OBT(N)	Output Binary Trace Data	4-18
OCD(N)	Output Calibration Data	4-18
OCF(N)	Output Cursor Frequency	4-16
OCH (N)	Output Complex Limits High	4-7
OCL (N)	Output Complex Limits Low	4-7
OCP	Output Cursor Position	4-16
OCR(N)	Output Cursor Readout	4-16
ODF(N)	Output Relative Cursor Frequency	4-16

Table 4-14. Alphabetical Index to the Command Codes (Continued)

MNEMONIC CODE	NAME	PAGE NUMBER
ODR(N)	Output Relative Cursor Readout	4-16
OEB	Output Extended Status Byte	4-16
OFF(N)(n)	Set Channel Offset (dB)	4-6
OID	Output Identify	4-16
OLT(N)	Output Limits Test Result	4-7
OPM(X)	Output Parameter X	4-16
OPB	Output Primary Status Byte	4-16
ORB	Output Redirected Status Bytes	4-16
ORD	Output Redirected Data	4-16
ORF(N)	Ref. Cursor Readout	4-16
ORP	Output Reference Cursor Position	4-16
ORR(N)	Ref. Cursor Readout	4-16
OSB	Output Status Byte	4-18
OSS	Output Stored Setup	4-18
OTM (N)	Output Trace Memory	4-18
PC	Output Custom Plot	4-14
PGR	Print Graph	4-14
PLA	Plot All	4-14
PLC	Plot Cursor	4-14
PLG	Plot Graticule	4-14
PLR	Plot Trace	4-14
PLT	Plot Titles	4-14
PRV(X)	Preview	4-9
PST	Stop Print	4-14
PT(X)	Print Tab Data	4-14
PTL	Print Complex Limits	4-14
RCC(X)	Recall With Calibration Data	4-9
RCF(N)(F)	Move Reference Cursor To Frequency	4-13
RDB(X)	Pass Through Command For Binary Data	4-19
RDR(X)	Pass Through Command For ASCII Data	4-19
RCP(P)	Move Reference Cursor To Position P	4-13
RCS(M)	Recall Front Panel Setup	4-9
RCT(X)	Recall trace memory; X=1 to 4	4-10
REF(N)(X)	Set Reference Line Position	4-6
ROF(N)	Reference Line Display Off	4-6
RON(N)	Reference Line Display On	4-6
RST	Reset Instrument	4-10
RTL	Return To Local	4-21
SCL(N)(X)	Set Resolution (dB/Div.)	4-6
SCP(bit mask)	Specify Custom Plot	4-14
SDP(X)	Set Plotter Address (Dedicated GPIB)	4-19
SDS(X)	Set Sweeper Address (Dedicated GPIB)	4-19
SDX(X)	Set 562 Address	4-19
SF10	1: Max Hold	4-21
SF11	1: Min Hold	4-21
SF12	1: Pk-Pk Hold	4-21
SF13	1: Normal	4-21
SF14	2: Max Hold	4-21
SF15	2: Min Hold	4-21
SF16	2: Pk-Pk Hold	4-21
SF17	2: Normal	4-21
SF20	1: Min-Max	4-22
SF21	1: From Max	4-22
SF22	2: Min-Max	4-22
SF23	2: From Max	4-22
SF24	Repeat	4-22
SF25	Normal	4-22
SF40	User Titles	4-22
SF41	Stnd Titles	4-22
SF50	Fxd Range 1	4-22
SF51	Fxd Range 2	4-22
SF52	Fxd Range 3	4-22
SF53	Auto Range	4-22
SF60	Hi Res Cal	4-22
SF61	Standard Cal	4-22
SF62	Allow 6700A Corrn.	4-22
SF63	Stop 6700A Corrn.	4-22
SF70	Channel 1	4-23
SF71	Channel 2	4-23
SF74	Continue	4-23
SI1 (X)	Set Input For Channel 1	4-6
SI2 (X)	Set Input For Channel 2	4-6
SIF(S)	User Interface ON/OFF	4-6
SM1(X)	Set Channel 1 Measurement Display	4-6
SM2(X)	Set Channel 2 Measurement Display	4-6
SML(X)	Set maximum Power Level; X= –120 to +30 dBm	4-10
SMO (X)	Set Smoothing	4-11
SOF	Smoothing Off	4-11
SON(X)	Smoothing On	4-11
SQ0	Disable SRQs	4-11
SQ1	Enable SRQs	4-11
SQS(X)	Program Number of Sweeps	4-11
SSL(X)	Set Start Power Level; X= –120 to +30 dBm	4-10
SVC(X)	Save Setup With Calibration Data	4-9
SVS(M)	Save Front Panel Setup	4-9
SVT(X)	Save Trace Memory; X=1 to 4	4-10
TCR(N)	Adjust Offset so that Trace at Cursor Moves To Ref. Line	4-7

Table 4-14. Alphabetical Index to the Command Codes (Continued)

MNEMONIC CODE	NAME	PAGE NUMBER
TM1 (S)	Apply Trace Memory to Channel 1	4-7
TM2 (S)	Apply Trace Memory to Channel 2	4-7
TMD (N)	Load Trace Memory With Signal Trace Data	4-7
TMH (N)	Load Trace Memory With Complex High Limits	4-7
TML (N)	Load Trace Memory With Complex Low Limits	4-7
TMO	Turn Off Manual Labelling	4-10
TSS “title”	Title Stored Setups	4-6
TST	Run Instrument Test Routine	4-10
XCG	Exchange Cursor and Reference Cursor	4-13

APPENDIX A
Installation and Configuration Instructions for the National Instruments GPIB-PCII/IIA Card and NI-488 MS-DOS Handler Software

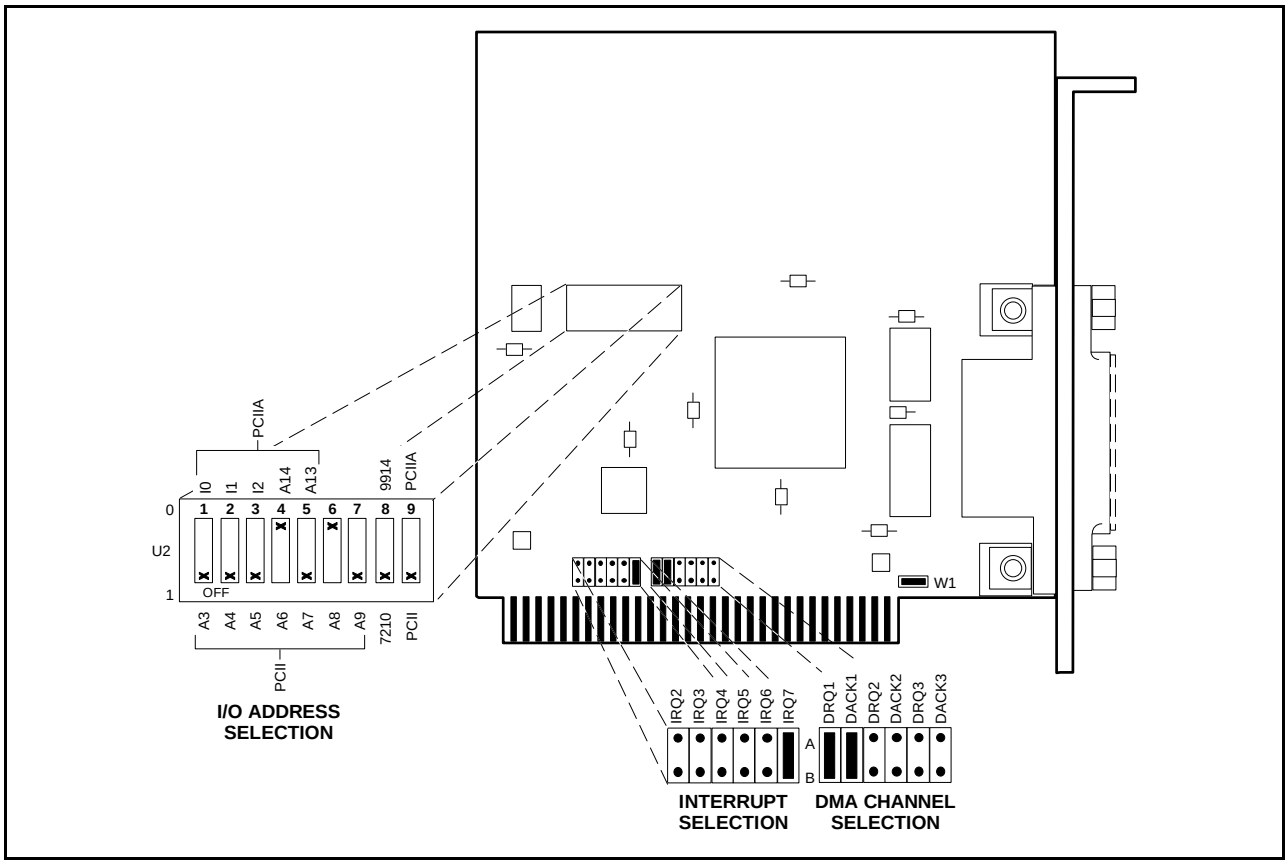


Figure A-1. GPIB-PCII/IIA Hardware Configuration

A-1 INSTALLING THE GPIB-PCII/IIA CARD

The following steps provide detailed instructions for installing the National Instruments GPIB-PCII/IIA Interface Card (P/N 181065-02) into a personal computer.

1. Before installation, set the switches and jumpers on the GPIB-PCII/IIA card as shown in Figure A-1.

2. Turn off the computer and unplug the power cord from the power source.

3. Remove the top cover from the computer and install the GPIB-PCII/IIA card into any unused slot. Install the card with the IEEE-488 connector protruding out of the back panel.

4. Secure the card by fastening the GPIB-PCII/IIA mounting bracket to the back panel rail with a screw, then replace the computer cover.

5. Plug the power cord into the power source and power up (boot) the computer.

A-2 INSTALLING AND CONFIGURING THE NI-488 MS-DOS HANDLER SOFTWARE

The following steps provide detailed instructions for installing the NI-488 MS-DOS Handler software in support of the GPIB-PCII/IIA card and for changing the default software configuration options of the handler.

NOTE

When installing the MS-DOS Handler software, use ***only*** the National Instruments NI-488 Distribution Disk for GPIB-PCII/PCIIA MS-DOS Handler, P/N 420039-09, Revision C.11. Use of any other versions of the GPIB handler software can cause interfacing problems between the handler and the devices on the bus.

1. Insert the NI-488 Distribution Disk for the GPIB-PCII/IIA MS-DOS Handler into the disk drive. At the DOS prompt:
   Type: A:
   Press: <ENTER> (The A:\DOS prompt will appear.)

2. Run the installation program IBSTART and specify the start up (boot) drive. For example, if C: is the boot drive, at the DOS prompt:
   Type: IBSTART C:
   Press: < ENTER>

3. Follow the instructions on the display. The installation program first copies the files, GPIB.COM and IBCONF.EXE, from the distribution disk to the root directory of the boot drive, then creates the directory GPIB-PC on the boot drive and copies all the files on the distribution disk into this directory. Next the program adds the line, DEVICE = GPIB.COM, to the computer's CONFIG.SYS file so that DOS will load the handler whenever the computer is booted. The program then prompts you to run the hardware diagnostic program (IBDIAG) to insure the GPIB-PCII/IIA card is installed and working properly.

4. Run the software program (IBCONF) to change the default software configuration options of the GPIB handler. At the DOS prompt:
   Type: IBCONF
   Press: <ENTER>

5. Follow the instructions on the display. The program firsts displays a device map for the GPIB card (Figure A-2). Select the GPIB-PCII/IIA Card or device whose parameters you wish to display, then press the function key, F8. Change the configuration of the GPIB-PC-II/IIA card to that shown in Figure A-3 and verify the configuration of the device DEV6 matches Figure A-4.

6. Reboot your computer to install the GPIB handler software and the software configuration changes.

7. Run the software diagnostic program (IBTEST) to verify that the GPIB handler software is installed correctly. To do this, at the DOS prompt:
   Type: CD\GPIB-PC
   Press: <ENTER>
   Type: IBTEST
   Press: <ENTER>
   If errors are encountered, refer to Appendix B of the GPIB-PC Users Manual, that accompanied your GPIB board, for an explanation of the errors and their solutions.

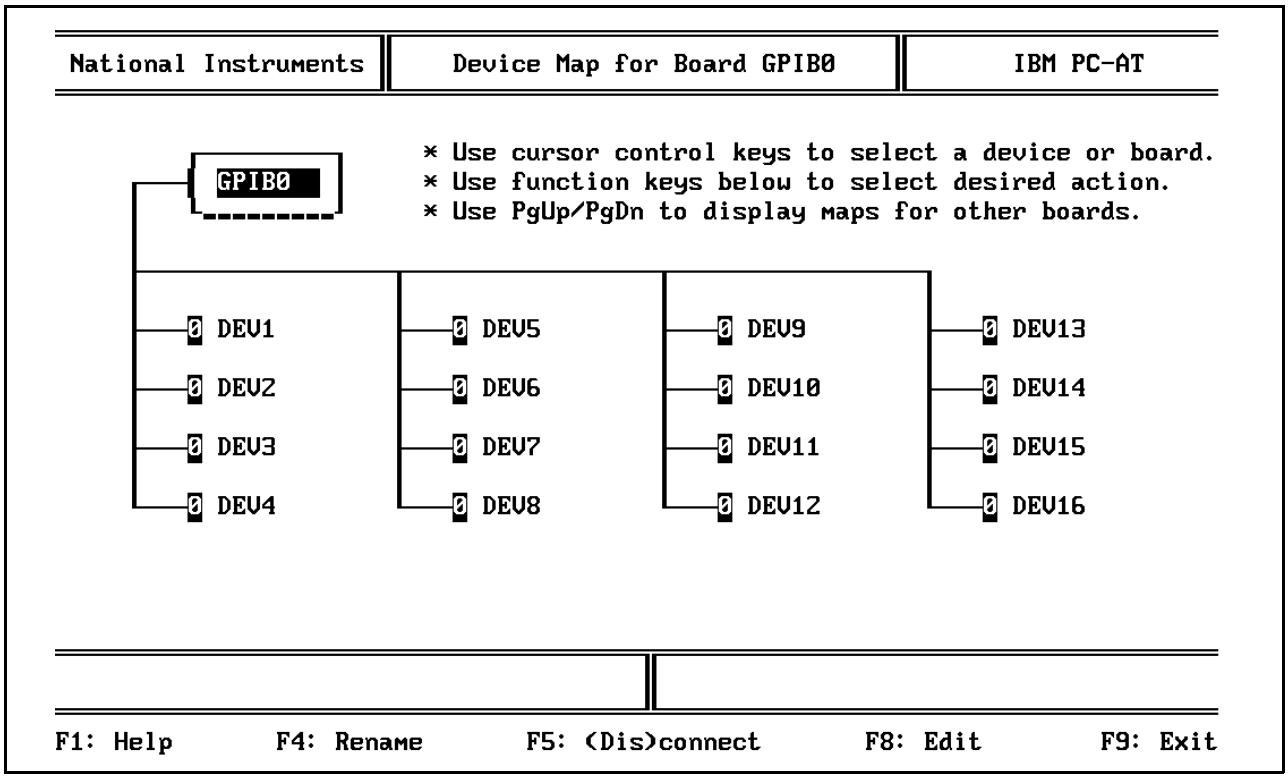


Figure A-2. Device Map for the GPIB-PCII/IIA Card

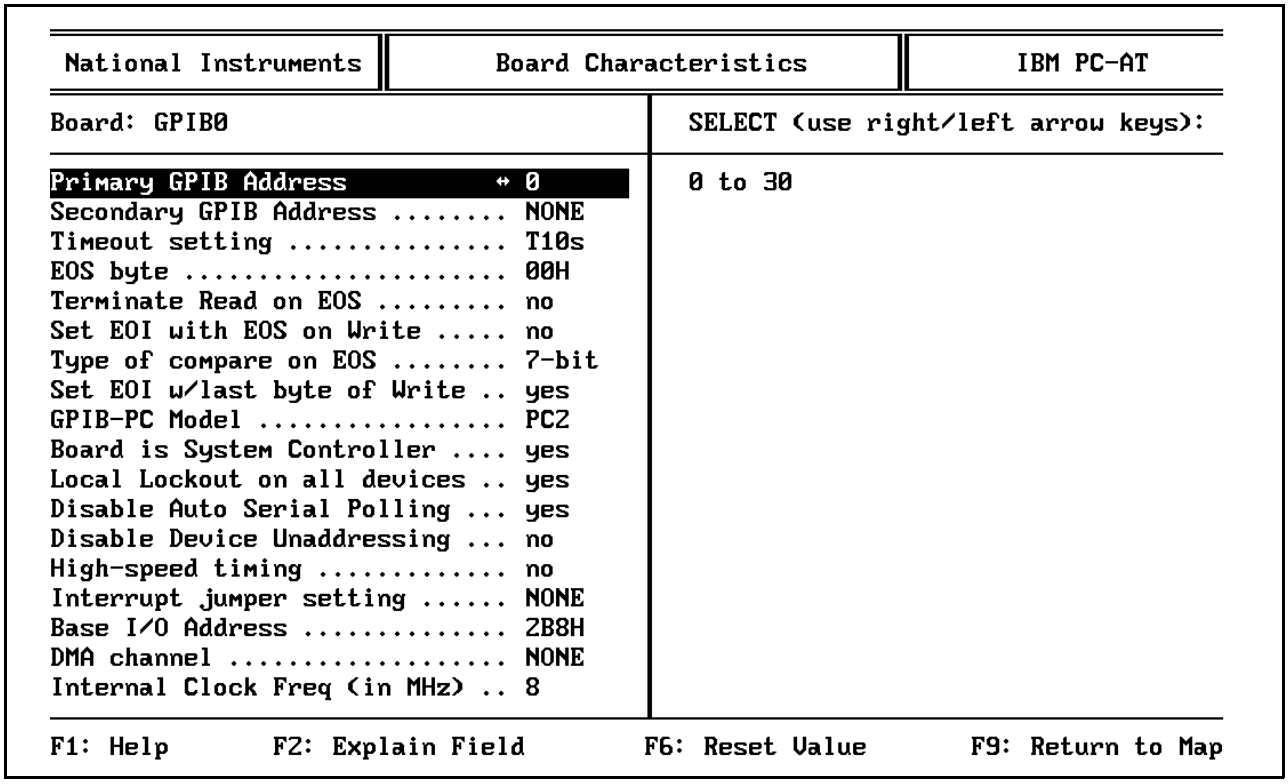


Figure A-3. GPIB-PCII/IIA Card Configuration Parameters

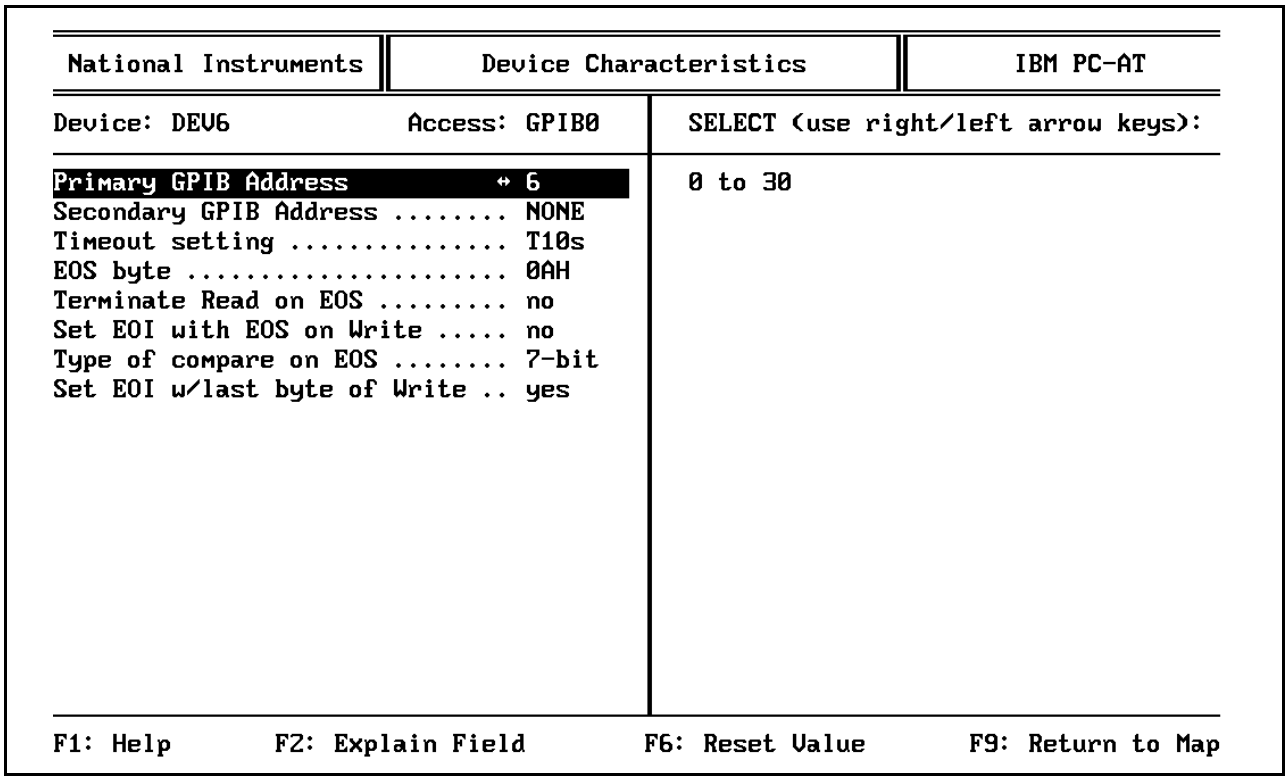


Figure A-4. GPIB Device 6 (360 VNA) Configuration Parameters