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58502A Broadband Distribution Amplifier

User's Guide

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This manual provides information on the 58502A Broadband Distribution Amplifier, including performance tests, command reference, functional description, service, and specifications.

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Warning Symbols That May Be Used In This Book



Instruction manual symbol; the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual.



Indicates hazardous voltages.



Indicates earth (ground) terminal.



or



Indicates terminal is connected to chassis when such connection is not apparent.



Indicates Alternating current.



Indicates Direct current.

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Guide Organization

Table of Contents

Chapter 1, "**Getting Started**," provides an overview of the 58502A Broadband Distribution Amplifier's indicators, connectors, inputs, and outputs. This chapter also provides installation, power-up instructions, and sample commands to familiarize you with the 58502A.

Chapter 2, "**Performance Tests**," provides procedures that verify the 58502A operates properly and meets its electrical performance specifications. Electrical performance is tested against the specifications listed in Chapter 7, "Specifications," of this guide.

Chapter 3, "**Guide Organization**," provides information on 58502A features and functions, and how to connect it to computers.

Chapter 4, "**Command Reference**," lists and describes the Standard Commands for Programmable Instruments (SCPI) commands used to monitor, set, or change parameters of the 58502A.

Chapter 5, "**Functional Description**," provides a brief, simplified, block-diagram description of how the instrument works.

Chapter 6, "**Service**," provides information for calibration and troubleshooting to determine if the product should be returned for repair.

Chapter 7, "**Specifications**," lists all of the 58502A's specifications and characteristics.

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Description of the 58502A Broadband Distribution Amplifier

Overview

The 58502A is a 1-to-12 Broadband Distribution Amplifier that is used to distribute precision sine wave signals from Cesium, Rubidium, quartz, or GPS frequency standards. It provides 12 outputs of the source frequency, which can range from 100 kHz to 10 MHz, and is designed for site frequency distribution for manufacturing, R&D, and standards lab environments.

In addition, the 58502A may be used as a standalone precision signal source by operating only from its optional internal oscillator.

The 58502A Broadband Distribution Amplifier has low signal distortion and very high isolation between output channels (**OUTPUTS 1-12)**. Low output phase noise also helps maintain the spectral purity of the source input signal, entering the 58502A through the **INPUTS A** or **B** channel.

Auto-Switching and Alarm-Inputs Features

The 58502A has two features that ensure your critical frequencies are always present. First, there is the auto-switching feature. When the 58502A detects one of its inputs is removed or the amplitude of the input is greatly reduced, it will automatically switch to the other input. Second, there is the alarm-inputs feature. The 58502A is compatible with the alarm signals from the 58503A GPS Time and Frequency Reference Receiver and the 5071A Primary Frequency Standard. If the alarm of one of these sources is active, the 58502A switches to the other input source, and it can reflect the alarm in its own alarm outputs and route this information to the **ALARM/STATUS** port.

Auto switching between two inputs ensures continuous availability of critical frequencies, and a fault alarm is activated when the system is not functioning correctly.

The auto-switching and alarm-inputs features can also be monitored and controlled through the RS-232 serial interface port.

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RS-232C Port and Indicators Features

Querying through the **RS232** serial interface port and viewing the front-panel LEDs or indicators facilitate monitoring the system. Registers within the 58502A allow you to query, through the **RS232** interface port, the individual distribution input and output channels for the presence or absence of a signal. Front-panel status indicators provide you with a quick visual indication of individual channel health.

Accessories Supplied and Available

Supplied

- Power cord, 180 cm (6 ft.) detachable

Manuals

- 58502A Distribution Amplifier User's Guide — this guide (part number 097-58502-01)

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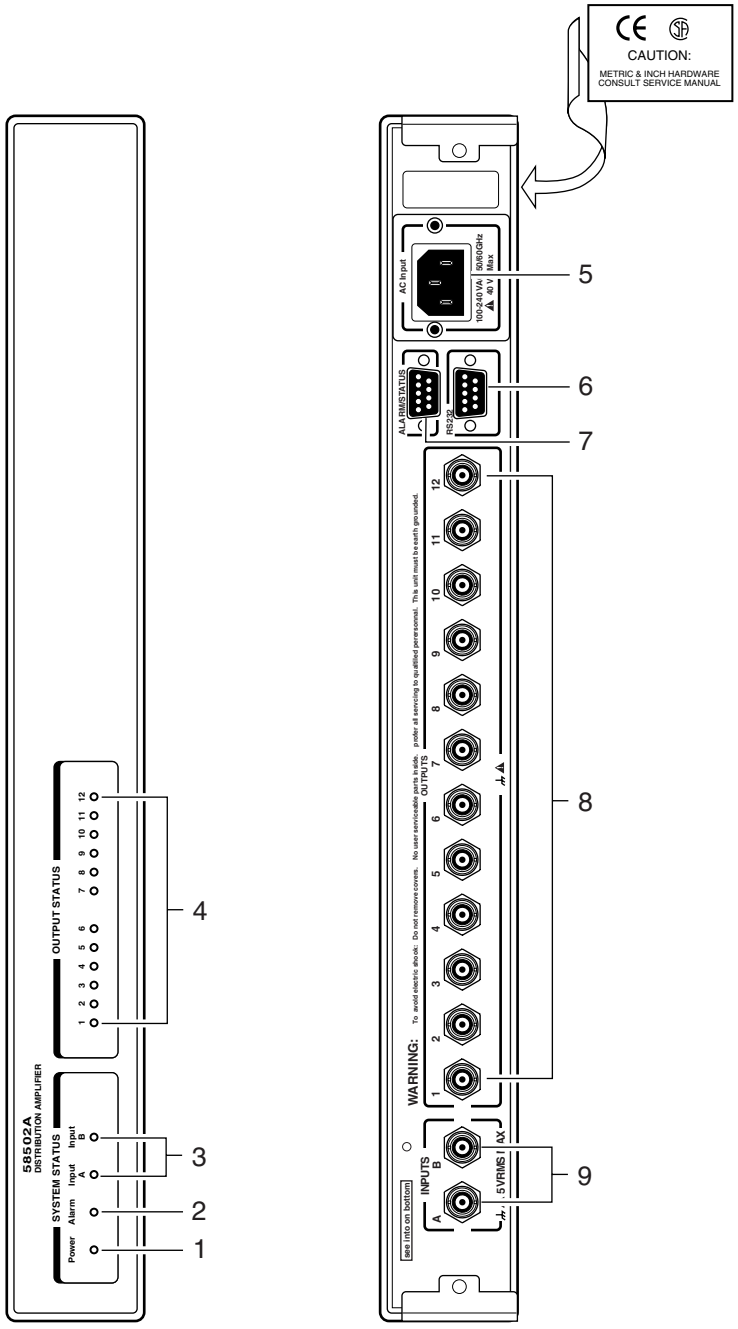
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1

Getting Started

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58502A Broadband Distribution Amplifier at a Glance



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NOTE

See Chapter 3, "Features and Functions," for a detailed discussion of the items described below.

1 When the **Power** indicator lights, it indicates that the proper input power is supplied to the 58502A.

2 When the **Alarm** indicator lights, it indicates that operation is no longer normal. One or more outputs are at fault, or input signals are absent at both inputs A and B.

3 When the **Input A** or **B** indicator lights, it indicates that an input signal is present at input A or B.

4 When any of the **OUTPUT STATUS 1-12** indicators light, it indicates the associated output is functioning.

5 **AC Input** power jack.

6 **RS232** serial interface port allows you to remotely control and monitor the 58502A. Its communication language is SCPI. The connector is a DTE configuration DE-9P (male).

7 **ALARM/STATUS** port is a DE-9P (male) connector. This port allows you to receive an alarm or input an alarm.

8 **OUTPUTS 1-12** 50Ω BNC output signal ports.

9 **INPUTS A** and **B** 50Ω BNC ports allow two input signal connections to the 58502A. The internal circuitry selects one of these signals for distribution.

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Preparing the Distribution Amplifier for Use

To Mount the 58502A Into an Equipment Rack (Using Option AX4)

1 Position the 58502A on your work surface with the front panel facing you.

2 As shown in Figure 1-1, place the long side of an angle bracket (**1**), part number 58502-00004, with its four mounting holes aligned with the four holes present on the 58502A front side. Note that you may select the four bracket holes appropriate for either a flush or protruding installation.

The angle brackets are provide in the Option AX4 Rack Mount Kit.

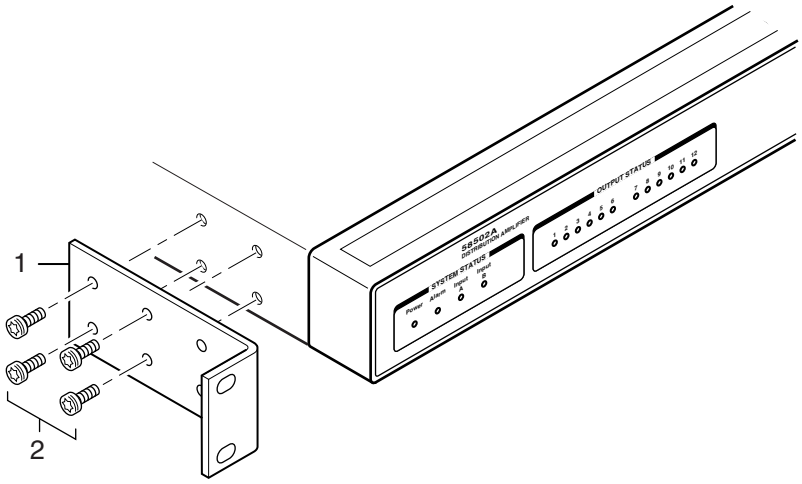


Figure 1-1. Attaching Mounting Brackets for Equipment Rack

3 Attach the bracket to the instrument using four T-15 TORX® screws (**2**), part number 0515-0380. These screws are provided in the Option AX4 Rack Mount Kit.

4 Repeat steps 1 through 3 to attach a bracket to the other side of the instrument.

5 Place the instrument in the position it will occupy in the equipment rack (providing support as required while attaching the mounting hardware). Secure the instrument to the rack with the appropriate hardware.

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To Connect AC Power

The nominal ac input range is 100-132, 175-240 Vac, 47-63 Hz, 40 VA. The power module or jack senses the incoming voltage and automatically selects the proper setup. Just connect the proper ac power using the supplied power cord.

Connecting a Terminal or Computer to the 58502A

NOTE

You may skip this section if you do not plan to use a terminal or computer; proceed to the power-up procedure, starting on page 1-9. The 58502A may be operated without a terminal or computer. The computer is needed for you to remotely monitor the status of the 58502A and to change setup parameters.

1 *If you are going to communicate with the 58502A using a terminal or PC (personal computer)*, connect the computer to the rear-panel **RS232** port using an HP 24542U interface cable (or equivalent RS-232 null-modem cable with DE-9S female connectors at each end) as shown in Figure 1-2.

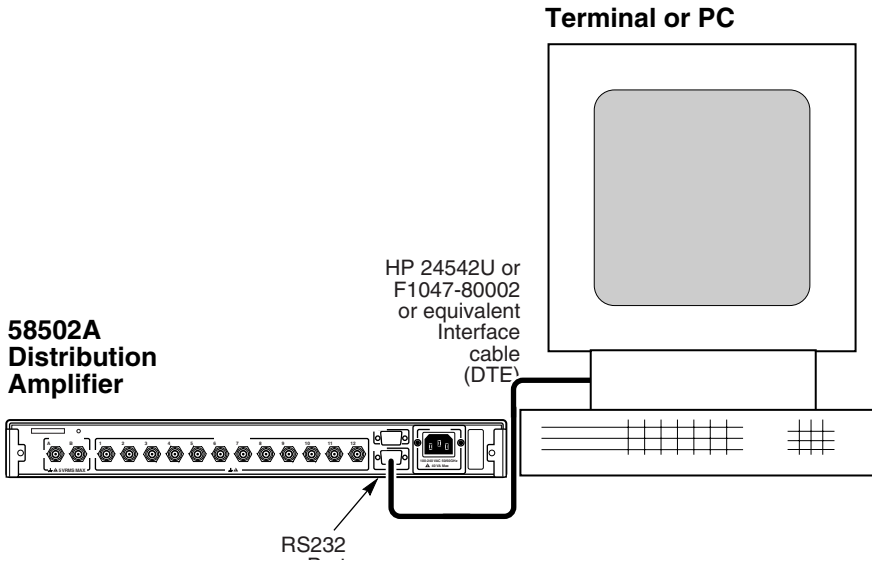


Figure 1-2. Connecting a PC or Terminal to the 58502A

2 Turn the terminal or computer on.
If you are using a personal computer (PC), you will need to run a terminal emulation or telecommunication program on your PC in order

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to communicate via the RS-232 serial port. Most PCs contain a terminal emulation program, especially PCs equipped with Windows. If your PC does not contain a telecommunication program, purchase one of the following programs: PROCOMM PLUS (DATASTORM Technologies, Inc.®), PROCOMM PLUS for Windows, Cross Talk (Hayes®), or any other terminal emulation program.

3 *If you are using an NT®4.0-based or Windows® 95-based PC*, perform the procedure in the subsection "To Configure Terminal Communications for NT 4.0®/Windows® 95-Based PC" on page 1-7.

OR

If you are using a Windows®-based PC, perform the procedure in the subsection "To Configure Terminal Communications for Windows®-Based PC" on page 1-8.

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To Configure Terminal Communications for NT 4.0®/Windows® 95-Based PC

1 In the NT (or Windows 95) main window, click the **Start** button then select **Programs**.

2 Select **Accessories**, **Hyperterminal**, and **Hyper Terminal**.

The **Connection Description** dialog box is displayed.

3 In the "Name" window, type **58502A** (for example), select one of the icons (the first one will do), then click **OK**.

The **Connect To** dialog box is displayed.

4 In the "Connect using" window, select the appropriate port or connector (COM1 or COM2), then click **OK**.

The **COM1** (or **COM2**) **Properties** dialog box is displayed. This dialog box allows you to configure the RS-232 port of your PC.

5 Set the RS-232 port of your PC to match the following default values:

Baud rate (Bits per second):	9600
Parity:	None
Data bits:	8
Stop bits:	1
Pace (flow control):	None

NOTE

The RS-232 port configurations of the 58502A and the PC must be the same for communications between the two. If the 58502A is being powered up for the first time, set your PC to match the factory default values listed above.

If an error-number prompt (**E-xxx>**) or no **scpi>** prompt is displayed after pressing Return (or Enter) on your PC, the default values of the 58502A have been modified. See the subsections "Making Changes to the Serial Port Settings (If Needed)" and "Determining the Serial Port Settings" on page 3-8 in Chapter 3 for more information.

6 Click **OK**.

7 Next, perform the power-up procedure described in the section "Powering Up the Distribution Amplifier" on page 1-9.

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To Configure Terminal Communications for Windows®-Based PC

1 Select or double click on the Terminal icon (a picture of a PC with a telephone in front of it) in the Accessories window.

2 Select **Settings,** then choose **Communications**.

A dialog box is displayed that allows you to configure your PC.

3 Set the RS-232 port of your PC to match the following default values:

Pace:	None
Baud Rate:	9600
Parity:	None
Data Bits:	8
Stop Bits:	1

NOTE

See the important NOTE on page 1-7 that provides information on what to do if the factory-default values of the 58502A's RS-232 port have been changed.

4 In the **Communications** dialog box, be sure to select the appropriate port or connector (COM1, for example).

5 Next, perform the power-up procedure described in the section "Powering Up the Distribution Amplifier" on page 1-9.

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Powering Up the Distribution Amplifier

Overview of the Power-Up Procedure (What to Expect)

When you power up the 58502A Distribution Amplifier for the first time, you should expect it to run through the following sequence:

- front-panel **Alarm** indicator momentarily flashes, indicating the unit is going through self-test, and
- enters steady-state operation, acting as a twelve-channel distribution amplifier.

To Power Up the Distribution Amplifier

NOTE The 58502A may be operated without a terminal or computer. The computer is needed for you to remotely monitor the status of the 58502A and to change setup parameters.

1 As shown in Figure 1-3 (note that the terminal or computer is optional), connect the 58502A's outputs as required for your application, and provide at least one input at either the input **A** or **B** rear-panel input connector.

NOTE Without 50Ω termination of the outputs, the front-panel **OUTPUT STATUS** indicators may not operate properly because the amplitude of the output signals may not be within specifications.

See the section "Features and Functions" in Chapter 3, "Features and Functions," for information on connection and operation for your chosen application.

2 If you are using the Distribution Amplifier with a terminal, personal computer (PC) see the section "Connecting a Terminal or Computer to the 58502A" starting on page 1-5.

3 Apply the proper power source to the rear-panel **AC input** jack of the Distribution Amplifier. (See the subsection "To Connect AC Power" on page 1-5.)

If an input signal is connected to either input **A** or **B**, the 58502A should now be distributing the input signal to all 12 output ports.

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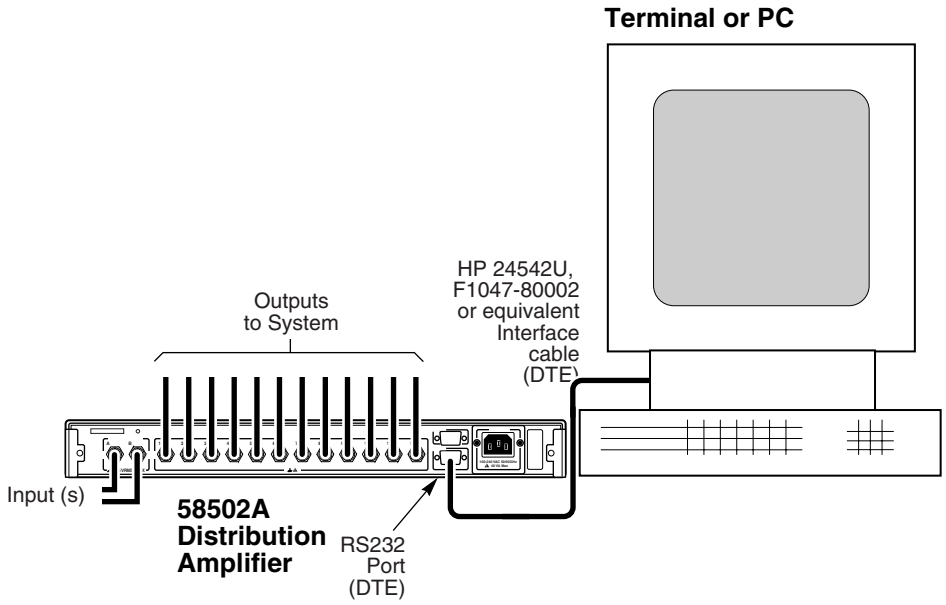


Figure 1-3. Inputs and Outputs Connections For Your System (Terminal or PC is Optional)

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Using Commands to Control Key Functions (Examples)

Overview

This section provides you with specific program command examples that perform particular tasks. Enter the examples at the **scpi>** prompt exactly as they appear to avoid creating an error.

If you accidentally make a mistake:

- enter the *CLS command to clear the error queue, then
- re-enter the correct command string at the **scpi>** prompt.

There are four types of signal distribution that can be used with the 58502A:

- Distribution of one input (A or B)
- Distribution of two inputs (A and B)
- Distribution of input A with internal backup oscillator (OCXO)
- Distribution of the internal backup oscillator (OCXO) only

Each of the above require a different set of commands to be used with this instrument. See the subsection “Setup Commands for the Different Distribution Applications” starting on page 1-12.

There are tasks that are common to all distribution applications. These are:

- Checking the Output Channels Status
- Changing the RS-232 Serial Port Characteristics

The example commands to perform these tasks are described in the subsection “Commands That Are Common to All Distribution Applications” starting on page 1-14.

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Setup Commands for the Different Distribution Applications

Distributing One Input Signal (A or B)

To determine which input channel is active:

enter INP:A:QUES?, and press Return,

or

enter INP:B:QUES?, and press Return.

If 0 is returned, input signal is present. If 1 is returned, input signal is absent. The 58502A will distribute the one signal present regardless of which input channel is used.

Distributing Two Input Signals (A and B)

To Check the Input A Channel Signal Status

Enter INP:A:QUES?, and press Return.

If 0 is returned, input signal is present. If 1 is returned, input signal is absent.

To Check the Input B Channel Signal Status

Enter INP:B:QUES?, and press Return.

If 0 is returned, input signal is present. If 1 is returned, input signal is absent.

To Select the Input A Channel

Enter INP:SEL A, and press Return.

Enables the A input. Use the query form INP:SEL? to see which input channel is currently in use.

To Select the Input B Channel

Enter INP:SEL B, and press Return.

Enables the B input. Use the query form INP:SEL? to see which input channel is currently in use.

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To Check the Input Channel Automatic Switching Status

Enter INP:SEL:AUTO?, and press Return.

If 0 is returned, automatic switching is disabled. If 1 is returned, automatic switching is enabled.

To Enable the Input Channel Automatic Switching

Enter INP:SEL:AUTO 1, and press Return.

To Disable the Input Channel Automatic Switching

Enter INP:SEL:AUTO 0, and press Return.

Distributing Input A and Backup Oscillator (Option 010) Signals

To Check the Input A Channel Signal Status

Enter INP:A:QUES?, and press Return.

If 0 is returned, input signal is present. If 1 is returned, input signal is absent.

To Verify that the Internal Oscillator (Option 010) is Producing 10 MHz

Enter ROSC:QUES?, and press Return.

If 0 is returned, oscillator output is normal. If 1 is returned, oscillator output is questionable.

To Check the Input Channel Automatic Switching Status

Enter INP:SEL:AUTO?, and press Return.

If 0 is returned, automatic switching is disabled. If 1 is returned, automatic switching is enabled.

To Enable the Input Channel Automatic Switching

Enter INP:SEL:AUTO 1, and press Return.

To Disable the Input Channel Automatic Switching

Enter INP:SEL:AUTO 0, and press Return.

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Distributing of the Backup Oscillator (Option 010) Signal Only

Just apply ac power to the 58502A. After powerup, allow the oscillator to warm up for 5 minutes before using the signal. You do not have to send a command. The oscillator will provide the output signals.

Commands That Are Common to All Distribution Applications

Checking the Output Channels Status

To Use Unpacked Integer to Check Output Channels

Enter OUTP:QUES:UNP?, and press Return.

A string of 12 digits, consisting of 0s and 1s, is returned. The leftmost digit designates channel 1 and the rightmost digit stands for channel 12. *A 0 indicates that the associated output is functional*, *while a 1 indicates an output fault*. For example, the following string indicates that channels 2 and 7 are not functioning - 0,1,0,0,0,0,1,0,0,0,0,0.

To Use Packed Integer to Check Output Channels

Enter OUTP:QUES:PACK?, and press Return.

An array of Boolean returns. The returned string provides status on each 10 MHz output in a single packed integer. Each bit is associated with an output channel. The least significant bit = chan 1, next bit = chan 2, and so on. If a bit is 0, the output signal is present. Hence, a value of 0 shows indicates that all outputs are functioning. If there was no output from channels 2 and 3, the response would be:
6 (1*0 + 2*1 + 4*1 + 8*0 + ... = 6).

To Check the Alarm Status

Enter ALAR?, and press Return.

If 0 is returned, alarm is off. If 1 is returned, alarm is on.

To Check for Serial-Port Errors

Enter SYST:ERR?, and press Return.

An integer and quoted string are returned. The first parameter is the error number and the quoted string is the error description.

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To Check Instrument Identification

Enter *IDN?, and press Return.

A quoted identification string is returned, similar to the following:

HEWLETT-PACKARD, 58502A,3426A–00123,3422 – A

To Clear the Error Queue

Enter *CLS, and press Return.

The error message disappears and the **scpi>** prompt returns.

Changing the RS-232 Serial Port Characteristics

Refer to the subsections “Making Changes to the Serial Port Settings (If Needed)” and “Determining the Serial Port Settings” on page 3-8 in Chapter 3 for complete details and cautions concerning the use of these commands. Always remember to make corresponding changes to your PC serial-port parameters after changing the instrument’s serial-port characteristics.

At first power-on from the factory, serial-port settings are as follows:

- Full Duplex is *ON* (can be turned OFF)
- Baud rate is *9600* (can also be set to 1200, 2400, or 19200)
- Data bits is *8* (set by parity = None)
- Pace is *NONE* (can be changed to XON)
- Parity is *NONE* (can also be set to ODD or EVEN for 7 data bits)

If you need to change one of these, enter the desired parameters appended to the following commands for the stated purpose.

To Turn Off Full-Duplex Communication

Enter SYST:COMM:SER:FDUP 0, and press Return.

To Turn On Full-Duplex Communication

Enter SYST:COMM:SER:FDUP 1, and press Return.

To Check If Full-Duplex Communication is On or Off

Enter SYST:COMM:SER:FDUP?, and press Return.

If 1 is returned, duplex is on. If 0 is returned, duplex is off.

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To Set Baud Rate, Pacing, Parity, and Data Bits

To set the baud rate, for example, to 19200, enter SYST:COMM:SER:BAUD 19200 and press Return.

To set pacing, for example, to XON enter SYST:COMM:SER:PACE XON and press Return.

To see how pacing is currently set, enter SYST:COMM:SER:PACE? and press Return.

To set parity, for example, to ODD enter SYST:COMM:SER:PARITY ODD and press Return.

To see what data bits are set, enter SYST:COMM:SER:BITS? and press Return.

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2

Performance Tests

Verifying Specifications

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Introduction

This chapter provides procedures to test the electrical performance of the 58502A Distribution Amplifier specifications listed in Chapter 7, "This chapter provides electrical specifications and supplemental characteristics for the 58502A Broadband Distribution Amplifier. Electrical specifications describe the instrument's warranted performance. Supplemental characteristics are intended to provide information useful to apply to the instrument by giving typical or nominal, but non-warranted performance parameters.," of this guide. It also provides calibration procedures for the 58502A units that contain the Option 010 Backup Oscillator.

Three types of testing are provided:

- Operational Verification, *starting on page 2-2*
- Performance Tests, *starting on page 2-2*
- Calibration (Option 010 Only), *starting on page 2-2*

Operational Verification

The Operational Verification test is an abbreviated series of checks that may be performed to give a high degree of confidence that the instrument is operating properly without performing the Acceptance Test. An operational verification is useful for incoming inspection and after instrument repair.

Performance Tests

The Performance Tests verify the specifications listed in Chapter 7, "Specifications." All tests can be performed without access to the inside of the instrument.

Calibration (Option 010 Only)

The recommended 58502A calibration period is 12 months. You may perform calibration more often to obtain greater accuracy. This is dependent on the aging rate of the 58502A's internal reference oscillator and the amount of deviation from the frequency stability needed for your application.

Test Record

The results of the Operational Verification, and Acceptance Test should be recorded on a copy of the Acceptance Test Record, located at the end of this chapter.

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Test Equipment Required

Table 2-1. Recommended Test Equipment

Instrument	Required Characteristics	Recommended Model	Use*
Signal Generator	Frequency Range: 100 kHz to 10 MHz Output Level: +6 to +16 dBm Harmonic Distortion:<-30 dBc Spurious Distortion:<-80 dBc	HP 8663A (or equivalent)	OV, P
Digitizing Oscilloscope	Frequency range: 100 kHz to 100 MHz	HP 54600B (or equivalent)	OV
Universal Counter	Frequency Range: 100 kHz to 100 MHz: >10 digits resolution @ 10 MHz	HP 53131A (or equivalent)	C (for Option 010 only)
10 MHz Reference Source	10 MHz Reference Signal Accuracy: ± 2 X 10^{-12}	HP 5071A (or equivalent)	C
Terminal or computer	Communication software, RS-232 connection	Any Model	OV, P, C
RMS Voltmeter	Accuracy: ± 2% at 3V Full Scale, 1 MHz	HP 3400B (or equivalent)	P
50Ω BNC Feedthrough	_____	HP 10100C (or equivalent)	OV, P, C
RS-232 Interface Cable	DTE-to-DTE 9-pin (f) to 9-pin (f)	HP 24542U (or equivalent)	C
Type N-to-BNC Connector	_____	H P 1250-0780 (or equivalent)	OV, P
50Ω BNC Coaxial Cable (2)	RG-58, 12 meter, male-to-male	HP 10503A (or equivalent)	OV, P, C

* C= Calibration (Option 010 only)
OV = Operational Verification
P = Performance Tests

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58502A Operational Verification

These following procedures check the standalone functionality of the 58502A Broadband Distribution Amplifier.

Equipment

- Signal Generator: HP 8663A
- Oscilloscope: HP 54600B
- 50Ω BNC Feedthrough: HP 10100C *(Use the 50Ω feedthrough if you are using the HP 54600B Oscilloscope; however, if you are not using this scope DO NOT use the 50Ω feedthrough.)*[1]
- BNC Cables (1 meter, male-to-male)

CAUTION Input amplitude at the 58502A input **A** or **B** connector must be below 5 Vrms (+27 dBm) or damage to the Amplifier will occur.

NOTE If any of these verification procedures fail, try repeating them. If failure still occurs, refer to Chapter 6, "Service," in this guide for fault determination and instructions on returning the defective unit for repair.

Outputs (1-12) Verification

1 Apply power to the 58502A and verify successful completion of self-test before proceeding to step 2. (See the subsection "To Connect AC Power" on page 1-5 in Chapter 1 of this guide, if needed.)

NOTE Once the 58502A Distribution Amplifier has powered on, all that is required for operation is an input signal connected to either the input **A** or **B**, located on the rear-panel.

2 Set the HP 8663A Signal Generator to the following conditions:

Frequency: 10 MHz
Wave type: Sinusoidal
Amplitude: +10 dBm

[1] The HP 54600B scope has only 1 MΩ input impedance. It does not allow you to switch or set the impedance to 50Ω.

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3 Connect the equipment as shown in Figure 2-1. (Connect the Signal Generator output to the 58502A's input **A** or **B** rear-panel input, and connect oscilloscope Channel 1 to output **1** port of the 58502A.

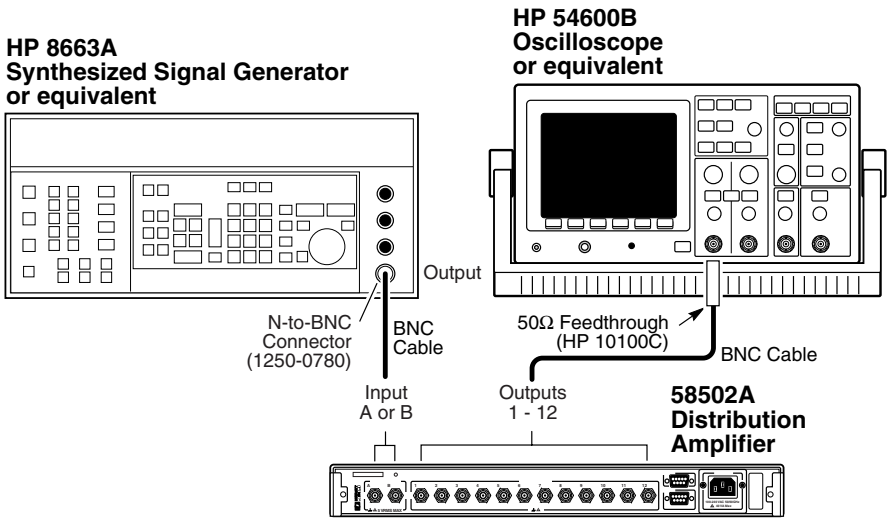


Figure 2-1. Operational Verification Setup

4 Verify that the front-panel **Input A** or **B** and all twelve **OUTPUT STATUS (1-12)** output LEDs are illuminated.

5 Set the oscilloscope to the following:

Channel 1: 0.5 V/div
Timebase: 50 ns/div

6 Connect the oscilloscope to each of the rear-panel output ports in turn to verify that the output signal is a nominal 1 V rms (2.8 Vp-p) sine wave at 10 MHz.

7 Disconnect the signal from the 58502A rear-panel input connector.

8 Verify that all input and output LEDs are off.

This indicates loss of input and output.

9 Mark Pass or Fail in Line 1 on the Operational Verification portion of the 58502A Performance Test Record, located on page 2-14.

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Alarm and Status Output Verification

1 Connect the equipment as shown in Figure 2-2, using output **12** as the test output. (Note that any one of the outputs can be used for this alarm verification.)

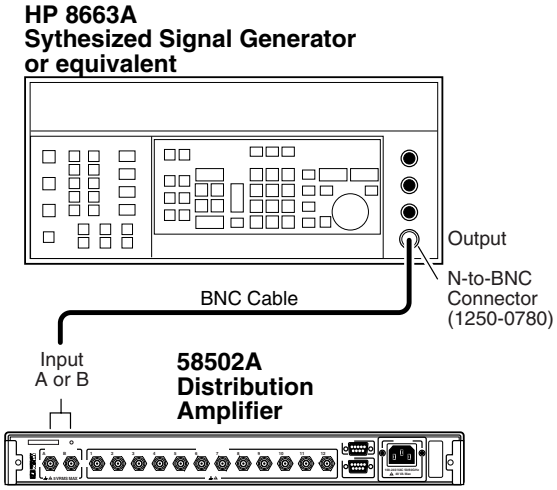


Figure 2-2. Alarm/Status Output Verification Setup

2 Verify the **ALARM/STATUS** output function by shorting to ground any of the outputs (**1-12**). Let's use output **12** as shown in Figure 2-3.

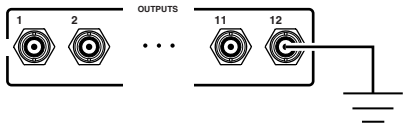


Figure 2-3. Output 12 Grounded

3 Observe that the front-panel **Alarm** indicator illuminates and the **ALARM/STATUS** output pins (2, 3, and 4) go active (TTL low, approximately 20 mV).

Figure 2-4 shows the output pins (2, 3, and 4) and ground pins (1, 5, and 9.

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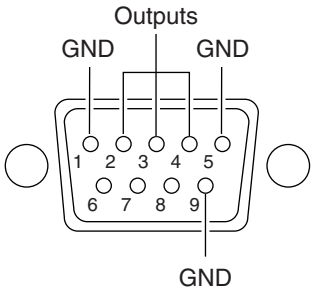


Figure 2-4. ALARM/STATUS Port

If the **Alarm** indicator illuminates and output pins 2, 3, and 4 go low, then all associated **ALARM/STATUS** output circuitry is functional.

4 Mark Pass or Fail in Line 2 on the Operational Verification portion of the 58502A Performance Test Record, located on page 2-14.

This completes the operational verification.

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RS-232 Verification (Optional)

NOTE *You may skip this verification if you do not plan to use the* ***RS232*** *port.*

1 Apply the proper power source to the rear-panel **AC input** jack of the Distribution Amplifier.

2 If you are using the Distribution Amplifier with a Terminal or personal computer (PC), connect it to the rear-panel **RS232** port using an HP 24542U interface cable (or equivalent RS-232 null-modem cable with DE-9S female connectors at each end) as shown in Figure 2-5.

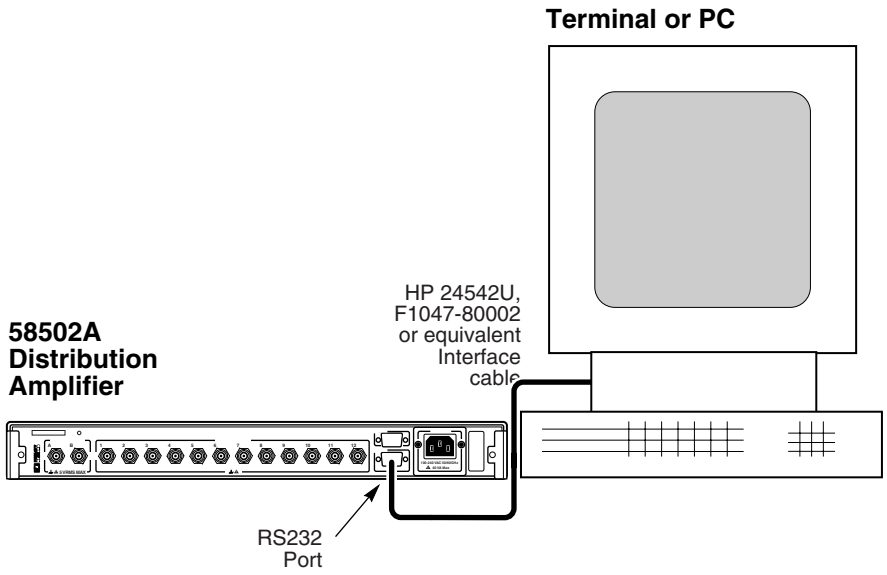


Figure 2-5. RS-232 Verification Setup

3 Turn on the PC or terminal.

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4 Set the RS-232 port of your PC to match the following default values:

Pace:NONE

Baud Rate: 9600

Parity: NONE

Data Bits: 8

Stops Bits: 1

If needed, see "Connecting a Terminal or Computer to the 58502A" starting on page 1-5 in Chapter 1 for information on setting above parameters.

a. Press Return (or Enter) key on the PC.

The **scpi>** prompt should be displayed.

b. At the prompt, type

*IDN?

c. Press Return.

This query returns the 58502A identification similar to the following:

HEWLETT-PACKARD, 58502A,3426A–00123,3422 – A

5 Mark Pass or Fail in Line 3 on the Operational Verification portion of the 58502A Performance Test Record, located on page 2-14.

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58502A Performance Tests

These tests verify the specified electrical performance of the 58502A Distribution Amplifier. The tests do not require access to the inside of the instrument and do not test typical specifications or supplementary characteristics.

If the performance test is to be considered valid, the following conditions must be met:

- Instrument being tested is powered on and warmed up.
- Tests are conducted as presented in this section.
- Tests are conducted under normal operating conditions as stated in Chapter 7, "Specifications."
- Test equipment is selected according to the Table 2-1, "Recommended Test Equipment," on page 2-4.

Equipment

- HP 8663A Signal Generator or equivalent
- HP 3400B RMS Voltmeter or equivalent
- 50Ω BNC Feedthrough: HP 10100C or equivalent *(Use the 50Ω feedthrough if you are using the HP 54600B Oscilloscope; however, if you are not using this scope DO NOT use the 50Ω feedthrough.)*[2]

Input Level Response Tests

A 10 MHz signal is input to the 58502A from a signal generator. The level of this signal is adjusted from +7 dBm to +15 dBm while the twelve Outputs are verified for a 0.707 to 1.12 Vrms signal.

Specifications Tested:
58502A Input Ranges

Minimum Level	+7 dBm
Maximum Level	+15 dBm

58502A Outputs, 50Ω load

Output Level	+13 dBm +1 dB/–3dB

[2] The HP 54600B scope has only 1 MΩ input impedance. It does not allow you to switch or set the impedance to 50Ω.

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Test 1: +7 dBm Input Level

1 Apply power to the 58502A and observe successful completion of self-test.

2 Set the signal generator to:
FREQUENCY: 10 MHz
LEVEL: +7 dBm

3 Connect the signal generator output to the 58502A input **A** or **B** rear-panel input connector as shown in Figure 2-6.

4 Connect the RMS voltmeter via the 50Ω load to the 58502A Output 1 as shown in Figure 2-6.

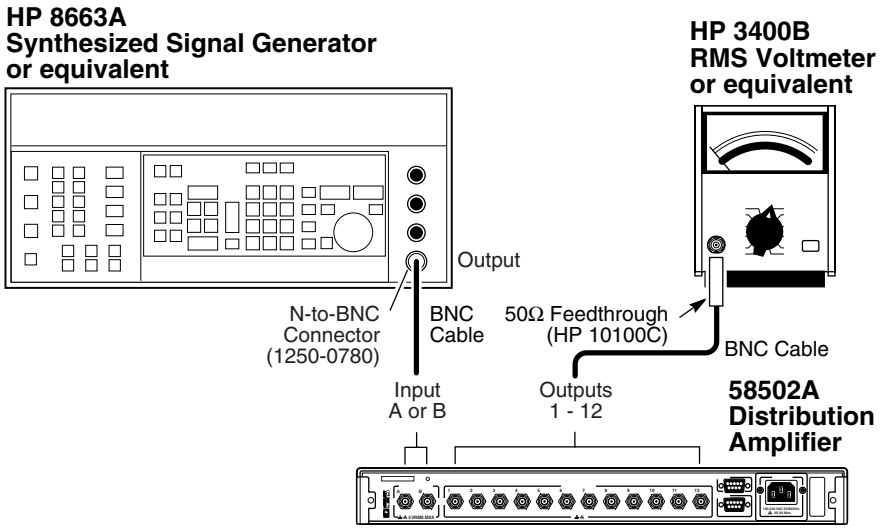


Figure 2-6. Input Level Response Test Setup

5 Set the RMS voltmeter to 3V Full Scale Range.

6 Starting with Output 1, verify that the RMS voltage on each of the twelve Outputs is from 0.707 to 1.12 Vrms.

7 Record the reading of each output channel on the Performance Tests portion of the 58502A Performance Test Record in the Test 1 section, located on page 2-14.

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Test 2: +15 dBm Input Level

1 Using the same test setup (see Figure 2-6) and the RMS voltmeter still set to 3V Full Scale Range, adjust the signal generator to:

LEVEL: +15 dBm

2 Verify that the RMS voltage on each of the twelve Outputs is from 0.707 to 1.12 Vrms.

3 Record the reading of each output channel on the Performance Tests portion of the 58502A Performance Test Record in the Test 2 section, located on page 2-15.

This completes the performance tests.

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58502A Performance Test Record (Page 1 of 2)

Model 58502A
Broadband Distribution Amplifier

Serial Number:_____ Repair/Work Order No._____
Test Performed By:_____ Temperature:_____
Date:_____ Relative Humidity:_____
Notes: _____

Line Number	Operational Verification	Test Results Pass	Fail
1	Outputs (1-12) Verification	____	____
2	Alarm/Status Verification	____	____
3	RS-232 Verification	____	____

58502A Performance Tests
Input Level Response Tests

Test 1: +7 dBm Input Level

Minimum	Actual Reading (Outputs 1 – 12)	Maximum
0.707 Vrms <	1. _____	< 1.12 Vrms
0.707 Vrms <	2. _____	< 1.12 Vrms
0.707 Vrms <	3. _____	< 1.12 Vrms
0.707 Vrms <	4. _____	< 1.12 Vrms
0.707 Vrms <	5. _____	< 1.12 Vrms
0.707 Vrms <	6. _____	< 1.12 Vrms
0.707 Vrms <	7. _____	< 1.12 Vrms
0.707 Vrms <	8. _____	< 1.12 Vrms
0.707 Vrms <	9. _____	< 1.12 Vrms
0.707 Vrms <	10. _____	< 1.12 Vrms
0.707 Vrms <	11. _____	< 1.12 Vrms
0.707 Vrms <	12. _____	< 1.12 Vrms

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58502A Performance Test Record (Page 2 of 2)

58502A Performance Tests (Continued) Input Level Response Tests (Continued)		
Test 2: +15 dBm Input Level		
Minimum	**Actual Reading (Outputs 1 – 12)**	**Maximum**
0.707 Vrms <	1. _____	< 1.12 Vrms
0.707 Vrms <	2. _____	< 1.12 Vrms
0.707 Vrms <	3. _____	< 1.12 Vrms
0.707 Vrms <	4. _____	< 1.12 Vrms
0.707 Vrms <	5. _____	< 1.12 Vrms
0.707 Vrms <	6. _____	< 1.12 Vrms
0.707 Vrms <	7. _____	< 1.12 Vrms
0.707 Vrms <	8. _____	< 1.12 Vrms
0.707 Vrms <	9. _____	< 1.12 Vrms
0.707 Vrms <	10. _____	< 1.12 Vrms
0.707 Vrms <	11. _____	< 1.12 Vrms
0.707 Vrms <	12. _____	< 1.12 Vrms

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58502A Calibration (Option 010 Only)

This section provides procedures to perform routine periodic calibration of the Option 010 Broadband Distribution Amplifier.

Overview

The following procedure uses software commands to calibrate the oscillator.

NOTE The optional oscillator of the 58502A has a specified aging rate of $\pm 5 \times 10^{-10}$ per day ($\pm 1 \times 10^{-7}$/year). Refer to the specifications in Chapter 7 to ensure that the 58502A oscillator has warmed up for a sufficient period of time to make this adjustment.

NOTE When attempting to calibrate the 58502A with the SCPI software commands, you will need to establish serial communication via a terminal or PC.

Frequency adjustments can be made after determining the internal oscillator frequency error of the 58502A. The basic 10 MHz oscillator frequency can be adjusted as required to obtain the desired frequency using the software, SCPI-based EFC adjust that has a control range of 2×10^{-6} maximum with a minimum resolution of 4×10^{-12}.

The software EFC control range is mapped onto a numerical range of values as follows:

Minimum: 0
Maximum: 1,048,575 (2^{20}-1)
Mid-Range: 524,288
Default Step Size: 10,000
Minimum Step Size: 1
Maximum Step Size (LIMIT ON): 35,000

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Equipment

- 10 MHz Primary Frequency or House Standard: HP 5071A (or equivalent)
- Terminal or computer (PC): Any Model with communication software and RS-232 connection
- HP 53131A Universal Counter (or equivalent)
- HP 24542U (or F1047-80002) (or equivalent) Serial Interface Cable
- HP 10100C 50Ω BNC Feedthrough (or equivalent)
- Two BNC Cables (1 meter, male-to-male)

Procedures

Determining Frequency Difference

The frequency difference is measured by synchronizing the frequency counter with a known standard and observing the 58502A frequency output to a resolution of at least 10 digits.

1 Connect 10 MHz reference to HP 53131A Universal Counter's (or equivalent) rear-panel external timebase (Reference) input as shown in Figure 2-7.

2 Connect any output of the 58502A to the Counter's input as shown in Figure 2-7.

3 Set the Counter's gate time to 1-second to display at least 10 digits (10,000,000.000).

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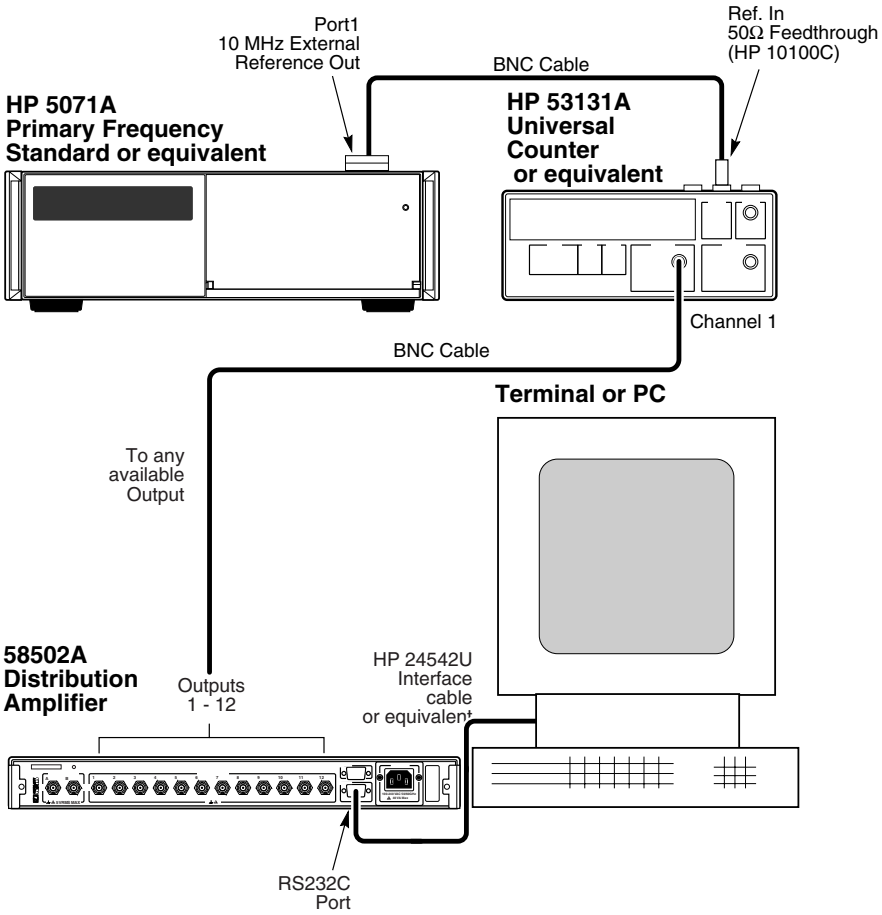


Figure 2-7. 58502A Calibration Setup

4 Observe Counter reading.

If difference from 10 MHz is $<5 \times 10^{-8}$ (0.5 Hz), then perform the "Software Oscillator Adjustment" procedure below.

Software Oscillator Adjustment

1 Use the terminal and serial port to send the following SCPI command to ascertain the EFC value currently applied:

DIAG:CAL:ROSC:EFC:ABS?

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2 Use the terminal and serial port to send one of the following SCPI commands to incrementally adjust the EFC control signal to bring the oscillator frequency closer to 10 MHz:

DIAG:CAL:ROSC:EFC:ABS UP (or)
DIAG:CAL:ROSC:EFC:ABS DOWN

Where UP increases frequency and DOWN decreases frequency.

3 As you approach the proper frequency, change the step size to smaller values by sending the following SCPI command:

DIAG:CAL:ROSC:EFC:ABS:STEP <value>

The default step size is 10,000. A recommended first reduction in size should be to 1,000.

4 Continue to adjust UP or DOWN with finer increments until the frequency output is 10 MHz ± $<1 \times 10^{-9}$ (0.01 Hz).

5 Record the date, EFC value, and frequency value on the Calibration recorded, located on page 2-20.

6 Return the EFC step size to its original value by sending the following SCPI command:

DIAG:CAL:ROSC:EFC:ABS:STEP 10000

This completes the 58502A calibration.

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Calibration Record (Page 1 of 1)

Model 58502A
Option 010 Broadband Distribution Amplifier

Serial Number: _____ Repair/Work Order No. _____

Test Performed By: _____ Temperature: _____

Date: _____ Relative Humidity: _____

Notes: _____

Calibration Dates and Values

Date	EFC Value	Frequency or Frequency Difference
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		

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3

Features and Functions

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Chapter Contents

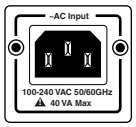
You will find that this chapter makes it easy to look up all the details about a particular feature of the 58502A Broadband Distribution Amplifier.

This chapter is organized as follows:

- Inputs page 3-3
  - AC Input page 3-3
  - INPUTS A and B Ports page 3-3
- Outputs page 3-3
  - OUTPUTS (1-12) Ports page 3-3
  - ALARM/STATUS Port page 3-4
- Indicators page 3-6
  - Power Indicator page 3-6
  - Alarm Indicator page 3-6
  - Input A and B Indicators page 3-6
  - OUTPUT STATUS (1-12) Indicators page 3-6
- Serial Interface Ports page 3-7
  - RS-232 Port page 3-7
  - RS-232 Configuration page 3-7
- Connecting a Terminal or Computer page 3-9
  - To Connect a Terminal or Computer to the 58502A page 3-9
- Different Ways to Check Alarm Status page 3-11
- Configuring the Inputs page 3-11
  - To Configure One Input Operation page 3-11
  - To Configure Two-Input Operation page 3-11
  - To Configure the Internal Oscillator as a Backup (Option 010) Input page 3-12
  - To Configure the Internal Oscillator as the Only Source Input (Option 010) page 3-12

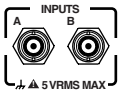
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Inputs



AC Input

This rear-panel ac power module or jack senses the incoming voltage and automatically selects the proper setup. The nominal ac input range is 100-132, 175-240 Vac, 47-63 Hz, 40 VA.



INPUTS A and B Ports

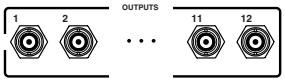
These rear-panel 50Ω BNC input connectors or ports allow two-input signal connection to the 58502A. These ports will accept sinusoidal signals, ranging from 100 kHz to 10 MHz with power level of +7 to +15 dBm.

These ports form a 2-to-1 auto-switch. When the 58502A detects that one of its inputs is removed or the amplitude of the input is greatly reduced, it will automatically switch to the other input. Thus, the auto-switch feature ensure your critical frequencies are always present.

Only one input is used at a time. Factory default is set to input **A** over **B** if valid signals are present at both ports.

If input A signal goes away while there is a signal at input B, the auto-switching feature automatically switches to using the input B signal. However, if the input A signal returns, the 58502A will continue to use the input B signal. It will not return to using the input A signal until you send the SCPI commands INP:SEL A *and* INP:SEL:AUTO 1.

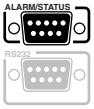
Outputs



OUTPUTS (1-12) Ports

These twelve 50Ω BNC, rear-panel connectors or ports allow distribution of sinusoidal signals (ranging from 100 kHz to 10 MHz) with very low phase noise and signal distortion. The isolated output signals are derived from a single sine wave input signal, from input **A** or **B**. The outputs have fixed and identical characteristics, and retain the integrity (that is, frequency, amplitude, phase, etc.) of the input signal. The state of each distributed output signal is communicated via the front-panel indicators or LEDs, and can be monitored at the **ALARM/STATUS** port.

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ALARM/STATUS Port

This DE-9P (male) subminiature D connector or port allows you to monitor the status of the 58502A via pins 2, 3, and 4 (see Table 3-1). This port also allows you to receive compatible BITE (Built In Test Equipment) alarm inputs from the 58503A GPS Time and Frequency Reference Receiver and the HP 5071A Primary Frequency Standard via pins 6 and 7.

The pin assignments are described in Table 3-1.

Table 3-1. ALARM/STATUS Port Pin Assignments

Pin Number	Signal	Description
1, 5, 9	GROUND	Signal return, ground potential.
2, 3, 4	ALARMS OUT	TTL
6, 7	ALARMS IN	TTL
8	_____	Do not use or ground.

See the section “Different Ways to Check Alarm Status,” which discusses three different ways you can check the alarm status of the 58502A.

ALARM/STATUS Port Outputs

The output pins (2, 3, and 4) of this port, shown in Figure 3-1, allow you to monitor the status of the 58502A. Output pins 2, 3, and 4 are a TTL high (3.5 Vdc, minimum) when operation is normal, and TTL low (1.5 Vdc, maximum) if there is an alarm.

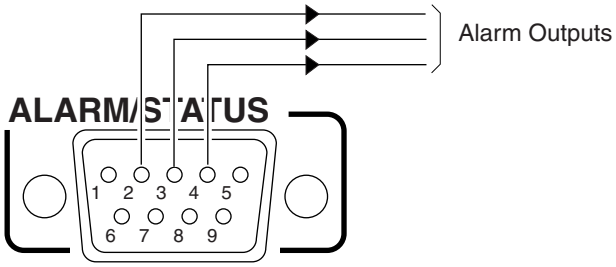


Figure 3-1. Alarm Outputs

All of the output pins are at a TTL high when there is no alarm condition. When an alarm condition exists, all of the output pins drop to a TTL low. These outputs echo the state of front-panel **Alarm** indicator.

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ALARM/STATUS Port Inputs

The input pins (6 and 7) of this port are shown in Figure 3-2. The input pins are a TTL high (3.5 Vdc, minimum) when operation is normal, and TTL low (1.5 Vdc, maximum) if there is an alarm.

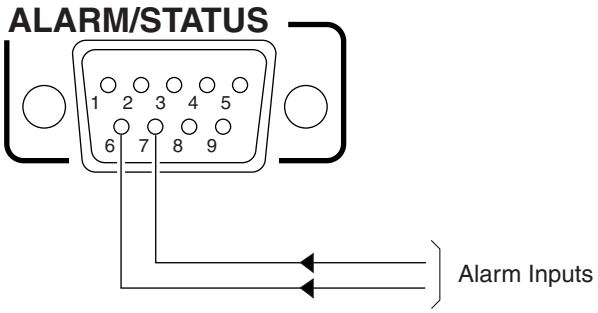


Figure 3-2. Alarm Inputs

Always connect the input **A** input device to pin 6 of the **ALARM/STATUS** connector, and connect the input **B** input device to pin 7. Do NOT use or ground pin 8.

When an alarm input from the device connected to input **A** is received by the 58502A, the 58502A switches to using the backup signal (input **B**) as the source signal, and automatically reflects the alarm in its own alarm outputs and routes this information to pin 6 of the **ALARM/STATUS** connector. Conversely, similar actions occur when an alarm input from the device connected to input **B** is received by the 58502A, except the alarm information is routed to pin 7 of the **ALARM/STATUS** connector.

The INP:ALARM? query returns the alarm status of frequency sources connected to pins 6 and 7. See Chapter 4, “Command Reference,” for details on this query.

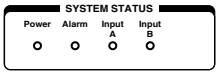
The following paragraphs provide an example on how the alarm system works.

Let’s say you connected the HP 5071A Primary Frequency Standard signal to input **A**, and connected the 58503A GPS Receiver signal to input **B**. Then you connected the HP 5071A status output to pin 6 of the **ALARM/STATUS** port, and the 58503A alarm output to pin 7. (The common or return for these signals should be connected to pin 9, ground. You need to make a special cable for these connections.)

If the HP 5071A fails and sends an alarm, the 58502A will automatically switch to the backup input signal from the 58503A on input **B**. Using INP:ALARM? query would return 1,0,0, indicating that the alarm occurred in the device connected to pin 6.

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Indicators



Power Indicator

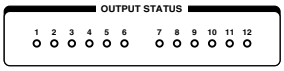
This indicator lights when the input power is supplied to the 58502A. The indicator cannot be set or queried via the serial interface.

Alarm Indicator

This indicator lights when an alarm is detected in the distribution system. Illumination of this indicator could mean that one or more outputs are at fault, or an input signal is absent at both inputs A and B, or the 58502A has received alarm signals from the external precision frequency sources.

Input A and B Indicators

These indicators light when a sinusoidal input signal is present at input A or B.

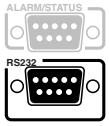


OUTPUT STATUS 1-12 Indicators

These indicators light when the associated outputs are functioning.

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Serial Interface Ports



RS-232 Port

This 9-pin male subminiature D (DE-9P) rear-panel connector is a RS-232 DTE configuration serial interface port. It allows serial interface connection to an external computer for remote operations.

This serial interface port allows you to remotely control and monitor the 58502A.

See the section “Connecting a Terminal or Computer” starting on page 3-9 for information on interface cable use.

RS-232 Port Configuration

Software pacing, baud rate, parity, data bits, and stop bits parameters for this interface are user-selectable. Table 3-2 shows the factory default settings and the commands to send to change them.

Table 3-2. RS-232 Port Interface Factory Default Values and Commands.

Parameter	Default	Command	Possible Choices
Software Pacing	NONE	SYST:COMM:SER:PACE	XON or NONE
Baud Rate	9600	SYST:COMM:SER:BAUD	1200, 2400, 9600, or 19200
Parity	NONE	SYST:COMM:SER:PAR	EVEN, ODD, or NONE
Data Bits	8	SYST:COMM:SER:BITS	7 or 8
Stops Bits	1	No command exists	Fixed (no choices available)
Full Duplex	ON	SYST:COMM:SER:FDUP	ON or OFF

Procedures for configuring the RS-232 ports are provided in the following subsections.

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Making Changes to the Serial Port Settings (If Needed)

CAUTION

If you change the serial port settings, your changes will be stored in the 58502A. Cycling power will not reset to factory defaults. Therefore, if you make a change, it is recommended that you record the settings and keep the record with the 58502A.

If you need to change the serial port settings, for example, to set up for a different computer, use the guidelines given in this section.

Serial port settings are changed by issuing commands.

It is recommended that you issue a single compound command which simultaneously sets all the serial port parameters. Then connect the other computer and begin using the instrument with the new settings.

NOTE

If you choose to set parameters one at a time, you will make the procedure more difficult. That is, with each change, the instrument will be updated, but your computer will retain its original settings. At each step, you will have stopped serial communications and be forced to modify your PC settings to match the 58502A in order to continue. It is recommended that you make all changes in a single compound command, verify the changes, and record all parameters.

The command line below would set the RS-232C port pacing to XON, baud rate to 2400, and parity to EVEN.

```
SYST:COMM:SER:PACE  XON; BAUD  2400; PARITY  EVEN
```

Determining the Serial Port Settings

If you connect your PC, press Return, and do not get a **scpi>** prompt back from the 58502A, your 58502A's serial communication settings may have been modified. You need to systematically step through the data communication settings on your PC until your PC matches the 58502A. The 58502A cannot communicate its settings until this process is complete.

Iterate until you are able to verify that settings on your PC match the 58502A.

When you are successful, you will have restored full RS-232 communications, enabling you to query the 58502A's communication settings. Once you establish communications with the serial port, you can query the 58502A for settings of the port.

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Issue the following queries to the serial port to verify its configuration.

```
SYST:COMM:SER:PACE?
SYST:COMM:SER:BAUD?
SYST:COMM:SER:PARITY?
SYST:COMM:SER:BITS?
SYST:COMM:SER:SBITS?
```

Connecting a Terminal or Computer

To connect the 58502A to a terminal or computer, you must have the proper interface cable. Most computers are DTE (Data Terminal Equipment) devices. Since the 58502A is a DTE device, you must use a DTE-to-DTE interface cable when connecting to a computer. These cables are also called “null-modem” cables. The rear-panel **RS232** port is DTE.

The interface cable must also have the proper connector on each end and the internal wiring must be correct. Connectors typically have 9 pins (DE-9 connector) or 25pins (DB-25 connector) with a “male” or “female” pin configuration. A male (m) connector has pins inside the connector shell and a female (f) connector has holes inside the connector shell.

To simplify interface cable selections, the following subsections tell you which cables to use.

To Connect a Terminal or Computer to the 58502A

Use an HP 24542U interface cable (or equivalent RS-232 null-modem cable with DE-9S female connectors at each end) to connect the 58502A’s rear-panel **RS232** port to a terminal or computer as shown in Figure 3-3.

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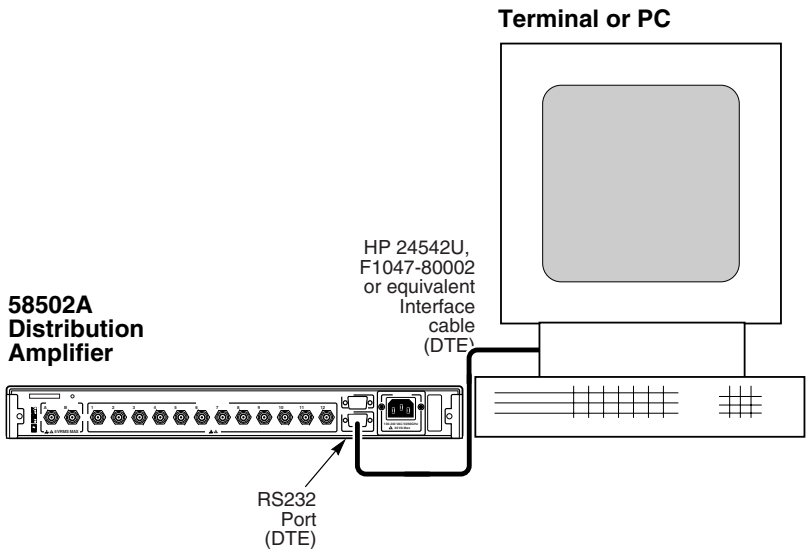


Figure 3-3. Connecting a PC or Terminal to the 58502A

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Different Ways to Check Alarm Status

The 58502A provides three ways to check its alarm status: visually viewing the front-panel indicators, querying for status via the **RS232** port, and monitoring the **ALARM/STATUS** port.

Configuring the Inputs

The 58502A Broadband Distribution Amplifier can be manually operated, or operated with a computer or terminal for enhanced features.

The 58502A can be manually operated in all four modes of operation as described in the following paragraphs.

To Configure One Input Operation

Connect the input signal to either input A or B. The input signal will appear on all twelve outputs.

To Configure Two-Input Operation

Connect the primary or preferred input signal to input **A,** and connect the secondary input to input **B**. The input signal will appear on all twelve outputs. If the primary input fails the 58502A will automatically switch to input **B**, and the secondary input signal will appear on all twelve outputs.

NOTE

If input A signal goes away while there is a signal at input B, the auto-switching feature automatically switches to using the input B signal. However, if the input A signal returns, the 58502A will continue to use the input B signal. It will not return to using the input A signal until you send the SCPI commands INP:SEL A and INP:SEL:AUTO 1.

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To Configure the Internal Oscillator as a Backup (Option 010)

Connect the input signal to input **A** . Then connect the 58502A to ac power. The internal oscillator will provide the source signal for the 58502A only if input **A** signal fails. After powerup, allow the oscillator to warm up for *5 minutes* before using the signals.

To Configure the Internal Oscillator as the Only Source Input (Option 010)

If the 58502 Distribution Amplifier contains the optional quartz oscillator (Option 010), you only need to connect the 58502A to ac power. The oscillator will provide the output signals. After powerup, allow the oscillator to warm up for at least *5 minutes* before using the signals.

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4

Command Reference

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Chapter Contents

This chapter provides a description for each command that can be used to operate the 58502A Broadband Distribution Amplifier.

This chapter is organized as follows:

- SCPI Conformance page 4-3
  - – Command Syntax Conventions page 4-3
  - – IEEE 488.2 Common Commands page 4-3
- 58502A Command Summary page 4-4
- System Status Reporting Commands page 4-6
- Identification Command page 4-8
- Internal Oscillator Calibration and Status Commands (Option 010 Only) page 4-9
- Input Ports Status and Setup Commands page 4-11
- Serial Interface Communication Commands page 4-13

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SCPI Conformance Information

The Standard Commands for Programmable Instruments (SCPI) commands used in the 58502A are in conformance with the SCPI Standard Version 1992.0.

Command Syntax Conventions

[ ]	An element inside brackets is optional. Note, the brackets are NOT part of the command and should not be sent to the instrument.
1 | 2	Means use either 1 or 2.
<numeric_value>	Means enter a number.
POSition	Means you MUST use either all the uppercase letters or the entire word. The lowercase letters are optional. For example, POS and POSITION are both valid. However, POSI is not valid. (Note POSition is used here as an example, but this convention is true for all command keywords.) In other words, the short form of the keywords is shown in uppercase.
<n>	The notation <n> ending a command keyword indicates a numeric suffix, used to differentiate multiple instances of the same structure. The numeric suffix is applied to both the short and long forms. The valid range for the value n is specified from an enumerated list, for example [1|2|3], or from a range, for example [1..3] to indicate any of the integers from 1 to 3.
"TSTamp 1"	When you see quotation marks in the command's parameter, you must send the quotation marks with the command.

IEEE 488.2 Common Commands

The Common Commands are general purpose commands that are common to all instruments (as defined in IEEE 488.2). Common Commands are easy to recognize because they all begin with an asterisk or star "*" (for example, *CLS, *IDN?). These commands are generally not related to measurement configuration. They are used for functions like clearing alarms or errors, identification, or setting alarm enables.

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58502A Command Summary

Table 4-1 lists and briefly defines all of the commands that can be used to operate the 58502A.

Table 4-1. 58502A Command Summary

Keyword/Syntax	Parameters	Description
*CLS		Clears error queue.
*IDN?	returns unquoted string	Returns identification string.
:ALARm?	returns 0 or 1	0 = alarm is off, 1 = alarm is on. Alarm is on when any of the outputs are not functional. (There may be additional internal conditions that generate alarm.)
DIAGnostic		Diagnostic Subsystem (**USED WITH OPTION 010 ONLY**)
:CALibration		Node Only
:ROSCillator		Node Only
:EFC		Node Only
:ABSolute	Send: <EFC value> or UP or DOWN	Sets the absolute EFC (electronic frequency control) of the oscillator. Use UP or DOWN to adjust the EFC by the increment specified in the STEP command (see next command). For example, if present EFC value is 1000 and STEP value is 13, :EFC:ABS:UP will increase EFC value to 1013.
:ABSolute?	returns: <EFC value>	Query.
:STEP	<EFC increment value>	Increments the EFC value by this amount.
:STEP?	returns <EFC increment value>	Query.
INPut		INPUT Subsystem
:A:QUEStionable?	returns 0 or 1	Reports if there is a signal present on input A. 0 = signal present 1 = no signal present.
:B:QUEStionable?	returns 0 or 1	Reports if there is a signal present on input B. 0 = signal present (not questionable), 1 = no signal present.
:ALARm?	0,0,0 or 1,0,0 or 0,1,0	Reports the alarm status of devices connected to the input pins (6, 7) of the **ALARM/STATUS** port. 0, 0,0 = no alarm exists. 1, 0,0 = alarm from input **A** devices connected to pin 6. 0,1, 0 = alarm from input **B** devices connected to pin 7.
:SELect	A or B	Enables either Input **A** or Input **B**. Use the query form to see which input is currently in use. This command also disables auto-switching.

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Table 4-1. 58502A Command Summary (Continued)

Keyword/Syntax	Parameters	Description
INPut (Continued)		INPUT Subsystem (Continued)
:AUTO :AUTO?	append 0 or OFF, or 1 or ON returns 0 or 1	Enables or disables the automatic input switching feature. 0 or OFF disables it while 1 or ON enables it. This setting is stored in non-volatile memory. Query.
:DEFault :DEFault?	A or B returns A or B	Selects the default input channel (or port) to be used at powerup. This setting has no impact on auto-switching and does not affect the current input channel selection. This setting is stored in non-volatile memory. Query.
OUTPut:QUEStionable		OUTPut:QUEStionable Subsystem
:PACKed?	returns binary weighted decimal	Provides status on each output in a single packed integer. Each bit is associated with an output channel. The least significant bit = output 1, next bit = output 2, and so on. If bit is 0, output signal is present. Hence value of 0 indicates that all outputs are outputting the source signal. If there was no output from outputs 2 and 3, the response would be: 6 (1*0 + 2*1 + 4*1 + 8*0 + ... = 6)
[:UNPacked]?	returns array of Boolean	Provides status on each output (lowest numbered output to highest). 0 = signal at output, 1 = no signal at output. Same result as PACKed? (see prior command), but information on each output is provided with separate value. If outputs 3 and 5 were not outputting the source signal, the response would be: 0,0,1,0,1,0,0,0,0,0,0,0
[SOURce]:ROSCillator		ROSCillator Subsystem **(USED WITH OPTION 010 ONLY)**
:WARM?	0 or 1	Reports if internal oscillator is warmed up. 0 = not warm. 1 = warm.
SYSTem		SYSTem Subsystem
:COMMunicate:SERial		Node Only
:FDUPlex	0 or 1	Sets duplex. (0 = echo Off, 1 = echo On).
[:RECeive] | TRANsmit		Node Only. There is a single setting of commands under this node for both transmit and receive. Default values are in italics.
:BAUD	<numeric>	Sets the BAUD rate (1200, 2400, *9600*, 19200).
:BITS?	7 or 8	Returns Data Bits set by PARity (7 for odd/even, *8* for *none*).
:PACE	XON | NONE	Sets flow control. (On or *None*).
:PARity		Node Only.
[:TYPE]	EVEN | ODD | NONE	Sets parity. (Odd, Even, or *None*).
:ERRor?	returns integer, quoted string	First parameter is error number, quoted string is error description.

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System Status Reporting Commands

*CLS

This command clears the error queue.

ALARm?

This query returns alarm status of the 58502A.

Returns a single character, 0 or 1.

A value of 0 indicates alarm is off; a value of 1 indicates alarm is on.

If any of the outputs are not functional or there is an input alarm (there may be additional internal conditions that generate alarm), 1 is returned.

If all of the outputs are functional and there is no input alarm, 0 is returned.

OUTPut:QUEStionable:PACKed?

This query returns the status on each output in a single packed integer. Each bit is associated with an output channel. The least significant bit = output 1, next bit = output 2, and so on.

Returns binary weighted decimal

If bit is +0, output signal is present. Hence value of +0 indicates that all outputs are outputting the source signal. If there was no output from outputs 2 & 3, the response would be:

+6 (1*0 + 2*1 + 4*1 + 8*0 + ... = 6)

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OUTPut:QUEStionable[:UNPacked]?

This query returns the status on each output (lowest numbered output to highest).

Returns array of Boolean.

0 = signal at output; 1 = no signal at output. Same result as PACKed? (see prior command), but information on each output is provided with separate value. If outputs 3 and 5 were not outputting the source signal, the response would be:

+0,+0,+1,+0,+1,+0,+0,+0,+0,+0,+0,+0

SYSTem:ERRor?

This query returns the oldest error in the Error Queue and removes that error from the queue (first in, first out)

Returns an error number.

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Identification Command

*IDN?

This query returns the 58502A identification.

A sequence of ASCII-encoded bytes:

HEWLETT-PACKARD, 58502A, XXXXY–ZZZZZ, WWWW – V

where 58502A is the product model number, XXXXYZZZZZ is the product serial number, and WWWW is the product's firmware revision date code, and V is the hardware revision letter.

In the product serial number (XXXXY–ZZZZZ):

– XXXX is a four-digit prefix that identifies a series of instruments.

– Y identifies the country in which the instrument was manufactured (e.g., the "A" in 3752A000123 stands for America).

– ZZZZZ is a five-digit suffix that identifies a particular instrument within a series.

For example,

HEWLETT-PACKARD, 58502A, 3752A–00123,3422 – A

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Internal Oscillator Calibrating and Status Commands (Option 010 Only)

DIAGnostic:CALibration:ROSCillator:EFC:ABSolute UP | DOWN

This command sets the absolute EFC (electronic frequency control) of the oscillator.

Use UP or DOWN to adjust the EFC by the increment specified in the STEP command described below.

For example, if present EFC value is 1000 and STEP value is 13, DIAG:CAL:ROSC:EFC:ABS:UP will increase the EFC value to 1013.

DIAGnostic:CALibration:ROSCillator:EFC:ABSolute?

This query returns the absolute EFC value of the oscillator.

Returns an integer.

DIAGnostic:CALibration:ROSCillator:EFC:ABSolute:STEP <numeric_value>

This command sets amount by which the absolute EFC value is incremented when being adjustment.

Use an integer for the STEP incremental value (<numeric_value>.

For example, if present EFC value is 1000 and STEP value is 13, DIAG:CAL:ROSC:EFC:ABS:UP will increase the EFC value to 1013.

DIAGnostic:CALibration:ROSCillator:EFC:ABSolute:STEP?

This query returns the incremental step value by which the absolute EFC value is adjusted.

Returns an integer.

[SOURce]:ROSCillator:QUEStionable?

This query reports if the internal oscillator is producing 10 MHz.

Returns a single character, 0 or 1.

A value of 0 indicates oscillator output is normal.

A value of 1 indicates oscillator output is questionable.

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[SOURce]:ROSCillator:WARM?

This query reports if the internal oscillator is warmed up.

Returns a single character, 0 or 1.

A value of 0 indicates oscillator is not warm.

A value of 1 indicates oscillator output is warm.

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Input Port Status and Setup Commands

INPut:A:QUEStionable?

This query reports if there is a signal present on input A.

Returns a single character, 0 or 1.

A value of 0 indicates signal is present (not questionable).

A value of 1 indicates no signal is present.

INPut:B:QUEStionable?

This query reports if there is a signal present on input B or backup oscillator (Option 010).

Returns a single character, 0 or 1.

A value of 0 indicates signal is present (not questionable).

A value of 1 indicates no signal is present.

INPut:ALARM?

This query returns the alarm status of devices connected to the alarm input pins (6 and 7) of the ALARM/STATUS port.

A value of 0,0,0 indicates no alarm exists.

A value of 1,0,0 indicates that an alarm exists from the device connected to pin 6.

A value of 0,1,0 indicates that an alarm exists from the device connected to pin 7.

An example of how to use and interpret the alarm inputs is given on page 3-5 in Chapter 3 of this guide.

INPut:SELect A | B

This command selects either input A or input B or backup oscillator (Option 010) as the input channel. This command also disables auto-switching.

Use A or B to select the appropriate input port.

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INPut:SELect?

This query indicates which input is selected as the source input.

Returns single character, A or B.

INPut:SELect:AUTO 0 | 1

This command enables or disables the automatic input switching feature.

This setting is stored in non-volatile memory.

Use 0 (OFF) to disable auto-switching.

Use 1 (ON) to enable auto-switching.

INPut:SELect:AUTO?

This query returns the state of the automatic input switching feature.

Returns single character, 0 or 1.

A value of 0 indicates disabled.

A value of 1 indicates enabled.

INPut:SELect:DEFault A | B

This command selects the default input channel (or port) to be used at powerup.

This setting has no impact on auto-switching and does not affect the current input channel selection.

This setting is stored in non-volatile memory.

Use A or B to select the appropriate power-up default input port.

INPut:SELect:DEFault?

This query returns default input channel (or port) to be used at powerup.

Returns single character, A or B.

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Serial Interface Communication Commands

SYSTem:COMMunicate:SERial:BAUD <numeric_value>

This command sets the baud rate of the RS-232 port.

The possible baud rate values that can be entered are 1200, 2400, 9600, or 19200.

The baud rate value is stored in non-volatile memory. It is unaffected by powerup.

SYSTem:COMMunicate:SERial:BAUD?

This query returns the baud rate value of RS-232 port.

Returns a an integer.

SYSTem:COMMunicate:SERial:BITS?

This query returns the data bits value of the RS-232 port.

Returns 7 for even or odd parity.

Returns 8 for no parity.

SYSTem:COMMunicate:SERial:FDUPlex ON | OFF

This command sets the duplex state of the RS-232 port. Use this command when you cannot see, on the computer screen, the characters you are typing for your command.

ON enables echoing of the characters you type (i.e., when typing a command, the ON state allows you to see on the computer screen the characters you type).

OFF disables the echoing of the characters you type.

The duplex state is stored in non-volatile memory. It is unaffected by powerup.

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SYSTem:COMMunicate:SERial:FDUPlex?

This query returns the duplex state of the RS-232 port.

Returns a single character, 0 or 1.

A value of 0 indicates echo is OFF; a value of 1 indicates echo is ON.

SYSTem:COMMunicate:SERial:PACE XON | NONE

This command sets flow control of the RS-232 port.

The choices are XON or NONE.

The software pacing or flow control state is stored in non-volatile memory. It is unaffected by powerup.

SYSTem:COMMunicate:SERial:PACE?

This query returns the flow control state of the RS-232 port.

Returns XON or NONE.

SYSTem:COMMunicate:SERial:PARity EVEN | ODD | NONE

This command sets parity of the RS-232 port.

The choices are EVEN, ODD, or NONE.

The parity state is stored in non-volatile memory. It is unaffected by powerup.

If parity is enabled, the 58502A sends/receives 7 data bits plus 1 parity bit. If parity is disabled, the 58502A sends/receives 8 data bits.

SYSTem:COMMunicate:SERial:PARity?

This query returns the parity setting of the RS-232 port.

Returns EVEN, ODD, or NONE.

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5

Functional Description

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Introduction

This chapter gives a simplified functional description of the 58502A Broadband Distribution Amplifier. The 58502A provides twelve-channel isolation and distribution for a input timing signal, which frequency can range from 100 kHz to 10 MHz.

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Functional Block Description of the 58502A

The 58502A electronic circuits consist of five primary blocks:

- Controller
- Panel LEDs
- 2-to-1 Switch
- 1-to-12 Amplifiers and Isolators
- Power Supply Module

Figure 5-1 is a simplified, overall-block diagram the 58502A circuitry.

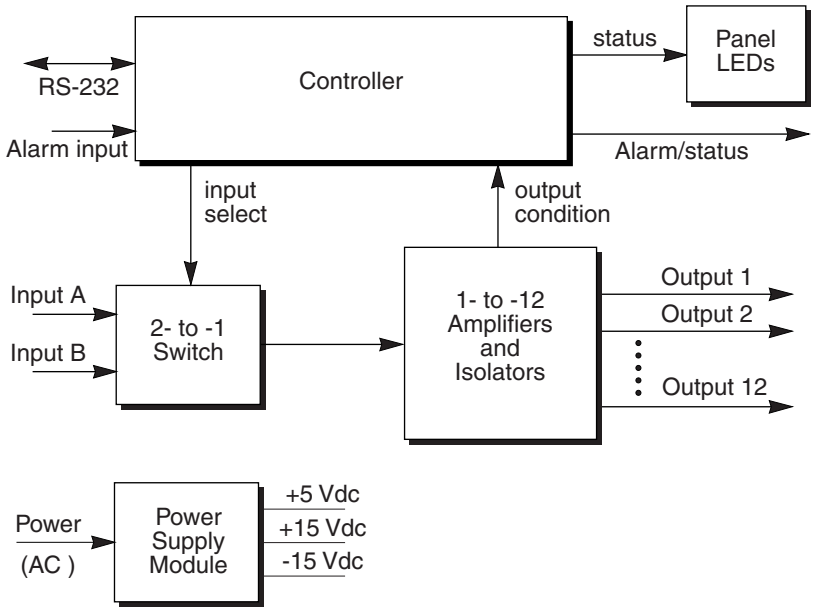


Figure 5-1. Simplified Block Diagram

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Controller Block

This block provides remote instrument management via commands transferred through the RS-232 serial port. It also provides hardware output alarm signals via the Alarm/Status connector that go active when the controller block lights the front-panel system status alarm indicator. Alarm inputs are received and processed by the controller block.

The block consists of a microprocessor and associated support circuitry that together facilitate control of all internal housekeeping, command actions, diagnostic, and system status instrument functions. All instrument functions are controlled and/or monitored by this block.

Panel LEDs Block

This block consists of hardware that provides visual indicators for the operating status of instrument power, system alarm, inputs A and B, and distribution amplifier channels 1 through 12. During normal operation the power, all output status, and one or both input system status indicators should illuminate.

If an effective input signal is lost (absent on both inputs A and B), then both input A and B, and all output status indicators will be extinguished, and the alarm indicator will be lit. If a hardware fault occurs on one or more output distribution channels, then that channel's associated indicator will be extinguished and the alarm indicator will illuminate.

2-to-1 Switch Block

This block consists of inputs A and B routed to a programmable switch that provides a single output to the input of the 1-to-12 Amplifiers and Isolators block. Input selection switching for this block is controlled by the input select line that arrives from the controller block.

The controller block input select line state (at power on from the factory) selects input A over B, if valid signals are present at both connectors, but will switch to input B automatically, if the signal at input A fails. If input B fails and input A signal reappears, the controller block will select input A again as the valid input signal source. If both inputs fail, no select line state change will occur.

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1-to-12 Amplifiers and Isolators Block

This block consists of twelve separate individual isolation amplifiers that accomplish the distribution of the source frequency (ranging from 100 kHz to 10 MHz) into twelve available output channels with very low phase noise and signal distortion at the rear-panel output BNC connectors. In addition, each output is impervious to the effects an adjacent channel short or open connection during normal operation.

A single input signal feeds all twelve isolation amplifiers that is routed from the output of the 2-to-1 Switch block. This block includes BITE hardware (Built In Test Equipment) that monitors the presence of all twelve outputs and routes this information to the Controller block via the output condition signal line.

Power Supply Module Block

This block provides +5, +15, and -15 Vdc to all other blocks in the instrument. When ac power is used, it provides fuse protection, steps down, rectifies, filters, regulates, and distributes internal dc power.

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6

Service

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Introduction

This chapter provides the information required to determine if the 58502A Broadband Distribution Amplifier is faulty.

Determining 58502A Fault Status

Use the following procedure to determine fault status of the 58502A Distribution Amplifier.

1 Perform the Power-on Self test as described in Chapter 1, “Getting Started,” of this guide.

If self test passes, go to step 2.

If the test fails, go to step 5.

2 Verify RS-232 serial-port setup and operation as described in Chapter 1, “Getting Started,” of this guide.

If the test passes, go to step 3.

If the test fails, go to step 5.

3 Verify the Alarm/Status output operation as described in the “ALARM/STATUS Verification” subsection in Chapter 2, “Performance Test.”

If pass, go to step 4.

If the test fails twice, go to step 5.

4 If steps 1 through 3 pass successfully, performance the procedures in the section titled “58502A Performance Tests” in Chapter 2, “Performance Test,” of this guide.

If the performance tests pass, Re-check all system input signals and output loads connected to the 58502A and troubleshoot them as required.

If performance tests fail, go to step 5.

5 If any combination of steps 1 through 4 fail, return the instrument for service.

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7

Specifications

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Introduction

This chapter provides electrical specifications and supplemental characteristics for the 58502A Broadband Distribution Amplifier. Electrical specifications describe the instrument's warranted performance. Supplemental characteristics are intended to provide information useful to apply to the instrument by giving typical or nominal, but non-warranted performance parameters.

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Electrical Specifications

Input, A or B

Frequency Range:	0.1 MHz to 10 MHz
Impedance:	50Ω nominal SWR <1.5
Amplitude:	+15 dBm maximum +7 dBm minimum
Connector:	BNC (female)

Outputs (into 50Ω)

Amplitude:	+13 dBm, +1 dB/–3 dB
Harmonics:	<–32 dBc
(for Option 010):	<–20 dBc
Spurious:	<–110 dBc, <–113 typical
(for Option 010):	<–80 dBc
Connector:	BNC (female)

Mechanical Specifications

Weight:	2.95 kg
Shipping Weight:	6.35 kg
Dimensions:	Height: 45 mm Width: 426 mm Depth: 344 mm

Supplemental Characteristics

Outputs

Single Sideband Phase Noise
(1 Hz bandwidth)

Offset Frequency	Phase Noise
100 Hz	<–127 dBc/Hz
1 kHz	<–142 dBc/Hz
10 kHz	<–148 dBc/Hz

Port-to-Port Isolation: <–100 dBc typical
(measured by switching between open and short loads on output port and measuring associated phase noise on adjacent output port)

Environmental Specifications

Temperature

Operating:	0° C to +55° C
Non-operating:	–40° C to +70° C
EMI:	CISPR 11, Group 1, Class B

Remote System Interface and Control

Data Communications:	RS-232C, DTE
Connector:	DE-9P (male)

Alarm/Status Input and Output

Connector:	DE-9P (male)
Normal State:	TTL High
Alarm State:	TTL Low
Output Configuration:	Open-collector output, 10kΩ pull-up to 5 Vdc

Power Requirements

AC Input:	100–132 or 175–240 Vac 47–63 Hz 80 VA Max

Available Options

Option 010:	Internal Backup Oscillator (10 MHz Precision Oven Controlled Quartz Crystal)—replaces Input B
Stability:	
Temperature Stability:	6×10^{-9} (0° C to +55° C)
Aging/Day:	5×10^{-10}
Aging/Year:	1×10^{-7}
Tuning Range:	7×10^{-7} (minimum)
Option AX4:	Rack Mount Kit

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Introduction

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