

Errata

Title & Document Type: 8558B Spectrum Analyzer Operating & Service Manual

Manual Part Number: 08558-90102

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HP References in this Manual

This manual may contain references to HP or Hewlett-Packard. Please note that Hewlett-Packard's former test and measurement, semiconductor products and chemical analysis businesses are now part of Agilent Technologies. We have made no changes to this manual copy. The HP XXXX referred to in this document is now the Agilent XXXX. For example, model number HP8648A is now model number Agilent 8648A.

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OPERATION AND SERVICE MANUAL

8558B SPECTRUM ANALYZER 0.1 – 1500 MHz

(Includes Option 001 and 002)

SERIAL NUMBERS

This manual applies directly to instruments with serial numbers prefixed 2436A.

With modifications described in Section VII, this manual also applies to instruments with serial number prefixes 1914A through 2332A. For instruments with serial number prefixes lower than 1914A, refer to the HP 8558B Operation and Service Manual dated October 1977, HP Part Number 08558-90043, and the Manual Changes supplement supplied with it.

For additional important information about serial numbers, see INSTRUMENTS COVERED BY MANUAL in Section I.

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TABLE 1-4. RECOMMENDED TEST EQUIPMENT (4 OF 4)

Equipment	Critical Specifications	Recommended Model	Use*
<i>Cable</i>	<i>BNC, 75Ω, 60 cm (24 in)</i>	<i>HP 11652-60013</i>	<i>P, A, T</i>
<i>Cable</i>	<i>BNC, 75Ω, 90 cm (37 in)</i>	<i>HP 11652-60014</i>	<i>P, A, T</i>
<i>Adapter</i>	<i>BNC (m) to BNC (m)</i>	<i>HP 1250-1288</i>	<i>P, A, T</i>
<i>Adapter</i>	<i>Type N (m) to SMA (f)</i>	<i>HP 1250-1250</i>	<i>P, A, T</i>

* P = Performance Test; A = Adjustment; T = Troubleshooting

TABLE 1-4. RECOMMENDED TEST EQUIPMENT (3 OF 4)

Equipment	Critical Specifications	Recommended Model	Use*
Adapter	BNC Tee	HP 1250-0781	A
Adapter	Type N (m) to Type N (m)	HP 1250-1475	P
Adapter	BNC (m) to BNC (m)	HP 1250-0216	P
Adapter	Type N (f) to BNC (m)	HP 1250-0077	P
Adapter	SMC (m) to SMC (m)	HP 1250-0827	A, T
Adapter	Type N (m) to SMC (m)	HP 1250-1023	A, T
Adapter	BNC (f) to alligator clips	HP 8120-1292	A, T
Adapter	SMC (f) to SMC (f)	HP 1250-1113	A, T
Adapter	Type N (m) to SMA (f)	HP 1250-1250	P, A
Adapter	BNC (f) to SMA (m)	HP 1250-1200	P
Adapter	SMA (f) to SMA (f)	HP 1250-1158	P
Extender Board	6 pin, 12 contacts with 51.1Ω resistor from pin 1 to pin 5	HP 08505-60109 HP 0757-0394	A, T
NOTE The following equipment is required for Option 001 and Option 002.			
Termination	<i>Impedance: 75Ω</i>	HP 11652-60010	P
Power Sensor	<i>Frequency Range: 10 MHz to 2 GHz</i> <i>Maximum SWR: 1.18, 10 MHz to 2 GHz</i>	HP 8483A	T
Adapter	<i>75Ω BNC (m) to 75Ω BNC Type N (f)</i>	HP 1250-1534	T
Minimum Loss Adapter	<i>75Ω BNC (f) to 50Ω SMA (m)</i> <i>5.72 dB attenuation</i>	HP 08558-60031	P, A, T
Adapter	<i>BNC (f) to SMA (m)</i>	HP 1250-1200	T
Adapter	<i>SMA (f) to SMA (f)</i>	HP 1250-1158	P, T
Adapter	<i>Type N (f) to Type N (f)</i>	HP 1250-0777	A, T
Cable	<i>BNC, 75Ω, 30 cm (12 in)</i>	HP 11652-60012	P, A, T

* P = Performance Test; A = Adjustment; T = Troubleshooting

TABLE 1-4. RECOMMENDED TEST EQUIPMENT (2 OF 4)

Equipment	Critical Specifications	Recommended Model	Use*
300 MHz LPF	Rejection: >50 dB for signals above 300 MHz	Telonic TPL 300-4AB	P, A, T
Power Splitter	Frequency Range: 100 kHz to 1.5 GHz Input SWR: ≤1.15	HP 11667A	P, A
Directional Bridge	Frequency Range: 900 kHz to 30 MHz	HP 8721A	P
10 dB Attenuator (2 required)	Frequency Range: 100 kHz to 1.5 GHz Accuracy: ± 0.5 dB	HP 8491A, Opt. 010	P, A
Step Attenuator	Frequency Range: 20 MHz to 305 MHz Attenuation: 12 dB in 1 dB steps calibrated at 30 MHz by a standards lab Accuracy: ± 0.25 dB	HP 355C, Opt. H80	P, A, T
Step Attenuator	Frequency Range: 20 MHz to 305 MHz Attenuation: 80 dB in 10-dB steps calibrated at 30 MHz and 280 MHz by a standards lab Accuracy: ± 0.01 dB ± 0.02/10 dB step at calibrated frequencies	HP 355D, Opt. H82	P, A, T
Termination	Impedance: 50Ω	HP 908A/11593A	P, A
Type N Cable	50Ω coaxial cable with Type N (m) connectors on both ends	HP 11500A	P, A
BNC Cable	50Ω coaxial cable with BNC (m) connectors on both ends, 20 cm (9 in)	HP 10502A	P, A, T
BNC Cable (2 required)	50Ω coaxial cable with BNC (m) connectors on both ends, 120 cm (48 in)	HP 10503A	P, A, T
Cable	BNC to banana plug	HP 11001A	P
Cable	SMC (f) to BNC (m)	HP 11592-60001	A, T
Cable	Banana plug to alligator clips	HP 11102A	A
Adapter	Banana plugs to BNC (f)	HP 10111A	P, T
Adapter (3 required)	Type N (m) to BNC (f)	HP 1250-0780	P, A
Adapter	SMC (m) to BNC (m)	HP 1250-0831	P
Adapter	BNC (f) to BNC (f)	HP 1250-0080	P

* P = Performance Test; A = Adjustment; T = Troubleshooting

TABLE 1-4. RECOMMENDED TEST EQUIPMENT (1 OF 4)

Equipment	Critical Specifications	Recommended Model	Use*
Display Mainframe	HP 180T Series with variable persistence	HP 181T/TR	P, A, T
Oscilloscope	Time Base: 1 msec/cm to 10 msec/cm Vertical Sensitivity: 1 mV/cm to 20 V/cm	HP 1741A	A, T
Frequency Counter	Frequency Range: 150 MHz to 1.5 GHz Sensitivity: -30 dBm	HP 5342A	P, A, T
Timer/Counter	Time base: 10 μ sec	HP 5308A	A, T
Digital Voltmeter	Accuracy: $\pm (.05\% \text{ Rdg} \pm 1 \text{ digit})$	HP 3455A	P, A, T
Power Meter	Power Range: -20 dBm to +10 dBm	HP 435A/B	P, A, T
Power Sensor	Frequency Range: 100 kHz to 1.5 GHz Maximum SWR: 1.1, 0.1 to 1 GHz	HP 8482A	P, A, T
Amplifier	Frequency Range: 200 MHz to 300 MHz Gain: >20 dB Impedance: 50 Ω	HP 8447D	P, A, T
Signal Generator (2 required)	Frequency Range: 4 MHz to 305 MHz Drift: Less than 50 ppm (or 5 Hz, whichever is greater) Harmonic Distortion: >30 dB below fundamental Noise Sidebands: >80 dB down, 50 kHz away, 1 kHz BW	HP 8640B	P, A, T
Tracking Generator	Frequency Range: 5 MHz to 1500 MHz	HP 8444A, Opt. 059	P, T
Sweep Oscillator	Manual Sweep	HP 8350A	A
RF Plug-In	Frequency Range: 10 MHz to 1.5 GHz Flatness (external leveling): $< \pm 0.1 \text{ dB}$	HP 83522A	A
Spectrum Analyzer	Frequency Range: 10 MHz to 1.5 GHz	HP 141T/8552B/8555A	T
Comb Generator	Accuracy: 0.01%	HP 8406A	P, A, T
Function Generator	Frequency Range: 5 kHz to 5 MHz	HP 3310A	P, T
Crystal Detector	Frequency Range: 10 MHz to 1.5 GHz Frequency Response: $\pm 0.2 \text{ dB/octave}$ to 2 GHz; $\pm 0.5 \text{ dB}$ overall	HP 423B	A, T

* P = Performance Test; A = Adjustment; T = Troubleshooting

Item	Description	CD	HP Part Number
1	Board Puller, two prongs to lift PC boards	1	03950-4001
2	Extender Board: 6 pin, 12 contacts	8	08505-60109
3	Extender Board: 10 pin, 20 contacts	2	85680-60028
4	Extender Board: 22 pin, 44 contacts	8	08565-60107
5	Extender Cable Assembly, for plug-in operation out of display mainframe	9	5060-0303
6	Tuning Tool, modified 5/16-inch nut driver with modified No. 10 Allen driver	6	08555-60107
7	Alignment tool, metal tip in plastic	7	8710-0630
8	Alignment tool, non-metallic	4	8710-0033
9	Wrench, No. 2 Bristol	0	8710-0055
10	Wrench, 15/64-inch, combination	8	8710-0946
11	Wrench, 1/4-inch, open end	2	8720-0014
12	Wrench, 5/16-inch, slotted box end/open end	9	08555-20097

FIGURE 1-3. SERVICE ACCESSORIES (2 OF 2)



FIGURE 13. SERVICE ACCESSORIES (1 OF 2)

1-40. Extender Cable Assembly

1-41. An Extender Cable Assembly (Figure 1-3), HP Part Number 5060-0303, allows operation of the HP 8558B outside the display mainframe. This provides access to the HP 8558B for necessary adjustments and some performance tests. This cable is also useful for troubleshooting.

1-42. MEASUREMENT ACCESSORIES

1-43. AC Probe

1-44. The HP Model 8558B Spectrum Analyzer has a front-panel PROBE POWER connector for the use of high-impedance active probes such as the HP 1120A, HP 1121A, HP 1123A, and HP 1124A. High-impedance probes permit testing of high-frequency circuits without significant loading effects. The low-noise, AC-coupled HP 1121A is preferred for use with the HP 8558B.

CAUTION

The 75-ohm BNC input connector on Option 001 and 002 instruments is not compatible with 50-ohm BNC connectors. Direct connection of an AC probe might damage the input connector.

001 and 002: The AC probes have a 50-ohm output impedance. Use of a probe with the 75-ohm

Option 001 or 002 without proper impedance matching causes a +1.58 dB error in displayed signal levels.

1-45. Modification Kit (Option 807 Connections)

1-46. A modification kit, HP Part Number 00180-69503, provides the materials and information necessary to install unbuffered rear-panel connections (formerly included in Option 807) in the following display mainframes: 180A/AR, 180C/D, 181A/AR, 182A/C, and 184A/B. Refer to Table 1-3 for a description of parts included in the modification kit.

1-47. Oscilloscope Camera

1-48. The HP Model 197B, Option 002, General Purpose Camera can be used with 180- and 181-series display mainframes to make a permanent record of measurements. The HP 10367A adapter allows the camera to be used with 182-series mainframes.

1-49. SERVICE ACCESSORIES

1-50. Service accessories are shown in Figure 1-3.

1-51. RECOMMENDED TEST EQUIPMENT

1-52. Equipment required for operation verification, performance tests, adjustments, and troubleshooting of the HP Model 8558B is listed in Table 1-4. Other equipment may be substituted if it meets or exceeds the critical specifications listed in the table.

TABLE 1-3. PARTS INCLUDED IN MODIFICATION KIT 00180-69503

Quantity	Description	HP Part Number
1	Output Amplifier Assembly (Auxiliary Output Board)	00180-66551
1	Label	7120-3116
2	3/4-inch pieces of shrink tubing	0890-0720
1	Service Note	180A/AR-10, 180C/D-2, 181A/AR-8, 182A/C-1, or 184A/B-1 (modification is similar for all instruments listed)

1-22. This information should not be confused with information contained in the yellow Manual Updating supplement, which is intended to adapt this manual to instrument changes that are effected after its printing.

1-23. OPTIONS

CAUTION

The two 75-ohm BNC connectors on Option 001 and Option 002 instruments are not compatible with 50-ohm BNC connectors. Direct use of 50-ohm BNC connectors with these instruments might damage the INPUT and CAL OUTPUT connectors.

1-24. Option 001

1-25. Option 001 provides direct-measurement capability in a 75-ohm system. The BNC input and calibration-output connectors have 75Ω impedance (nominal). Option 001 is calibrated in dBm, providing a measurement range from -110 dBm to $+30$ dBm. Throughout the manual, differences between the standard instrument and Option 001 are given in italic type following applicable text references and as necessary in tables and illustrations.

1-26. Option 002

1-27. Option 002 provides direct-measurement capability in a 75-ohm system. The BNC input and calibration-output connectors have 75Ω impedance (nominal). Option 002 is calibrated in dBmV, providing a measurement range from -63 dBmV to $+80$ dBmV. Throughout the manual, differences between the standard instrument and Option 002 are given in italic type following applicable text references and as necessary in tables and illustrations.

1-28. Option 910

1-29. One additional Operation and Service manual is provided for each Option 910 ordered. To obtain additional manuals after initial shipment, order by the manual part number, which appears on the title page and on the back cover.

1-30. ACCESSORIES SUPPLIED

1-31. The following accessories, supplied with the instrument, are shown in Figure 1-1:

1-32. A BNC, 50-ohm termination, HP Model 11593A, is supplied for the front-panel 1ST LO OUTPUT.

1-33. A Type N male to BNC female adapter, HP Part Number 1250-0780, is supplied with the standard instrument for the use of lightweight cables with BNC connectors.

1-34. A side stop kit, HP Part Number 08558-60131, is supplied to prevent the spectrum analyzer from sliding out of the mainframe. When the side stops are installed, the plug-in cannot be removed from the mainframe. Refer to Section II for installation or removal of the side stops.

1-35. Three graticule overlays provide the operator with reference-level labels for the CRT. HP Part Number 5020-8565 is the overlay for 180-series display mainframes. HP Part Number 5020-8566 is the overlay for 181-series display mainframes. HP Part Number 5020-8567 is the overlay for 182-series display mainframes. For proper installation of the graticule overlay, refer to Section II.

1-36. EQUIPMENT REQUIRED BUT NOT SUPPLIED

1-37. Display Mainframe

1-38. An HP 853A digital Spectrum Analyzer Display is recommended for use with the HP 8558B. The rear panel of the HP 853A mainframe provides the following output connections: HORIZONTAL (SWEEP), VERTICAL (VIDEO), BLANK (PENLIFT), 21.4 MHz IF, and HP-IB interface connector.

1-39. An HP 180T-series display mainframe (180TR, 181T, or 182T) is also designed for use with the HP 8558B. In the HP 180T-series mainframe, the rear-panel auxiliary output connectors (AUX A, AUX B, AUX C, and AUX D) provide, respectively, Vertical Output, Pen Lift Output, 21.4 MHz IF Output, and Horizontal Output. A standard HP 180-series display mainframe (HP 180A/AR, HP 180C/D, HP 181A/AR, HP 182A/C, or HP 184A/B) provides only horizontal, vertical, and blanking rear panel outputs. Furthermore, these outputs are attenuated and shifted in dc level. Unbuffered rear panel outputs (similar to the HP 180T-series) are provided only if Option 807 is installed.

TABLE 1-2. HP MODEL 8558B/180-SERIES SUPPLEMENTAL CHARACTERISTICS (3 OF 3)

SUPPLEMENTAL CHARACTERISTICS	
NOTE: Values in this table are not specifications. They are typical characteristics included for user information.	
CAL OUTPUT –30 dBm at 280 MHz with second through fourth harmonics greater than –70 dBm (into 50 ohms). <i>001: –30 dBm at 280 MHz (into 75 ohms)</i> <i>002: +20 dBmV at 280 MHz (into 75 ohms)</i>	AUX A VERTICAL OUTPUT BNC output provides detected video signal from a 50-ohm output impedance. Typical 0–800 mV range corresponds to full 8-division CRT vertical deflection.
1ST LO OUTPUT +10 dBm nominal into 50 ohms, 2.05–3.55 GHz. Terminate with a 50-ohm load when not in use.	AUX B PENLIFT/BLANKING OUTPUT BNC output provides a +15V penlift/blanking signal from a 10K-ohm output impedance when CRT trace is blanked. Otherwise, output is low at 0V (low impedance, 150 mA max.) for an unblanked trace.
PROBE POWER +15V, –12.6V, and GND (150 mA maximum) for use with HP High-Impedance Probes (i.e. HP 1120A, 1121A, 1123A, 1124A). The HP 1121A is recommended for its low noise characteristics. ¹	AUX C 21.4 MHz IF OUTPUT BNC output provides 21.4 MHz IF signal (linearly related to spectrum analyzer RF input) from a 50-ohm output impedance. Output bandwidth controlled by spectrum analyzer RESOLUTION BW setting; output amplitude controlled by INPUT ATTEN, REFERENCE LEVEL FINE, and first six REFERENCE LEVEL positions (i.e. –10 through –60 dBm with 0 dB input attenuation). Output level is approximately –10 dBm into 50 ohms with a signal displayed at Reference Level. <i>002: (i.e. +40 to –10 dBmV with 0 dB input attenuation)</i>
REAR PANEL OUTPUT CHARACTERISTICS²	AUX D HORIZONTAL OUTPUT BNC output provides horizontal sweep voltage from a 5K-ohm output impedance. –5V to +5V range corresponds to full 10-division CRT horizontal deflection.
VERTICAL, PENLIFT/BLANKING, AND HORIZONTAL OUTPUTS (AUX A, B, D) These outputs are compatible with and may be used to drive HP X-Y Recorders (using positive pencoils or TTL penlift input) and CRT monitors.	

¹ See Section II for details regarding use with 001 and 002 75-ohm inputs.

² Rear panel outputs refer to 180T-series display mainframes and other 180-series mainframes with Option 807 installed. Horizontal, vertical, and blanking outputs, attenuated and shifted in dc level, are available on other 180-series mainframes at the MAIN SWEEP, MAIN GATE, and DELAYED GATE outputs, respectively. DO NOT connect an X-Y recorder to the DELAYED GATE OUTPUT, or damage will result.

TABLE 1-2. HP MODEL 8558B/180-SERIES SUPPLEMENTAL CHARACTERISTICS (2 OF 3)

SUPPLEMENTAL CHARACTERISTICS

NOTE: Values in this table are not specifications. They are typical characteristics included for user information.

GAIN COMPRESSION

Gain compression is typically less than 1 dB for a -10 dBm input level with 0 dB input attenuation.

001: -5 dBm input level

002: +45 dBmV input level

AMPLITUDE SCALE SWITCHING

Reference Level variation is typically less than ± 1 dB for any change in Amplitude Scale.

SPURIOUS RESPONSES

SECOND HARMONIC AND THIRD ORDER INTERMODULATION DISTORTION

The graphs below illustrate typical second harmonic and third order intermodulation distortion.

SWEEP CHARACTERISTICS

SWEEP TIME

CALIBRATED SWEEP TIME ACCURACY (Sec/DIV, mSec/DIV)

Sweep times are typically $\pm 10\%$ of indicated value.

MANUAL

Spectrum analyzer may be swept manually, in either direction, with front panel control.

SWEEP TRIGGER

FREE RUN

End of each sweep triggers new sweep.

LINE

Sweep triggered at ac line frequency.

VIDEO

Sweep triggered on post-detection video waveform. One-half major division of vertical deflection required to trigger sweep.

SINGLE

Single sweep started or reset by turning SWEEP TRIGGER clockwise momentarily.

FRONT PANEL INPUT AND OUTPUT CHARACTERISTICS

SIGNAL INPUT

INPUT IMPEDANCE

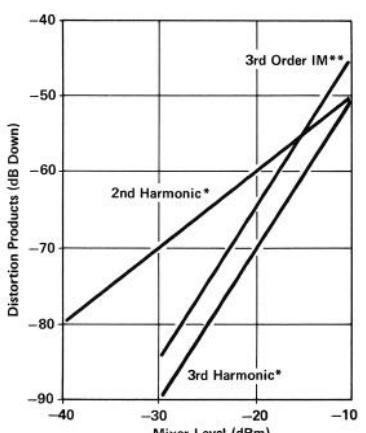
50 ohms nominal; Precision Type N female connector.

001 and 002: 75 ohms nominal; 75-ohm BNC female connector.

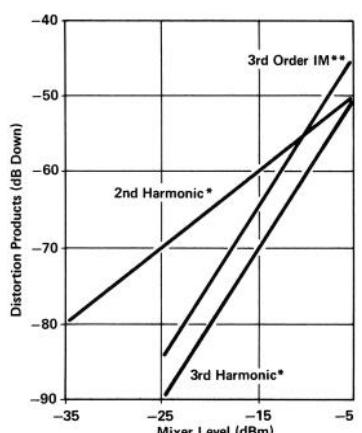
INPUT SWR

<1.5 SWR with ≥ 10 dB input attenuation

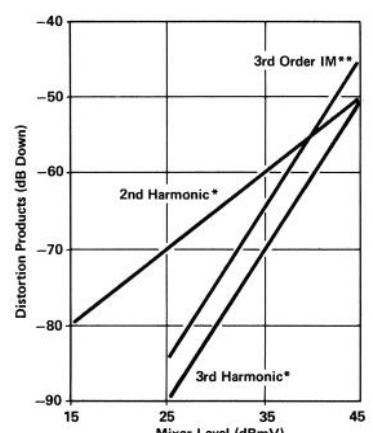
001 and 002: <1.5 SWR



(Standard HP 8558B)



(Option 001)



(Option 002)

Distortion vs. Mixer Level

TABLE 1-2. HP MODEL 8558B/180-SERIES SUPPLEMENTAL CHARACTERISTICS (1 OF 3)

SUPPLEMENTAL CHARACTERISTICS

NOTE: Values in this table are not specifications. They are typical characteristics included for user information.

FREQUENCY CHARACTERISTICS

FREQUENCY ACCURACY

FREQUENCY ZERO

Adjusts digital FREQUENCY MHz readout. FREQUENCY ZERO control may be used to calibrate the frequency readout on a known signal or on the LO feedthrough.

FREQUENCY CAL

Removes tuning hysteresis from first LO (YIG oscillator). FREQUENCY CAL button should be pressed to maintain FREQUENCY MHz readout accuracy whenever TUNING is changed by more than 50 MHz.

FREQUENCY RANGE

OUT-OF-RANGE BLANKING

The CRT trace is automatically blanked whenever the spectrum analyzer is swept or tuned beyond its frequency range (approximately -50 MHz and 1600 MHz).

SPECTRAL RESOLUTION AND STABILITY

FREQUENCY DRIFT

At fixed start/center frequency, after 2-hour warmup: <50 kHz in 10 minutes.

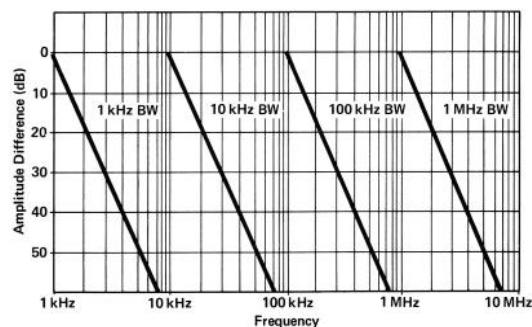
With temperature changes: <200 kHz/°C

RESOLUTION BANDWIDTH SHAPE

Approximately gaussian (synchronously-tuned, 4-pole filter).

SPECTRAL RESOLUTION

The following graph shows typical spectrum analyzer resolution for different resolution bandwidths.



Signal Resolution vs. Frequency Separation

AMPLITUDE CHARACTERISTICS

AMPLITUDE RANGE AND ACCURACY

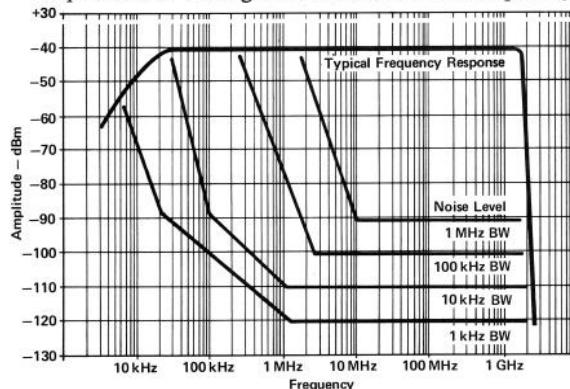
DYNAMIC RANGE

Maximum power ratio of two signals simultaneously

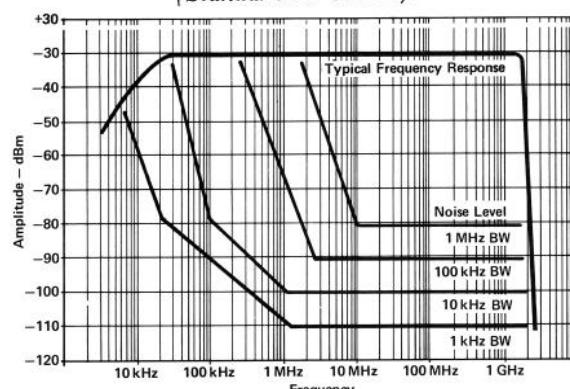
present at the input that may be measured within the limits of specified accuracy, sensitivity, and distortion (i.e. spurious responses): >70 dB

FREQUENCY RESPONSE AND AVERAGE NOISE LEVEL

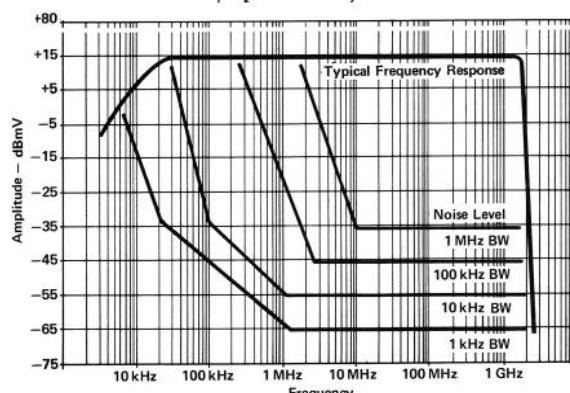
The following graphs show typical frequency response and average noise level versus frequency.



(Standard HP 8558B)



(Option 001)



(Option 002)
Average Noise Level and Frequency Response

TABLE 1-1. HP MODEL 8558B SPECIFICATIONS (4 OF 4)

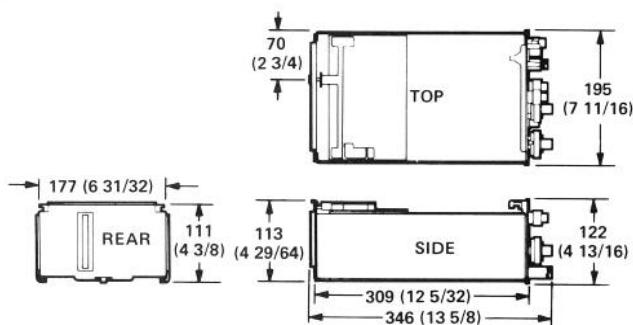
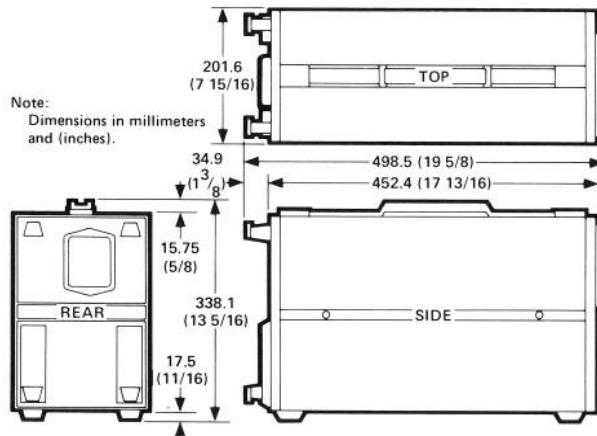
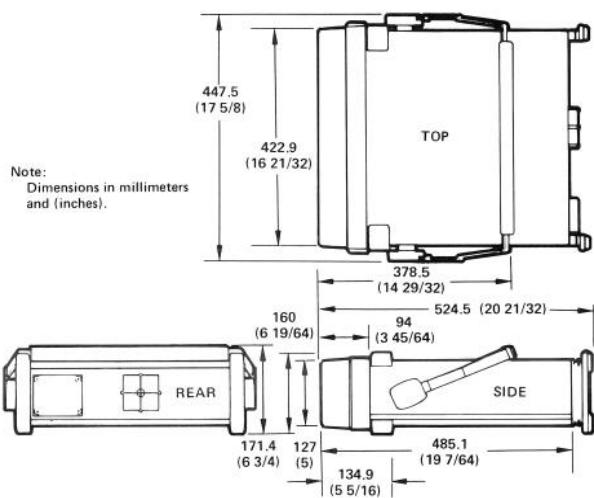
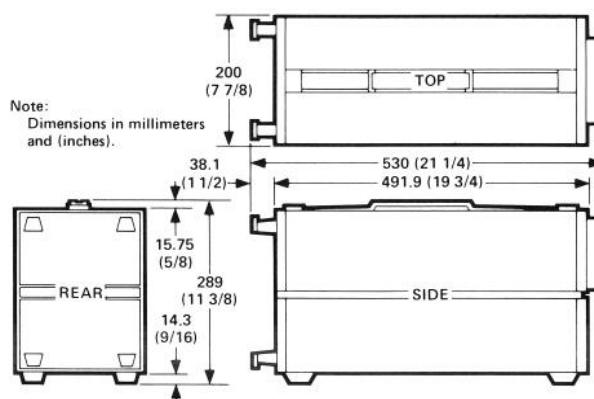
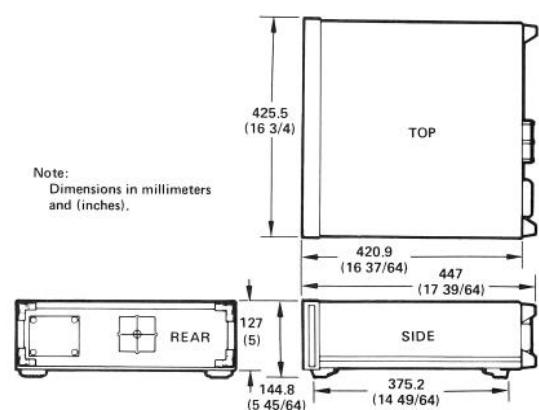
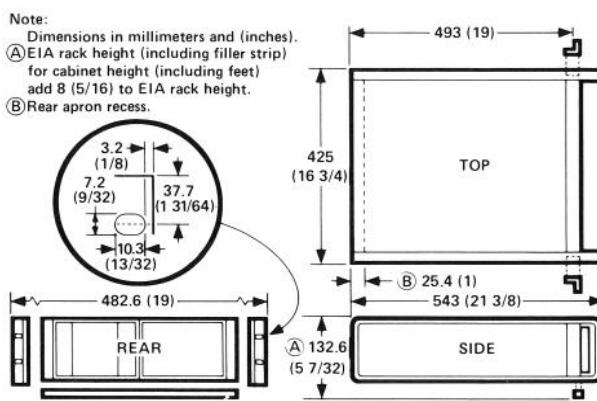
DIMENSIONS**HP Model 8558B Spectrum Analyzer:****HP Model 182T Display:****HP Model 853A Display:****HP Model 181T Display:****HP Model 853A Option 001 Display:****HP Model 180TR/181TR Display:**

TABLE 1-1. HP MODEL 8558B SPECIFICATIONS (3 OF 4)

POWER REQUIREMENTS	WEIGHT
HP Model 853A Display with HP Model 8558B Spectrum Analyzer: 100 or 120 Vac +5%–10%, 48 to 66 Hz, single-phase. Power consumption is less than 200 VA with plug-in installed.	HP Model 8558B Spectrum Analyzer: Net: 5.5 kg (12 lbs) Shipping: 10.5 kg (23 lbs)
HP Model 182T/180TR Display with HP Model 8558B Spectrum Analyzer: 115 or 230 Vac ±10%, 48 to 440 Hz. Power consumption is less than 200 VA with plug-in installed, convection cooled.	HP Model 853A Display: Net: 15.9 kg (35 lbs) Shipping: 18.6 kg (41 lbs)
HP Model 181T/181TR Display with HP Model 8558B Spectrum Analyzer: 115 or 230 Vac ±10%, 48 to 440 Hz. Power consumption is less than 225 VA with plug-in installed, convection cooled.	HP Model 853A Option 001 Display: Net: 14.5 kg (32 lbs) Shipping: 17.3 kg (38 lbs)
	HP Model 182T Display: Net: 12.5 kg (27 lbs) Shipping: 16.5 kg (36 lbs)
	HP Model 181T Display: Net: 11.0 kg (24 lbs) Shipping: 15.5 kg (34 lbs)
	HP Model 181TR Display: Net: 12.0 kg (26 lbs) Shipping: 17.5 kg (38 lbs)
	HP Model 180TR Display: Net: 12.0 kg (26 lbs) Shipping: 17.5 kg (38 lbs)

TABLE 1-1. HP MODEL 8558B SPECIFICATIONS (2 OF 4)

Reference Level
10-dB steps and a 12-dB vernier for calibrated Reference Level adjustment from -112 dBm to +60 dBm.
(002: -62 dBmV to +110 dBmV)¹

Step Accuracy:
Steps referenced with 0 dB input attenuation.
-10 dBm to -80 dBm: ± 0.5 dB
-10 dBm to -100 dBm: ± 1.0 dB

Vernier Accuracy
 ± 0.5 dB

Frequency Response
Frequency response includes input attenuator, limiter, and mixer flatness:
 $\leq \pm 1.0$ dB with 10 dB input attenuation

Input Attenuator
0 dB to 70 dB of input attenuation selectable in 10-dB steps

Step Accuracy:
0 dB to 70 dB: $\leq \pm 0.5$ dB per 10-dB step

Maximum Cumulative Error:
0 dB to 70 dB: $\leq \pm 1.0$ dB

Bandwidth Switching (Amplitude Variation)
Bandwidths 3 MHz to 300 kHz: $\leq \pm 0.5$ dB
Bandwidths 3 MHz to 1 kHz: $\leq \pm 1.0$ dB²

Display Fidelity
CRT linearity and log or linear fidelity affect amplitude accuracy at levels other than Reference Level.

Log Incremental Accuracy:
 ± 0.1 dB per dB from Reference Level

Log Maximum Cumulative Error:
 $\leq \pm 1.5$ dB over entire 70-dB range

Linear Accuracy:
 $\pm 3\%$ of Reference Level

SPURIOUS RESPONSES**Second Harmonic Distortion:**

> 70 dB³ below a -40 dBm input signal with 0 dB input attenuation.

001: -35 dBm input signal

002: +15 dBmV input signal

Third Order Intermodulation Distortion:

> 70 dB³ below two -30 dBm input signals, separated by ≥ 50 kHz, with 0 dB input attenuation.

001: two -25 dBm input signals

002: two +25 dBmV input signals

Image and Multiple Responses:

> 70 dB³ below a -40 dBm input level with 0 dB input attenuation.

001: -35 dBm input level

002: +15 dBmV input level

RESIDUAL RESPONSES

< -100 dBm (1-1500 MHz) with 0 dB input attenuation and no signal present at input.

001: < -95 dBm (1-1500 MHz)

002: < -50 dBmV (1-1500 MHz)

SWEEP SPECIFICATIONS**SWEEP TIME****Automatic (AUTO):**

Sweep time adjusted automatically to maintain absolute amplitude calibration for any combination of frequency span, resolution bandwidth, and video filter bandwidth.

Calibrated Sweep Times (sec/Div, mSec/Div):

16 selectable sweep times in 1-2-5 sequence from 0.1 msec/div to 10 sec/div, provided primarily for time-domain calibration in zero span (0).

GENERAL SPECIFICATIONS**TEMPERATURE RANGE**

Operating: 0°C to +55°C

Storage: -40°C to +75°C.

HUMIDITY RANGE

Type-tested from 50% to 95% relative humidity ($\leq 40^\circ\text{C}$) per requirements of MIL-STD-810C, Method 507.1, Procedure IV.

EMI

Conducted and radiated interference is in compliance with MIL-STD 461A, Methods CE03 and RE02, CISPR Publication 11 (1975) and Messempfaenger Postverfuegung 526/527/79 (Kennzeichnung Mit F-Nummer/Funkschutzzeichen).

¹ Input level not to exceed +30 dBm (*002: +80 dBmV*) damage level.

² 100 kHz bandwidth limited to $< 80\%$ relative humidity. Amplitude variation is $< \pm 2.5$ at 95% relative humidity, +40°C.

³ > 60 dB for 100 kHz to 5 MHz input signals.

TABLE 1-1. HP MODEL 8558B SPECIFICATIONS (1 OF 4)

FREQUENCY SPECIFICATIONS		AMPLITUDE SPECIFICATIONS
FREQUENCY RANGE	100 kHz to 1500 MHz	Video Filter Post-detection low-pass filter averages displayed noise for a smooth trace. The MAX (detent) position selects a video filter bandwidth of approximately 1.5 Hz for noise level measurement.
FREQUENCY SPANS		
Per Division (MHz/Div, kHz/Div)		
14 frequency scale calibrations in 1-2-5 sequence from 5 kHz/div to 100 MHz/div. Start or center frequency is set with the TUNING control and indicated by the FREQUENCY MHz readout.		
Zero Span (0)		
Analyzer functions as a manually tuned receiver, at the frequency indicated by the FREQUENCY MHz readout, for time-domain display of signal modulation.		
FREQUENCY ACCURACY		
Tuning Accuracy		
Frequency MHz readout (start or center frequency), after zeroing on the LO feedthrough and operating the FREQUENCY CAL control, +10°C to +40°C: 0–195 MHz: $\pm(1 \text{ MHz} + 20\% \text{ of frequency span per division})$		
195–1500 MHz: $\pm(5 \text{ MHz} + 20\% \text{ of frequency span per division})$		
Frequency Readout Resolution		
0–195 MHz: 100 kHz		
195–1500 MHz: 1 MHz		
Frequency Span Accuracy		
$\pm 5\%$ of displayed frequency separation		
SPECTRAL RESOLUTION AND STABILITY		
Resolution Bandwidths		
Eight selectable resolution (3-dB) bandwidths in 1-3 sequence from 1 kHz to 3 MHz. Bandwidth may be selected independently or coupled with frequency span. Optimum ratio of frequency span to resolution bandwidth is indicated by alignment of markers ($>$ <) on the two controls.		
Resolution Bandwidth Accuracy:		
Individual resolution bandwidth 3-dB points: $\pm 20\%$ (+10°C to +40°C)		
Selectivity:		
60-dB: 3-dB resolution bandwidth ratio: $< 15:1$		
Stability		
Residual FM:		
$< 1 \text{ kHz p-p}$ in 0.1 second		
Noise Sidebands:		
$\geq 65 \text{ dB}$ down, $> 50 \text{ kHz}$ from center of CW signal with 1 kHz resolution bandwidth and full video filtering.		
		AMPLITUDE RANGE –117 dBm to +30 dBm 001: –110 dBm to +30 dBm 002: –63 dBmV to +80 dBmV
		Maximum Input (Damage) Levels
		Total Power: +30 dBm (1W, 7.1 Vrms) 001: +30 dBm (1W, 8.7 Vrms) 002: +80 dBmV (1.3W, 10 Vrms)
		dc or ac (<100 Hz): ±50V
		Peak Pulse Power: +50 dBm (100W, <10 μsec pulse width, 0.01% duty cycle) with input attenuation $\geq 20 \text{ dB}$ 002: +100 dBmV (130W)
		Average Noise Level The displayed average noise level determines sensitivity (minimum discernible signal). Signals at this input level peak approximately 3 dB above the displayed noise.
		Maximum average noise level with 10 kHz resolution bandwidth, 0 dB input attenuation, and maximum (MAX) video filtering: <–107 dBm (1–1500 MHz) 001: <–100 dBm (1–1500 MHz) 002: <–53 dBmV (1–1500 MHz)
		Calibrated Display Range
		Log (from Reference Level): 70 dB with 10 dB/DIV Amplitude Scale 8 dB with 1 dB/DIV Amplitude Scale
		Linear: 8 divisions with LIN Amplitude Scale
		AMPLITUDE ACCURACY With AUTO sweep time selected, amplitude accuracy is determined by one or more of the following factors, depending on the measurement technique.
		Calibrator Output –30 dBm $\pm 1 \text{ dB}$ (into 50Ω) 280 MHz $\pm 300 \text{ kHz}$ 001: –30 dBm $\pm 1 \text{ dB}$ (into 75Ω) 002: +20 dBmV $\pm 1 \text{ dB}$ (into 75Ω)

1-10. SPECIFICATIONS

1-11. Instrument specifications are listed in Table 1-1. These specifications are the performance standards or limits against which the instrument is tested. Table 1-2 lists supplemental characteristics. Supplemental characteristics are not specifications but are typical characteristics included as additional information for the user.

NOTE

To ensure that the HP Model 8558B meets the specifications listed in Table 1-1, the performance tests (Section IV) should be performed every six months.

1-12. SAFETY CONSIDERATIONS

1-13. Before operating this instrument, you should familiarize yourself with the safety markings on the instrument and the safety instructions in this manual. This instrument has been manufactured and tested according to international safety standards. However, to ensure safe operation of the instrument and personal safety of the user and service personnel, the cautions and warnings in this manual must be followed. Refer to the summary of safety considerations at the beginning of this section. Refer also to individual sections of this manual for detailed safety notation concerning the use of the instrument as described in those individual sections.

1-14. INSTRUMENTS COVERED BY MANUAL

1-15. Serial Numbers

1-16. Attached to the rear of your instrument is a mylar serial number label. The serial number is in two parts. The first four digits and letter are the serial number prefix; the last five digits are the suffix (see Figure 1-2). The prefix is the same for all identical instruments; it changes only when a change is made to the instrument. The suffix, however, is assigned sequentially and is different for each instrument. The contents of this manual apply to instruments with the serial number prefix(es) listed under SERIAL NUMBERS on the title page.

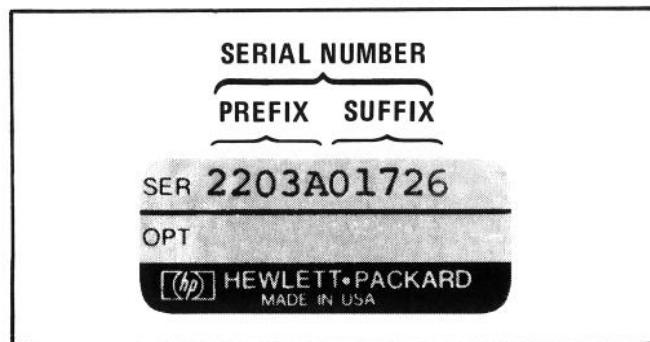


FIGURE 1-2. TYPICAL SERIAL NUMBER LABEL

1-17. Manual Updating Supplement

1-18. An instrument manufactured after the printing of this manual might have a serial number prefix that is not listed on the title page. This unlisted serial number prefix indicates that the instrument is different from those described in this manual. The manual for this newer instrument is accompanied by a yellow Manual Updating supplement. This supplement contains change information that explains how to adapt the manual to the newer instrument.

1-19. In addition to change information, the supplement may contain information for correcting errors in the manual. To keep this manual as current and accurate as possible, Hewlett-Packard recommends that you periodically request the latest Manual Updating supplement. The supplement carries a manual identification block that includes the model number, print date of the manual, and manual part number. Complimentary copies of the supplement are available from Hewlett-Packard. Addresses of Hewlett-Packard offices are located at the back of this manual.

1-20. Manual Backdating Changes

1-21. Instruments manufactured before the printing of this manual have been assigned serial number prefixes other than those for which this manual was directly written. Manual backdating information is provided in Section VII to adapt this manual to earlier serial number prefixes. For instruments with serial number prefixes 1829A and earlier, refer to the HP 8558B Operating and Service Manual dated October 1977, HP Part Number 08558-90043, and to the Manual Updating supplement supplied with that manual.

SECTION I GENERAL INFORMATION

1-1. INTRODUCTION

1-2. This Operation and Service manual contains information required to install, operate, test, adjust, and service the Hewlett-Packard Model 8558B Spectrum Analyzer. Figure 1-1 shows the standard instrument and accessories supplied. This section covers instrument identification, description, options, accessories, specifications, and other basic information.

1-3. DESCRIPTION

1-4. The HP 8558B displays the amplitude and frequency of each component of an input signal on a CRT. This display gives quantitative information often not available from a conventional oscilloscope. The HP 8558B is capable of measuring signals from -117 dBm to +30 dBm over a frequency range of 100 kHz to 1500 MHz.

*Option 001: -110 dBm to +30 dBm
Option 002: -63 dBmV to +80 dBmV*

1-5. The complete measuring system includes the HP 8558B Spectrum Analyzer plugged into a compatible Hewlett-Packard display mainframe.

1-6. MANUAL ORGANIZATION

1-7. This manual is divided into eight sections as follows:

SECTION I, GENERAL INFORMATION: contains the instrument description and specifications, explains accessories and options, and lists recommended test equipment.

SECTION II, INSTALLATION AND OPERATION VERIFICATION: contains information concerning initial mechanical inspection, preparation for use, operating environment, packaging and shipping, and operation verification.

SECTION III, OPERATION: contains detailed instructions for operation of the instrument.

SECTION IV, PERFORMANCE TESTS: contains the necessary tests to verify that the electrical operation of the instrument is in accordance with published specifications.

SECTION V, ADJUSTMENTS: contains the necessary adjustment procedures to adjust the instrument properly after repair.

SECTION VI, REPLACEABLE PARTS: contains the information necessary to order parts and/or assemblies for the instrument.

SECTION VII, MANUAL BACKDATING CHANGES: contains backdating information to make this manual compatible with earlier equipment configurations.

SECTION VIII, SERVICE: contains schematic diagrams, block diagrams, component location illustrations, parts lists, circuit descriptions, and troubleshooting information to aid in repair of the instrument.

1-8. On the title page of this manual, below the manual part number, is a microfiche part number. This number may be used to order 4- by 6-inch microfilm transparencies of the manual. Each microfiche contains up to 60 photo-duplicates of the manual pages. The microfiche package also includes the latest Manual Updating supplement.

1-9. Where text changes are required to reflect Options 001 and 002, these changes are shown in italic type immediately following applicable text. Notes are also included in tables and illustrations where users of Options 001 and 002 need to be informed of differences from the standard instrument. Users of the standard instrument should ignore references to Options 001 and 002.

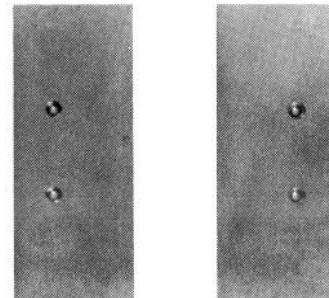


SIDE STOP KIT
08558-60131

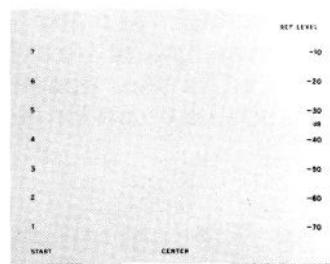
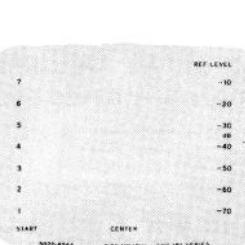
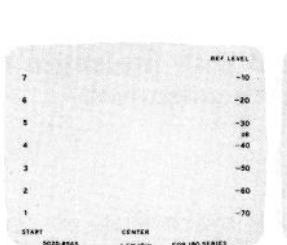
ADAPTER
1250-0780



TERMINATION
11593A



SPECTRUM ANALYZER OVERLAY KIT
5060-0319



5020-8565

5020-8566

5020-8567

FIGURE 1-1. HP MODEL 8558B SPECTRUM ANALYZER WITH ACCESSORIES SUPPLIED

SAFETY SYMBOLS

The following safety symbols are used throughout this manual and in the instrument. Familiarize yourself with each of the symbols and its meaning before operating this instrument.



Instruction manual symbol. The instrument will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect the instrument against damage. Location of pertinent information within the manual is indicated by use of this symbol in the table of contents.



Indicates dangerous voltages are present. Be extremely careful.

CAUTION

The CAUTION sign denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in damage to or destruction of the instrument. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

WARNING

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

GENERAL SAFETY CONSIDERATIONS

WARNING

BEFORE THIS INSTRUMENT IS SWITCHED ON, make sure it has been properly grounded through the protective conductor of the ac power cable to a socket outlet provided with protective earth contact. Any interruption of the protective (grounding) conductor, inside or outside the instrument, or disconnection of the protective earth terminal can result in personal injury.

WARNING

There are voltages at many points in the instrument which can, if contacted, cause personal injury. Be extremely careful. Any adjustments or service procedures that require operation of the instrument with protective covers removed should be performed only by trained service personnel.

CAUTION

BEFORE THIS INSTRUMENT IS SWITCHED ON, make sure its primary power circuitry has been adapted to the voltage of the ac power source. Failure to set the ac power input to the correct voltage could cause damage to the instrument when the ac power cable is plugged in.

SECTION II

INSTALLATION AND OPERATION VERIFICATION

2-1. INTRODUCTION

2-2. This section includes information on initial inspection, preparation for use, and storage and shipping requirements for the HP 8558B.

2-3. INITIAL INSPECTION

2-4. Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically. The contents of the shipment should be as shown in Figure 1-1. The electrical performance is checked by the Operation Verification procedure in this section. If the contents are incomplete, or if the instrument does not pass Operation Verification tests, notify the nearest Hewlett-Packard office. If the shipping container is damaged, or the cushioning material shows signs of stress, notify the carrier as well as the Hewlett-Packard office. Keep the shipping materials for carrier's inspection. The HP office will arrange for repair or replacement without waiting for claim settlement.

2-5. PREPARATION FOR USE

2-6. Installation

2-7. When properly installed, the spectrum analyzer obtains all necessary power from the display mainframe. The rear panel connector provides the interface.

CAUTION

BEFORE SWITCHING ON THIS INSTRUMENT, make sure it is adapted to the voltage of the ac power source to be used and the proper fuse is installed. Failure to set the ac power input of the instrument for the correct voltage level could cause damage to the instrument

when plugged in. Refer to the display mainframe Operation and Service Manual for line voltage and fuse selection.

2-8. To install the spectrum analyzer in the mainframe:

- a. Set display mainframe LINE switch to OFF.
- b. Pull out lock knob and slide plug-in toward rear of compartment until it is seated firmly in place.
- c. Push in lock knob to secure spectrum analyzer in mainframe.

2-9. Side Stop Kits

2-10. Side stops unique to the installation of this instrument into the HP 853A Spectrum Analyzer Display are included with the HP 853A. Refer to the HP 853A Operation and Service Manual for further information.

2-11. Installation of a Side Stop Kit, HP Part Number 08558-60131, prevents the removal of the analyzer from the HP 180-Series mainframe without the use of hand tools. This kit contains two side stops, mounting hardware, label, and installation instructions. (Refer to Table 2-1 for part numbers of individual items.)

TABLE 2-1. SIDE STOP KIT (08558-60131)

Qty	Description	HP Part Number	C D
2	SIDE STOP	08558-00094	7
4	MACHINE SCREW, 4-40 .438 IN-LG 82 DEG FLATHEAD	2200-0168	9
1	LABEL, FRONT-PANEL	7120-8131	7
1	LABEL, INSTRUCTIONS	7120-8215	8

2-12. To install side stops:

WARNING

Before removing covers from display mainframe, disconnect line power by removing ac power cord.

1. Remove side covers from bottom section of mainframe. (Remove only right side cover if mainframe is a rack-mounted model.)
2. Use flathead machine screws to install side stops as shown in Figure 2-1.
3. Reinstall side covers on mainframe.

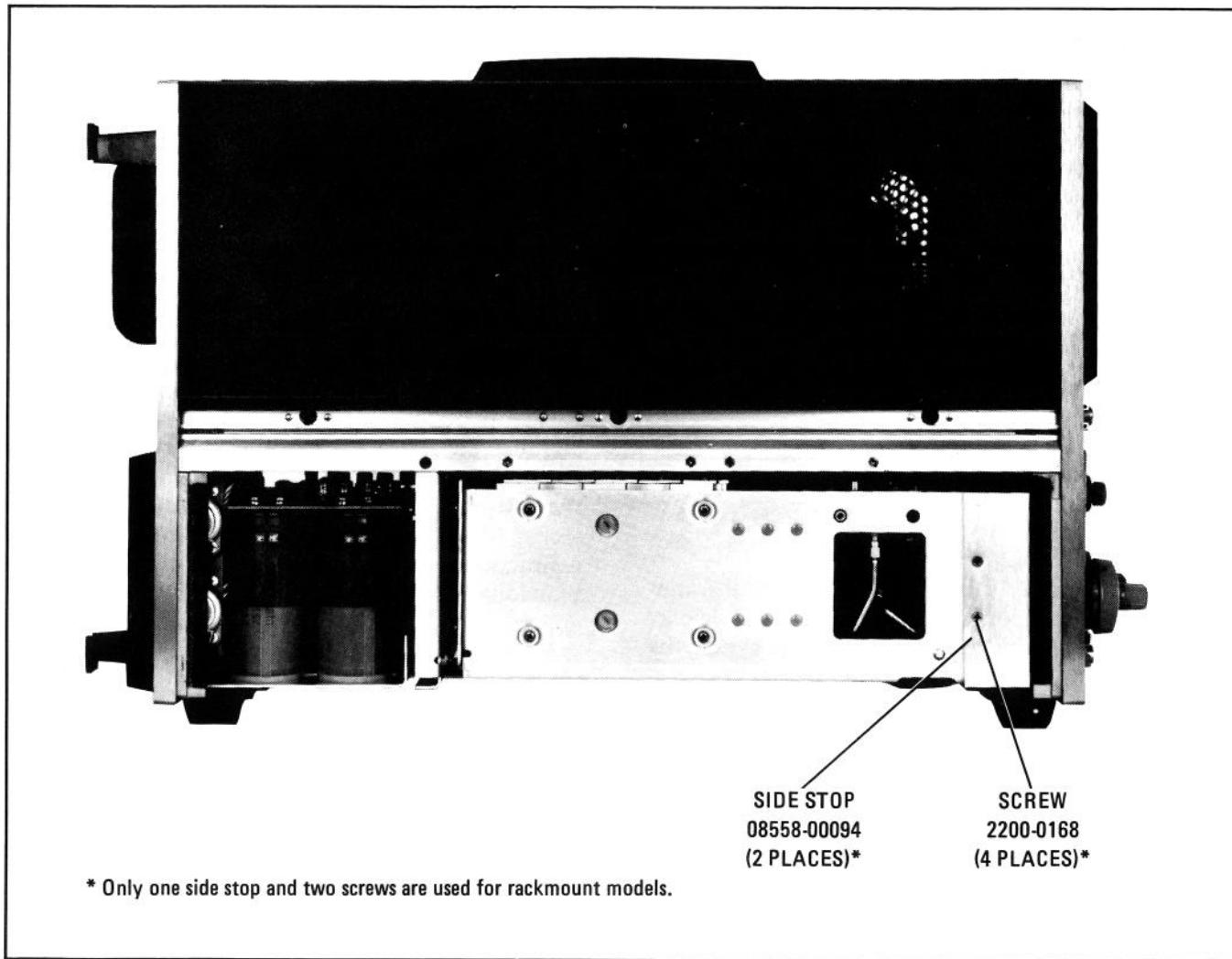
4. Place label on front panel of spectrum analyzer (upper right-hand corner) to indicate that the plug-in is secured with side stops.

2-13. To remove side stops:

WARNING

Before removing covers from display mainframe, disconnect line power by removing ac power cord.

1. Remove side covers from bottom section of mainframe. (Remove only right side cover if mainframe is a rack-mounted model.)
2. Remove side stops. See Figure 2-1.
3. Reinstall side covers on display mainframe.



* Only one side stop and two screws are used for rackmount models.

FIGURE 2-1. LOCATION OF SIDE STOPS

2-14. Graticule Overlays

2-15. To install a graticule overlay:

1. Select proper overlay. HP Part Number 5020-8565 is for HP 180TR display mainframes, HP Part Number 5020-8566 is for HP 181T/TR display mainframes, and HP Part Number 5020-8567 is for HP 182T display mainframes.
2. For HP 180TR and HP 181T/TR mainframes, remove CRT bezel and metallic-mesh contrast filter. Insert proper overlay and replace contrast filter and CRT bezel.
3. For HP 182T mainframes, grasp top portion of CRT bezel and pull straight up. Remove metallic-mesh contrast filter and insert proper overlay and contrast filter. (Either the metallic-mesh contrast filter or a light blue contrast filter may be used.)
4. Slide bezel back into place to retain overlay and filter.

2-16. Mainframe Interconnections

2-17. When the HP 8558B is properly installed in the display mainframe, the interconnections are as listed in Table 2-2.

2-18. Operating Environment

2-19. Temperature. The instrument may be operated in temperatures from 0°C to + 55°C.

2-20. Humidity. The instrument may be operated in environments with relative humidity from 5 percent to 95 percent, 0°C to + 40°C. The recommended long-term operating environment is 5 percent to 80 percent relative humidity. The instrument should also be protected from abrupt temperature changes that cause internal condensation.

2-21. Altitude. The instrument may be operated in altitudes up to 4572 meters (15,000 feet).

2-22. Modifications

2-23. A Modification Kit, HP Part Number 00180-69503, provides materials and information necessary to add Option 807 rear-panel connections to the standard HP 180-series display. Refer to Table 1-3 in Section I. Option 807 is factory-installed in HP 180TR, HP 181T, HP 181TR, and HP 182T mainframes. The modification kit is required for use with other HP 180-series mainframes if all four rear-panel outputs are needed.

TABLE 2-2. HP MODEL 8558B MAINFRAME INTERCONNECTIONS

Pin on P1	Signal or Voltage	Pin on P1	Signal or Voltage
1	CRT HORIZ (adjusted horizontal signal)	17	BLANKING
2	GROUND from mainframe (jumpered to pin 8)	18	NC
3	NC	19	GROUND from mainframe (jumpered to pin 24)
4	L NORM	20	AUTO SWP
5	Y NORM	21	BEAM FINDER
6	NC	22	NC
7	SING SWP	23	NC
8	GROUND from mainframe (jumpered to pin 2)	24	GROUND from mainframe (jumpered to pin 19)
9	MAN SWP	25	NC
10	NC	26	NC
11	AUX D Horizontal Output (to mainframe rear panel)	27	NC
12	AUX C 21.4 MHz IF Output (to mainframe rear panel)	28	- 12.6 Vdc from mainframe
13	AUX B Penlift/Blanking Output (to mainframe rear panel)	29	+ 15 Vdc from mainframe
14	AUX A Vertical Output (to mainframe rear panel)	30	+ 100 Vdc from mainframe
15	GROUND	31	30V p-p from mainframe (for LINE TRIGGER)
16	NC	32	NC
		W10P3 (2 contacts)	+ VERT (top contact, yellow wire) - VERT (bottom contact, orange wire)

2-24. STORAGE AND SHIPMENT

2-25. Environment

2-26. The instrument may be stored or shipped in environments within the following limits:

Temperature: -40°C to +75°C

Humidity: 5% to 95% (0°C to +40°C)

Altitude: Up to 15240 meters (50,000 feet)

The instrument should also be protected from temperature extremes which cause condensation within the instrument.

2-27. Packaging

2-28. Original Packaging. Containers and materials identical to those used in factory packaging are available through Hewlett-Packard offices. If the instrument is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service required, return address, model number, and full serial number. A supply of these tags is provided at the end of this section. Also mark the container FRAGILE to assure careful handling. In any correspondence, refer to the instrument by model number and full serial number.

2-29. Other Packaging. The following general instructions should be used for repackaging with commercially available materials:

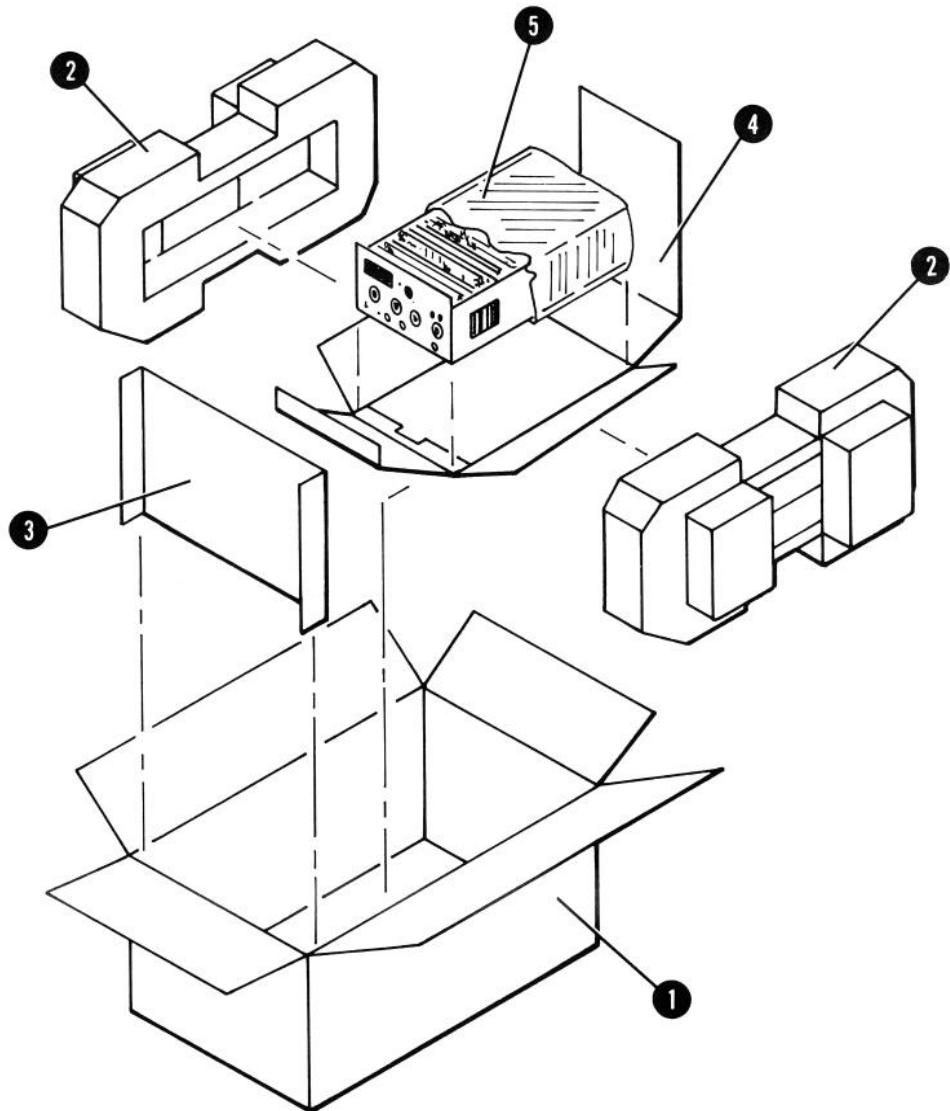
1. Wrap the instrument in heavy paper or plastic. If shipping to a Hewlett-Packard office or service center, attach a tag indicating the type of service required, return address, model number, and full serial number. A supply of these tags is provided at the end of this section.

2. Use a strong shipping container. A double-wall carton made of 350-pound test material is adequate.
3. Use enough shock-absorbing material (3-inch to 4-inch layer) around all sides of the instrument to provide firm cushion and prevent movement inside the container. Protect the control panel with cardboard.
4. Seal the shipping container securely.
5. Mark the shipping container FRAGILE to assure careful handling.

2-30. OPERATION VERIFICATION

2-31. The Operation Verification tests only the most critical specifications and operating features of the instrument. It requires much less time and equipment than the complete performance tests provided in Section IV, and is recommended for verification of overall instrument operation, either as part of incoming inspection or after repair. Operation Verification consists of the following performance tests:

- Paragraph 4-11, Frequency Span Accuracy
- Paragraph 4-17, Average Noise Level
- Paragraph 4-21, Bandwidth Switching (Amplitude Variation)
- Paragraph 4-22, Input Attenuator Accuracy
- Paragraph 4-24, Display Fidelity
- Paragraph 4-25, Calibrator Accuracy



Item	Qty	C D	HP Part Number	Description
1	1	4	9211-3026	CARTON - OUTER
2	2	1	9220-3024	FOAM PADS - INNER
3	1	7	9220-3129	MANUAL PAD - FRONT
4	1	9	9220-3048	CARTON - INNER
5	1	7	9222-1054	BAG - ANTISTATIC

FIGURE 2-2. PACKAGING FOR SHIPMENT USING FACTORY PACKAGING MATERIALS

SECTION III OPERATION

3-1. INTRODUCTION

3-2. This section provides operating information for the HP 8558B Spectrum Analyzer plug-in. It also provides a brief description of display mainframe controls. For a detailed description of the display mainframe, refer to its manual.

3-3. The HP 8558B Spectrum Analyzer plug-in can be used with either the HP 180-Series display mainframes or the HP 853A Spectrum Analyzer Display mainframe.

3-4. DESCRIPTION

3-5. HP 8558B Spectrum Analyzer

3-6. The HP 8558B Spectrum Analyzer plug-in has a measurement range of 100 kHz to 1500 MHz, and can display frequency spans from 50 kHz to 1000 MHz. A four-digit LED readout indicates the spectrum analyzer start or center frequency with a resolution of 1 MHz or 100 kHz. The HP 8558B can be used to measure signals over an amplitude range of -117 dBm to +30 dBm. A front-panel 1ST LO OUTPUT is provided for stimulus/response measurements, using the HP 8444A Option 059 Tracking Generator.

3-7. The HP 853A Spectrum Analyzer Display is a large-screen, digital storage display mainframe for use exclusively with the HP 8559A, 8558B, and 8557A Spectrum Analyzer plug-ins. Digital memory provides buffer storage for two independent traces, both of which can be displayed or blanked as desired. Digital processing also provides pushbutton features such as maximum signal hold, digital averaging, and trace normalization. A conventional analog display mode can also be selected.

3-8. HP-IB

3-9. The HP 853A has limited HP-IB capabilities. CRT trace and graticule data is dumped directly to a listen-only HP-IB plotter by pressing two front-panel pushbuttons. Control setting on the spectrum analyzer plug-in cannot be monitored via the HP-IB; however, all digital display functions are programmable via a controller, and two lines of annotation

can be displayed on the CRT for labelling purposes or operator prompting. In addition, controller commands allow transfer of trace data for analysis or storage.

3-10. CONTROLS, INDICATORS, AND CONNECTORS

3-11. Control Grouping

3-12. The Spectrum Analyzer plug-in and Display mainframe front-panel controls fall into three general groups: those that deal with the displays, those that deal with frequency, and those that deal with amplitude. These controls are shown in Figure 3-1 and accompanied by detailed explanations of their use.

3-13. Display. The display group consists of:

SWEEP TIME/DIV	VIDEO FILTER
SWEEP TRIGGER	BASELINE CLIPPER
VERT POSN	HORIZONTAL
VERT GAIN	POSITION
MANUAL SWEEP	INTENSITY
HORIZ GAIN (rear panel of HP 8558B)	FOCUS
	TRACE ALIGN

3-14. The display group enables the operator to calibrate the display and to select a variety of scan and display conditions. However, when the SWEEP TIME/DIV control is placed in the AUTO position, sweep time is controlled by the RESOLUTION BW, FREQ SPAN/DIV, and VIDEO FILTER controls.

3-15. Frequency. The frequency group consists of:

TUNING
RESOLUTION BW
FREQ SPAN/DIV

3-16. The frequency group enables the operator to control how the Spectrum Analyzer displays the frequency domain. The RESOLUTION BW and FREQ SPAN/DIV controls, when pushed in, are coupled together, and moving either control moves the other. When the SWEEP TIME/DIV control is in the AUTO position, varying the RESOLUTION BW or

the FREQ SPAN/DIV (coupled or uncoupled) will change the sweep time to maintain calibration. With the two controls coupled together in the optimum position, RESOLUTION BW's of 3 MHz to 1 kHz will be automatically selected as the FREQ SPAN/DIV is narrowed from 100 MHz to 0 (Zero). TUNING controls coarse and fine (coarse is the larger knob) set the center frequency of the displayed spectrum. RESOLUTION BW control determines the resolution of the signals of the CRT.

3-17. Amplitude. The amplitude group consists of:

REFERENCE LEVEL dBm
INPUT ATTEN
REF LEVEL FINE
REF LEVEL CAL
10 dB/DIV – 1dB/DIV – LIN (Amplitude Scale)

3-18. The amplitude group enables the operator to measure signal amplitude in units of either voltage or dBm.

3-19. OPERATING PRECAUTIONS

3-20. Signal Input

3-21. The HP 8558B Spectrum Analyzer plug-in is a sensitive measuring instrument. Overloading the input with too much power, peak voltage, or dc voltage will permanently damage the input circuits. Do not exceed the input levels specified below:

Maximum Input (Damage) Levels

HP 8558B

Total Power:

+ 30 dBm (1W, 7.1 Vrms)
Option 001: + 30 dBm (1W, 8.7 Vrms)
Option 002: + 80 dBmV (1.3W, 10 Vrms)

dc or ac (<100 Hz): ±50V

Peak Pulse Power: + 50 dBm (100W, >10 μsec pulse width, 0.01% duty cycle) with ≥ 20 dB input attenuation. *Option 002: + 100 dBmV (130W).*

NOTE

When you are measuring input signals of unknown power levels, a preliminary instrument setting of ≥ 30 dB INPUT ATTEN is recommended.

CAUTION

Although the spectrum analyzer's reference level can be set for power levels up to + 60 dBm, the total input power must not exceed the absolute maximum limits listed above.

3-22. Line Power On

3-23. Before connecting the line power cord, make sure the proper line voltage and line fuse have been selected for the display mainframe. Failure to set the ac power input selector on the display mainframe to correspond with the level of the ac source voltage could cause damage to the instrument when the power cord is plugged in.

WARNING

The spectrum analyzer and any device connected to it must be connected to power line ground. Failure to ensure proper grounding could result in shock hazard to personnel or damage to the instrument.

3-24. LINE power is switched at the display mainframe front panel. A safety indicator lights when the ac power is on. **NEVER** remove a spectrum analyzer plug-in from the display mainframe without first switching the ac LINE power switch to OFF.

3-25. For optimum performance, you should allow the spectrum analyzer to warm up for at least 30 minutes before using it to make measurements.

3-26. FRONT-PANEL ADJUSTMENT PROCEDURE

3-27. The front-panel adjustment procedure adapts the HP 8558B Spectrum Analyzer plug-in to a particular display mainframe, and should be performed daily after instrument warm-up. The step-by-step adjustment is also an excellent way for new users to become acquainted with the various spectrum analyzer controls. Once the procedure is completed, the spectrum analyzer is calibrated for absolute amplitude and frequency measurements. Set the controls as shown in Table 3-1 before you start the adjustment procedure.

TABLE 3-1. ADJUSTMENT SETTINGS

Function	Setting
Spectrum Analyzer Plug-In	
INPUT ATTEN (dB)* (push knob to engage)	10 dB
REFERENCE LEVEL Option 002	0 dBm +50 dBmV
REF LEVEL FINE	0 dBm
Amplitude Scale	LIN
FREQ SPAN/DIV	10 MHz (uncoupled)
RESOLUTION BW	1 MHz (uncoupled)
SWEEP TIME/DIV	AUTO
SWEEP TRIGGER	FREE RUN
START – CENTER	CENTER
TUNING	>60 MHz
BASELINE CLIPPER	OFF
VIDEO FILTER	OFF
*On older plug-ins, set OPTIMUM INPUT to -30 dBm.	
HP 853A Spectrum Analyzer Display	
TRACE A	WRITE
TRACE B	STORE BLANK
DGTL AVG	OFF
INPUT – B→A	OFF
HP 180-Series Display Mainframe	
DISPLAY	INT
MAGNIFIER	X1
SCALE (180TR, 182T)	OFF
PERSISTENCE (181T/TR)	MIN
Display Mode (181T/TR)	WRITE

3-28. Display Adjustments – HP 853A Spectrum Analyzer Display

1. Switch LINE power OFF then ON while holding PLOT GRAT pushbutton down to activate the digital test routines. The "#0" that appears on the left side of the CRT means that digital test routine #0 is now activated.
2. Press and release the PLOT GRAT pushbutton four times to step to digital test routine #4, as indicated by the "#4" displayed on the left side of the CRT.

3. With an adjustment tool, adjust the FOCUS control as necessary to make the characters on the CRT as clear as possible.
4. Adjust the X POSN and Y POSN controls to align the square trace pattern with the outermost CRT graticule lines.
5. Momentarily press the PLOT GRAT and PLOT TRACE pushbuttons simultaneously to exit the digital test routines.

3-29. Display Adjustments – HP 180-Series Display Mainframe

1. With an adjustment tool, adjust the VERTICAL POSN control to place the CRT trace on a horizontal graticule line near the CRT center.
2. Reduce the INTENSITY and set the SWEEP TIME/DIV control to MAN. Use the MAN SWEEP knob to center the CRT dot.

CAUTION

Leaving a dot on the CRT for prolonged periods at high intensity can burn the phosphor.

3. Adjust the FOCUS and ASTIG controls for the smallest round dot possible.
4. Reset the SWEEP TIME/DIV control to AUTO and increase the INTENSITY for an optimum CRT trace. Adjust the HORIZONTAL POSITION control to center the CRT trace. If the horizontal deflection is not exactly 10 divisions, adjust the HORIZ GAIN control located on the rear panel of the spectrum analyzer plug-in.

NOTE

To adjust the HORIZ GAIN, you must switch the LINE power OFF, then remove the spectrum analyzer plug-in from the mainframe.

5. Adjust TRACE ALIGN so that the CRT trace is parallel to the horizontal graticule line.

3-30. Frequency and Amplitude Adjustments

1. Adjust VERTICAL POSN to align the CRT trace with the bottom graticule line.
2. Center the LO feedthrough (i.e., the “signal” at 0 MHz) on the CRT with the TUNING control, pressing the FREQUENCY CAL pushbutton two or three times to remove tuning hysteresis in the first LO (YIG oscillator).
3. Narrow the FREQ SPAN/DIV to 200 kHz, and press the FREQUENCY CAL pushbutton once more. Adjust the REF LEVEL FINE control as necessary to position the signal peak near the top CRT graticule line.
4. Center the LO feedthrough again, if necessary, and adjust the FREQUENCY ZERO to calibrate the FREQUENCY MHz readout at 00.0 MHz.
5. Set the FREQ SPAN/DIV control to 1 MHz and the REF LEVEL FINE control to 0. Adjust the TUNING control for a FREQUENCY MHz readout of approximately 280 MHz.

6. Press the 10 dB/DIV Amplitude Scale pushbutton, and set the REFERENCE LEVEL control to -20 dBm (+30 dBmV for Option 002 instruments).
7. Connect the 280 MHz CAL OUTPUT to the spectrum analyzer input. Center the signal on the CRT with the TUNING control, pressing the FREQUENCY CAL pushbutton two or three times. The FREQUENCY MHz readout will indicate 280 MHz \pm 5 MHz.
8. Press the LIN Amplitude Scale pushbutton. Adjust the REF LEVEL FINE control to place the signal peak at the top CRT graticule line.
9. Press the 10 dB/DIV Amplitude Scale pushbutton. Adjust VERTICAL GAIN to place the signal peak at the top CRT graticule line.
10. Repeat steps 8 and 9 until the signal peak remains at the top CRT graticule line when the Amplitude Scale is alternated between 10 dB/DIV and LIN.
11. Set the REF LEVEL FINE control to 0, and the REFERENCE LEVEL control to -30 dBm (+20 dBmV for Option 002 instruments).
12. Press the LIN Amplitude Scale pushbutton and adjust REF LEVEL CAL to place the signal peak at the top CRT graticule line.

HP 853A SPECTRUM ANALYZER DISPLAY

REAR PANEL FEATURES

- 1 Line Power Receptacle: Three-conductor male receptacle for connecting ac power cable. Power plug retaining bracket, included with standard instrument, can be installed to prevent power cable disconnection when instrument is in transit. Power cable coils on special rear feet when not in use.
- 2 FUSE: Spring-loaded holder for cartridge-type primary power fuse.
- 3 SELECTOR (VOLTS): Adapts primary power transformer configuration to voltage of ac primary power source.
- 4 ADDRESS: Switch settings determine address of instrument to be used for communications via HP-IB. Address is set as sum of the switches, where A5 = 16, A4 = 8, A3 = 4, A2 = 2, and A1 = 1.
- 5 HORIZ (SWEEP) OUTPUT: BNC jack is a sweep output or sweep input, depending on the position of SWEEP switch on Interface Assembly A9. SWEEP switch on assembly A9 is factory set for sweep output (INT).

As a BNC output, HORIZ (SWEEP) OUTPUT provides horizontal sweep voltage from a 5K-ohm output impedance. The -5V to +5V output range corresponds to a full 10-division CRT horizontal deflection.

As a BNC input with a 20K-ohm input impedance, HORIZ (SWEEP) OUTPUT allows the CRT display to be swept by a -5V to +5V external horizontal sweep signal (approximately 30V/sec maximum sweep rate for digital display mode).

- 6 VERTICAL (VIDEO) OUTPUT: BNC output provides detected video signal from a 50-ohm output impedance. Typical 0–800 mV output range corresponds to full 8-division CRT vertical deflection.

7 BLANK (PENLIFT) OUTPUT: BNC output provides a +15V penlift/blanking signal from a 10K-ohm output impedance when CRT trace is blanked. Otherwise, output is low at 0V (low impedance, 150 mA max.) for an unblanked trace.

- 8 21.4 MHz IF OUTPUT: BNC output provides 21.4 MHz IF signal (linearly related to spectrum RF input) from a 50-ohm output impedance. Spectrum analyzer RESOLUTION BW controls the output bandwidth. Spectrum analyzer INPUT ATTEN, REFERENCE LEVEL FINE, and the first six REFERENCE LEVEL positions control the output amplitude. Output level is approximately -10 dBm into 50 ohms with a signal displayed at Reference Level.
- 9 HP-IB Connector: Hewlett-Packard Interface Bus connection allows remote instrument operation and direct digital plotting of CRT display.

FRONT PANEL FEATURES

- 10 TRACE A, B: Selects CRT display mode for each of two independent digital trace memories.

CLEAR WRITE: Continuously updates trace memory with current input signal data and displays trace memory contents on CRT.

MAXHOLD: Updates trace memory with maximum input signal data and displays trace memory contents on CRT.

STORE VIEW: Current trace memory contents are preserved and displayed on CRT.

STORE BLANK: Current trace memory contents are preserved without being displayed on CRT.

ANALOG DISPLAY: CRT display switches to conventional analog display of current input signal when both STORE BLANK push buttons are depressed.

- 11 DGTL AVG: Activates digital filtering algorithm that averages trace data over successive sweeps. Digital averaging should be restarted after any change in spectrum analyzer control settings.

7 BLANK (PENLIFT) OUTPUT: BNC output provides a +15V penlift/blanking signal from a 10K-ohm output impedance when CRT trace is blanked. Otherwise, output is low at 0V (low impedance, 150 mA max.) for an unblanked trace.

HP 853A SPECTRUM ANALYZER DISPLAY

REAR PANEL FEATURES

- 1 Line Power Receptacle: Three-conductor male receptacle for connecting ac power cable. Power plug retaining bracket, included with standard instrument, can be installed to prevent power cable disconnection when instrument is in transit. Power cable coils on special rear feet when not in use.
- 2 FUSE: Spring-loaded holder for cartridge-type primary power fuse.
- 3 SELECTOR (VOLTS): Adapts primary power transformer configuration to voltage of ac primary power source.
- 4 ADDRESS: Switch settings determine address of instrument to be used for communications via HP-IB. Address is set as sum of the switches, where A5 = 16, A4 = 8, A3 = 4, A2 = 2, and A1 = 1.
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- 10 TRACE A, B: Selects CRT display mode for each of two independent digital trace memories.
- 11 DGTLL AVG: Activates digital filtering algorithm that averages trace data over successive sweeps. Digital averaging should be restarted after any change in spectrum analyzer control settings.
- 12 INPUT – B→A: Subtracts contents of trace B memory point-by-point from current input signal data and stores result (normalized input signal data) in trace A memory. Reference line is factory-preset at center horizontal CRT graticule line; normalized trace appears at reference line when input signal data is identical to stored trace B. Reference line indicates 0 dB for relative amplitude measurements.
- 13 PLOT GRAT/HP-IB CLEAR: Initiates sequence of plotter commands over HP-IB to plot CRT graticule lines (and remotely-programmed annotation). Press push button again to abort active plot. To recover from illegal HP-IB commands (SYN-TAX ERR) and to reset display state, press push button for at least 3 seconds to perform HP-IB CLEAR. Instrument returns to LOCAL and discards any HP-IB operation in progress.
- 14 PLOT TRACE: Initiates sequence of plotter commands over HP-IB to plot displayed CRT trace(s). Press push button again to abort active plot. HP-IB plotter must be set to listen-only mode.
- 15 LINE: AC line switch. Switches instrument primary power ON and OFF.
- 16 INTENSITY: Adjusts brightness of CRT trace(s) and annotation characters.
- 17 SCALE: Adjusts CRT background illumination. SCALE control is disabled in ANALOG DISPLAY mode.
- 18 Y POSN: Adjusts vertical position CRT trace. Use Y POSN with reference pattern in digital test routine #4 to align digital trace memory coordinates with corresponding CRT graticule lines.
- 19 X POSN: Adjusts horizontal position of CRT trace. Use X POSN with reference pattern in digital test routine #4 to align digital trace memory coordinates with corresponding CRT graticule lines.
- 20 TRACE ALIGN: Rotates trace about center of CRT.
- 21 FOCUS: Adjusts sharpness of CRT trace.
- 22 CRT Annotation: Indicates display control settings.
- 23 FREQUENCY MHZ: Displays spectrum analyzer center or start frequency.
- 24 START-CENTER: Selects mode of FREQUENCY MHZ (23) readout.
- 25 TUNING: Adjusts spectrum analyzer start or center frequency. Coarse tuning is provided by large knob; smaller knob provides FINE tuning.
- 26 VERTICAL POSN: Adjusts vertical position of CRT trace.
- 27 VERTICAL GAIN: Adjusts deflection circuit gain for amplitude scale calibration of CRT display.
- 28 FREQUENCY CAL: Removes tuning hysteresis from first LO (YIG oscillator). FREQUENCY CAL should be pressed before calibration and whenever TUNING (25) is changed by more than 50 MHz.
- 29 FREQUENCY ZERO: Adjusts FREQUENCY MHZ (23) readout for calibration on LO feed-through (0 Hz).
- 30 BASELINE CLIPPER: Prevents CRT blooming in variable persistence, storage display mainframes (such as the HP 181T/TR) by blanking the lower portion of the CRT display. When it is operating in its digital display mode, the HP 853A Spectrum Analyzer Display does not respond to this control.
- 31 VIDEO FILTER: Post-detection low-pass filter smooths CRT trace by averaging random noise. The MAX (detent) position selects 1.5 Hz bandwidth for maximum noise averaging and noise level measurements. The VIDEO FILTER bandwidth is scaled by resolution bandwidth (36) setting. The MAX VIDEO FILTER should **not** be used for CW signal analysis.
- 32 SWEET Indicator: Remains lit during each sweep.

- 12 INPUT – B→A: Subtracts contents of trace B memory point-by-point from current input signal data and stores result (normalized input signal data) in trace A memory. Reference line is factory-preset at center horizontal CRT graticule line; normalized trace appears at reference line when input signal data is identical to stored trace B. Reference line indicates 0 dB for relative amplitude measurements.
- 13 PLOT GRAT/HP-IB CLEAR: Initiates sequence of plotter commands over HP-IB to plot CRT graticule lines (and remotely-programmed annotation). Press push button again to abort active plot. To recover from illegal HP-IB commands (SYN-TAX ERR) and to reset display state, press push button for at least 3 seconds to perform HP-IB CLEAR. Instrument returns to LOCAL and discards any HP-IB operation in progress.
- 14 PLOT TRACE: Initiates sequence of plotter commands over HP-IB to plot displayed CRT trace(s). Press both PLOT GRAT and PLOT TRACE push buttons to revert to normal display state.
- 15 LINE: AC line switch. Switches instrument primary power ON and OFF.
- 16 INTENSITY: Adjusts brightness of CRT trace(s) and annotation characters.
- 17 SCALE: Adjusts CRT background illumination. SCALE control is disabled in ANALOG DISPLAY mode.
- 18 Y POSN: Adjusts vertical position CRT trace. Use Y POSN with reference pattern in digital test routine #4 to align digital trace memory coordinates with corresponding CRT graticule lines.
- 19 X POSN: Adjusts horizontal position of CRT trace. Use X POSN with reference pattern in digital test routine #4 to align digital trace memory coordinates with corresponding CRT graticule lines.
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- 13 PLOT GRAT/HP-IB CLEAR: Initiates sequence of plotter commands over HP-IB to plot CRT graticule lines (and remotely-programmed annotation). Press push button again to abort active plot. To recover from illegal HP-IB commands (SYN-TAX ERR) and to reset display state, press push button for at least 3 seconds to perform HP-IB CLEAR. Instrument returns to LOCAL and discards any HP-IB operation in progress.
- 14 PLOT TRACE: Initiates sequence of plotter commands over HP-IB to plot displayed CRT trace(s). Press both PLOT GRAT and PLOT TRACE push buttons to revert to normal display state.
- 15 LINE: AC line switch. Switches instrument primary power ON and OFF.
- 16 INTENSITY: Adjusts brightness of CRT trace(s) and annotation characters.
- 17 SCALE: Adjusts CRT background illumination. SCALE control is disabled in ANALOG DISPLAY mode.
- 18 Y POSN: Adjusts vertical position CRT trace. Use Y POSN with reference pattern in digital test routine #4 to align digital trace memory coordinates with corresponding CRT graticule lines.
- 19 X POSN: Adjusts horizontal position of CRT trace. Use X POSN with reference pattern in digital test routine #4 to align digital trace memory coordinates with corresponding CRT graticule lines.
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- 32 SWEET Indicator: Remains lit during each sweep.

- iER:** Selects sweep trigger mode. Sweep triggered on internal post-video waveform. One-half major vertical deflection (noise, AM signals required to trigger sweep. VIDEO signal used with 0 (zero) frequency span in main analysis.
- jN:** End of each sweep triggers (). Single sweep triggered or reset by SWEEP TRIGGER clockwise ().
- 3/DIV:** Selects time required to 1 horizontal division on CRT. Automatically selects fastest allowed time as a function of FREQ V (35), RESOLUTION BW (36), iO FILTER (31) settings to maintain amplitude calibration. AUTO operation with FREQ SPAN/DIV and RESOLUTION BW controls uncoupled.
- V:** Selects calibrated sweep time. V is used primarily with 0 (Zero) span for time-domain analysis of waveforms. Display amplitude can not be guaranteed for other frequencies.
- EN:** Enables manual frequency scan N SWEEP knob.
- DIV:** Selects CRT horizontal axis resolution.
- 36** RESOLUTION BW: Selects spectrum analyzer 3-dB bandwidth. Alignment of OPTIMUM markings ($> <$) automatically selects optimum resolution bandwidth for any frequency span. When pushed in, RESOLUTION BW couples mechanically with FREQ SPAN/DIV (35).
- 37** INPUT ATTEN: Selects desired RF input attenuation, indicated by blue numbers (push and turn).
- 38** REFERENCE LEVEL: Adjusts power level (in dBm or dBmV) represented by top CRT graticule line. Large outer knob adjusts REFERENCE LEVEL in calibrated 10-dB steps; FINE vernier provides 12 dB of continuous adjustment.
- 39** 10 dB/DIV – 1 dB/DIV – LIN (Amplitude Scale): Selects CRT vertical axis amplitude calibration (logarithmic or linear scale). Reference Level remains constant at top CRT graticule line.
- 40** CAL OUTPUT: BNC (female) output provides calibration signal from 50-ohm output impedance. Options 001 and 002: 75-ohm output impedance.
- 41** REF LEVEL CAL: Adjusts spectrum analyzer RF gain to calibrate top CRT graticule line for absolute amplitude measurements.
- 42** PROBE POWER: Provides power for high-impedance active probes, such as the HP 1121A.
- 43** INPUT 50Ω: Precision type N (female) signal input connector with 50-ohm input impedance. Options 001 and 002: INPUT 75Ω – 75-ohm BNC (female) signal input connector.
- 44** 1st LO OUTPUT: 50-ohm BNC output provides 2.05 – 3.55 GHz first LO signal at approximately +10 dBm. Terminate 1st LO OUTPUT with 50-ohm load when not in use.

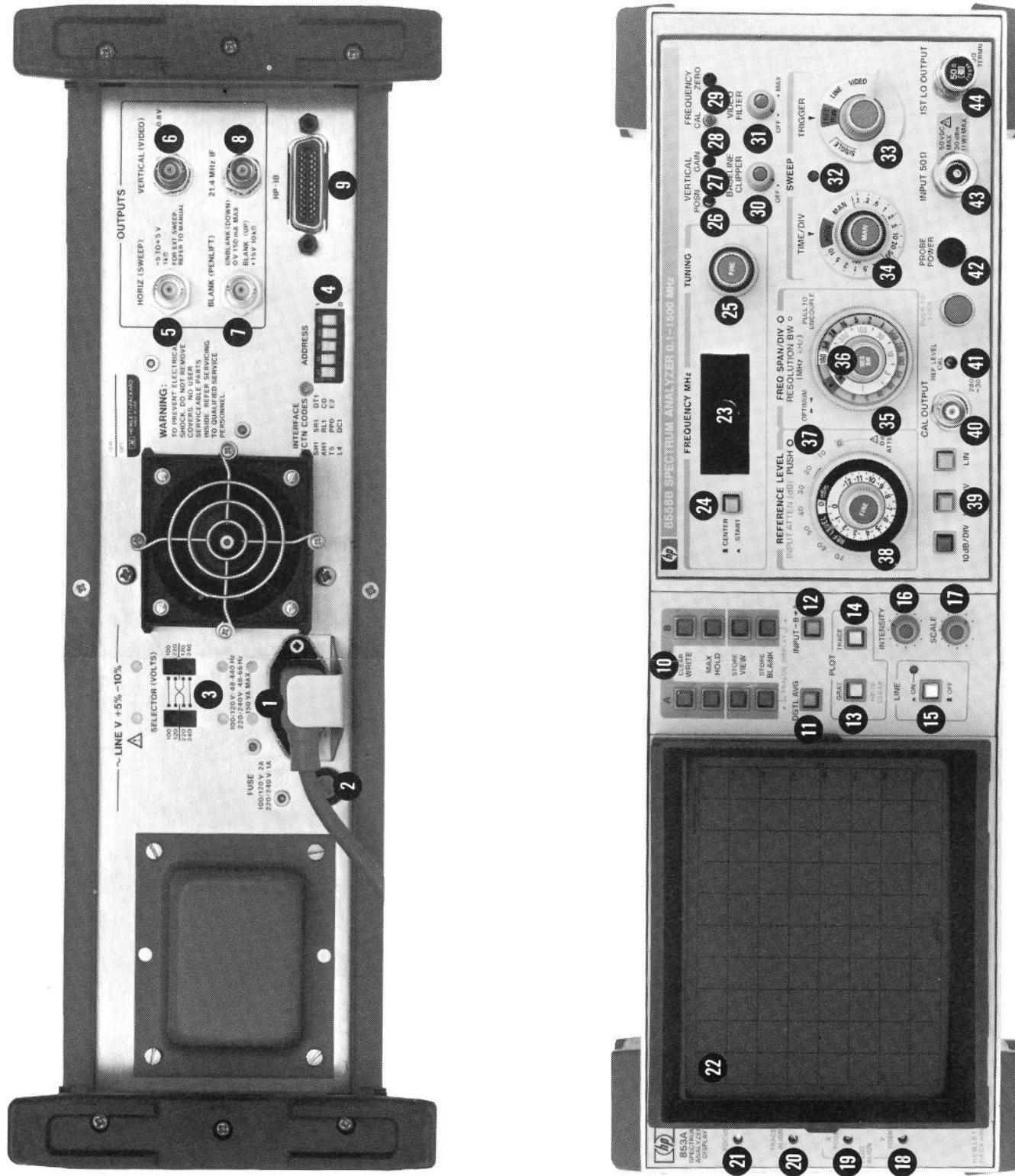


FIGURE 3-1. HP 8558B/853A CONTROLS, CONNECTORS, AND INDICATORS