



HP 4395A Network/Spectrum/Impedance Analyzer

Technical Specifications

Specifications describe the instrument's warranted performance over the temperature range of 0°C to 40°C (except as noted). Supplemental characteristics are intended to provide information that is useful in applying the instrument by giving non-warranted performance parameters. These are denoted as *SPC (supplemental performance characteristics), typical, or nominal*. Warm up time must be greater than or equal to 30 minutes after power on for all specifications.

Network Measurement

Source Characteristics

Frequency Characteristics

Range 10 Hz to 500 MHz

Resolution 1 mHz

Frequency reference

Accuracy

at 23 ± 5°C, referenced to 23°C <±5.5 ppm

Aging <±2.5 ppm/year (SPC)

Initial achievable accuracy <±1.0 ppm (SPC)

Temperature stability

at 23 ± 5°C, referenced to 23°C <±2ppm (SPC)

Precision frequency reference (option 1D5)

Accuracy

at 0°C to 40°C, referenced to 23°C <±0.13 ppm

Aging <±0.1 ppm/year (SPC)

Initial achievable accuracy <±0.02 ppm (SPC)

Temperature stability

at 0°C to 40°C, referenced to 23°C <±0.01 ppm (SPC)

Output Characteristics

Power range -50 dBm to +15 dBm

Level accuracy

at 0 dBm output, 50 MHz, 23 ± 5°C, ±1.0 dB

Level linearity

Output Power	Linearity ¹
≥ -40 dBm	±1.0 dB
< -40 dBm	±1.5 dB

¹ at relative to 0 dBm output, 50 MHz, 23 ± 5°C

Flatness

at 0 dBm output, relative to 50 MHz, $23 \pm 5^\circ\text{C}$ ± 2 dB

Resolution 0.1 dB

Spectral Purity Characteristics

Harmonics

at +10 dBm output < -30 dBc

Non-harmonics spurious

at +10 dBm output < -30 dBc

Noise sidebands

at ≥ 10 kHz offset from carrier < -95 dBc/Hz

Power sweep range 20 dB max.

Power sweep linearity

deviation from linear power referenced to the stop power level ± 0.5 dB

Impedance 50Ω nominal

Return loss

frequency ≤ 200 MHz > 15 dB (SPC)

frequency > 200 MHz > 7 dB (SPC)

Connector Type N female

Receiver Characteristics

Input Characteristics

Frequency range 10 Hz to 500 MHz
Input attenuator 0 to 50 dB, 10 dB step
Full scale input level (R,A,B)

Attenuator setting (dB)	Full scale input level
0	-10 dBm
10	0 dBm
20	+10 dBm
30	+20 dBm
40	+30 dBm
50	+30 dBm

IF bandwidth (IFBW) 2, 10, 30, 100, 300, 1 k, 3 k, 10 k, 30 kHz

Note: The IFBW should be set to less than 1/5 of the lowest frequency in the sweep range.

Noise level (referenced to full scale input level, 23 ± 5°C)

at 10 Hz ≤ frequency < 100 Hz, IFBW=2 Hz -85 dB (SPC)
 at 100 Hz ≤ frequency < 100 kHz, IFBW=10 Hz -85 dB
 at 100 kHz ≤ frequency, IFBW=10 Hz -115 dB

Input crosstalk

for input R ... +10 dBm input, input attenuator: 20 dB

for input A, B ... input attenuator: 0 dB

at <100 kHz

R through A, B <-100 dB
 others <-100 dB (SPC)

at ≥100 kHz

R through A, B <-120 dB
 others <-120 dB (SPC)

Source Crosstalk (for input A, B)(typical for input R)

at +10 dBm output, <100 kHz, input attenuator: 0 dB <-100 dB
 at +10 dBm output, ≥100 kHz, Input attenuator: 0 dB <-120 dB

Multiplexer switching impedance change

at Input attenuator 0 dB <0.5% (SPC)
 at Input attenuator 10 dB and above <0.1% (SPC)

Connector Type N female

Impedance 50 Ω nominal

Return loss

	Input attenuator		
	0 dB	10 dB	20 dB to 50 dB
10 Hz ≤ frequency < 100 kHz	25 dB ¹	25 dB ¹	25 dB ¹
100 kHz ≤ frequency ≤ 100 MHz	25 dB ¹	25 dB	25 dB ¹
100 MHz < frequency	15 dB ¹	15 dB	15 dB ¹

¹ SPC

Maximum input level +30 dBm (at input attenuator: 40 dB or 50 dB)

Maximum safe input level +30 dBm or ±7 Vdc (SPC)

Magnitude Characteristics

Absolute amplitude accuracy (R, A, B)

at -10 dBm input, input attenuator: 10 dB, frequency ≥ 100 Hz, IFBW ≤ 3 kHz, $23 \pm 5^\circ\text{C}$, $< \pm 1.5$ dB

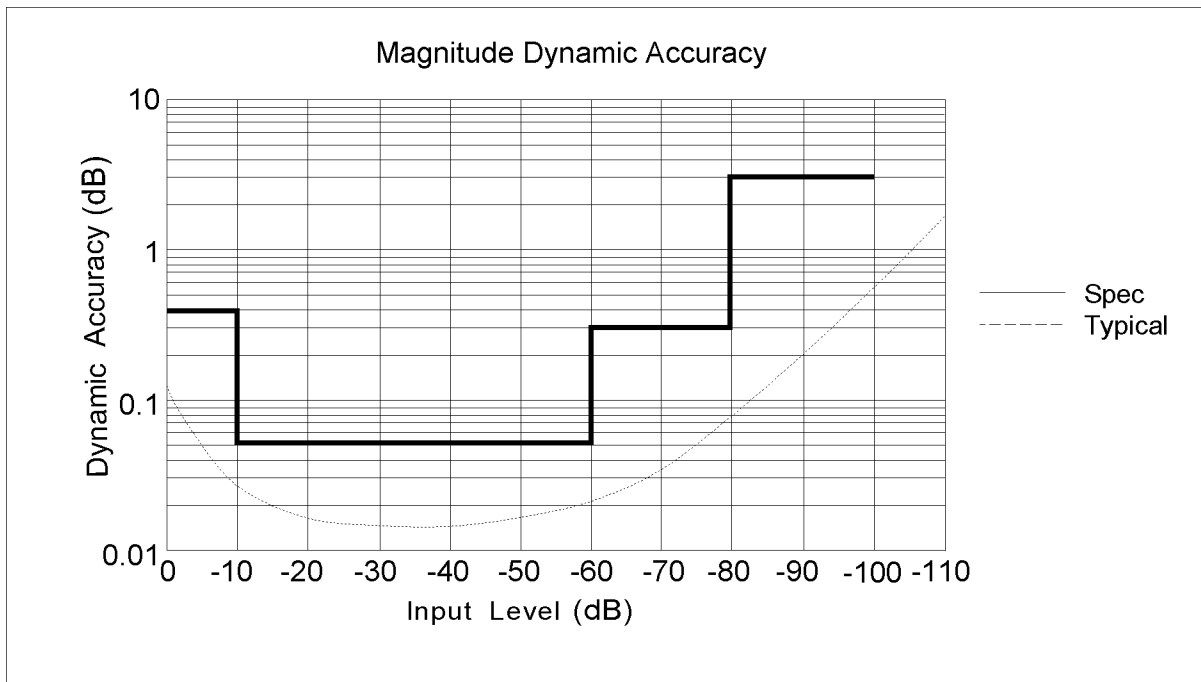
Ratio accuracy (A/R, B/R) (typical for A/B)

at -10 dBm input, input attenuator: 10 dB, IFBW ≤ 3 kHz, $23 \pm 5^\circ\text{C}$, $< \pm 2$ dB

Dynamic accuracy (A/R, B/R) (typical for A/B)

Input Level (relative to full scale input level -10 dB)	Dynamic Accuracy ¹ frequency ≥ 100 Hz
0 dB \geq input level > -10 dB	± 0.4 dB
-10 dB \geq input level ≥ -60 dB	± 0.05 dB
-60 dB $>$ input level ≥ -80 dB	± 0.3 dB
-80 dB $>$ input level ≥ -100 dB	± 3 dB

1. R input level (B input level for A/B) = full scale input level -10 dB, IFBW = 10 Hz, $23 \pm 5^\circ\text{C}$



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Figure 1-1. Magnitude Dynamic Accuracy

Residual responses <-80 dB full scale (SPC)
Trace noise (A/R, B/R, A/B)
 at 50 MHz, both inputs: full scale input level -10 dB, IFBW = 300 Hz <0.005 dB rms (SPC)
Stability (A/R, B/R, A/B) < ±0.01 dB/°C (SPC)

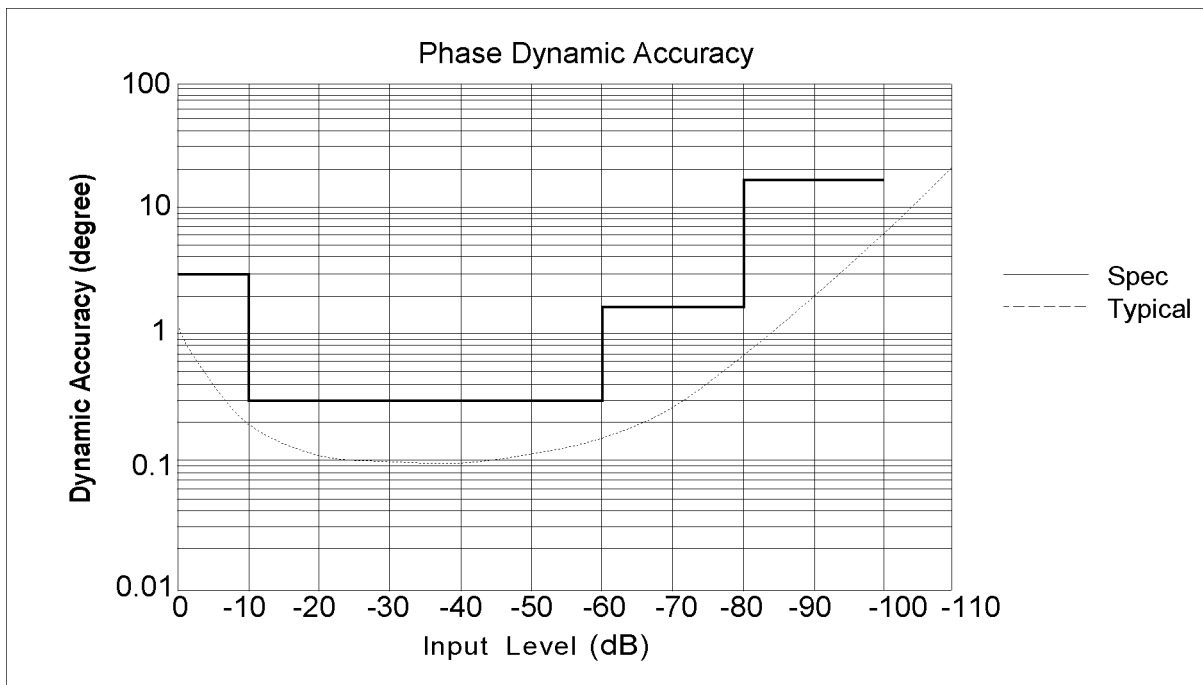
Phase Characteristics

Measurements format Standard format, Expanded phase format
Frequency response (deviation from linear phase) (A/R, B/R) (SPC for A/B)
 at -10 dBm input, input attenuator: 10 dB, IFBW ≤ 3 kHz, 23 ± 5°C < ±12°

Dynamic accuracy (A/R, B/R) (SPC for A/B)

Input Level (relative to full scale input level -10 dB)	Dynamic Accuracy ¹ frequency ≥ 100 Hz
0 dB ≥ input level > -10 dB	±3°
-10 dB ≥ input level ≥ -60 dB	±0.3°
-60 dB > input level ≥ -80 dB	±1.8°
-80 dB > input level ≥ -100 dB	±18°

1. R input level (B input level for A/B) = full scale input level -10 dB, IFBW = 10 Hz, 23 ± 5°C



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Figure 1-2. Phase Dynamic Accuracy

Trace noise (A/R, B/R, A/B)
 at 50 MHz, both inputs: full scale input level -10 dB, IFBW=300 Hz <0.04° rms (SPC)
Stability (A/R, B/R, A/B) < ±0.1 °/°C (SPC)

Group Delay Characteristics

Aperture [Hz] 0.25% to 20% of span

Accuracy

In general, the following formula can be used to determine the accuracy, in seconds, of a specific group delay measurement:

$$\text{.....} \frac{\text{PhaseAccuracy}(\text{degree})}{\text{Aperture}(\text{Hz}) \times 360(\text{degree})}$$

Sweep Characteristics

Sweep type Linear frequency, Log frequency, Power, List frequency

Sweep direction Upper direction only

Trigger type Hold, Single, Number of groups, Continuous

Trigger source Internal (free run), External, Manual, HP-IB (bus)

Event trigger On point, On sweep

Spectrum Measurement

Frequency Characteristics

Frequency range 10 Hz to 500 MHz

Frequency readout accuracy

..... $\pm((freq\ readout[Hz]) \times (freq\ ref\ accuracy[1]) + RBW[Hz] + \frac{SPAN[Hz]}{NOP-1})[Hz]$
where NOP means number of display points

Frequency reference

Accuracy

at $23 \pm 5^\circ\text{C}$, referenced to 23°C $<\pm 5.5$ ppm

Aging $<\pm 2.5$ ppm/year (SPC)

Initial achievable accuracy $<\pm 1.0$ ppm (SPC)

Temperature stability

at $23 \pm 5^\circ\text{C}$, referenced to 23°C $<\pm 2$ ppm (SPC)

Precision frequency reference (option 1D5)

Accuracy

at 0°C to 40°C , referenced to 23°C $<\pm 0.13$ ppm

Aging $<\pm 0.1$ ppm/year (SPC)

Initial achievable accuracy $<\pm 0.02$ ppm (SPC)

Temperature stability

at 0°C to 40°C , referenced to 23°C $<\pm 0.01$ ppm (SPC)

Resolution bandwidth (RBW)

Range

3 dB RBW at span > 0 1 Hz to 1 MHz, 1-3 step

3 dB RBW at span = 0 3k, 5k, 10k, 20k, 40k, 100k, 200k, 400k, 800k, 1.5M, 3M, 5MHz

Selectivity (60 dB BW / 3 dB BW)

at span > 0 <3

Mode Auto or Manual

Accuracy

at span > 0 $<\pm 10\%$

at span = 0 $<\pm 30\%$

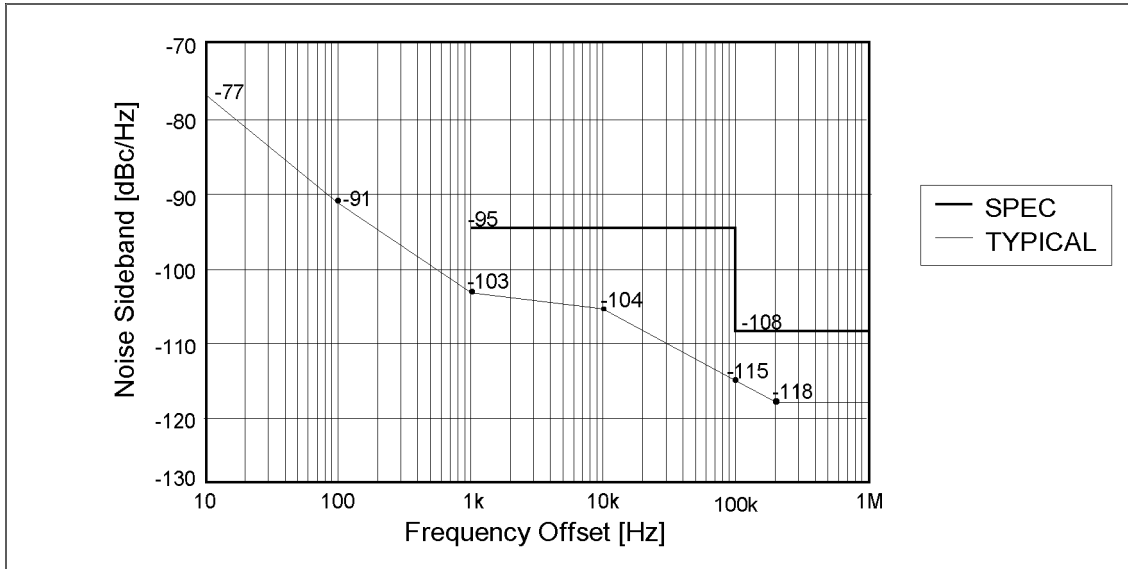
Video bandwidth (VBW)

Range

at span > 0 3 mHz to 3 MHz, 1-3 step, $0.003 \leq VBW/RBW \leq 1$

Noise sidebands

Offset from Carrier	Noise Sidebands
≥1 kHz	< -95 dBc/Hz
≥100 kHz	< -108 dBc/Hz



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Figure 1-3. Noise Sidebands

Amplitude Characteristics

- Amplitude range** displayed average noise level to +30 dBm
- Reference value setting range** -100 dBm to +30 dBm
- Level accuracy**
at -20 dBm input, 50 MHz, input attenuator: 10 dB, 23 ± 5°C <±1.0 dB
- Frequency response**
at -20 dBm input, input attenuator: 10 dB, referenced to level at 50 MHz, 23 ± 5°C
- frequency ≥ 100 Hz <±1.5 dB
- frequency < 100 Hz <±3.0 dB
- Amplitude fidelity**¹
- Log scale**²

Range (dB to reference input level) [dB]	Amplitude Fidelity [dB]
0 to -30	±0.05
-30 to -40	±0.1
-40 to -50	±0.2
-50 to -60	±0.5
-60 to -70	±1.0
-70 to -80	±3.0

Linear scale² <±3%

¹ Fidelity shows an extent of nonlinearity referenced to the reference input level.

² RBW = 10 Hz, -20 dBm ≤ reference value ≤ +30 dBm, reference input level=full scale input level -10 dB, 23 ± 5°C

Note: Refer to *Input attenuator* part for the definition of full scale input level.

Displayed average noise level

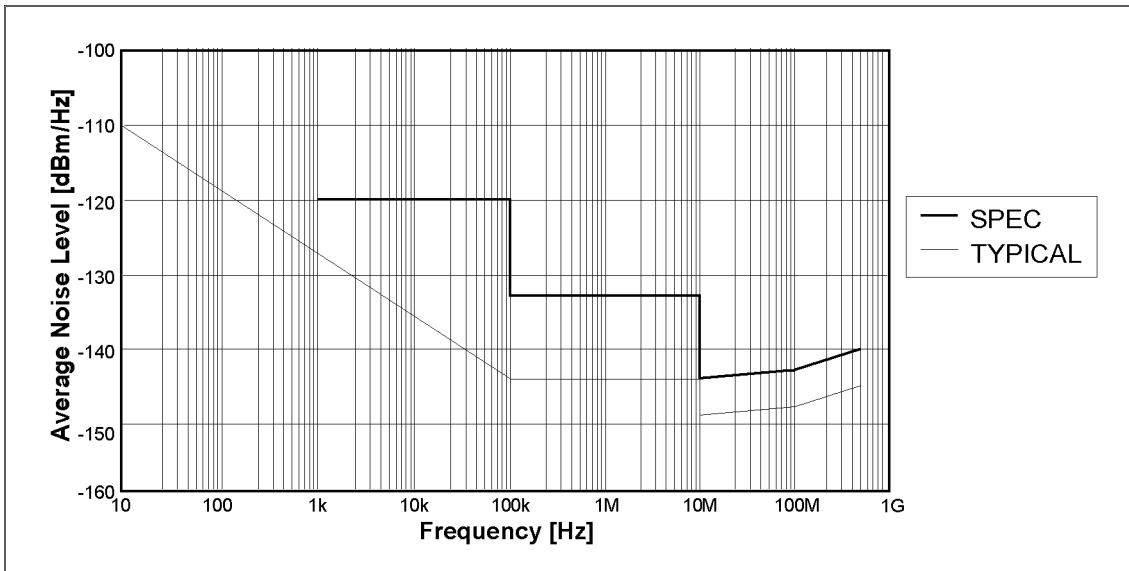
at reference value ≤ -40 dBm, input attenuator: auto or 0 dB

at frequency ≥ 1 kHz -120 dBm/Hz

at ≥ 100 kHz -133 dBm/Hz

at ≥ 10 MHz (-145 + frequency/100 MHz) dBm/Hz¹

¹ at start frequency ≥ 10 MHz



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Figure 1-4. Typical Displayed Average Noise Level

On-screen dynamic range

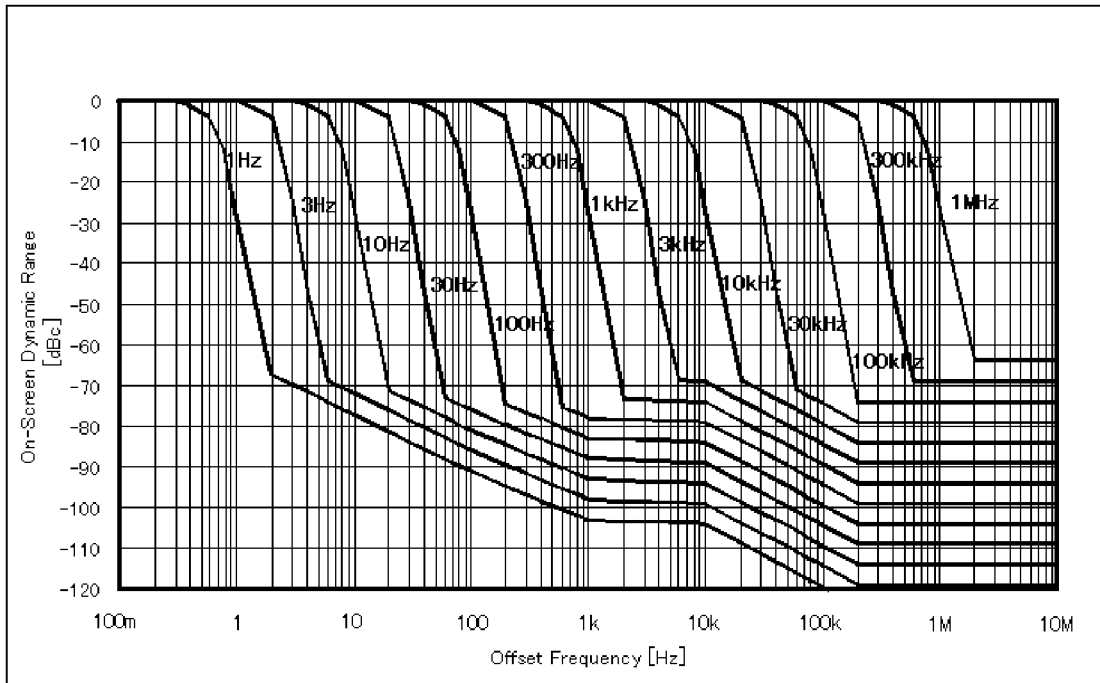


Figure 1-5. Typical On-screen Dynamic Range (Center: 100 MHz)

Spurious responses

Second harmonic distortion

at single tone input with full scale input level -10 dB, input signal frequency ≥ 100 kHz
 <-70 dBc, <-75 dBc (SPC)

Third order inter-modulation distortion

at two tones input with full scale input level -16 dB, separation ≥ 100 kHz
 <-75 dBc, <-80 dBc (SPC)

Spurious

at single tone input with full scale input level -10 dB, input signal frequency ≤ 500 MHz
 <-75 dBc
 except for the following frequency ranges:
 5.6 MHz ± 1 MHz, 30.6 MHz ± 1 MHz, 415.3 MHz ± 1 MHz

Residual response

at reference value setting ≤ -40 dBm, input attenuator: auto or 0 dB <-110 dBm

Typical dynamic range

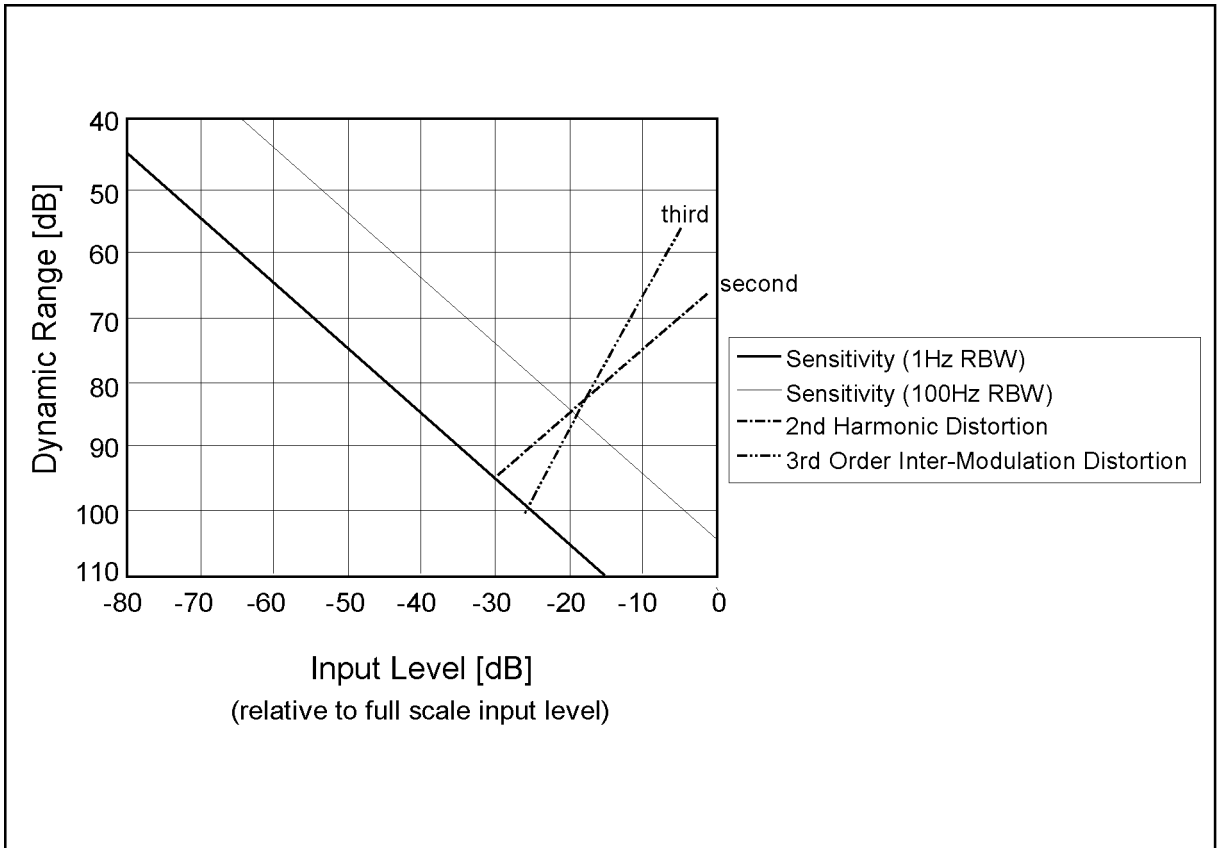


Figure 1-6. Typical Dynamic Range at Inputs R, A, and B

Input attenuator

Setting range 0 dB to 50 dB, 10 dB step

Attenuator Setting (dB)	Full Scale Input Level (dBm)
0	-20
10	-10
20	0
30	+10
40	+20
50	+30

Mode Auto or Manual

(In auto mode, the attenuator is set to 20 dB above the reference value; this ensures that the maximum signal level after the attenuator will not be greater than -20 dBm.)

Input attenuator switching uncertainty

at attenuator: ≤ 30 dB, referenced to 10 dB $<\pm 1.0$ dB
 at attenuator: ≥ 40 dB, referenced to 10 dB $<\pm 1.5$ dB

Temperature drift $<\pm 0.05$ dB/°C (SPC)

Scale

Log 0.1 dB/div to 20 dB/div
Linear
at watt 1.0×10^{-12} W/div
at volt 1.0×10^{-9} V/div
Measurement format Spectrum or Noise (Hz)
Display unit dBm (unit of marker: dBm, dBV, dB μ V, V, W)

Sweep Characteristics

Sweep type Linear, List
Trigger type Hold, Single, Number of groups, Continuous,
Trigger source Internal (free run), External, Manual, Level gate, Edge gate, HP-IB (bus)

Sweep time (excluding each sweep setup time)

RBW	SPAN	Typical Sweep Time
1 MHz	500 MHz	190 ms
100 kHz	100 MHz	300 ms
10 kHz	10 MHz	240 ms
1 kHz	1 MHz	190 ms
100 Hz	100 kHz	270 ms
10 Hz	10 kHz	2.0 s
1 Hz	1 kHz	11 s
—	Zero Span	_1

1 See the next item for sweep time at zero span

Zero span

RBW	Minimum Resolution	Maximum Sweep Time
5 MHz	40 ns	1.28 ms
100 kHz	1.28 μ s	81.92 ms
3 k Hz	40.96 μ s	2.62 s

Number of display points

at span > 0 2 to 801 points (automatically set)
at span = 0 2 to 801 points (selectable)

Input Characteristics

Input Port R, A, B

Crosstalk

from any input to other inputs, at the same input attenuator settings < -100 dB (SPC)

Connector Type N female

Impedance 50 Ω nominal

Return Loss

	Input Attenuator		
	0 dB	10 dB	20 dB to 50 dB
10 Hz ≤ frequency < 100 kHz	25 dB ¹	25 dB ¹	25 dB ¹
100 kHz ≤ frequency ≤ 100 MHz	25 dB ¹	25 dB	25 dB ¹
100 MHz < frequency	15 dB ¹	15 dB	15 dB ¹

¹ (SPC)

Input Level +30 dBm max. at input attenuator: 50 dB

Maximum safe input level +30 dBm or ±7 Vdc (SPC)

Specifications when Option 1D6 Time-Gated spectrum analysis is installed

All specifications are identical to the standard HP 4395A except the following items.

Gate length

Range 6 μ s to 3.2 s
Resolution

Range of Gate Length(T_l)	Resolution
$6 \mu\text{s} \leq T_l \leq 25 \text{ ms}$	0.4 μ s
$25 \text{ ms} < T_l \leq 64 \text{ ms}$	1 μ s
$64 \text{ ms} < T_l \leq 130 \text{ ms}$	2 μ s
$130 \text{ ms} < T_l \leq 320 \text{ ms}$	5 μ s
$320 \text{ ms} < T_l \leq 1.28 \text{ s}$	20 μ s
$1.28 \text{ s} < T_l \leq 3.2 \text{ s}$	100 μ s

Gate delay

Range 2 μ s to 3.2 s
Resolution

Range of Gate Delay (T_d)	Resolution
$2 \mu\text{s} \leq T_d \leq 25 \text{ ms}$	0.4 μ s
$25 \text{ ms} < T_d \leq 64 \text{ ms}$	1 μ s
$64 \text{ ms} < T_d \leq 130 \text{ ms}$	2 μ s
$130 \text{ ms} < T_d \leq 320 \text{ ms}$	5 μ s
$320 \text{ ms} < T_d \leq 1.28 \text{ s}$	20 μ s
$1.28 \text{ s} < T_d \leq 3.2 \text{ s}$	100 μ s

Additional Amplitude Error

Log scale < 0.3 dB (SPC)

Linear scale < 3% (SPC)

Gate Control Modes Edge (positive/negative) or Level

Gate Trigger Input (External Trigger Input is used)

Connector BNC female

level TTL

Gate Output

Connector BNC female

level TTL

HP 4395A Option 010 Impedance Measurement

The following specifications are applied when the HP 43961A Impedance Test Kit is connected to the HP 4395A.

Measurement Functions

Measurement parameters Z, Y, L, C, Q, R, X, G, B, θ
Display parameters $|Z|$, θ_z , R, X, $|Y|$, θ_y , G, B, $|\Gamma|$, θ_γ , Γ_x , Γ_y , C_p, C_s, L_p, L_s, R_p, R_s, D, Q

Display Formats

- Vertical lin/log scale
- Complex plane
- Polar/Smith/admittance chart

Sweep Parameters

- Linear frequency sweep
- Logarithmic frequency sweep
- List frequency sweep
- Power sweep (in dBm unit)

IF Bandwidth

- 2, 10, 30, 100, 300, 1k, 3k, 10k, 30k [Hz]

Calibration

- OPEN/SHORT/LOAD 3 term calibration
- Fixture compensation
- Port extension correction

Measurement Port Type

- APC-7

Output Characteristics

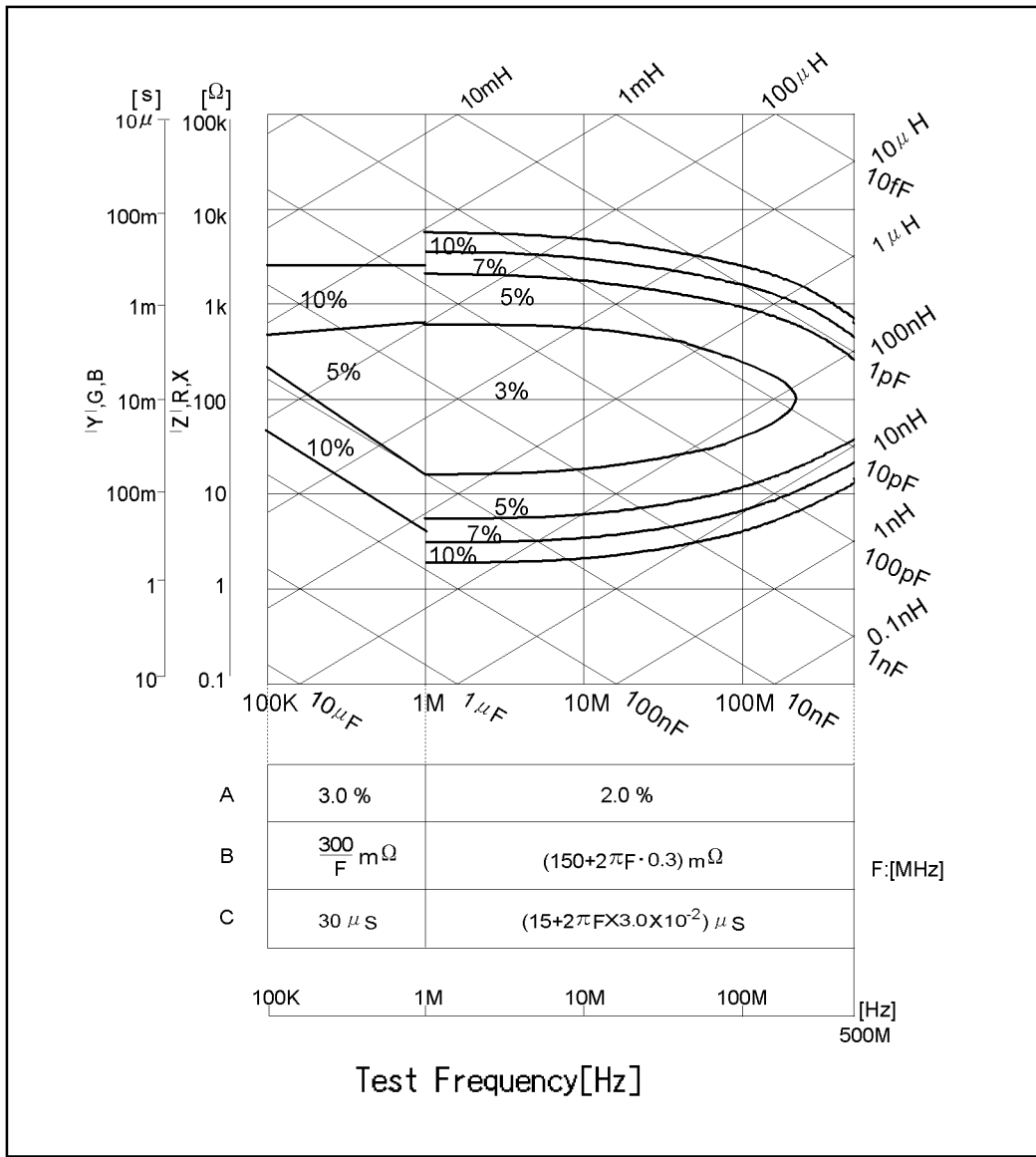
Frequency range 100 kHz to 500 MHz
Frequency resolution 1 mHz
Output impedance 50 Ω nominal
Output Level
 when the measurement port is terminated by 50 Ω ¹ -56 to +9 dBm
 when the measurement port is open 0.71 mVrms to 1.26 Vrms
¹ Note: When the measurement port is terminated with 50 Ω , the signal level at the measurement port is 6 dB lower than the signal level at the RF OUT port.
Resolution 0.1 dBm
Level accuracy $\pm (A + B + 6 \times F/(1.8 \times 10^9))$ dB
Where

A = 2 dB
B = 0 dB (at 0 dBm \leq P \leq +15 dBm)
or B = 1 dB (at -40 dBm \leq P < 0 dBm)
or B = 2 dB (at -50 dBm \leq P < -40 dBm)
F is setting frequency [Hz], P is output power setting

Measurement Basic Accuracy (Supplemental Performance Characteristics)

Measurement accuracy is specified at the connecting surface of the APC-7 connector of the HP 43961A under the following conditions:

Warm up time	> 30 minutes
Ambient temperature	23°C ± 5°C, within ±1°C from the temperature at which calibration is performed
Signal level (setting)	0 to +15 dBm
Correction	ON
IFBW (for calibration and measurement)	≤ 300 Hz
Averaging factor (for calibration and measurement)	≥ 8



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Figure 1-7. Impedance Measurement Accuracy

|Z| - θ Accuracy

$|Z|$ accuracy $Z_a = A + (B/|Z_m| + C \times |Z_m|) \times 100[\%]$

θ accuracy $\theta_a = \sin^{-1}(Z_a/100)$

Where, $|Z_m|$ is $|Z|$ measured. A, B, and C are obtained from Figure 1-7.

YI - θ Accuracy

$$|Y| \text{ accuracy} \quad Y_a = A + (B \times |Y_m| + C/|Z_m|) \times 100[\%]$$

$$\theta \text{ accuracy} \quad \theta_a = \sin^{-1}(Y_a/100)$$

Where, $|Y_m|$ is $|Y|$ measured. A, B, and C are obtained from Figure 1-7.

R - X Accuracy (Depends on D)

Accuracy	$D \leq 0.2$	$0.2 < D \leq 5$	$5 < D$
R_a	$\pm X_m \times X_a / 100[\Omega]$	$R_a / \cos\theta[\%]$	$R_a[\%]$
X_a	$X_a[\%]$	$X_a / \sin\theta[\%]$	$\pm R_m \times R_a / 100[\Omega]$

Where,

D can be calculated as: R/X , or
 $R/(2\pi f \times L_s)$, or
 $R \times 2\pi f \times C_s$

θ can be calculated as: $\tan^{-1}(X/R)$, or
 $\tan^{-1}(2\pi f \times L_s/R)$, or
 $\tan^{-1}(1/(R \times 2\pi f \times C_s))$

$$R_a = A + (B/|R_m| + C \times |R_m|) \times 100[\%]$$

$$X_a = A + (B/|X_m| + C \times |X_m|) \times 100[\%]$$

R_m and X_m are the measured R and X, respectively. A, B, and C are obtained from Figure 1-7.

G - B Accuracy (Depends on D)

Accuracy	$D \leq 0.2$	$0.2 < D \leq 5$	$5 < D$
G_a	$\pm B_m \times B_a / 100[S]$	$G_a / \cos\theta[\%]$	$G_a[\%]$
B_a	$B_a[\%]$	$B_a / \sin\theta[\%]$	$\pm G_m \times G_a / 100[S]$

Where,

D can be calculated as: G/B , or
 $G/(2\pi f \times C_p)$, or
 $G \times 2\pi f \times L_p$

θ can be calculated as: $\tan^{-1}(B/G)$, or
 $\tan^{-1}(2\pi f \times C_p/G)$, or
 $\tan^{-1}(1/(G \times 2\pi f \times L_p))$

$$G_a = A + (B/|G_m| + C \times |G_m|) \times 100[\%]$$

$$B_a = A + (B/|B_m| + C \times |B_m|) \times 100[\%]$$

G_m and B_m are the measured G and B, respectively. A, B, and C are obtained from Figure 1-7.

D Accuracy

Accuracy	$D \leq 0.2$	$0.2 < D$
D_a	$Z_a/100$	$(Z_a/100) \times (1 + D^2)$

Where, Z_a is $|Z|$ accuracy.

L Accuracy (Depends on D)

Accuracy	$D \leq 0.2$	$0.2 < D$
L_a	$L_a/100$	$L_a(1 + D)$

Where, $L_a = A + (B/|Z_l| + C \times |Z_l|) \times 100[\%]$

$|Z_l| = 2\pi f \times L_m$, f is frequency in Hz, and L_m is measured L. A, B, and C are obtained from Figure 1-7.

C Accuracy (Depends on D)

Accuracy	$D \leq 0.2$	$0.2 < D$
C_a	C_a	$C_a(1 + D)$

Where, $C_a = A + (B/|Z_c| + C \times |Z_c|) \times 100[\%]$

$|Z_c| = 2\pi f \times C_m$, f is frequency in Hz, and C_m is measured C. A, B, and C are obtained from Figure 1-7.

Common to Network/Spectrum/Impedance Measurement

Display

LCD

Size/Type	8.4 inch color LCD
Number of pixels	640 x480
Effective Display Area	160 mm x 115 mm(600 x 430 dots)
Number of display channels	2
Format	single, dual (split or overwrite)
Number of traces	
For measurement	2 traces
For memory	2 traces
Data math	<i>gain x data - offset,</i> <i>gain x (data - memory) - offset,</i> <i>gain x (data + memory) - offset,</i> <i>gain x (data/memory) - offset</i>
Data hold	Maximum hold, Minimum hold

Marker

Number of markers

Main marker	1 for each channel
Sub-marker	7 for each channel
Δmarker	1 for each channel

Hard copy

Mode	Dump mode only (including color dump mode)
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Storage

Built-in flexible disk drive

Type	3.5 inch, 1.44 MByte, or 720 KByte, 1.44 MByte format is used for disk initialization
Memory	512 KByte, can be backed up by flash memory

HP-IB

Interface	IEEE 488.1-1987, IEEE 488.2-1987, IEC 625, and JIS C 1901-1987 standards compatible.
Interface function	SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT1, C1, C2, C3, C4, C11, E2
Data transfer formats	ASCII, 32 and 64 bit IEEE 754 Floating point format, DOS PC format (32 bit IEEE with byte order reversed)

Printer parallel port

Interface	IEEE 1284 Centronics standard compliant
Printer control language	HP PCL3 Printer Control Language
Connector	D-SUB (25-pin)

Option 001 DC Voltage/Current Source

The setting of option 001 DC voltage/current source is independent of Channel 1 and Channel 2 settings.

Voltage

Range	-40 V to +40 V
Resolution	1 mV
Current limitation	
at Voltage setting = -25 V to +25 V	±100 mA
at Voltage setting = -40 V to -25 V, 25 V to 40 V	±20 mA

Current

Range	-20 µA to -100 mA, 20 µA to 100 mA
Resolution	20 µA
Voltage limitation	
at Current setting = -20 mA to +20 mA	±40 V
at Current setting = -100 mA to -20 mA, 20 mA to 100 mA	±25 V

Accuracy

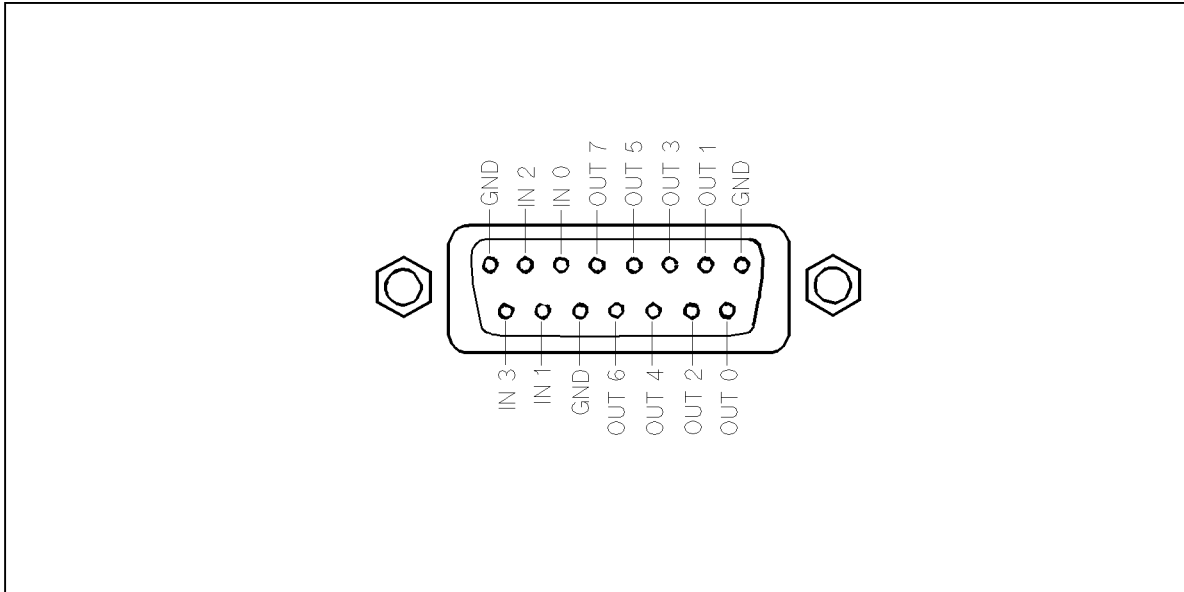
Voltage	
at $23 \pm 5^\circ\text{C}$	$\pm(0.1\% + 4 \text{ mV} + I_{\text{dc}}^1 [\text{mA}] \times 5 [\Omega] \text{ mV})$
Current	
at $23 \pm 5^\circ\text{C}$	$\pm(0.5\% + 30 \mu\text{A} + V_{\text{dc}}^2 [\text{V}]/10 [\text{k}\Omega] \text{ mA})$
	¹ current at DC source connector
	² voltage at DC source connector

Probe Power

Output voltage	+15 V (300 mA), -12.6 V (160 mA), GND nominal
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Specifications When HP Instrument BASIC Is Operated

Keyboard	PS/2 style 101 English keyboard
Connector	mini-DIN
8 bit I/O port	
Connector	D-SUB (15-pin)
Level	TTL
Number of Input/Output bit	4 bit for Input, 8 bit for Output

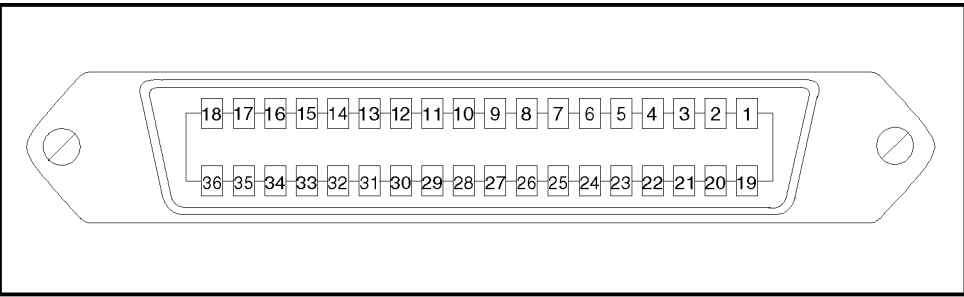


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Figure 1-8. 8 bit I/O Port Pin Assignments

24-bit I/O Interface

- Connector** D-SUB (36-pin)
- Level** TTL
- I/O** 8-bit for input or output, 16-bit for output



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Figure 1-9. 24-bit I/O Interface Pin Assignment

Table 1-1. Signal Source Assignment

Pin No.	Signal Name	Signal Standard
1	GND	0 V
2	INPUT1	TTL level, pulse input (pulse width: 1µs or above)
3	OUTPUT1	TTL level, latch output
4	OUTPUT2	TTL level, latch output
5	OUTPUT PORT A0	TTL level, latch output
6	OUTPUT PORT A1	TTL level, latch output
7	OUTPUT PORT A2	TTL level, latch output
8	OUTPUT PORT A3	TTL level, latch output
9	OUTPUT PORT A4	TTL level, latch output
10	OUTPUT PORT A5	TTL level, latch output
11	OUTPUT PORT A6	TTL level, latch output
12	OUTPUT PORT A7	TTL level, latch output
13	OUTPUT PORT B0	TTL level, latch output
14	OUTPUT PORT B1	TTL level, latch output
15	OUTPUT PORT B2	TTL level, latch output
16	OUTPUT PORT B3	TTL level, latch output
17	OUTPUT PORT B4	TTL level, latch output
18	OUTPUT PORT B5	TTL level, latch output
19	OUTPUT PORT B6	TTL level, latch output
20	OUTPUT PORT B7	TTL level, latch output
21	I/O PORT C0	TTL level, latch output
22	I/O PORT C1	TTL level, latch output
23	I/O PORT C2	TTL level, latch output
24	I/O PORT C3	TTL level, latch output
25	I/O PORT D0	TTL level, latch output
26	I/O PORT D1	TTL level, latch output
27	I/O PORT D2	TTL level, latch output
28	I/O PORT D3	TTL level, latch output
29	PORT C STATUS	TTL level, input mode: LOW, output mode: HIGH
30	PORT D STATUS	TTL level, input mode: LOW, output mode: HIGH
31	WRITE STROBE SIGNAL	TTL level, active low, pulse output (width: 10 µs; typical)
32	+5V PULLUP	
33	SWEEP END SIGNAL	TTL level, active low, pulse output (width: 20 µs; typical)
34	+5V	+5V, 100 mA MAX
35	PASS/FAIL SIGNAL	TTL level, PASS: HIGH, FAIL: LOW, latch output
36	PASS/FAIL WRITE STROBE SIGNAL	TTL level, active low, pulse output (width: 10 µs; typical)

General Characteristics

Input and Output Characteristics

External reference input

Frequency	10 MHz \pm 100 Hz (SPC)
Level	-5 dBm to +5 dBm (SPC)
Input impedance	50 Ω nominal
Connector	BNC female

Internal Reference Output

Frequency	10 MHz nominal
Level	0 dBm (SPC)
Output Impedance	50 Ω nominal
Connector	BNC female

Reference oven output (Option 1D5)

Frequency	10 MHz nominal
Level	0 dBm (SPC)
Output impedance	50 Ω nominal
Connector	BNC female

External trigger input

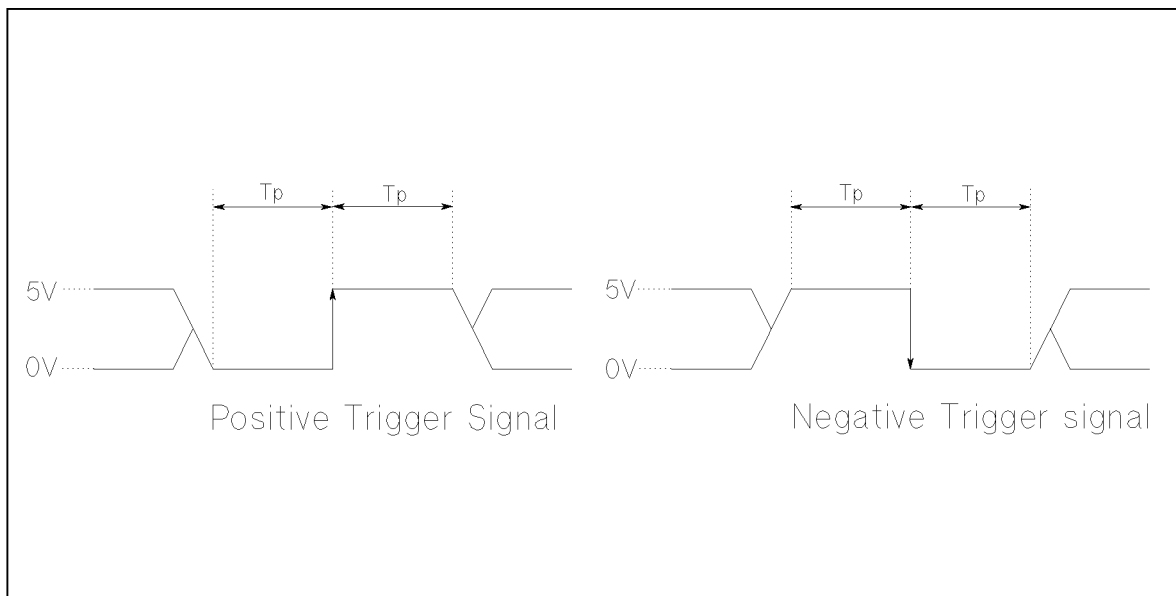
Level	TTL
Pulse width (T_p)	$\geq 2 \mu$ s Typically
Polarity	positive/negative selective
Connector	BNC female

External program Run/Cont input

Connector	BNC female
Level	TTL

Gate output (Option 1D6)

Level	TTL
Connector	BNC female

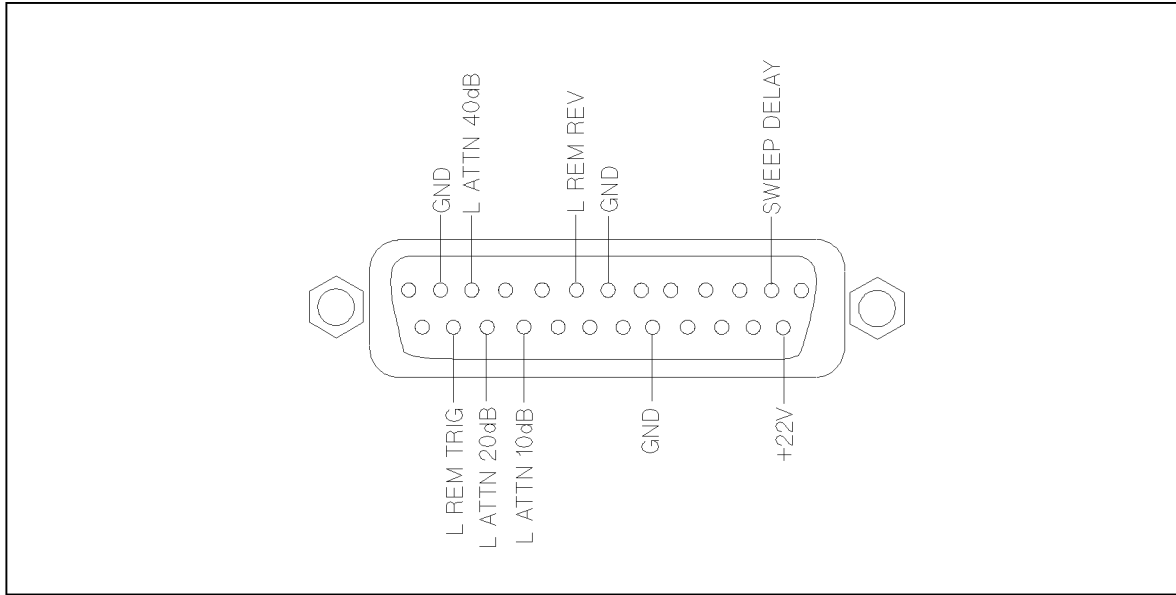


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Figure 1-10. Trigger Signal (External trigger input)

S-parameter test set interface**Connector** D-SUB (25-pin)

Caution Do not connect a printer to this connector. If you connect a printer with the S-parameter test set interface connector (TEST SET-I/O INTERCONNECT), it may cause damage to the printer.

**Figure 1-11. S-Parameter Test Set Interface Pin Assignments****External monitor output****Connector** D-SUB (15-pin HD)**Display resolution** 640 x 480 VGA**Operation Conditions****Temperature**

Disk drive non-operating condition 0°C to 40°C

Disk drive operating condition 10°C to 40°C

Humidityat wet bulb temperature $\leq 29^{\circ}\text{C}$, without condensation

Disk drive non-operating condition 15% to 95% RH

Disk drive operating condition 15% to 80% RH

Altitude 0 to 2,000 m**Warm up time** 30 minutes

Non-operation Conditions

Temperature -20°C to 60°C
Humidity
 at wet bulb temperature $\leq 45^\circ\text{C}$, without condensation 15% to 95% RH
Altitude 0 to 4,572 m

Others

EMC Complies with CISPR 11 (1990) / EN 55011 (1991) : Group 1, Class A
 Complies with EN 50082-1 (1992) / IEC 1000-4-2 (1995) : 4 kV CD, 8 kV AD
 Complies with EN 50082-1 (1992) / IEC 801-3 (1984) : 3 V/m
 Complies with EN 50082-1 (1992) / IEC 1000-4-4 (1995) : 1 kV / Main, 0.5kV / Signal Line
 Complies with IEC 1000-3-2 (1995) / EN 61000-3-2 (1995)
 Complies with IEC 1000-3-3 (1994) / EN 61000-3-3 (1995)
Safety Complies with IEC 1010-1 (1990), Amendment 1 (1992), Amendment 2 (1995)
 Certified by CSA-C22.2 No.1010.1-92
Power requirements 90 V to 132 V, or 198 V to 264 V (automatically switched), 47 to 63 Hz, 300 VA max.
Weight 21 kg (SPC)
Dimensions 425 (W) x 235 (H) x 553 (D) mm

Furnished Accessories

Accessory	HP part number	Accessory	HP part number
Operation Manual	04395-90000	Power Cable ²	—
Programming Manual	04395-90001	BNC Adapter ³	1250-1859
HP Instrument BASIC Users Handbook	E2083-90005	50 to 75 Ω minimum loss pad ⁴	HP 11825B option C04
Service Manual ¹	04395-90100	50 to 75 W adapter ⁴	1250-2438
Sample Program Disk	04395-18000	mini-DIN keyboard	C3757-60401
Floppy Disk	9164-0299	Handle Kit ⁵	5062-3991
BNC cable	8120-1839	Rack Mount Kit ⁶	5062-3979
BNC-N adapter	1250-0780	Rack Mount and Handle Kit ⁷	5062-3985

1 Option 0BW only

2 The power cable depends on where the instrument is used.

3 Option 1D5 only

4 Option 1D7 only

5 Option 1CN only

6 Option 1CM only

7 Option 1CP only

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