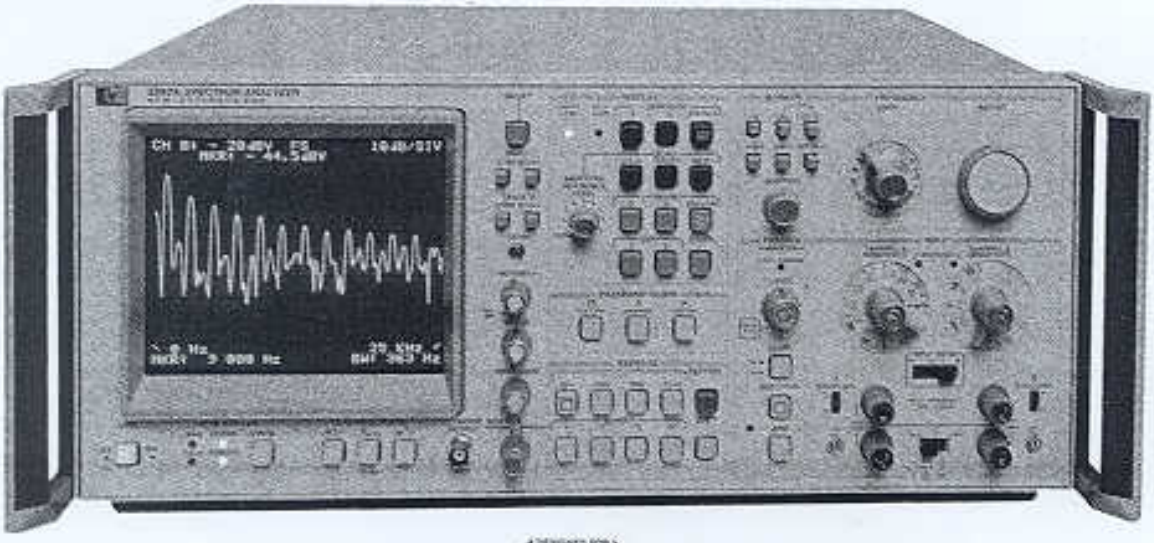
SIGNAL ANALYZERS

Dual-Channel, Dynamic Signal Analyzer 0.02 Hz to 25.5 kHz

Model 3582A

- Transfer function magnitude and phase measurements
- Coherence function measurement
- Phase spectrum measurement
- Transient capture and frequency domain analysis
- Internal periodic and random noise source
- Band selectabe analysis for 0.02 Hz resolution
- Alphanumeric CRT annotation and marker readout



HP 3582A

HP-IB SYSTEMS

Description

The HP 3582A offers outstanding value in a dual-channel, real-time spectrum analyzer that solves bench and systems measurement problems in the frequency range of 0.02 Hz to 25.599 kHz. Sophisticated LSI digital filtering combined with microcomputer execution of the Fast Fourier Transform (FFT) provides exceptional measurement capability and performance.

Exceptional Frequency Resolution

The ability to resolve closely spaced spectral components is often critical in the study of subtle phenomena such as structural transfer functions. Unlike conventional dynamic signal analysis which extends from dc to some maximum frequency, the HP 3582A can "zoom in" to analyze any selected band of frequencies with dramatically improved resolution. The start or center frequency of the 5 Hz to 25 kHz band analysis spans can be adjusted in 1 Hz increments to cover the entire frequency range of the instrument. This provides resolution down to 20 mHz across the entire range for spectrum analysis or 40 mHz for transfer functions, representing as much as 5000 to 1 improvement over conventional "baseband" analysis.

Excellent Low Frequency Coverage

Many electrical and physical measurements have significant spectral information in the audio and sub-audio range. With frequency ranges from 25 kHz down to 1 Hz full scale, the HP 3582A is extremely well suited to these types of measurements.

Real Time Measurement Speed

Long measurement times can be a major limitation of swept low frequency spectrum analyzers. In high volume testing or in applications requiring substantial on-line tuning these long measurement times are both expensive and inconvenient. Since the HP 3582A uses an advanced microcomputer to execute the Fast Fourier Transform (FFT), it can perform equivalent measurements as much as one to two orders of magnitude faster than a swept analyzer.

Wide Dynamic Range

In many applications the information of interest is contained not in the high amplitude fundamental, but rather in the low amplitude components. For a spectrum analyzer to provide useful information about these low level components in the presence of a large signal, it must offer wide dynamic range. The HP 3582A dynamic range is specified as 70 dB.

Phase Spectrum Measurement

Most spectrum analyzers can measure only the amplitude spectrum of a signal, yet complete characterization in the frequency domain also requires phase information. Signals with identical amplitude spectra, but different phase spectra can differ significantly. The advanced digital signal processing techniques incorporated in the HP 3582A provides direct measurement of phase spectra.

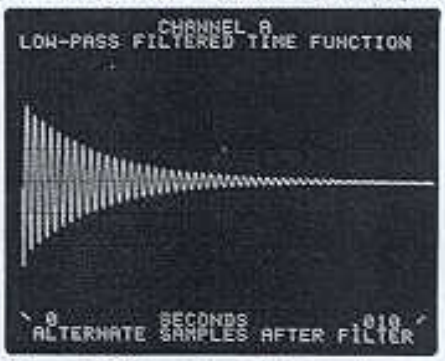


Figure 1: Captured transients can be measured in either the time or the frequency domain.

Transient Capture and Analysis

Many signals such as mechanical shocks and electrical transients may occur infrequently and spontaneously and may last only for a brief period of time. Swept spectrum analyzers generally cannot handle these transient signals. By using digital processing techniques, the HP 3582A can capture and analyze transients as short as a few milliseconds. This means that spectrum analysis and transfer function analysis are no longer limited to stable, time invariant signals.

Transfer Function Measurement with the Internal Noise Source

Many electrical circuits and mechanical systems can be treated as linear networks and can be characterized by the magnitude and phase of their transfer functions.

Most spectrum analyzers can measure only the magnitude portion of the transfer function—and even then only by assuming a flat drive signal. The HP 3582A directly measures the complete transfer function, both magnitude and phase. With dual channels analysis of

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linear and non-linear networks, respectively. In addition, the sources are bandlimited to concentrate all stimulus energy in the analysis range.

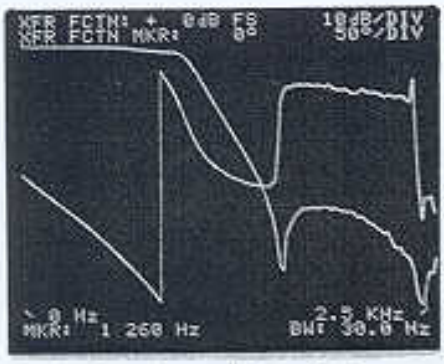

Figure 2: Transfer function amplitude and phase are measured with real time speed.

Coherence Function Measurement

The measurement of a device transfer function assumes that the device under test is linear and that no portion of the output is caused by noise or extraneous signal sources. In active electronic circuits or mechanical structures these conditions can easily be violated - yet such violations are very difficult to identify. The HP 3582A coherence function simplifies this problem by indicating the probability for causality between the two input signals at each frequency. If the coherence between input and measured output is low, the output signal contains a large amount of energy that is not related to the input. Thus, the transfer function measured at that frequency is not reliable.

Digital Averaging Capability

Many spectral measurements contain both discrete signals and random noise components. Obtaining proper amplitude readings can be difficult if the random components are really the ones of interest or are of nearly the same amplitude as the discrete signals.

The digital averaging techniques incorporated in the HP 3582A help solve these problems. The RMS averaging mode takes the power average of 4 to 256 successive spectra in order to reduce the uncertainty of the estimate of random spectral components.

When a synchronizing trigger signal is available, the TIME average can enhance the signal-to-noise ratio by as much as 24 dB. Since it involves the averaging of successive time records before transformation, it is also significantly faster than other types of averaging.

Powerful HP-IB Capability

All major front panel controls with the exception of the verniers are fully programmable via the HP-IB. The programming codes are simple and are logically derived from the front panel control labels.

From the HP-IB it is a simple matter to command the HP 3582A to output results in a usable form. Not only can the various control settings be retrieved, but numeric marker data can be extracted. More importantly, the full display can be read in ASCII format along with complete annotation.

HP 3582A Specifications

Frequency

Range: 0.02 Hz to 25.5 kHz with the low frequency limit the result of dc response.
Spans: 1 Hz to 25 kHz in a 1-2.5-5-10 sequence. The 1 Hz and 2.5 Hz spans are usable only in the 0-start mode.
Accuracy: ±0.003% of display center frequency.
Resolution: 0.4% of the frequency span for single channel or 0.8% of the frequency span for dual channels.

Filter Passband Shape

	Flat Top	Hanning	Uniform
3 dB Bandwidth (single channel)	(1.4 ± 0.1% of span)	(0.58 ± 0.05% of span)	(0.35 ± 0.02% of span)
Shape Factor	2.6 ± 0.1	9.1 ± 0.2	716 ± 20

Amplitude

Display Modes
Log: 10 dB/division or 2 dB/division
Linear: constant voltage/division
Measurement Range
Log: +30 dBV to −120 dBV noise floor
Linear: +30 V to 1μV noise floor
Dynamic range: 70 dB
DC response: adjustable to >40 dB below maximum input level
Accuracy
Accuracy at the Passband Center ±0.5 dB
Flat top filter: +0, −0.1 dB
Hanning filter: +0, −1.5 dB
Uniform filter: +0, −4.0 dB
Note: overall accuracy is the sum of the accuracy at the passband center plus the selected filter accuracy.
Resolution
Log: 0.1 dB
Linear: 3 digits

Phase

Display range: +200° to −200°
Accuracy: ±10°
Resolution: 1°

Transfer Function

Measurement Range
Log: +160 dB full scale to −80 dB full scale
Linear: 4×10^{8} full scale to 4×10^{-8} full scale
Phase display range: +200 degrees to −200 degrees
Accuracy

Amplitude	0.4 dB	0.8 dB
φ	±2°	±5°

02 Hz 5 kHz 25.5 kHz

Coherence: Range 0.0 to 1.0 with 0.01 resolution

Input

Impedance: 10^{6} Ω ±5% shunted by <60 pF from input high to low (for less than 75% relative humidity)
Isolation: input low may be floated up to 30V
Coupling: switch selection of ac or dc coupling. The low frequency 3 dB roll off is <1 Hz.
Common Mode Rejection: >58 dB

Output

X-Y Recorder Level: 0 V to 5.25 V ±5%
Noise Source Level: From <10 mV to >500 mV RMS into > 50 Ω.

General

Environmental
Temperature: 0° C to 55° C operating; −40° C to +75° C storage
Humidity: <95% R.H. 0° C to 40° C
Power Requirements: 100, 120, 220 or 240 volts (+5%, −10%); 48-66 Hz; less than 150 VA
Dimensions
Size: 425.5 W x 552.5 D x 188 mmH (16.75" x 21.75" x 7.4")
Weight: net, 24.5 kg (54 lb); shipping, 29 kg (63 lb)

HP 3582A Spectrum Analyzer **$11,600**