

# HP 3569A Real-Time Frequency Analyzer

## Configuration Guide

The HP 3569A is a two-channel real-time analyzer that offers a wide variety of noise and acoustics measurements in a portable package. To focus the HP 3569A on particular measurement types, you can choose from three application software modules:

- Real-time sound intensity (Option AY1) \*
- Narrowband FFT (Option AY2)
- Reverberation Time (Option AY3)

\* Note: Prior to February 1, 1994, real-time sound intensity was a standard feature of the HP 3569A. It is now configured as an option, allowing you to select the best combination of price and capability for your application.

### HP 3569A Real-Time Frequency Analyzer

The standard HP 3569A provides one- and two-channel octave measurements (both 1/3 and 1/1 resolutions) with the following center frequency bands:

Resolution	1 Channel	2 Channel
1/3 Octave	1.6 Hz to 20 kHz	1.6 Hz to 10 kHz
1/1 Octave	2 Hz to 16 kHz	2 Hz to 8 kHz

Measurements include:

- One- or two-channel 1/3 or 1/1 octave measurements (including A-weighted and unweighted simultaneously)
- Microphone calibration
- Exponentially averaged measurements
- Integrated sound level measurements
- Impulsive sound measurement (single channel)

- Statistical analysis (single channel)
- Level, event and external octave spectra and slices
- Up to 4096 spectra multispectra display

The standard HP 3569A includes a rechargeable battery pack, ac adapter, carrying case, SDF utilities to share data with a PC, operating manuals and a three-year warranty. The ac adapter recharges the batteries during operation and can recharge a spare external battery pack when used with a battery charge adapter (supplied with the optional extra battery pack).

### Measurement Results Summary

Real-Time Octave (Standard)	Real-Time Sound Intensity (Option AY1)	Narrowband FFT (Option AY2)	Reverberation Time (Option AY3)
CH1 Power	Mean Sound	CH1 Power	Power Spectrum
CH2 Power	Pressure	CH2 Power	PSD
CH1 PSD	Intensity	CH1 PSD	T20
CH2 PSD	P-I Index	CH2 PSD	T30
CDF	Field Indicator <sup>†</sup> ( $F_{p_i}$ )	CH1 Time	RT60 <sup>†</sup>
PDF	Field Indicator <sup>†</sup> ( $F_{p_i}$ )	CH2 Time	Std Deviation <sup>†</sup>
$L_1$		Diff Time	Avg. Count <sup>†</sup>
$L_{10}$		Freq. Response	
$L_{50}$		Cross Correlation	
$L_{90}$		Coherence	
$L_{99}$		Intensity	
$L_{user}$			

<sup>†</sup> Indicates Calculated Functions

### **Real-time Sound Intensity (Option AY1)**

The sound intensity option provides dual-channel real-time sound intensity, measurements for noise source identification, intensity mapping and sound power measurements. These measurements meet IEC 1043 standard class 1 processor requirements for measuring sound power utilizing sound intensity measurements. When used with the HP 3569A's sound power measurement table, the HP 3569A calculates the resultant sound power based on a series of sound intensity measurements. For each surface individual areas are entered into the table and sound power is automatically calculated at the end of the measurement. The analyzer provides the following measurements:

- Mean sound pressure level (average of the SPL of channel 1 and 2)
- Sound intensity
- Pressure - intensity index (ratio of average SPL to intensity)
- Sound power (calculated from intensity multispectrum and user defined areas entered into a table)
- Field indicator functions ( $F_{pi}$  and  $F_{+}$  calculated from the intensity and average SPL multispectrums in accordance with ISO 9614-2 Sound Power Standard).

### **Narrowband FFT (Option AY2)**

This option adds two-channel FFT analysis measurements for acoustics and vibration measurements. In addition to basic two channel FFT measurements, Option AY2 adds some special narrow band intensity displays which are complementary to the real-time intensity option AY1. This option includes baseband and zoom measurements of 100, 200, 400, 800 or 1600 lines of FFT resolution. Hann, uniform and flat top window maximize either amplitude accuracy or frequency resolution and force/exponential windows optimize modal impact tests.

### **Reverberation Time Measurements (Option AY3)**

The reverberation time option provides direct display of sound decay times for 1/3 or 1/1 octave bands. This option extends the real-time octave measurements by adding the automatic source control, input control, and analysis needed to compute RT-60.

The option includes a data smoothing algorithm using reverse-Schroeder integration technique and averaging techniques for handling spatial and multi-decay averaging. A special technique for short reverberation times removes the effects of the real-time octave filters. The

analyzer operates in one-channel mode and provides the following measurements:

- Power spectrum
- Power spectral density (PSD)
- T20 (extrapolated 20 dB decay from -5 to -25dB over a full 60 dB trace)
- T30 (extrapolated 30 dB decay from -5 to -35dB over a full 60 dB trace)
- RT60 (Combined results using high and low level thresholds, cumulative)
- Average count (displays the number of times the decay was valid)
- Standard deviation (displays confidence value for each frequency band)

### **Enhanced Data Transfer Utilities for PCs (Option 550)**

This option simplifies data transfer between the HP 3569A and portable PCs such as the HP 95LX Palmtop computer. These utilities provide the following functions:

- Interactive disk transfer of data from HP 3569A to MS DOS
- Measurement scheduler (allows the HP 95LX to make preprogrammed measurements at scheduled intervals)
- Spreadsheet link to Lotus 1-2-3 Sample spreadsheet for calculating ISO 9614 field indicator functions
- VIEWDATA program for the HP 95LX Palmtop computer

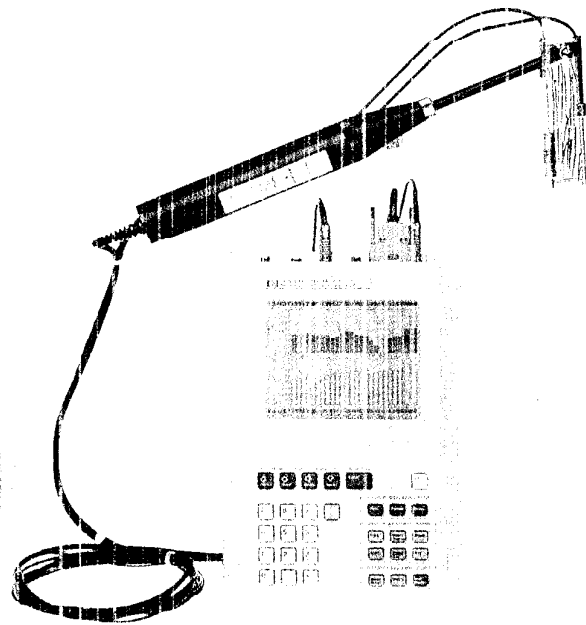
# SIGNAL ANALYZERS

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## Portable Dual-Channel Real-Time Frequency Analyzer, 1.4 Hz to 22.4 kHz

HP 3569A

- 22.4 kHz real-time 1/3 octave
- Two channels with microphone/ICP/voltage inputs
- Built-in white/pink noise source
- Sound pressure, sound intensity, statistics
- IEC 651 type-1 accuracy
- ANS S1.1 1986 type 1-D octave filter shapes
- IEC 1043 199X class-1 processor accuracy
- Three-year warranty



HP 3569A



### HP 3569A Real-Time Frequency Analyzer

The HP 3569A is a portable, battery-powered real-time frequency analyzer designed for onsite product-noise characterization, including sound-intensity analysis. Octave- and 1/3 octave resolution measurements are made in real time. For tonal measurements of single frequencies or narrowband signals, the optional FFT mode provides from 100 to 1600 lines of linear frequency resolution for high accuracy.

#### Lab-Quality Measurements in a Portable Package

This two-channel analyzer packs the performance of larger (transportable) analyzers into a small, neat package; the HP 3569A weighs less than 3.2 kg (7 lb), including the battery. The rugged case is water and shock resistant. A three-year warranty is standard.

State-of-the-art digital signal processing makes these lab-quality measurements more affordable than ever before. The digital technology also provides inherent stability and does not exhibit the drifting normally associated with analog analyzers.

The sound-intensity mode in the HP 3569A can be used to identify noise sources or measure sound power. Individual surface areas are entered into a sound-power measurement table and sound power is automatically calculated at the end of the measurement. Sound-intensity probes are directly compatible. The HP 3569A provides internal power supplies for direct microphone connections for sound-pressure measurements. Reverberation time analysis can also be added as an option. An ICP input mode can directly power accelerometers, so external signal conditioning hardware is not required for vibrator measurements.

#### Documentation and Analysis

An RS-232-C port provides direct printing of measurements to HP LaserJet printers or HP-GL plotters. Deep memory allows measurements to be saved and later transferred to a personal computer with Hewlett-Packard's SDF (Standard Data Format) utilities, which are included with the HP 3569A. An optional utilities package for the HP 95LX palmtop PC allows onsite data backup to the palmtop PC's RAM-disk cards, plus other conveniences.

#### Specification Summary

##### Octave Mode

**Frequency:** Maximum span of 33 bands plus two overall bands  
**1/3 octave bands, single channel:** 1.5 Hz to 20 kHz (real time)  
**Octave bands, single channel:** 2.0 Hz to 16 kHz (real time)  
**Maximum octave bands, dual channel:** 10 kHz: (1/3) and 8 kHz: (1/1)

**Amplitude accuracy:** ±0.3 dB

**Dynamic range:** 72 dBfs

**Input ranges:** 70 to 130 dB SPL in 10 dB steps (5 mV to 5 V)

**Weighting filters:** A-weight, C-weight, linear, flat (all pass)

**Measurement results:** Leq, SPL (maximum), SPL (minimum), L<sub>n</sub>, P<sub>SD</sub>

**Averaging:** Integration and exponential; from 3.5 μs to 100,000 s

**Trigger source:** SPL level, SPL event, external TTL

##### Intensity Mode (other specs same as octave mode)

**Frequency:** Maximum span of 33 bands plus two overall bands  
**1/3 octave:** 1.6 Hz to 10 kHz; **Octave:** 2.0 Hz to 8 kHz

**Indicator accuracy:** ±0.2 dB

**Measurement results:** Active intensity, sound-pressure level (2 ch avg), P-I index, P-V index, particle velocity

**Averaging:** Integration; 1.032 s to 100,000 s

**Trigger source:** External TTL for start or gating

##### Narrowband Mode (Opt AY2)

**Frequency:** 100 to 1600 lines of resolution. Input range, weighting filters, ampl. accuracy is the same as octave mode.

**Baseband spans:** 50 Hz to 25.6 kHz with 0-Hz start frequency  
**Digital zoom spans:** 20 Hz to 10 kHz

**Windows:** Uniform, Hann, flat top

**Measurement results:** Spectrum SPL, power spectral density, time, differentiated time, frequency response, coherence, cross-correlation, cross-spectrum

**Averaging:** RMS, RMS exponential, peak hold, time

##### Reverberation Time Mode (Opt AY3)

Computes reverberation time in octave or 1/3 octave bands by using Schroeder's reverse integration method to compute the decay times. Single channel; maximum bandwidth is 11.4 kHz; minimum integration time is 3.9 μs.

**Data storage:** Up to 3000 third-octave spectra can be saved in the nonvolatile RAM-disk memory. Up to 100 third-octave spectra can be measured and stored at a rate of 156 spectra/s.

##### General

**Power:** Internal battery power; rechargeable during operation

**Recharger:** 100/120 or 220/240 Vac, ±5%, ±10%, 48 to 66 Hz

**Weight:** Approximately 3.2 kg (7 lbs)

**Size:** 210 mm W × 300 mm H × 95 mm D (8.25 in × 11.75 in × 3.75 in)

**Accessories included:** The HP 3569A comes with a battery, ac adapter, carrying case, SDF utilities, and a three-year warranty.

##### Additional Accessories

**Microphones:** See p. 212; use HP 35224B preamplifiers.

**Calibrators:** See data sheet for complete list and specification.

**Accelerometers:** See data sheet for complete list and specifications.

**Cables:** See data sheet for complete list and specifications.

##### Sound Intensity Probes:

HP 35230A sound-intensity probe without microphones

HP 35230A Opt 001—add 1/2-in microphones and spacers

HP 35230A Opt 002—add 1/2-in microphones and spacers

HP 35239A B&K probe adapter kit

#### Ordering Information

**HP 3569A** Real-Time Frequency Analyzer

**Opt AY2** Narrowband FFT

**Opt AY3** Reverberation Time

**Opt 550** Data Transfer Utilities for HP Palmtop PC

#### Price

\$4300.00

\$2300.00

\$2300.00

\$500.00