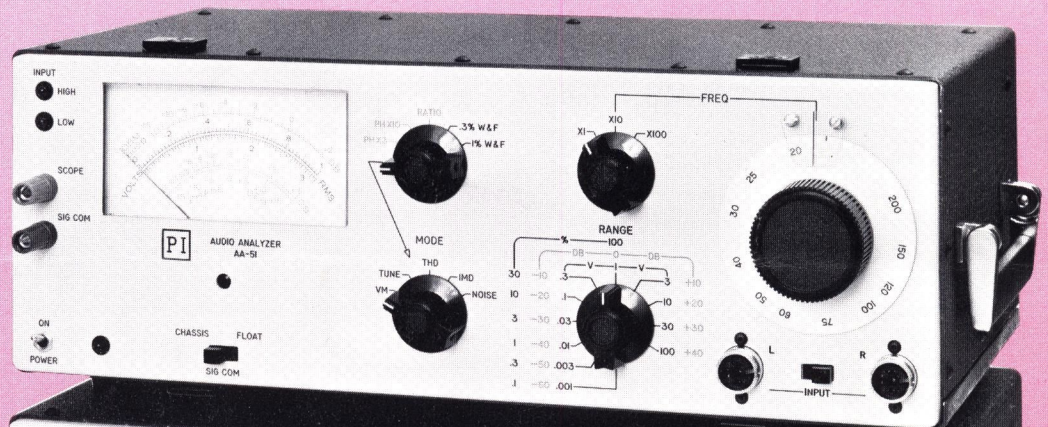
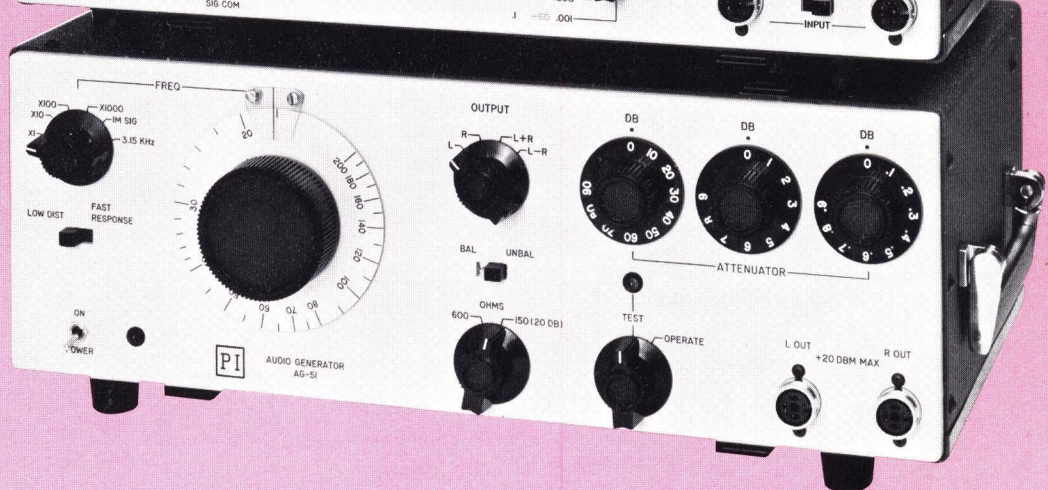


AA-51
AUDIO
ANALYZER



AG-51
AUDIO
GENERATOR



MEASURES

Harmonic Distortion, Intermodulation Distortion, Volts, dB, Signal + Noise/Noise Ratio, Wow and Flutter, Stereo Phasing, Differential Gain in Stereo Channels.

FEATURES

Separate Generator and Analyzer – Transformerless Stereo Outputs (Balanced or Unbalanced; switch selectable) – Source Resistance 150 ohms or 600 ohms (switch selectable) – Automatic Signal Leveling – Precision 10 dB, 1.0 dB and 0.1 dB Step Attenuators – RFI Shielding – Automatic “Set Level” and “Balance” Circuits – Scope Display of distortion products – Output Level Monitor.

The AT-51 is an innovative audio test system which facilitates the measurement of critical parameters in monophonic and stereophonic audio equipment. Designed primarily for commercial broadcast proof-of-performance measurements and equipment maintenance, the AT-51 exhibits features which are unique and well suited to laboratory type measurements by design engineers, quality control facilities and professional high fidelity service centers. The AG-51 Audio Generator and AA-51 Audio Analyzer are packaged separately for remote measurements requiring physical separation of signal source and signal analyzer. Both units are RFI shielded to enable accurate measurements in high level radio frequency environments typical to broadcast transmitter facilities. Signal input and output connectors are also RFI shielded.

DESCRIPTION

The AA-51 Audio Analyzer is an AUTOMATIC multi-purpose test instrument designed to accurately measure total harmonic distortion, intermodulation distortion, wow and flutter, frequency response, signal-to-noise ratio, RMS voltage level, stereo phasing, and a differential gain (ratio) of signals in the audio frequency spectrum. There are no "Set Level" or "Balance" controls. Input signals between 0.1 V RMS and 80 V RMS are automatically leveled to the proper reference for distortion measurements. Out-of-range lights are provided for indicating that input levels are within the usable 58 dB range.

For total harmonic distortion measurements, automatic nulling is accomplished via internal feedback circuitry. The operator merely coarse-tunes the input frequency, switches the function switch to THD and reads the meter. Accurate harmonic distortion measurements at various discrete frequencies and different power levels can be made much faster than with conventional distortion analyzers.

Intermodulation distortion measurements are performed with equal simplicity. Utilizing the SMPTE Standard intermodulation signal provided by the AG-51 generator, the AA-51 displays percent IM for input levels between 0.1 V RMS and 50V RMS. Again, measurements are automatic — no level or balance adjustments are required. With the function switch in the IM position, variations in intermodulation distortion may be observed over a wide dynamic range — automatically. This feature makes the AA-51 a very useful test instrument for troubleshooting audio systems.

Signal + Noise/Noise ratio measurements are made with the function switch in the "NOISE" position. In this mode, the voltmeter bandwidth is restricted to 20 kHz. S+N/N measurements are accomplished by reading the difference in audio output level between reference signal corresponding to 100% modulation and the residual noise of an unmodulated signal.

Accurate frequency response measurements are facilitated by a wideband voltmeter which exhibits a flat response (± 0.1 dB) from 20 Hz to 200 kHz. Input level range is from 1 mV to 100 V full scale. The average responding meter is calibrated to the RMS value of a sine-wave.

Incidental frequency modulation termed "Wow and Flutter" is usually associated with record and playback equipment such as tape decks, cart machines and turntables. The AA-51 measures weighted peak flutter as specified by IEEE standard 193. Wow and flutter measurements are automatic. Test signals may be derived from

a prerecorded standard test tape or record; or from the 3.15 kHz signal provided by the AG-51.

Stereo signals and mono signals derived from a stereo source are often degraded by phase errors and differential gain variation between LEFT and RIGHT channels of a given audio system. The AA-51 contains both Phase and Ratio measuring circuitry which enables the operator to evaluate these characteristics quickly and accurately throughout the complete audio spectrum and over a wide dynamic range. Phase angle is displayed with a zero center scale indication and full scale sensitivity of either ± 54 degrees or ± 180 degrees as determined by a front panel switch. The ratio meter is also a zero center scale device with ± 6 dB full scale deflection.

The Phase and Ratio measurement features of the AA-51 are particularly useful for line equalization measurements, azimuth alignment of stereo tape heads, and troubleshooting of audio consoles, amplifiers and networks.

SPECIFICATIONS

THD DISTORTION METER

Fundamental Frequency Range: 20 Hz to 20 kHz in 3 decade ranges

Bandwidth: 100 kHz

Distortion Range: 0.1% to 100% (full scale) 10 dB steps

Accuracy: $\pm 5\%$ (full scale)

Dynamic Range: 0.1 V RMS to 80 VRMS with automatic leveling

Input Impedance: 500K Ω shunted by 105 pF

Scope Output: 100 mV p-p (full scale)

Internal Distortion & Noise: $< 0.04\%$

IM DISTORTION METER

Input Signal Required: 60 Hz & 7 kHz @ 4:1 ratio (SMPTE Standard)

Distortion Range: 0.1% to 100% (full scale) 10 dB steps

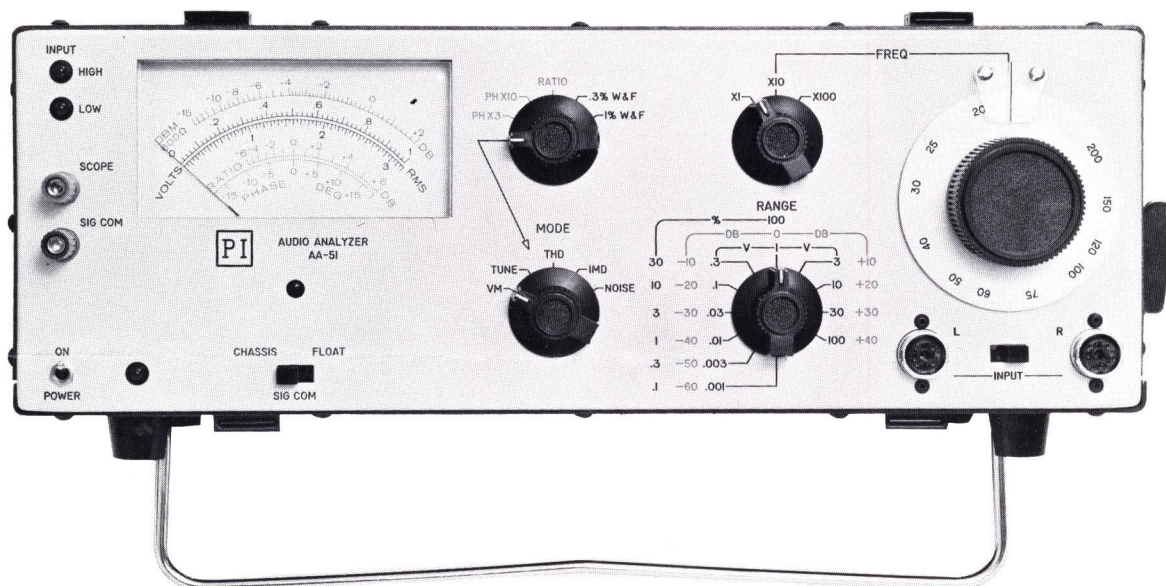
Accuracy: $\pm 5\%$ (full scale)

Dynamic Range: 0.1 V RMS to 80V RMS with automatic leveling

Input Impedance: 500K Ω shunted by 105 pF

Scope Output: 100 mV p-p (full scale)

Internal Distortion & Noise: $< 0.03\%$



A.C. VOLTMETER

Frequency Range: 20 Hz to 200 kHz
Voltage Range: 1 mV to 100 V RMS (full scale) 10 dB steps
Voltmeter Accuracy: $\pm 3\%$ (full scale) 20 Hz to 200 kHz
Input Impedance: 330K Ω shunted by 150 pF
Scope Output: 100 mV p-p (full scale)

SIGNAL PLUS NOISE METER

Frequency Range (-3 dB): 20 Hz to 20 kHz
Voltage Range: 1 mV to 100 V RMS (full scale)
Signal + Noise/Noise Accuracy: $\pm 5\%$ (full scale)
Residual Hum & Noise: $\ll -80$ dB
Input Impedance: 330 K Ω shunted by 150 pF
Scope Output: 100 mV p-p (full scale)

PHASE METER

Range: ± 54 degrees F.S. and ± 180 degrees F.S.; switch selected
Bandwidth: 20 Hz to 20 kHz
Accuracy: $\pm 5\%$ (full scale)
Resolution: 3 degrees
Dynamic Range: 0.3 V RMS to 6 V RMS
Input Impedance: 500 K Ω shunted by 180 pF
Scope Output: 0.5 V pulse train, pulse width proportional to phase angle

RATIO METER

Range: ± 6 dB
Bandwidth: 20 Hz to 20 kHz
Accuracy: $\pm 5\%$ (full scale)
Resolution: ± 0.25 dB
Dynamic Range: 0.3 V RMS to 6 V RMS
Input Impedance: 500 K Ω shunted by 180 pF
Scope Output: DC voltage proportional to ratio

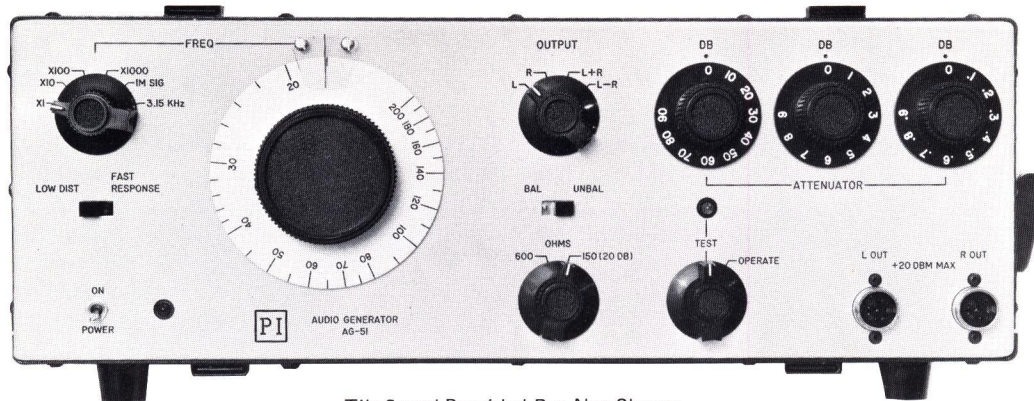
WOW AND FLUTTER METER

Range: 0.3% F.S. and 1.0% F.S.; switch selected
Input Frequency: 3.15 kHz $\pm 10\%$
Accuracy: $\pm 5\%$ (full scale)
Dynamic Range: 0.1 V RMS to 80 V RMS
Input Impedance: 500 K Ω shunted by 180 pF
Internal Distortion and Noise: $< 0.01\%$
Scope Output
Bandwidth: 0.2 Hz to 200 Hz
Sensitivity: 500 mV p-p/%

External Power: 117 VAC (230 VAC option) 50 or 60 Hz, 10 Watts
Weight with cover; kg (lbs): 5.44 (12)
Dimensions with cover, cm (in): 38.74 (15-1/4) wide, 13.34 (5-1/4) high, 25.72 (10-1/8) deep
Rack mount space with rack mount option: 5-1/4 inches

Specifications subject to change without notice.

AG-51 AUDIO GENERATOR



Tilt Stand Provided But Not Shown

The AG-51 Audio Generator contains a low distortion 20 Hz to 200 kHz sine wave generator, an SMPTE standard intermodulation signal generator and a fixed frequency sine wave generator at 3.15 kHz for wow and flutter tests. Signal outputs are simultaneously available at levels of up to +20 dBm (equivalent sine wave power for complex signals) at separate LEFT and RIGHT output connectors. Outputs may be switch selected for LEFT only, RIGHT only, LEFT and RIGHT in phase (L+R), and LEFT and RIGHT in phase opposition (L-R). Front panel switches enable the operator to select fully balanced or unbalanced outputs at impedance levels of 150 ohms or 600 ohms. A dynamic range of 99.9 dB in 0.1 dB steps utilizing a combination of 10 dB, 1.0 dB and 0.1 dB precision attenuators is provided. Attenuator dials display output level directly in dBm in the 150 ohm source im-

pedance configuration. Automatic output leveling circuitry with a built-in self-test feature provides a constant output level thereby eliminating the need for output metering. In the TEST mode the generator output level is reduced to zero, a useful feature during noise measurements.

The time constant of the leveling control loop is determined by a front panel switch. For rapid frequency response measurements, this switch is set to the FAST RESPONSE position. This feature enables the operator to evaluate frequency response of the device under test (amplifier, filter, etc.) with a manual sweep of the frequency dial and multiplier switch. For distortion measurements, the switch is set to the LOW DIST position. This mode of operation provides minimum distortion with a slightly longer control loop time constant for accurate signal analysis at any specific frequency.

SPECIFICATIONS

Frequency Range: 20 Hz to 200 kHz in four decade ranges

Outputs: LEFT only, RIGHT only, LEFT AND RIGHT in phase (L&R), or LEFT and RIGHT 180° out of phase (L-R); switch selected IM composite 60 Hz and 7 kHz @ 4:1 ratio (SMPTE standard) 3.15 kHz fixed wow & flutter signal (IEEE Standard 193-1971)

Output Impedance

Unbalanced: 150 ohms or 600 ohms; switch selected
Fully balanced: 150 ohms or 600 ohms; switch selected;

Output Level: (No attenuation)

Sine Wave Signals: +20 dBm (7.75V) across 600 ohm load, 15.5V open circuit. 0 dBm (.387V) across 150 ohm load, 0.774V open circuit

IM Signal: Peak-to-peak voltage of composite waveform is equal to peak-to-peak voltage of +20 dBm sine wave across 600 ohm load, 0 dB sine wave across 150 ohm load

Output Level Accuracy: 20 Hz - 100 kHz. ±0.2 dB, 100 kHz - 200 kHz, ±0.5 dB

Attenuator Range: 0 to 99.0 dB in 0.1 dB steps

Attenuator Accuracy

0 to 10 dB: ±1.5% of attenuation in dB
>10 dB: ±0.2 dB (max.)

Intrinsic Distortion*:

Harmonic	Low Distortion	Fast Response
20 Hz to 10 kHz	< .05%	< 1%
10 kHz to 20 kHz	< .08%	< 1%
Intermodulation		
Incidental FM (3.15 kHz)	< .03%	< 0.01%

Hum and Noise: >80 dB below rated output

Dial Accuracy: ±3%

External Power: 117 VAC, (230 VAC option) 50 or 60 Hz, 9 Watts

Dimensions with cover, cm (in): 38.74 (15-1/4) wide, 13.34 (5-1/4) high, 25.75 (10-1/8) deep

Rack mount space with rack mount option: 5-1/4 inches

Weight with cover, kg (lbs): 5.44 (12)

*Slightly higher at R output in L-R, UNBAL mode.



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IX-51 Input Transformer

The IX-51 is a balanced-to-unbalanced audio transformer designed for electrical and physical compatibility with the AA-51 Audio Analyzer. Intended primarily as an interface between the AA-51 and balanced lines, the IX-51 may be used as a general purpose matching transformer for other balanced-to-unbalanced applications in the Audio Spectrum.

The floating primary may be bridged across a 600 ohm balanced line with negligible loading effects. The primary can be internally terminated in 600 ohms, 150 ohms or an open circuit by means of a three position slide switch. When the IX-51 is connected to the AA-51 Analyzer for balanced measurements, degradation of frequency response and distortion is negligible for most applications. Performance curves shown elsewhere on this page show typical measurements of the IX-51 made using the AG-51 Audio Generator as a source and the AA-51 Audio Analyzer as the measuring instrument.

The IX-51 is housed in a cast aluminum box. The transformer secondary output is connected to a 15" cable with a matching connector for the AA-51 input jack. The primary is terminated by a connector identical to the input jack of the AA-51 for test lead compatibility.

SPECIFICATIONS

Voltage Ratio, Output/Input: 1:1 when terminated in high impedance load such as the AA-51 Audio Analyzer

Frequency response: See curves

Total Harmonic Distortion: See curves

Maximum Input Level

600 ohms: 2 W max (34.6Vrms)

150 ohms: 2 W max (17.3Vrms)

Input Impedance: Switch selected

600 ohms $\pm 1\%$

150 ohms $\pm 1\%$

Hi Z > 20 K

Dimensions: 3 x 2.75 x 1.75 (in)

7.6 x 7.0 x 4.5 (cm)

Continued

DX-51 AM Detector

The DX-51 is a low distortion envelope detector designed for electrical and physical compatibility with the AA-51 Audio Analyzer. Intended for use in measuring modulation characteristics of amplitude-modulated carriers, the DX-51 exhibits low harmonic and intermodulation distortion, excellent frequency response, and a wide dynamic range.

The DX-51 provides a potentiometer in the output circuit which enables the operator to set the detected output level to a convenient value when measuring frequency response and signal-to-noise ratio. This potentiometer may also be switched, by means of a panel-mounted slide switch, to an audio input connector for reference level settings in direct audio frequency measurements.

Designed specifically for use in F.C.C. Audio Equipment Performance measurements of Standard Broadcast facilities, the DX-51 offers unique flexibility. It may be connected to any suitable R.F. sample from the transmitter final stage to tower-mounted sampling loop. This means that the station engineer can accurately evaluate signal degradation of his transmitted signal at various points in the power distribution network.

The DX-51 is housed in a cast aluminum box. The output circuitry is connected to a 15" cable with a matching connector for the AA-51 input jack.

SPECIFICATIONS

RF INPUT

Frequency Range: 400 kHz to 150 MHz $+125\%$

Maximum Input Level: 10 Vrms carrier with -100% modulation (65V p-p)

Driving Source Impedance: ≤ 75 ohms for best results

Connector: BNC jack

DC Input Voltage: < 150 Volts

MODULATION FREQUENCY RESPONSE

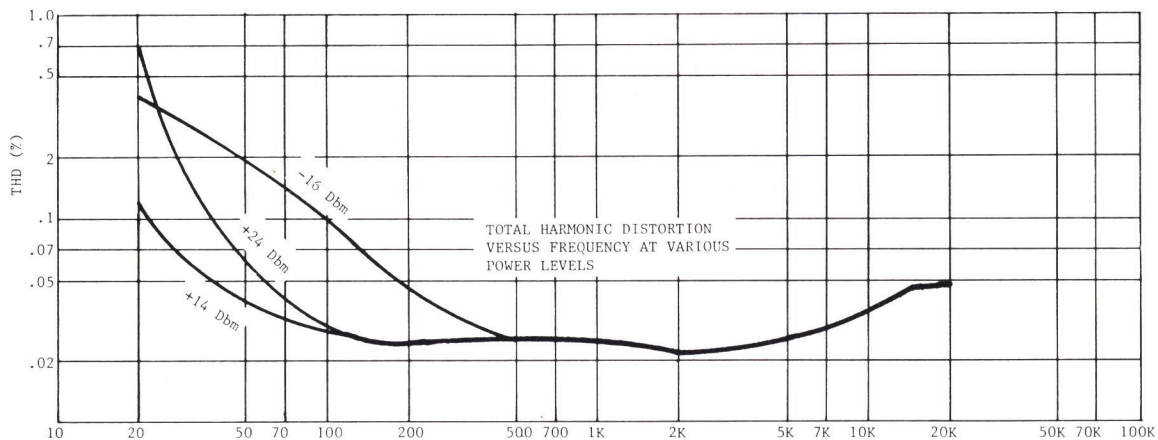
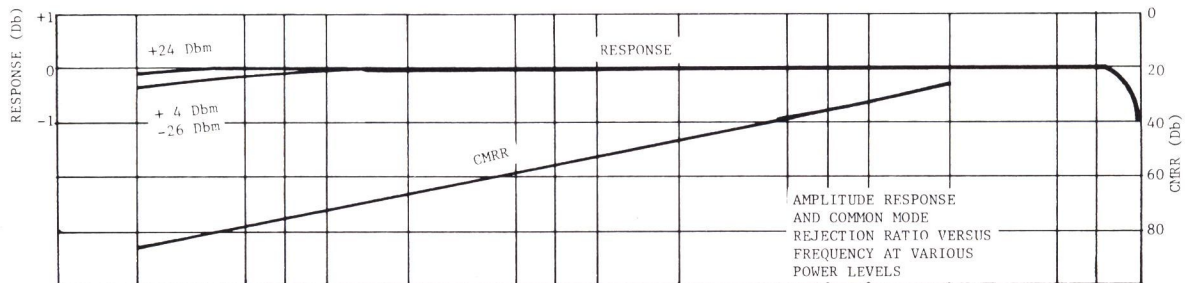
DC - 20 kHz: ± 0.1 dB maximum

50 kHz: -1.0 dB typical

80 kHz: -3.0 dB typical

Continued

IX-51 Input Transformer (Cont.)



DX-51 AM Detector (Cont.)

Total Harmonic Distortion: Typical overall performance with a low distortion AM source for modulating frequencies between 20 Hz and 20 kHz.

Carrier Input Volts r.m.s	% THD @ % MOD		
	100%	80%	50%
0.50	1.1	0.4	0.3
1.0	0.35	0.2	0.15
3.0	0.27	0.05	0.04
6.0	0.15	0.04	0.04

Intermodulation Distortion: Typical overall performance with a low distortion AM source for IMD test signals at 60 Hz and 7 kHz, 4:1 amplitude ratio.

Carrier Input Volts r.m.s	% IMD @ % MOD		
	100%	80%	50%
0.50	2.0	.40	.28
1.0	.70	.58	.34
3.0	.50	.27	.18
6.0	.36	.27	.13

Output Level: Max. level, 0.7 x r.m.s. carrier voltage @ 100% modulation (approx.)
10 dB (min.) gain reduction with level control – Hi Z load.

Test Points

Det DC Out: This DC voltage plus 0.3 volt approximately equals r.m.s. carrier voltage.
Batt Test: Indicates condition of detector bias battery.

Input Impedance: 14K ± 1.2K ohms.

Gain Range: 0 to -10 dB (min.)

Frequency Response: @ gain of -6 dB (worst case)
-0.1 dB @ 25 kHz
-1.0 dB @ 75 kHz

Input Connector: Switchcraft 57HA3F (same as AA-51)

Dimensions: 3 x 2.75 x 1.75 (in.)
7.6 x 7.0 x 4.5 (cm).

Specifications subject to change without notice.

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