SONIPULSE ®
ACOUSTICAL AUDIO SYSTEM
ANALYZER
Covered by U.S. Patent No. 3.732.370
and corresponding Foreign Patents.

APPLICATIONS:

- **Frequency response measurement of sound playback systems and sound reinforcement systems.**

- **Equalization of auditoriums, theatres and studios.**

- **Optimizing positioning of microphones, monitors and listening positions.**

- **Measurement of acoustic absorption and transmission properties of materials.**

- **Measurement and manufacturing quality control of frequency response characteristics of electroacoustical devices, such as microphones or loudspeakers.**

SONIPULSE from U.R.E.I. is a revolutionary new concept in frequency response measurement of a loudspeaker system, including its electronics and environment. Entirely self-contained in an attractive metal attache case, the Model 100-A offers unmatched convenience of operation combined with precision, portability and economy. Using SONIPULSE and suitable ⅓-octave filters, such as the U.R.E.I. Model 529 ⅓-octave Room Equalizer Set, a speaker system and its acoustical environment may be equalized in 30 minutes or less. Performance of monitor systems in multi-track recording studios may be quickly and precisely compared and matched, and SONIPULSED on a regular basis to insure continued conformance to an established norm.

Repeatable accuarcy and stable meter readings are assured because the SONIPULSE system employs a **coherent** signal source, rather than white or "pink" noise which we have been forced to use in the past for lack of a better device. Noise sources are subject to change with aging; and since their energy spikes are random, power within a given bandwidth varies from moment to moment—so readings fluctuate and must be averaged over a period of time to determine a mean. With SONIPULSE, the power in a given bandwidth remains CONSTANT AND PRECISE, so readings are instantaneous with no need for "eyeball integration" or averaging.

Response may be equalized concurrently with measurement, using the U.R.E.I. Model 529 ⅓-octave Room Equalizer (or other good ⅓-octave filters) or, the response may be plotted for analysis and later corrected by acoustical treatment of the environment or by electronic equalization, or both.

SONIPULSE is an indispensable tool for the acoustical consultant, transducer manufacturer, sound contractor or studio operator.

THEORY OF OPERATION:

The Sonipulse contains a signal generator and a readout system designed for measuring the acoustic frequency response of transducers and environments.

The generator delivers a repetitive exponential pulse which contains frequencies covering the entire audio spectrum. The level at any point in the audio spectrum is precisely known and not subject to statistical fluctation as with random noise sources. This allows exact measurements to be taken very quickly and easily. Harmonics of the signal source appear at 10 Hz intervals throughout the spectrum.

The receive circuit consists of a high gain microphone pre-amplifier followed by a tuneable band pass filter set, scaling network, and **true** RMS voltmeter. The filter may be switched to center in any $\frac{1}{3}$ octave bandwidth within the audio spectrum allowing each $\frac{1}{3}$ octave band to be measured individually. The voltmeter reads out linearly in decibels, with 0 dB at scale center. Relative frequency response of a system is normally measured after choosing a 0 dB reference (typically 1 kHz) by adjusting send level and receive sensitivity, then comparing all other frequency bands to the reference level. Through the use of true RMS detection, actual acoustical power in each $\frac{1}{3}$ octave band is measured.

SONIPULSE Model 100-A may be used with any standard low-impedance microphone, when it is desired to include the microphone in the system to be measured and equalized. For loudspeaker playback system evaluation, any good low-impedance microphone can be used, if it has been calibrated against a known standard, and its response anomalies compared to the system response plot. If the accessory AKG C-451 condenser microphone is ordered with your SONIPULSE Model 100-A, the instrument's input preamplifier will be factory equalized so that when the Input Selector is set to CALIBRATED, response will be flat when using the AKG microphone.

SYNOPSIS OF FEATURES:

27 Bandpass filter channels with ISO standard $\frac{1}{3}$-octave center frequencies.

Generator and analyzer combined in one unit.

Small, light weight, portable.

Low cost, no additional test equipment needed.

Analysis over full audio spectrum.

Fast; complete analysis in less than 10 minutes.

True RMS value of measured signals, indicated in dB.

High input sensitivity continuously variable from -100 dBm.

High measurement accuracy and repeatability.

Large display range of 20 dB.

Pulsed coherent signal—no averaging time is required as with random noise sources.

Measurements updated every 100 ms.

Equals accuracy of much more expensive real time audio spectrum analyzers.

High confidence level.

Response may be plotted on graph paper and output circuit is provided for driving analog instrumentation, such as a graphic level recorder.

Microphone input selectable: One input flat, while calibrated input is adjusted to compensate for the individual frequency response of the AKG C-451 test microphone.

Microphone input phantom powered for accessory precision condenser microphone.
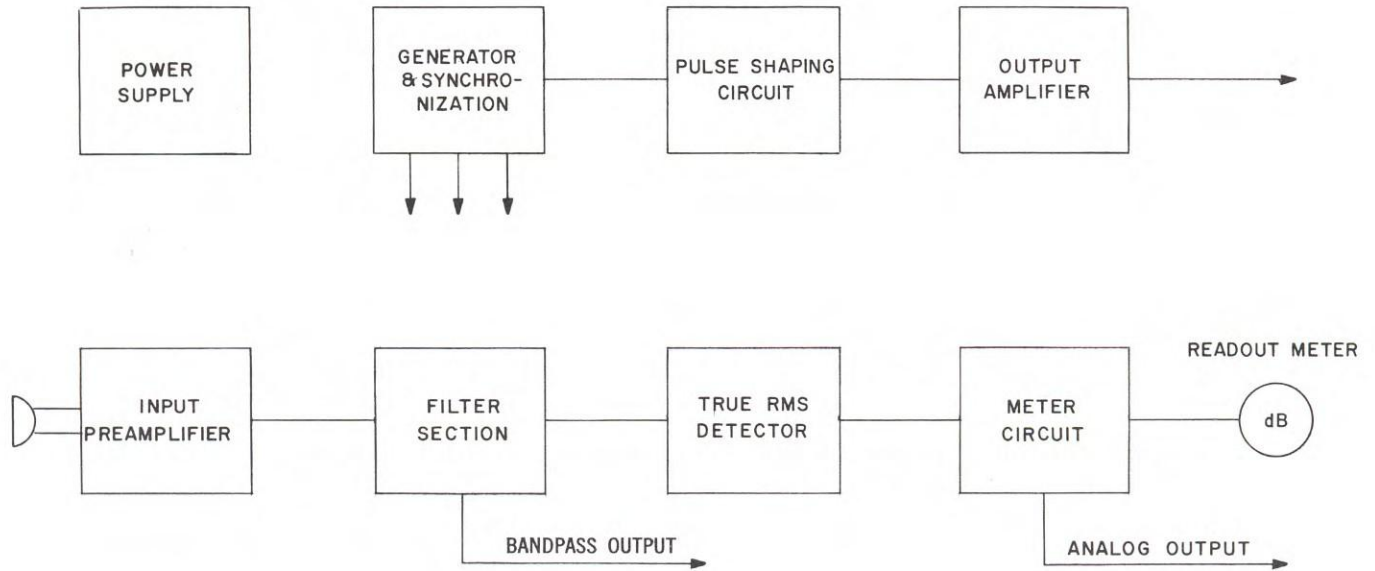
Meter indication calibrated for direct reading in dB with resolution of 0.5 dB.

Internal precision reference signal for instrument self-test.

Modern LED readout to indicate input overloads as brief as 50 us.

Output of $\frac{1}{3}$-octave Bandpass Filter available at front panel BNC-connector.

100-A BLOCK DIAGRAM

```
┌──────────┐      ┌──────────────┐      ┌──────────────┐      ┌──────────────┐
│  POWER   │      │  GENERATOR   │      │ PULSE SHAPING│      │   OUTPUT     │
│  SUPPLY  │      │ & SYNCHRO-   │──────│   CIRCUIT    │──────│  AMPLIFIER   │────────▶
│          │      │  NIZATION    │      │              │      │              │
└──────────┘      └──────────────┘      └──────────────┘      └──────────────┘
                    │    │    │
                    ▼    ▼    ▼
```

```
                                                                        READOUT METER
        ┌──────────────┐    ┌──────────────┐    ┌──────────────┐    ┌──────────────┐
        │    INPUT     │    │    FILTER    │    │   TRUE RMS   │    │    METER     │      ╱──╲
◁───────│ PREAMPLIFIER │────│   SECTION    │────│   DETECTOR   │────│   CIRCUIT    │─────│ dB │
        │              │    │              │    │              │    │              │      ╲──╱
        └──────────────┘    └──────────────┘    └──────────────┘    └──────────────┘
                                   │                                       │
                                   └──── BANDPASS OUTPUT ────▶             └──── ANALOG OUTPUT ────▶
```

SPECIFICATIONS

FREQUENCY RANGE	:	From 40 Hz to 16 kHz
ACCURACY	:	± 1 dB
MEASUREMENT RANGE	:	From -100 dBm to 0 dBm with 20 dB display range.
INPUT GAIN	:	Continuously variable.
INPUT IMPEDANCE	:	Bridging 50 to 250 ohm microphone source.
INPUT SELECTION	:	Flat and Calibrated for microphone freqeuncy response.
BANDPASS FILTER	:	27 Contiguous channels with center frequencies at ⅓-octave increments according to ISO from 40 Hz to 16 kHz.

$$Q = \frac{f_o}{f_1\text{-}f_2} = 4.3$$

BANDPASS FILTER OUTPUT	:	1 V RMS max. Impedance: 600 ohm.
METER	:	Precision taut band meter movement, calibrated linearly in decibels from -10 dB to $+10$ dB.
METER INDICATION	:	Signal level in the selected ⅓-octave filter channel.
METER RESOLUTION	:	0.5 dB
DISPLAY RANGE	:	20 dB can be shifted continuously over entire measurement range.
INPUT OVERLOAD INDICATOR:		LED readout at the end of the meter scale indicating overload peaks as brief as 50 µs.
SIGNAL SOURCE	:	Full spectrum burst with 5 Hz repetition rate.

SPECIFICATIONS (continued)

OUTPUT SIGNAL LEVEL	:	From —50 to +4 dBm.
OUTPUT SOURCE IMPEDANCE:		600 ohm
ANALOG OUTPUT	:	±0.1 VDC per decibel. Impedance: 10 K ohm
INTERNAL CALIBRATION	:	Receive Selector may be switched to internal precision reference signal to check instrument response and accuracy.
CONTROLS	:	Receive response selector Receive attenuator and trimmer 10-position frequency selector Frequency multiplier Send Level Control
CONNECTORS	:	Send signal output = TRS Microphone input = XLR-3 with "phantom" 18 VDC for condenser microphones Analog DC Output = BNC Bandpass Output = BNC
ENVIRONMENT	:	Operating temperature from 0°C to +50°C. Storage temperature from —20°C to +60°C.
POWER REQUIREMENTS	:	115/230 Volt AC, ±15%, 50/60 Hz, less than 10 watts.
CABINET	:	Rugged aluminum covered carrying case. Contains additional space for microphone, cables, graph paper, operating manual, etc.
DIMENSIONS	:	6.5 X 15 X 13 inches (165 X 381 X 330 mm)
WEIGHT	:	13 pounds (5.9 kg)
OPTIONAL ACCESSORIES	:	Condenser Microphone "AKG" C-451E Module with Ck-2 Omni-directional capsule. Flat response characteristic. (Sonipulse provides "phantom" 18 VDC polarizing voltage through XLR-3 connector.)