Proceedings of The Institute of Acoustics

AN OFF-THE-SHELF, STATE-OF-THE-ART ACOUSTIC TEST SYSTEM

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ABSTRACT

Development or improvement of Acoustic Test Facilities has always been complicated by the lack of equipment that would serve the needs of such facilities. To accommodate this lack of equipment, laboratories have either constructed their own one-of-a-kind system or have assembled a system from a variety of commercial instruments modified according to individual needs and personal preferences. Both of these approaches have many shortcomings. This paper briefly describes an economical, flexible, state-of-the-art system that is especially suited to the needs of acoustic testing.

BACKGROUND

As all of us are well aware, network measurements require the use of a stimulus signal that causes a response from the network. For acoustics work, the network is usually a transducer that is electrically stimulated and responds by generating a pressure field. The transfer function of the transducer is obtained by measuring its electrical input parameters, usually voltage and current, as well as an electrical signal that can be related to the acoustic pressure output. Therefore, an acoustic test system should be capable of measuring three separate channels of time-related signals. Although it is possible to perform the needed measurements by alternate use of a single-channel system, this method is time consuming and requires good repeatability. The system described in this paper is designed for use as a one-, two-, or three-channel instrument.

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SYSTEM DESCRIPTION

Taking advantage of the latest developments in electronics has allowed the packaging of a three-channel acoustic test system in a standard 19-inch-wide by 15-inch-high rack mount. The system's instruments are assembled on plug-in cards. Figure 1 shows a view of the system's front panel layout.

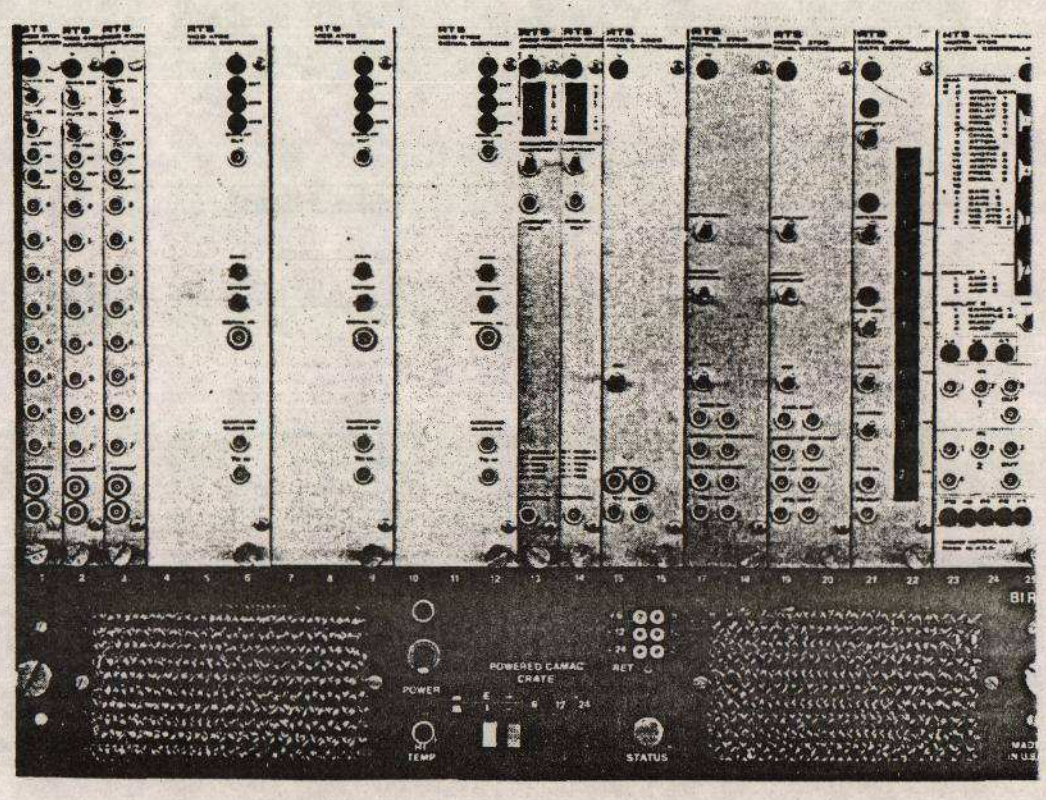

Figure 1. Front Panel of Acoustic Test System

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The system was designed and constructed by Real Time Systems Corporation of Mount Vernon, New York, in accordance with the author's specifications. It communicates with an external computer via IEEE-488 bus hardware. A block diagram of the system is shown in figure 2.

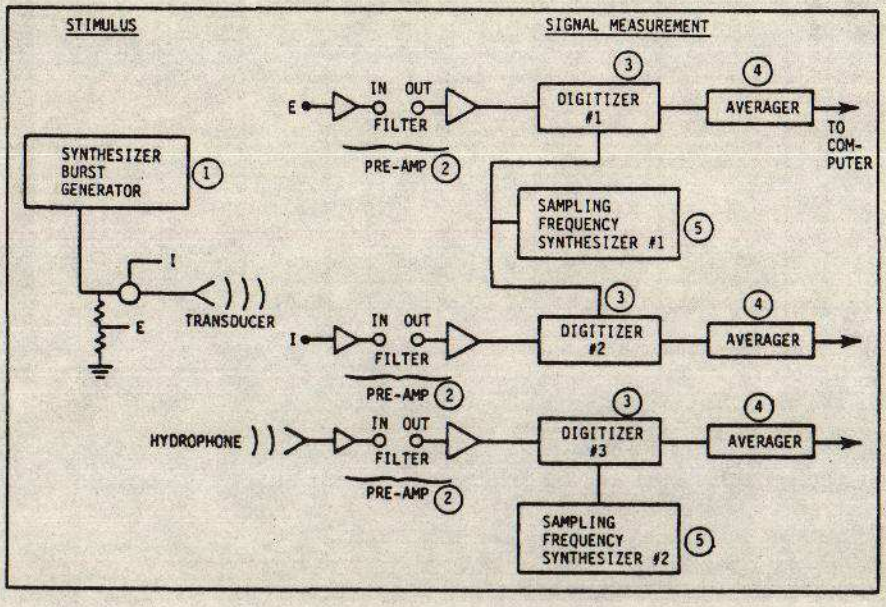

Figure 2. System Block Diagram

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The system's specifications and special features are outlined on the following pages. A typical measurement sequence is shown in figure 3.

NOTE: Circled numbers refer to numbered portions of figure 2.

Stimulus ①

- Range: dc to 3 MHz in 1-Hz steps
- Programmable output amplitude
- Burst timing: 0 to 10 seconds in 1-μsecond steps
- Zero-axis crossing and integral number of Hz in burst
- Half-sine if required for shock excitation

Pre-amplifiers ②

- Eight separate inputs with programmable selection
- Input (Z): 20-MΩ
- Bandwidth: 10 Hz to 10 MHz
- Gain: computer programmable or self-setting (automatic)
- Gain setting status to computer

Digitizers ③

- 10-bit
- Sampling rate to 20 MHz
- Memory segmentable 64 to 8192 in power-of-two steps

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Averagers (4)

- 10-bit
- Averages up to 4096 in power-of-two steps
- Data output to computer

Sampling Frequency Synthesizers (5)

- Range:
  - dc to 12 MHz in 1-Hz steps
  - 12 to 20 MHz in 2-Hz steps
- Sampling frequency burst:
  - On time: 0 to 10 seconds in 1-μsecond steps
  - Delay from stimulus: 0 to 10 seconds in 1-μsecond steps

System Characteristics

- Dynamic range: approximately 120 dB, 1V full scale
- Self-contained power supplies
- Common clock, phase-locked operation
- Externally triggerable

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Special System Features

- Easily programmable
- IEEE Bus communications
- One-, two-, or three-channel operation
- Self-adjusting gain
- Time averaging
- Adaptable (via software) to varying R&D requirements
- Integral sampling for accurate FFT detection
- Fast acquisition for production testing
- Operation to 3 MHz
- Software detection (external); peak-to-peak, rms, energy, or FFT
- Plug-in card maintainability

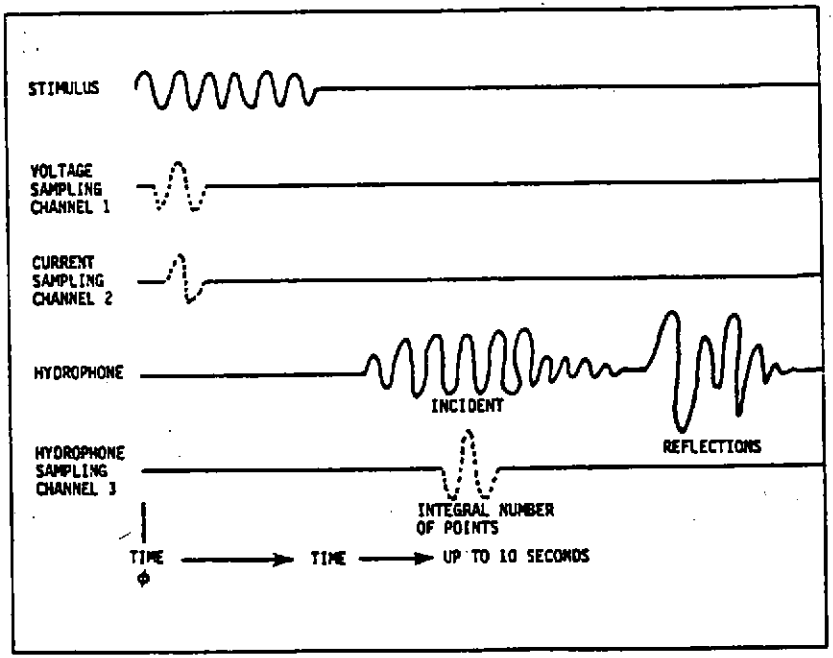

Figure 3. Typical Measurement Sequence

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SUMMARY

The state-of-the-art system briefly described in this paper offers an ecomonical and flexible means for developing or improving acoustic test facilities. The three-channel system is packaged in a standard 19-inch by 15-inch rack mount, and its components are assembled on plug-in cards. The system has been designed especially to suit the needs of acoustic testing.

More complete specifications on this acoustic test system are available from the author.