

LOUDSPEAKER INSTRUMENTATION

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## LOUDSPEAKER INSTRUMENTATION

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In the past few years, acoustical measuring equipment has become available which allows the design and testing of loudspeakers to be more scientific. A modern, sophisticated loudspeaker design facility has the capability of easily testing many performance criteria of new loudspeaker driver and systems designs that were previously time consuming and tedious. Production testing for quality assurance has become not only feasible, but economically desirable.

### I. INTRODUCTION

In order to determine the instrumentation necessary for making measurements of loudspeaker performance, it is necessary to first determine the various parameters to be measured. The parameters chosen for discussion are: acoustical output vs. frequency, impedance vs. frequency, resonance, non-linear distortion vs. frequency, transient response, polar response, and axial response. These parameters will be discussed and methods of measuring them will be shown. The emphasis will be on speed as well as accuracy. The accumulation of large amounts of data does not guarantee a scientific approach. One definition of science is "the ordering of knowledge". With this definition as a guide, a system of easily related measurements can be organized. Such a system should yield a great deal of inter-related information in a minimum amount of time.

Although only the instrumentation necessary for each test will be shown, the various instruments can be organized and interconnected through a "Test Function Control Unit". This method of routing and interconnecting test equipment can be used for both the design laboratory and the production test facilities. The fact that a lesser amount of data is necessary for production testing has been determined previously (1).

In progressing through the various measurements, certain data can be recorded on the same graph paper. This would seem to be the best way of ordering the data to yield the maximum amount of

information in a convenient form.

Since the correlation of objectively measured data with subjectively determined or psycho-acoustical reactions, is still a matter of debate, high quality sound recording and reproducing equipment should also be included in any complete discussion of loudspeaker instrumentation. The ability to make controlled master tape recordings for use in subjective testing should be considered to be an extremely important part of any modern loudspeaker design facility.

### II. THE ACOUSTICS DESIGN LABORATORY

Figure 1 shows some of the acoustical instrumentation which is available and which will be discussed in connection with specific measurements. It is part of the facility used in the design



FIGURE 1. Part of the acoustical design instrumentation used to design the Quadraflex loudspeakers.