SPECIFICATION PROCESS

INTRODUCTION

EAW continually strives to advance its engineering technology in two main areas:

1. Capability for engineering design: This includes more sophisticated modeling and analysis tools, as well as measurement equipment, techniques, and procedures.

2. Application of engineering design capabilities: This is focused on state-of-the-art professional loudspeaker design.

Viewed over EAW's history, the technological advancements made in both areas have been significant. Recent developments in modeling, measurement, and data analysis along with increasingly sophisticated product designs, made it clear that these advancements should be better represented in the specification sheets. In addition, generation and control of the specifications needed to be integrated with the computer-based design and manufacturing management system.

To address the above needs, the decision was made to design completely new specification sheets rather than attempt to revise the existing format. While seemingly straightforward initially, this task eventually grew to encompass a wide range of complex issues involving the entire design and engineering processes.

SPECIFICATION STANDARDS

The easiest way to produce a specification is to use a recognized industry standard that comprehensively defines the specification. One simply follows the standard to produce the specification.

There are a number of existing standards from various well-recognized organizations that address various loudspeaker measurements and, to some extent, the resulting specifications. However, these standards are inconsistent with each other and some are simply are not suited for specifying complete professional loudspeaker systems. More importantly, no existing or proposed standard addresses all the issues involved in creating a complete set of publishable, professional loudspeaker specifications from measurements and from other data. This lack of universal standards means that each manufacturer is essentially on its own to choose among many possible ways to measure loudspeakers, interpret data, format specifications, and, indeed, to choose what and what not to specify.

EAW "SYSTEM SPECIFICATION STANDARD" or "S3"

Because no complete and independent standard exists to produce professional loudspeaker system specifications, EAW decided to develop its own measurement and specification standard: *System Specification Standard* or *S3*. In everyday use, *S3* is essentially a set of instructions for producing an EAW specification sheet. However, *S3* means far more than that.

While it does not specifically reference existing standards, *S3* is heavily based on applicable existing and, more importantly, proposed standards. However, some of the measurement techniques, data processing, and resulting specifications go beyond those standards.

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HOW TO PRODUCE A SPECIFICATION

The major engineering factors involved in producing a specification include:

1. Definition (what it means)
2. Measurement equipment capability (accuracy, resolution, and precision)
3. Measurement parameters (required accuracy, resolution, precision, environment, levels, etc.)
4. Measurement method (how the measurement is performed)
5. Data post processing (what math or conversions are applied to measured data)
6. Production method (how the data or information is to be stored)
7. Format (how the specification is presented when published)

S3 had to address each of these items for each individual specification. In turn, this led to an examination of the entire specification process.

HOW *S3* CAME ABOUT

Creating and implementing *S3* evolved into an extensive and time-consuming undertaking that took several years to accomplish in the midst of normal, on-going, business operations. Some of the issues involved in this process were:

1. Researching a large number of manufacturers' loudspeaker specifications.
2. Researching the audio literature regarding loudspeaker measurement and specification.
3. Critically examining both existing and proposed loudspeaker standards from various professional and standards organizations.
4. Critically examining EAW's existing data acquisition methods, data post processing, and published specifications.
5. Harmonizing *S3* with, in particular, the drafts of two comprehensive loudspeaker system standards from the AES and IEC. *
6. Defining meaningful and useful standards for any specifications either not addressed or incompletely addressed in other standards.
7. Applying the correct internationally recognized scientific formats, units of measurement, and terminology to all data.
8. A thorough analysis of the measurement systems in terms of accuracy, resolution, and precision for each type of measurement.
9. Upgrading existing and developing new laboratory measurement equipment.
10. Upgrading the Laboratory Maintenance and Calibration program.
11. Refining existing measurement techniques and methods.
12. Developing new measurement techniques and methods.
13. Developing new data processing algorithms to correct for laboratory measurement limitations.
14. Developing measurement software to automate and standardize measurements.
15. Developing templates for importation of all data, information, and specifications.
16. Developing a glossary and style guide for specifications and other technical documentation.
17. Integrating measured data, product information, and the actual specification sheets into

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the computer-based design and manufacturing process.

18. Verifying the market validity of *S3* by measuring and specifying selected competitive products using S3 and comparing results to the product's published data and specifications.
19. Developing the additional detail required produce publishable-ready specifications.
20. Applying the appropriate technology and correct science to all of the above.

* EAW is represented on the AES SC-04-03 committee that is drafting a standard for measuring and specifying professional loudspeaker systems. The AES standard largely references the draft of IEC 60268-5 created for similar purposes.

IMPORTANCE OF *S3*

The importance of the *S3* for EAW customers is:

1. Specification sheet information is far more comprehensive and detailed.
2. Direct and accurate comparisons can be made between different EAW products.
3. Each specification, measurement, and data processing method is clearly defined.
4. Each unit of measurement is clearly defined.
5. Tolerances for each numerical specification are stated.
6. The production of the specifications is automated wherever possible to eliminate errors.
7. All data and specifications are formally controlled as part of EAW's manufacturing management system.
8. Generous "data interpretations" are not possible within the process.
9. There is good correlation with competitive measurements (though not necessarily the specifications derived from the measurements).

The importance of *S3* for EAW is:

1. Consistent methods and procedures are used to generate all product data and resulting specifications.
2. Diverse products have a consistent set of clearly defined specifications.
3. Engineering design and specification processes are intimately related.
4. The specifications provide a more complete and accurate representation of a product's design.
5. Specification sheets are produced entirely within one department (Engineering) to avoid technical errors and ensure scientific accuracy.
6. Both the process for creating and the content of the specification sheets is under rigorous control.

COMPETITIVE COMPARISONS

An interesting question is how specifications would compare between manufacturers if they measured and produced specifications for the same loudspeaker. This question is not whether one may be wrong and the other right. The question is whether there would be different specifications from the same data, the same specifications from different data, or different specifications from different data.

This can only be determined from detailed information about how the specifications were

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generated. Lack of this information does not mean specifications are inaccurate or do not accurately state what was measured. What it does mean is that there may be unknown measurement conditions or data processing methods that are different from those EAW used for a particular specification. As such, apparently similar specifications should not be directly compared unless this information is known. To this end EAW provides the information on its specification sheets about how each of its specifications are generated.

SPECIFICATIONS OVER TIME

As EAW's specifications have evolved since their inception, there have been changes in the way products have been specified. Some of these changes have been incremental; others have actually advanced the state-of-the-art in loudspeaker measurements and data analysis. Most changes were simply implemented without fanfare. In all cases, such changes were made only if they produced more accurate and precise data. This was always done irrespective of the marketing consequences, such as when the published results might not be as favorable.

SUMMARY

Recent developments in both engineering capabilities and product design prompted EAW to analyze its entire processes for loudspeaker measurements, data processing, and specifying products. A major result was the creation and implementation of *S3,* the *System Specification Standard*. *S3* collects, solidifies, and formally establishes various singular changes in these processes made over the years. At the same time, *S3* brings a high level of scientific discipline and accuracy to EAW's loudspeaker specification process and to the published specifications.

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