

## Smart Operator: Fundamentals Course Description

### Overview

The 3-Day *Smart Operator: Fundamentals* class covers the fundamentals of setting up and configuring a Smart measurement rig and using Smart to make basic RTA, Spectrograph, Transfer Function and Impulse Response measurements.

Special attention is paid throughout the course to the subject of how to make valid and useful measurements, as opposed to simply making cool squiggly lines appear on the screen. This course begins with an overview of both the general system measurement theory involved as well as the operational context in which Smart is used, namely in Sound System Engineering and Alignment. This course focuses on providing the attendee with a functional knowledge of how Smart operates as a tool before expanding to the application of that tool in sound system engineering, and as much as possible, examines data interpretation as much as acquisition.

The first 2 days of class are presented in a classroom lecture and lab format, relying heavily on in-class measurements by students utilizing a signal distribution system that distributes the instructor's measurement signals to the entire class. These session days focus equally on measurement theory as well as a detailed exploration of controlling and configuring the Smart software environment.

The 3rd day of the class is presented as a practicum and focuses on the "real-world" implementation of Smart measurement rigs, the gear involved, and of course, the practical application of the information presented in the first 2 days. It presents the use of Smart in the methodical process of evaluating and adjusting individual system components, as well as the subsequent combination of multiple subsystems into a multi-channel / distributed sound system. Throughout this practicum session, particular focus is given to the concept of Smart as a tool for aiding engineer's decisions in the system alignment process.

The *Smart Operator: Fundamentals* class is CTS Certified for 9.5 renewal units (RU's) in the Avixa CTS, CTS-I and CTS-D programs.



### Topics Covered Include (but not limited to):

#### **Fundamental Measurement Concepts:**

Single channel vs. dual-channel measurements / Time domain vs. frequency domain analysis / What the heck is an FFT?

**Smart Software Overview:**

Software install/update & upgrade / Measurement Configuration / Measurement control & interface navigation

**Anatomy of a Measurement Rig:**

Hardware requirements / Standard Configurations / Basic Troubleshooting

**RTA and Spectrograph Measurements:**

Averaging and Banding / Feedback identification (& other cool things to do with Spectrograph / Calibration for SPL

**Transfer Function Measurements:**

Magnitude, Phase & Coherence traces: how they are generated and how to read them / Data Thresholding Functions and Improving Measurement Quality / Data Storage and Trace Averaging

**Impulse Response Measurements:**

Setting up the delay for Transfer Function measurements: Live IR and Delay Tracking / Measuring delay times for speaker system time alignment / Tips for improving IR measurement quality / The Impact of FFT Time Constant (window length) on Measurements

**Measurement Position Choice and Microphone Placement**

- Measurement position selection – choosing our system alignment decision points
- Microphone placement and coping with boundary conditions (e.g. ground bounce)
- Single vs. Multiple position

**Measuring and Tuning an Individual Speaker System**

- Determining proper loudspeaker operation – near field measurements
- Evaluating loudspeaker coverage
- Measuring and adjusting speaker response in coverage area

**Extension of Coverage: The Addition of Fill and Delay Systems**

- Alignment checklist for each system – Freq. Response, Level, Delay and Polarity
- LTC: Level – Time – Combine, a systematic process for combining systems
- The 5-minute delay: a quick procedure for setting initial delay system parameters

**Subwoofer Mania**

- The curious issues involved in measuring sub woofers in the “real world”
- Timing the crossover between main systems and subs
- Cardioid subwoofer arrays – controlling / steering sub energy

### **Prerequisites:**

*Smaart Operator: Fundamentals* is open to all interested persons. Prior measurement / system alignment experience is not required but is helpful. This course does assume a working knowledge of professional sound system engineering practices and basic audio fundamentals.

### **Required Equipment:**

The measurement signals used in the instruction of the *Smaart Operator: Fundamentals* class will be distributed using a Dante audio network. Class attendees must bring a laptop computer with both the latest version of Smaart v8 measurement software and Dante Virtual Sound Card (DVS) installed.

### **Attendance Limitations**

Attendance is limited to 20 people per class to ensure the maximum amount of time and attention from the presenter and ample time for questions and discussion.

### **Class Schedule**

- **Day 1 schedule:** Class starts at 9AM, with a lite breakfast and coffee provided by Rational Acoustics. Lunch will be at 12:30 (lunch provided). The class will conclude at 5pm. We recommend arriving a little bit early on Day 1 so everyone can get their computers set up and be ready to go at 9.
- **Day 2 Schedule:** Class starts at 9AM, with a lite breakfast and coffee provided by Rational Acoustics. Lunch will be at 12:30 (lunch provided). The class will conclude at 5pm.
- **Day 3 Schedule:** Class starts at 9AM, with a lite breakfast and coffee provided by Rational Acoustics. Lunch will be at 12:30 (lunch provided). The class will conclude at 5pm.