

## Procedure for Measuring Absorption Coefficient with the Spectronics AcuPro Impedance Tube and the Larson Davis Model 2900 Acoustical Signal Analyzer

### Calibrating the Microphones

1. Mount the microphones in the end plate: remove the microphone cartridge from the preamplifier, push the preamplifier through the end plate hole, and reattach the cartridge.
2. Gently pull the preamplifier, seating the microphone cartridge flush with the end plate.
3. Attach the end plate to the open end of the tube and hand-tighten the three knurled screws.
4. Make sure the ports in the tube are totally closed and the engraved markings are aligned.
5. Connect the noise source to the JBL driver.
6. Connect the outputs of the microphone preamplifiers to the inputs of the analyzer with microphone #1 to channel #1 of the analyzer and microphone #2 to channel #2.
7. Turn on the analyzer by pressing the ON hardkey.
8. Recall absorption coefficient settings by pressing the **Setup** softkey on the main menu and selecting the setup **ABSCOE** (see end of procedures for setup details).
9. Press the **EXIT** hardkey to return to the main menu.
10. Create a new file on the analyzer: press the **FILES** softkey, press the **create** softkey, enter a six letter/number filename, and press **EXIT** twice to get back to the main menu.
11. Press the R/S (Run/Stop) hardkey to obtain the transfer function.
12. Press the STORE hardkey to save the transfer function in the analyzer. Watch the upper right corner of the screen when pressing STORE to see the file number come up. It will show STORE - Transfer Fn X where X is the file number.
13. Record the measurement configuration and this file number in your laboratory notebook.
14. Swap the positions of channel 1 and 2: loosen the knurled screws, rotate the end plate 180°, and retighten screws.
15. Press the R/S key again to obtain a second transfer function.
16. Store the transfer function and again record the configuration and file number it is saved under in your laboratory notebook.

### Measuring the Transfer Function

1. Remove the microphones from the end plate: remove the microphone cartridge from the preamplifier and pull the preamplifier out of the hole in the end plate.
2. Mount each microphone in a side plug: push the preamplifier through the hole in the side plug and reattach the cartridge.
3. Gently pull the preamplifier, seating the microphone cartridge flush with the side plug.
4. Mount the side plugs with microphones in the ports on the side of the impedance tube: microphone 2 should be closest to the sample, both microphones should be on the same side of the tube, the engraved marks on the plug should match the engraved marks on the tube (so that the curvature of the plug is flush with the curvature of the tube).
5. With the sample cutter, prepare 1-3/8 inch diameter samples.
6. The sample should fit snugly inside the sample holder.
7. Adjust the position of the plunger so that the face of the sample is flush with the flange without compressing the sample.
8. Attach the sample holder to the open end of the tube using the three knurled screws.
9. Press the R/S key to obtain the transfer function.

10. Press the STORE key to save it in the analyzer (note the file number).
11. Record the file number it is saved under in your laboratory notebook.
12. If averaging of samples is desired, repeat from step 5.

### **Translating the Data into ASCII Format for the AcuPro Software**

1. Install the Larson Davis RTA\_UTIL software according to the documentation and start it.
2. Establish a connection from the computer to the analyzer by pulling down the **Connect** menu and selecting **Dialup/Connect to RTA**.
3. Select the COM port (probably COM 1) that is used for the connection to the RTA.
4. Select the speed (Baud rate) that matches the analyzer speed (probably 9600). To check this, push the **SYSTEM** hardkey, then the **I/O** softkey and the baud rate will appear in the upper right hand corner of the screen. Push Exit twice to go back to the main menu.
5. Click on **OK** and connection should be established.
6. Download the data taken during the measurements: pull down the **File** menu and select **RTA Memory Files ...**, select the filename in which the transfer functions were stored, click the **Records...** button, click on records to be downloaded (or click **Select All**), click **Download**.
7. The records will now be downloaded into a single binary file on the computer with the same name as the file on the analyzer.
8. Once downloading is complete a screen will automatically come up that allows the records to be translated to an ASCII file. Alternatively, if a binary file needs to be translated at a later time, pull down the **File** menu and select **Translate...**
9. Make sure the **Translate Raw Data Only - No Header Info** option is checked.
10. Click the **Do Translation** button to complete the process.
11. After all desired files are downloaded and translated, select **Close** and **Ok**. Exit RTA\_UTIL.
12. Run the CONVERT program to convert the Text file (which contains all the measurement records in tab separated format) into individual files in comma separated format: select the Larson Davis input text file in the \LARDAV\RTAUTIL directory (the file you just translated), select the output directory (probably \ACUPRO), and click **Convert**.
13. The **CONVERT** program adds a two digit number to the end of each filename. If you started the measurement by creating a new analyzer file, these numbers will correspond to the file numbers recorded in your lab notebook.

### **Calculating and Plotting Results**

1. Exit to DOS and go into the AcuPro directory by typing: **cd \acupro**.
2. Check the computer printer port to make sure the security device is installed.
3. Type **acupro** at the DOS prompt to run the AcuPro software.
4. Highlight **1. Microphone pair calibration** and press ENTER.
5. Press F1 for a list of all the files in the current directory, highlight the first microphone calibration file and press ENTER.
6. Repeat this procedure for the second microphone calibration file.
7. Select a name for the output calibration file. Select **Start** to create the AcuPro calibration file.
8. Highlight **2. Acoustic property evaluation** and press ENTER.
9. Enter the name of the measurement file (i.e. the transfer function of the sample) and the

overall calibration file created above (F1 can be used to select filenames).

10. Enter the name of the output file where the acoustical properties and a short description to identify the results will be stored.
11. Change Reference Microphone location, microphone spacing, and temperature as required.
12. After all information is entered, highlight **Start** and press ENTER.
13. Up to five samples can be averaged through the **3. Results file averaging** option.
14. Exit to DOS by highlighting **4. Exit to DOS** and hitting enter or by pressing **ESC**.
15. To plot output files, type **graph** and press ENTER.
16. Highlight **1. Select result file** and press ENTER.
17. Either averaged or unaveraged results may be plotted. Also, either one or two plots can be made on a single graph. Highlight the plot that is desired and hit ENTER to plot.
18. NOTE: Output files are in ASCII format. Therefore, general plotting programs such as Excel can be used in addition to the AcuPro **Graph** program.

### **Analyzer Settings for Measuring the Absorption Coefficient**

1. Press **System** hardkey, press **Input** softkey, press **20-10k**, press **EXIT** hardkey.
2. Press **System** hardkey, press **Filter** softkey, press **400 line**, press **EXIT** hardkey.
3. Press **System** hardkey, press **Filter** softkey, press **Window**, press **Hanning**, press **EXIT**.
4. Press **System** hardkey, press **Filter** softkey, press **Base-Bd**, press **5kHz**, press **EXIT**.
5. Press **System** hardkey, press **Cross** softkey, press **EXIT**, press **X-fer** softkey (make sure right hand display shows **Transfer Function - H1**, if not, press **X-fer** again).
6. Press **System** hardkey, press **Noise** softkey (**Sig.Gen** on some analyzers), press **White** softkey, press **EXIT**, press **ON** softkey (*do not* press **ON** hardkey).
7. Press **EXIT** hardkey until Main Menu is displayed, press **Detectr** softkey, press **Count.S.**, press **Av. Time.**, press **128**, press **Exit** hardkey.
8. Press **Exit** hardkey until Main Menu is displayed, press **P<>R** softkey so that "Real" flag appears in the top left of screen.
9. Store settings: press **EXIT** hardkey until Main Menu is displayed, press **Setup** softkey, press **name** softkey, press a softkey to name (along bottom row), enter the name **ABSCOE**, press **Exit** hardkey. Then store the settings: press the **Store** softkey, press the **ABSCOE** softkey.