Application note: performing a measurement

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1 Introduction

ACME (ACoustic Measurement Environment) is a software tool for performing measurements and signal analysis using a sound card or data acquisition hardware (DAQ device). This application note covers the basics of performing a measurement.

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3.1 Tab Measure

Before starting, make sure the DAQ device is properly connected. Launch ACME. The main window is divided into two tabs, Measure and Analyze. Click the Measure tab (Figure 1).

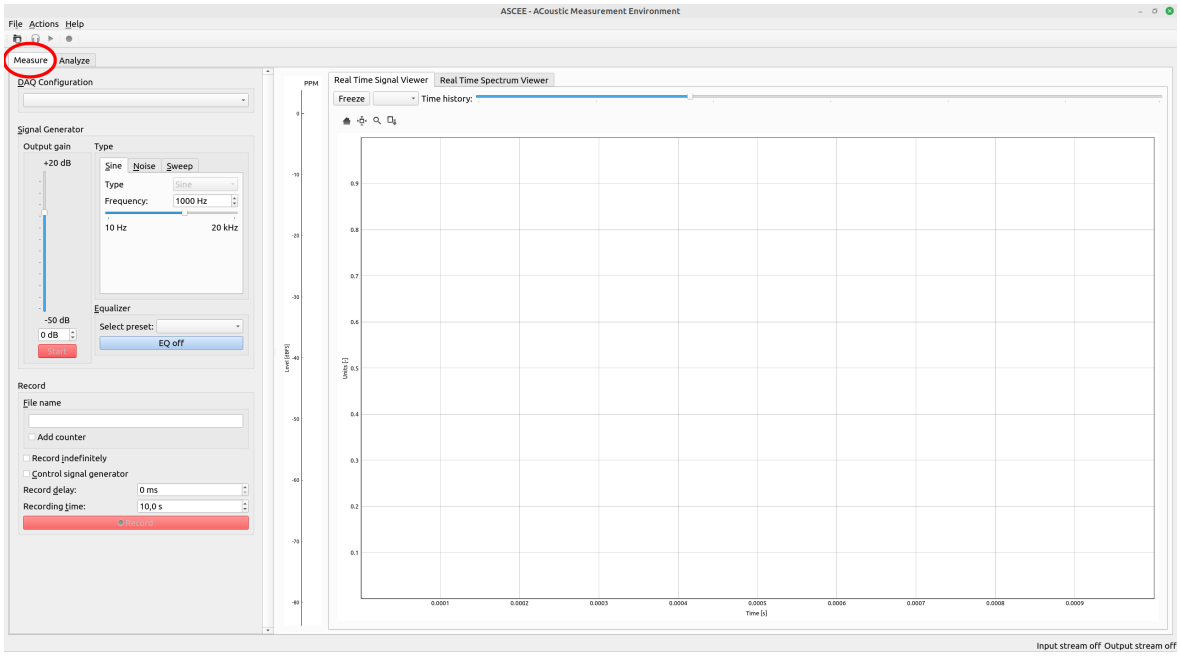

Figure 1 – Main window with the Measure tab active.

3.2 Create DAQ configuration

Next, create a DAQ (Data AcQuisition) configuration. This contains the settings of the DAQ device. Right-click the drop-down menu DAQ CONFIGURATION and click CREATE NEW CONFIGURATION... . The DAQ configuration window will open (Figure 3). The various settings are explained in Table 1. Select the connected DAQ device and enable the channels to be used by ticking the corresponding checkbox. If the DAQ device does not show up, return to the main window and click ACTIONS - RESCAN DAQ DEVICES (Figure 2). Rename the channels by slowly double-clicking the channel name (for example UNNAMED INPUT CHANNEL 0) or by right-clicking the channel name and selecting RENAME. Click OK to save and exit the menu. Once the DAQ configuration is created, it will be remembered and can be re-used.

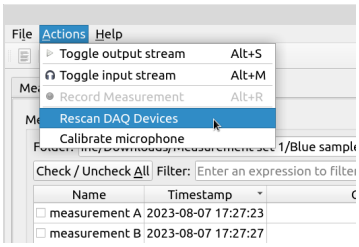

Figure 2 – Rescan DAQ Devices.

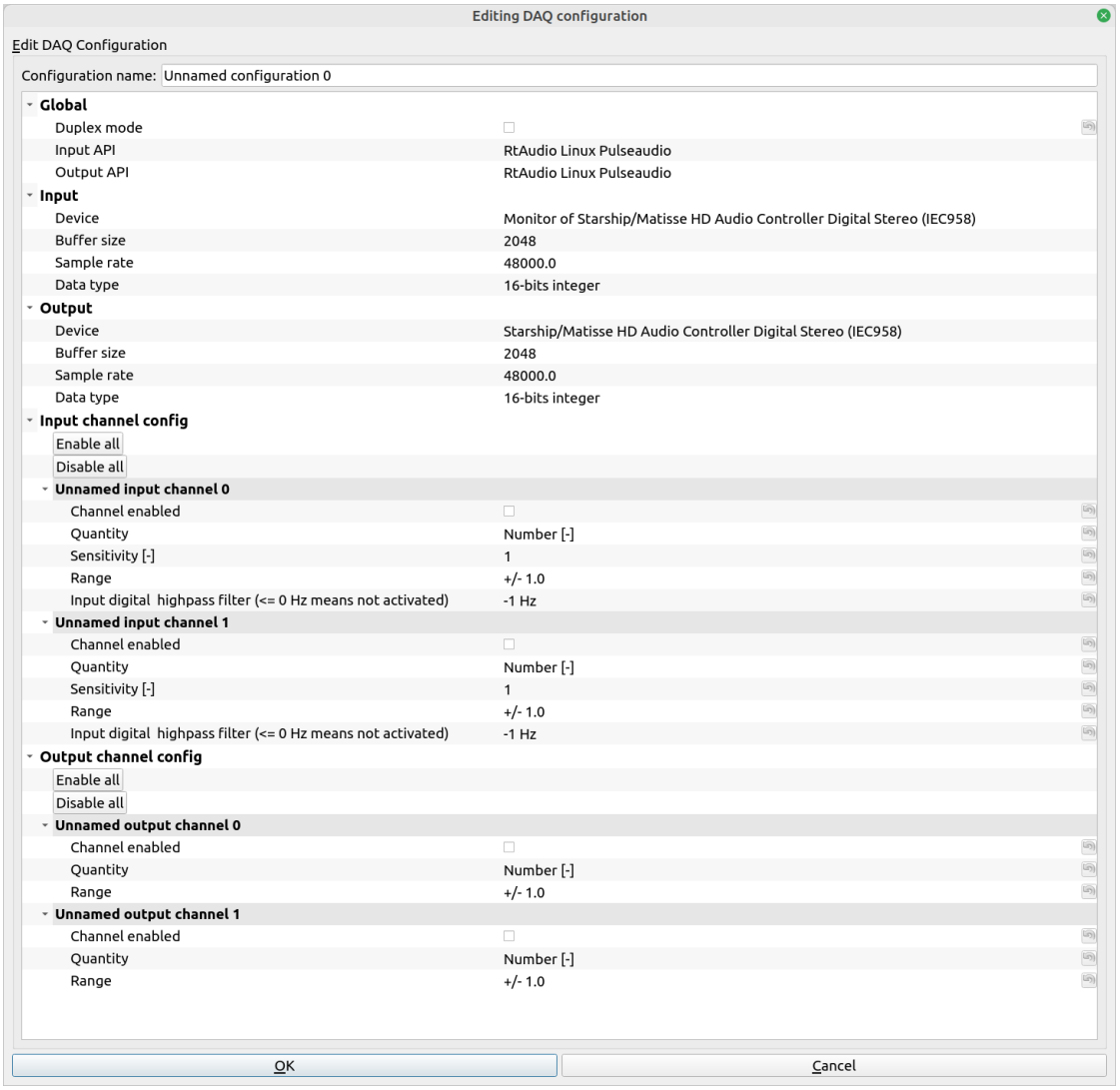

Figure 3 – DAQ configuration window.

Setting	Explanation	Recommended setting
Duplex mode	Ties the input and output stream together	Enable, if the input and output are handled by a single DAQ device that supports it
Read back output signal (only available in duplex mode)	Record the analog output signal (only on supported DAQ devices)	Disable
Input / Output API (combined in duplex mode)	Contains the set of DAQ devices	Such that the desired DAQ device is available under Input / Output - Device
Input / Output - Device (combined in duplex mode)	Select the name of the connected DAQ device	Desired DAQ device(s)
Input / Output - Buffer size (combined in duplex mode)		8192
Input / Output - Sample rate (combined in duplex mode)		48000
Input / Output - Data type (combined in duplex mode)		floating point if possible; largest number of bits
Channel enabled	Only enabled channels are used for recording and signal generation	Enable all input and output channels
Quantity	When using a calibrated microphone, this can be set to Acoustic pressure	Number [-]
Sensitivity	Recorded values are divided by this number	1; if using the button Actions - Calibrate microphone, use that value
Range	Range of digital values within which the DAQ device operates	+/- 1.0
Input digital highpass filter	Removes dc offset from the input signal	1 Hz
IEPE (only available if supported by the DAQ device)	Enable IEPE power	Disable (WARNING: IEPE power damages incompatible devices. Only enable if a compatible device is connected.)
AC coupling (only available if supported by the DAQ device)	Hardware-based high pass filter to remove the dc component from IEPE power.	Enable

Table 1 – DAQ settings. Some settings are unavailable for incompatible DAQ devices.

3.3 Select measurement folder

The measurements are stored in the measurement folder. Select a folder for this purpose (Figure 4).

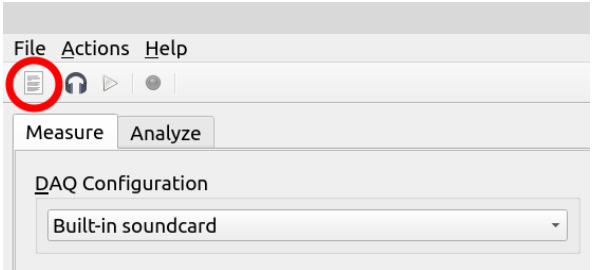

Figure 4 – Measurement folder.

3.4 Start stream

No data is communicated between ACME and the DAQ device until the data stream is started. To start the data stream, click the button with the headphone icon, on the top left of the screen (Figure 5). If the DAQ device is set to duplex mode, the output stream is started automatically. If not, enable it by clicking the playback icon. The input channels are monitored with a Peak Programme Meter (PPM) and a Real Time *Signal* Viewer or a Real Time *Spectrum* Viewer (Figure 6, 7). The PPM gives an overall view of the signal levels and lights up red when clipping is detected. Ideally, the levels are above -20 dB, for a good signal to noise ratio. The Real Time Viewers allow for a quick inspection of the signals. Select the desired viewer by clicking its tab. The plot in the active tab can be frozen and unfrozen by clicking the (Un)Freeze button. The settings for the Real Time Spectrum Viewer are covered in the application note about Power Spectral Analysis. If using IEPE, wait until the power has stabilized, which takes approximately one minute. It is ready once the Real Time Signal Viewer shows a steady microphone noise signal.

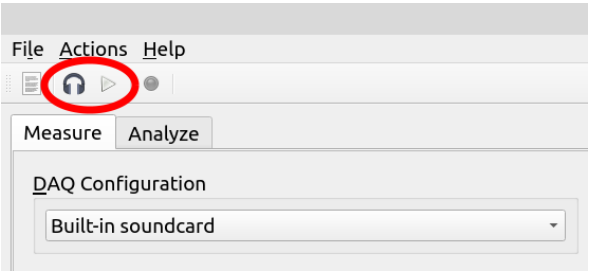

Figure 5 – Start stream.

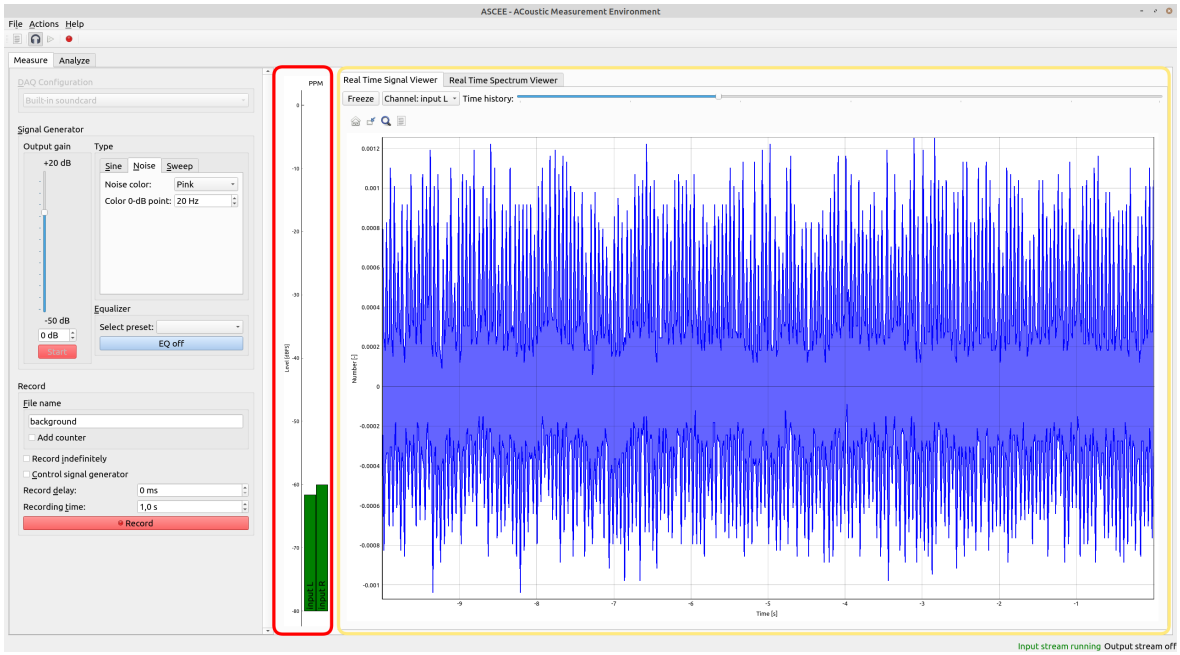

Figure 6 – Peak Programme Meter (red) and Real Time Signal Viewer (yellow).

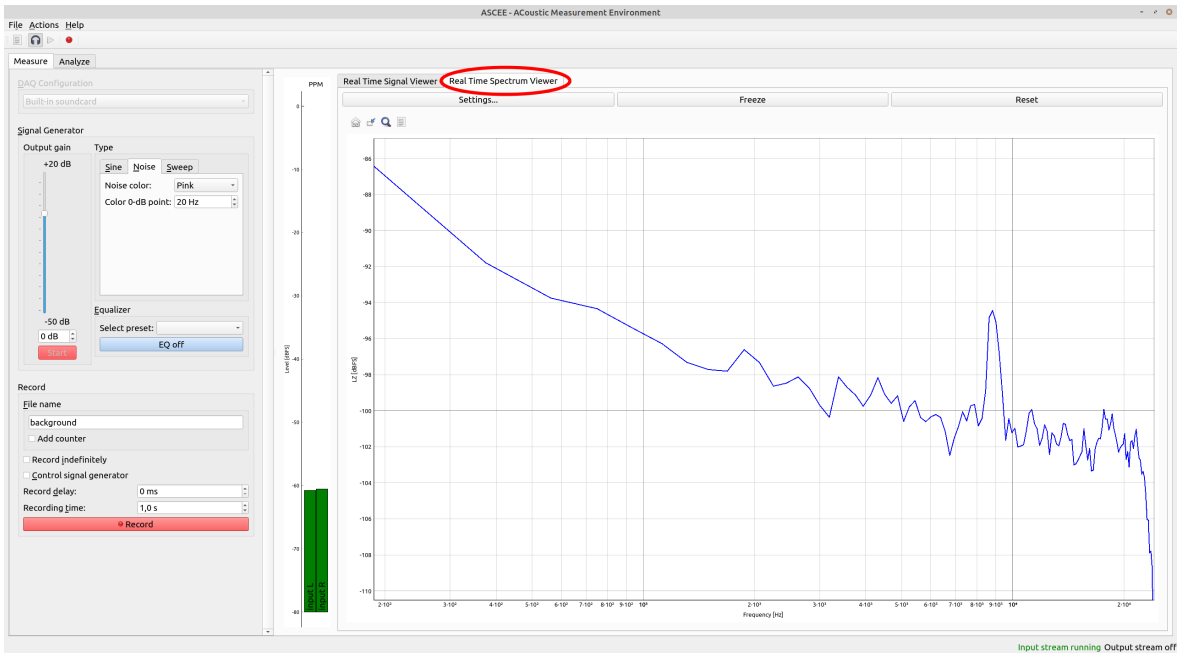

Figure 7 – Real Time Spectrum Viewer.

3.5 Set signal generator

The signal generator (Figure 8) controls the output signal. A general purpose signal is pink noise, with a cut-off frequency of 20 Hz. Be cautious with the output gain: Typically, it should not be set higher than 0 dB. On the bottom right, an equalizer can be set. Decrease the output gain if the equalizer uses large gains, to avoid clipping. The settings for the equalizer are covered in the application note about the Signal Generator

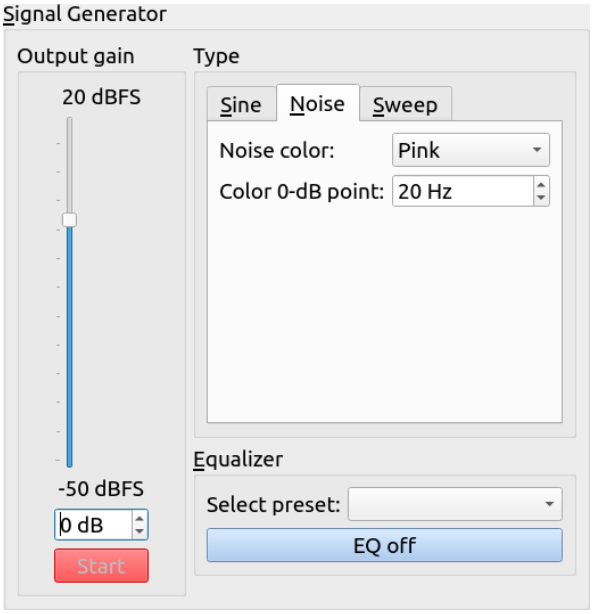

Figure 8 – Signal generator.

3.6 Record

Enter a file name and click RECORD (Figure 9). Checking the ADD COUNTER box wil add a running count number to the file name. RECORD INDEFINITELY means that the recording must be stopped manually. If the box CONTROL SIGNAL GENERATOR is checked, the signal generator will automatically be started when the recording starts and stopped at the end of the recording. Because enabling the signal generator takes time, set the RECORD DELAY to at least 1000 ms to ensure the recording is not started before the signal generator is fully enabled. During the recording a pop-up window will show the progress (Figure 10). If desired, the recording can be aborted and saved by clicking the button STOP RECORDING HERE. To cancel the recording and close it without saving, click the close button in the top right of the progress window. Once the recording is finished, it is stored in the measurement folder and can be accessed from the ANALYZE tab. The functionality of the ANALYZE tab is covered in the application note about Power Spectral Analysis.

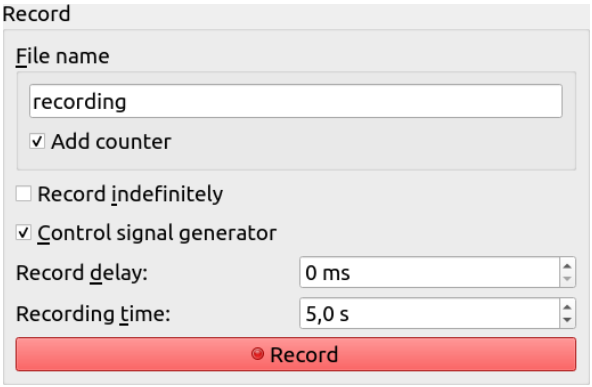

Figure 9 – Recording section.

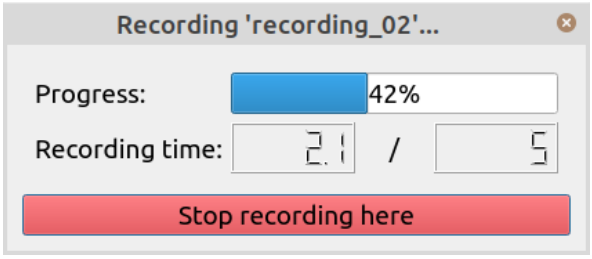

Figure 10 – Recording progress.

4 Notes

4.1 Loopback

If the signal generator is used, it is good practice to record the generated signal. This way, the characteristics of the generated signal can be analysed later on. Most importently, it is a requirement for using the transfer function related analysis functions.

Split the output signal and loop it back to another input (Figure 11). The signal must be looping back in the analog domain, because it must pass the same Digital to Analog Converter (DAC) and Analog to Digital Convert (ADC) as the microphone signal. The DAC and ADC add a small delay and do not necessarily have a frequency-independent transfer function.

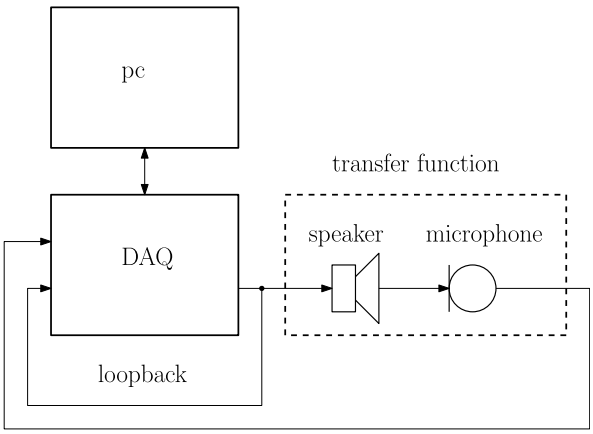

Figure 11 – Schematic overview with loopback connected.