

Online ENGINE

AUDIOSCOPE

OPERATING MANUAL

Online Electronics' Audioscope software plots the amplitude of audio signals against time allowing visual monitoring and interpretation of the audio signals generated by Acoustic or EM receivers

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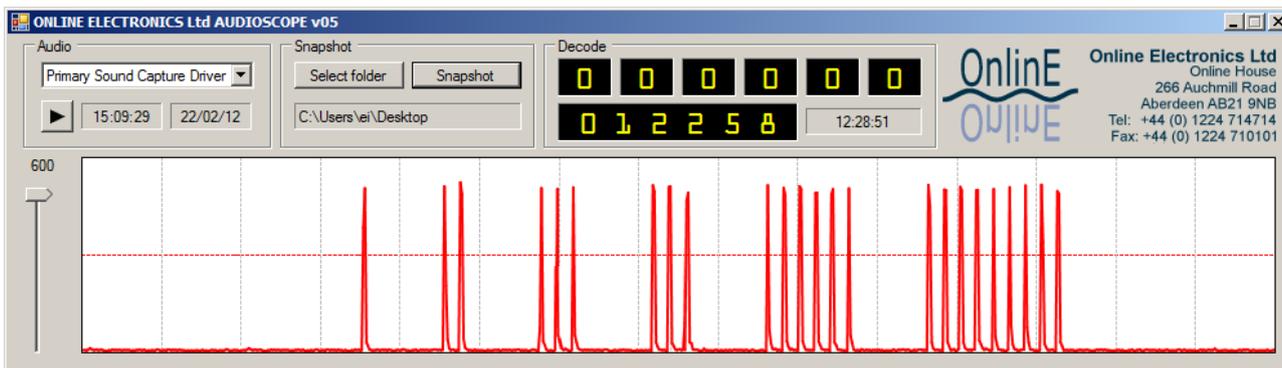


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1. DESCRIPTION

Online Electronics' AUDIOSCOPE software plots the amplitude of audio signals against time allowing visual monitoring and interpretation of the audio signals generated by Acoustic or EM receivers connected to the Line In or Microphone input of a laptop or PC. This is particularly useful when the signal being received consists of an amplitude modulated coded transmission.

The software has several intuitive and useful features such as a live 15 second buffered display, Y-Scale Adjustment, Pause/Play function, Screen Snapshot function, Audio Snapshot function and OEL Acoustic Data Transmitter decoding function.



1.1. LIVE VISUAL DISPLAY

The live visual display is 15 seconds 'long' and the vertical grey gridlines represent 1 second intervals. New data appears on the RHS and scrolls towards the LHS. The figure above shows a Snapshot of some real data from an OEL Acoustic Data Transmitter.

The slide-bar on the left of the graph controls the Y-Scale of the graph. If it is moved up the pulses will get larger, if it is moved down the pulses will get smaller.

1.2. AUDIO GROUP

The drop down menu at the top of the Audio group is used to select the audio device (installed on the PC) to capture data from, usually this will be the Line In or Microphone. The audio output from the receiver should be connected to this device.

The current PC time and date is shown within the Audio group, this provides a time stamp when using the Snapshot function.

The Play/Pause button starts or stops the visual display. The software starts a 15 second long buffer of the audio input as soon as a suitable audio device has been selected. If the Pause button is pressed the visual display will pause allowing the user to examine the signal at their leisure. In the background the software continues buffering the live audio so when Play is pressed again the previous 15 seconds of buffered audio will be shown with the newest data on the RHS of the screen.

1.3. SNAPSHOT GROUP

If the user has selected a suitable folder using the Select Folder button a screen snapshot of the current software window and current contents of the 15 second audio buffer can be captured at any point for subsequent examination by pressing the Snapshot button. If the display has been paused pressing the Snapshot button will take a snapshot of the paused screen and the paused audio corresponding to the captured, paused screen.

The screen snapshot will be saved into the selected folder as a *.PNG image with name <SNAPSHOT YYMMDD hhmmss.PNG> where "YYMMDD hhmmss" represents the current date (reversed) and time.

The 15 second audio snapshot will be saved into the selected folder as a *.WAV audio file with name <SNAPSHOT YYMMDD hhmmss.WAV> where "YYMMDD hhmmss" represents the current date (reversed) and time.

1.4. DECODE GROUP

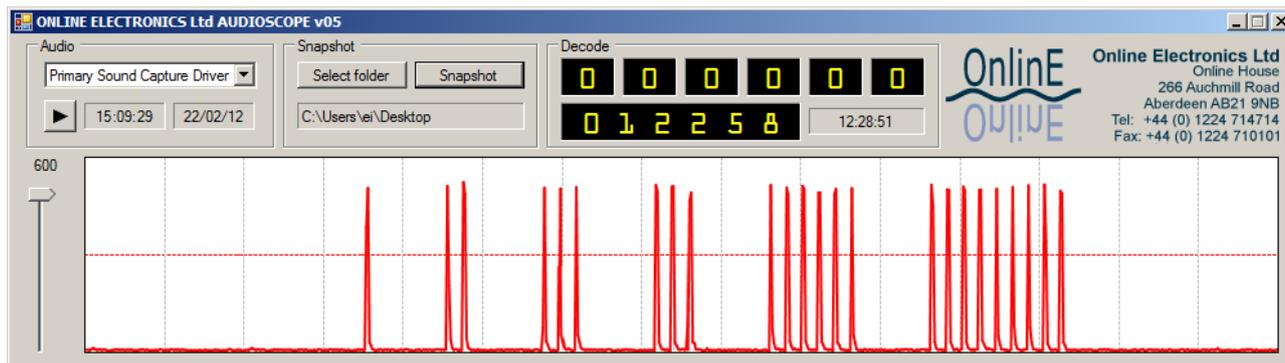
The software includes an automatic decode function for use with standard OEL Acoustic Data Transmitters. The horizontal red line shown on the graph represents a threshold level, whenever a pulse crosses this line one of the 6x counters on the top line within the Decode group will increment.

In order for the decode algorithm to function the PC audio input level, the Acoustic receiver audio output level, and the software Y-Scale must be adjusted so that all pulses cross this line and all background noise is below this line.

When 6 valid groups of pulses have been received the data will be decoded and displayed in the window on the bottom-left of the Decode group. When a successful decode occurs the time at the bottom-right of the Decode group will update. This time can be used to predict when to expect the next periodic data transmission.

The standard OEL Acoustic Data Transmitters transmit 6 groups of pulses representing a 6 digit number (which may represent a time, pressure, temperature or any other data). Each group is separated by exactly 1.0 second silence and each pulse within a group is separated by exactly 0.2 second silence. By simply counting the pulses in each group and subtracting one the data can be decoded. In the example shown below the pulse counts are [1 2 3 3 6 9] representing the data [0 1 2 2 5 8].

This example shows a real signal received in good acoustic conditions where the receiving hydrophone was able to be positioned approximately 10m from a high power transmitter installed inside a pipeline subsea. There was relatively little background acoustic noise caused by vessel thrusters and other sources of subsea noise. In such conditions the automatic decode function will work reliably and the user need not pay too much attention to the received signal however in more onerous conditions some interpretation of the signal will be required by the operator.



1.5. EXAMPLE 1 – DATA DECODE INTERPRETATION

The example below shows the real signal received in poor acoustic conditions when the receiving hydrophone was positioned several hundred metres from an acoustic transmitter installed inside a pipeline subsea. There was significant background acoustic noise caused by vessel thrusters, rough seas and other sources.

In this case the automatic decode function did not work reliably due to the effects of background acoustic noise (pulse 9 did not cross the threshold line) however with a little knowledge the operator successfully decoded the data.

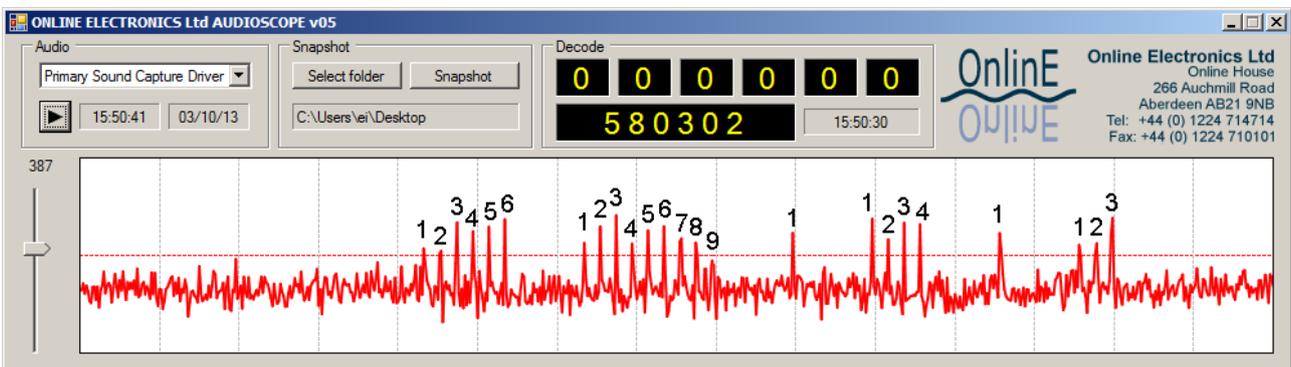
The 6x groups of pulses were relatively obvious.

The operator deduced that there was a missing pulse between pulse 8 of group 2 and pulse 1 of group 3 because there should be exactly 1.0 second between each group of pulses and exactly 0.2 seconds between pulses within a group. The vertical grey lines represent 1.0 second intervals so there is approximately 1.2 seconds between pulses 8 of group 2 and pulse 1 of group 3 so there is a missing pulse somewhere between them.

The operator used the audio Snapshot function to record the data transmission and listened to the recording repeatedly to help to interpret the signal, the human brain is exceptionally good at detecting patterns and rhythms.

By examining the waveform and listening repeatedly to the audio recording the operator deduced that there was a weak pulse which did not manage to cross the threshold at position 9 and the pulse count was [6 9 1 4 1 3] representing the data [5 8 0 3 0 2].

The operator was able to confirm that the interpretation was correct by waiting for the next data transmission and confirming there were indeed 9 pulses in the second group.



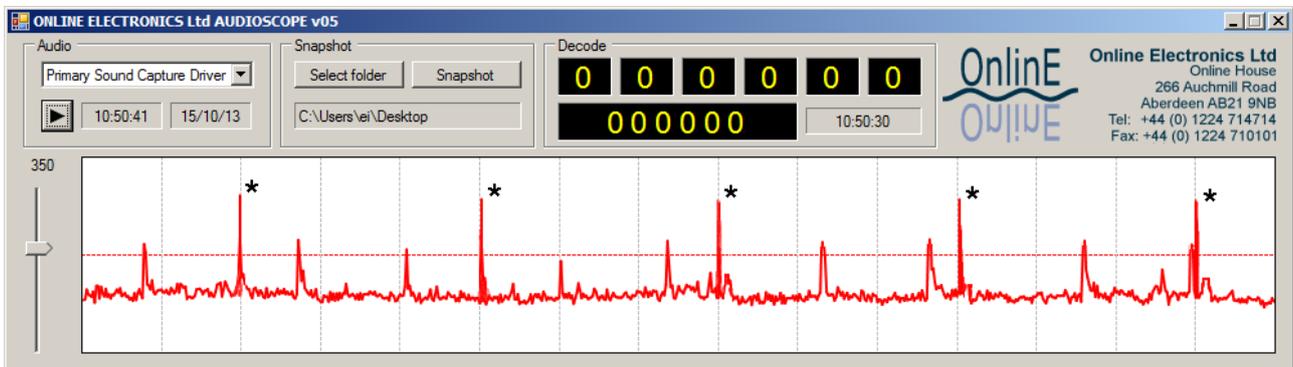
1.6. EXAMPLE 2 – SIGNAL INTERFERENCE INTERPRETATION

The example below shows the real signal received in average acoustic conditions when the receiving hydrophone was deployed from a vessel several kilometres from a 24kHz dual rate acoustic transmitter which was expected to be transmitting a pulse every 3 seconds indicating the working state of a piece of subsea equipment.

When the operator first deployed the hydrophone and listened to the audio alone there were a confusing number of pulses detected at a seemingly random repetition rate. The operator was not confident that a 3 second pulse was being received.

When AUDIOSCOPE was used it became clear that the expected 3 second pulse was present as indicated by the asterisks below however there were also a multitude of weaker pulses being received at a much faster and irregular rate.

AUDIOSCOPE showed an obvious difference in magnitude between the 3 second pulses and the weaker, irregular pulses which was not obvious by listening alone. It was later discovered that a nearby vessels' dynamic positioning system was working in the same frequency band as the 24kHz transmitter and causing these weaker, irregular pulses.



2. SETUP AND TEST

The instructions below describe how to connect an audio signal to a laptop running the AUDIOSCOPE software. Usually this signal will come from an Acoustic or EM receiver.

Before beginning ensure that Microsoft .NET, Microsoft DirectX, and the AUDIOSCOPE software have been successfully installed on the laptop following the instructions provided in this manual.

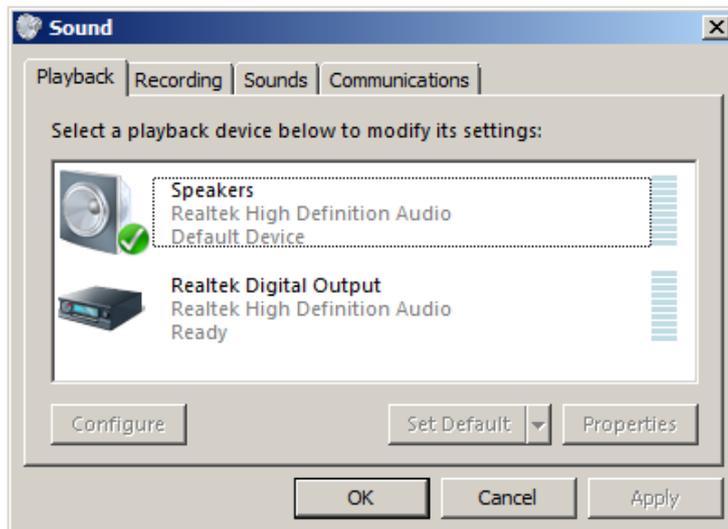
1. Following the relevant manuals set up the Acoustic or EM receiver frequency and gain so that a clear signal can be heard.
2. Connect the audio source from the receiver to the Line In or Microphone connection on the host PC. Plug a pair of headphones into the Headphone connection on the laptop.
3. Confirm that the same audio heard earlier from the receiver can now be heard in the headphones connected to the laptop. This confirms that the laptop is receiving a good quality signal and that the laptop settings and levels are configured correctly. If no audio is heard or you are unsure of the correct settings then refer to section 3 WINDOWS 7 AND 8 AUDIO CONTROLS for a starting point.
4. Start the AUDIOSCOPE software.
5. Select the audio device which the audio source has been connected to from the drop-down menu in the Audio group at the top-left of the window. Usually this will be the "Primary Sound Capture Device".
6. Press the Play button to start viewing the input signal amplitude against time. At this point the signal may or may not be too big to see.
7. Adjust the Y-scale slider within the AUDIOSCOPE software until pulses similar to those shown are received.
8. The horizontal red line shown on the graph represents the threshold level, whenever a pulse crosses this threshold, one of the 6x counters on the top line within the Decode group will increment.
9. Ensure that all levels are adjusted so that all pulses cross this line and all background noise is below this line. Fine adjustment of the Y-scale slider can be achieved by clicking on the slider and then using the keyboard up and down arrow keys.

3. WINDOWS 7 AND 8 AUDIO CONTROLS

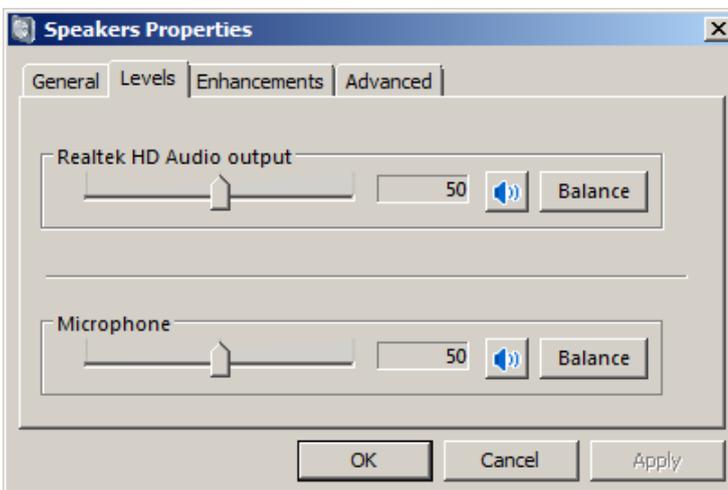
Note that these settings are relevant to Windows 7 and 8 which are Online Electronics' usual operating systems. Different operating systems will have similar controls and these instructions can be used to help understand them.

With the receiver turned on and plugged into the Microphone input on the laptop and a pair of headphones plugged into the Headphone output of the laptop follow the steps below.

From the desktop right click on the grey speaker symbol in the taskbar and click on Playback panel shown.



From within the Sound control panel Playback tab double click on the enabled Speakers device (green tick indicates the device is enabled) to access the Speakers Properties window shown.

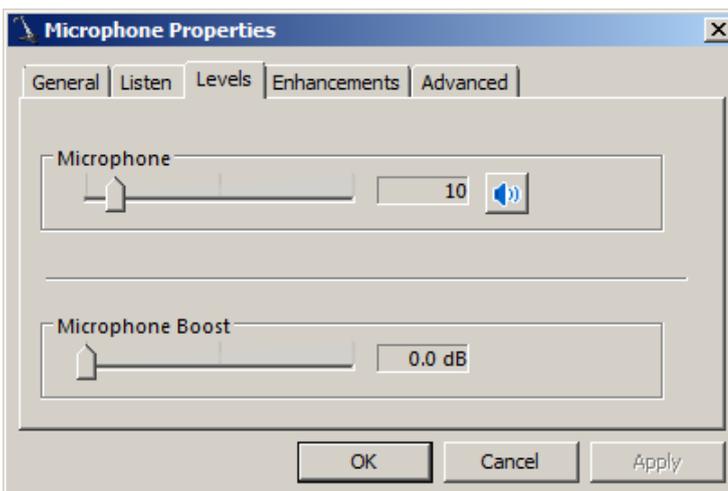


On the Speaker Properties Levels tab adjust the output volume and Microphone volume to 50% as shown. Ensure that both are not muted.

Move to the Enhancements tab and ensure Disable all sound effects has been selected.

Press OK to confirm changes and return to the Sound control panel.

From within the Sound control panel Recording tab double click on the enabled Microphone device to access the Microphone Properties window shown.



On the Microphone Properties Levels tab adjust the Microphone level to 10% and the Microphone Boost to 0.0 dB as shown. Ensure that the microphone is not muted.

Move to the Enhancements tab and ensure Disable all sound effects has been selected.

Move to the Listen tab and ensure Listen to this device has been selected.

You should now be able to hear the audio received by the microphone input over the headphones. If the sound is too loud then use the normal volume control on the laptop to reduce the volume.

4. INSTALLATION

There are three stages to the software installation described below. Ensure that the software has been installed and tested well in advance of when it will actually be required.

4.1. MICROSOFT .NET FRAMEWORK INSTALLATION

The software supplied by Online Electronics requires the Microsoft .NET Framework to be installed on the host PC. For more information about the .NET Framework, or to download the latest version, visit www.microsoft.com/net. The latest version can also be found on the memory stick supplied by Online Electronics and can be installed by following the instructions below.

1. Log into the host PC as an administrator with full administrator rights.
2. Execute the dotNetFx40_Full_x86_x64.exe file found in the .NET folder on the memory stick.
3. Follow all instructions provided on screen to complete the installation.

4.2. MICROSOFT DIRECTX INSTALLATION

The software supplied by Online Electronics requires the Microsoft DirectX Multimedia Application Programming Interfaces to be installed on the host PC. For more information about DirectX, or to download the latest version, visit <http://www.microsoft.com/en-gb/download>. The latest version can also be found on the memory stick supplied by Online Electronics and can be installed by following the instructions below.

1. Log into the host PC as an administrator with full administrator rights.
2. Execute the DXSETUP.exe file found in the DIRECTX folder on the memory stick.
3. Follow all instructions provided on screen to complete the installation.

4.3. AUDIOSCOPE SOFTWARE INSTALLATION

To install the software supplied by Online Electronics follow the instructions below.

1. Log into the host PC as an administrator with full administrator rights.
2. If a previous version of the AUDIOSCOPE software is already installed uninstall it using Start menu > Control Panel > Programs > Uninstall a Program.
3. Execute the setup.exe file found in the AUDIOSCOPE folder on the memory stick.
4. Follow all instructions provided on screen to complete the installation.
5. The software will now be available in the Start menu.