

professional measurements by

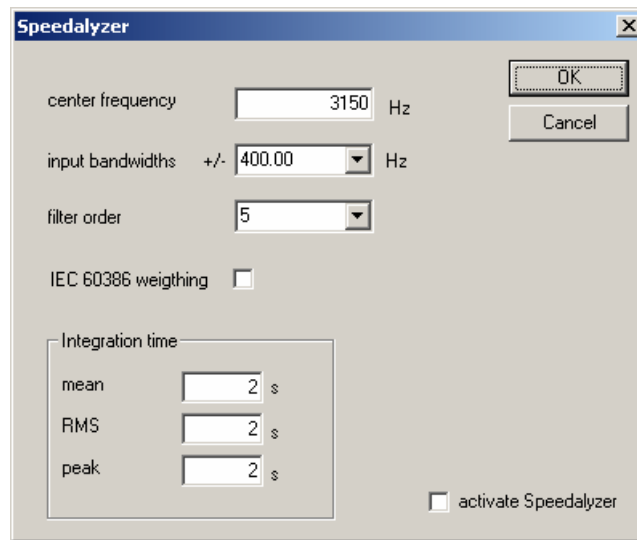
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1 Speed Analyser Plug-In (Speedalyzer)

This plug-in is a very versatile tool to monitor frequency deviations. It is applicable for all kind of rotating machines, in particular tape recorders or turntables, but not limited to these. The Speedalyzer can monitor low speed variations (wow) or fast variations which are known as flutter. You can monitor the variation in the time domain as well as in the frequency domain. The Speedalyzer shows constant speed variations (mean), peak and RMS. You can enter an individual time constant for each display.

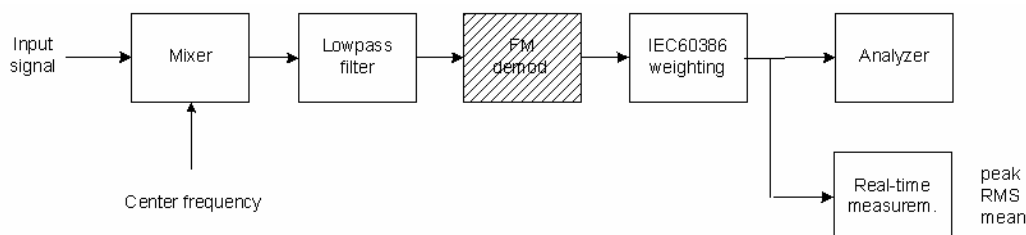
For the special case of tape machines, you can activate special weighting filters according to IEC60386/ CCIR 408. The widely used measurement frequencies of 3000Hz and 3150Hz are supported.

The analysis can be performed on live audio input or from .wav files.

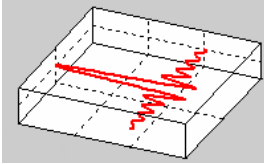


1.1 Architecture

The Speedalyzer contains a mixer, that shifts the input signal into the equivalent baseband representation. The center frequency is freely adjustable, depending on the package you ordered. An adjustable low-pass filter removes noise and aliasing mirror signals. You can adjust the cut-off frequencies within a 1/3 octave grid. The core component is a FM-demodulator. You can monitor the output signal in the time domain or with the FFT in the frequency domain. The Speedalyzer computes all three measurement values (mean, peak, RMS) from the time domain signal.



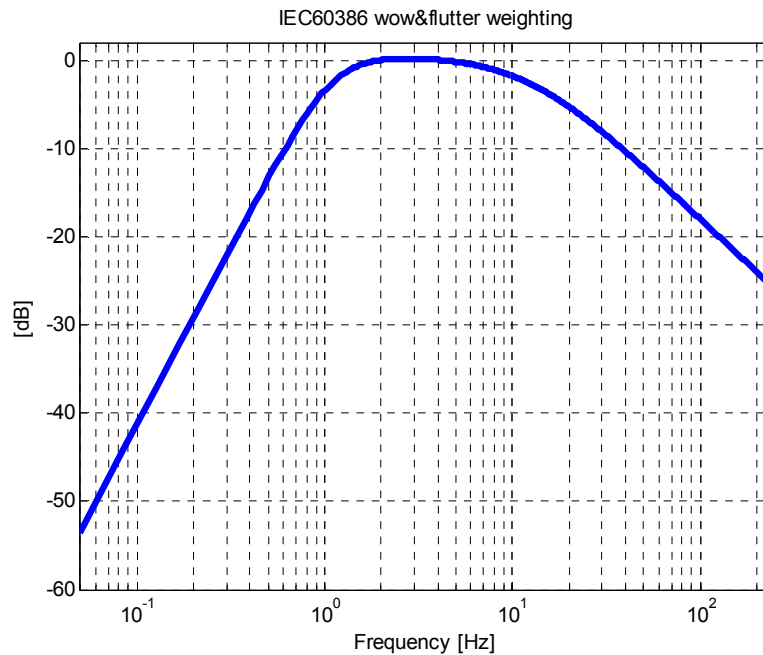
You can weight the signal with a special filter according to IEC60386 which is widely used for tape machine analysis.



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It has an attenuation of 0dB at 4Hz. It suppresses constant speed differences (DC component) and shows speed fluctuations, only. The picture below shows the frequency plot of such filter.



1.2 Real-time display

If you activate the Speedalyzer you will see a measurement window in addition to the signal itself. This measurement window contains:

1. Mean: Constant deviation from the center frequency
2. RMS: Root mean square
3. Peak: Maximum deviation

The display contains the relative values with respect to the center frequency and the absolute value in Hz. For each value you can enter a integration time constant for smoothing. A larger value suppresses fluctuations and reaches a higher precision, but requires a larger measurement time. The default value is 2s

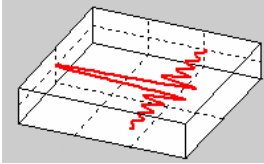
1.3 FM-Demodulator

If you enter a center frequency of 0Hz, the Speedalyzer converts to a pure digital FM-demodulator with adjustable bandwidths.

1.4 Frequency measurement

The Speedalyzer can measure frequency deviations with high precision. With an integration time of 2s the precision reaches already 1/100Hz. With 5s you reach typical 4/1000Hz. In this range the error is already dominated by quartz precision. A typical quartz used in Soundcard reaches 20ppm. At 44.1kHz sample rate, the error caused by the quartz is 0.8Hz. The precision of the Speedalyzer software is higher by two magnitudes.

With a pure FFT analysis this value is difficult to reach, because you will have to use extremely high FFT block sizes.

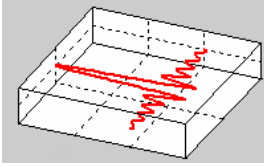


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1.5 Packages

We offer the Speedalyzer in two packages with different feature set. The first (Speedalyzer light) is focused on tape machine measurements. It is limited to 3 and 3.15kHz sample rate. The second version is not limited and is used for generic purposes.



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1.6 Measurements for tape machines

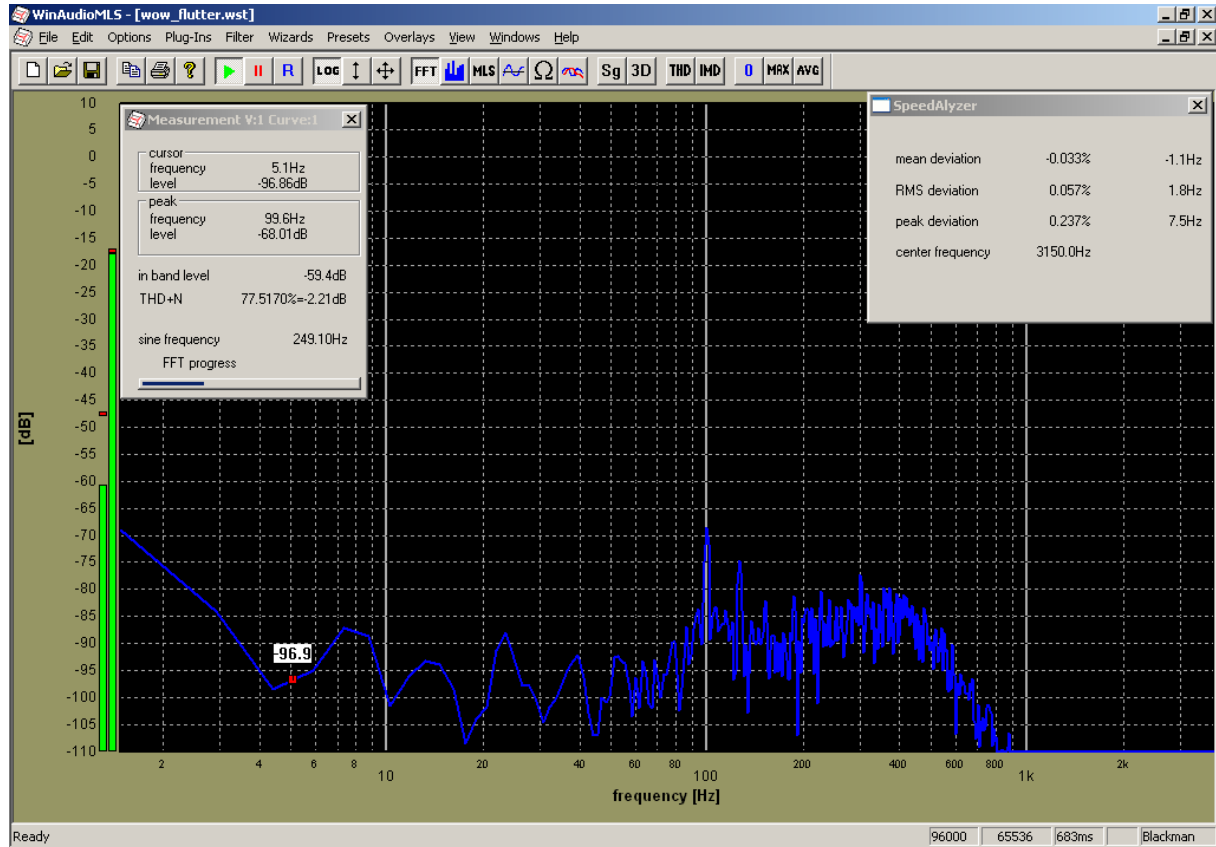
For measurements with tape machines you will need a reference tape with 30 or 3.15kHz pilot tone.

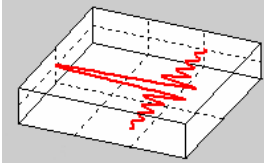
Connect the output of the tape machine with the input of your soundcard. When you active the Speedalyzer module, it will show the measurement results immediately.

If you do not own a reference tape, you can help with a recording from a known intact machine. In this case you will measure the error of both machines. In no case you should use the tape monitor, because in this case only a few parts of the tape mechanic are measured.

1.7 Example

The following measurement shows the analysis of a studio tape machine in the frequency domain. We use a large FFT size (64k) to reach sufficient frequency resolution.

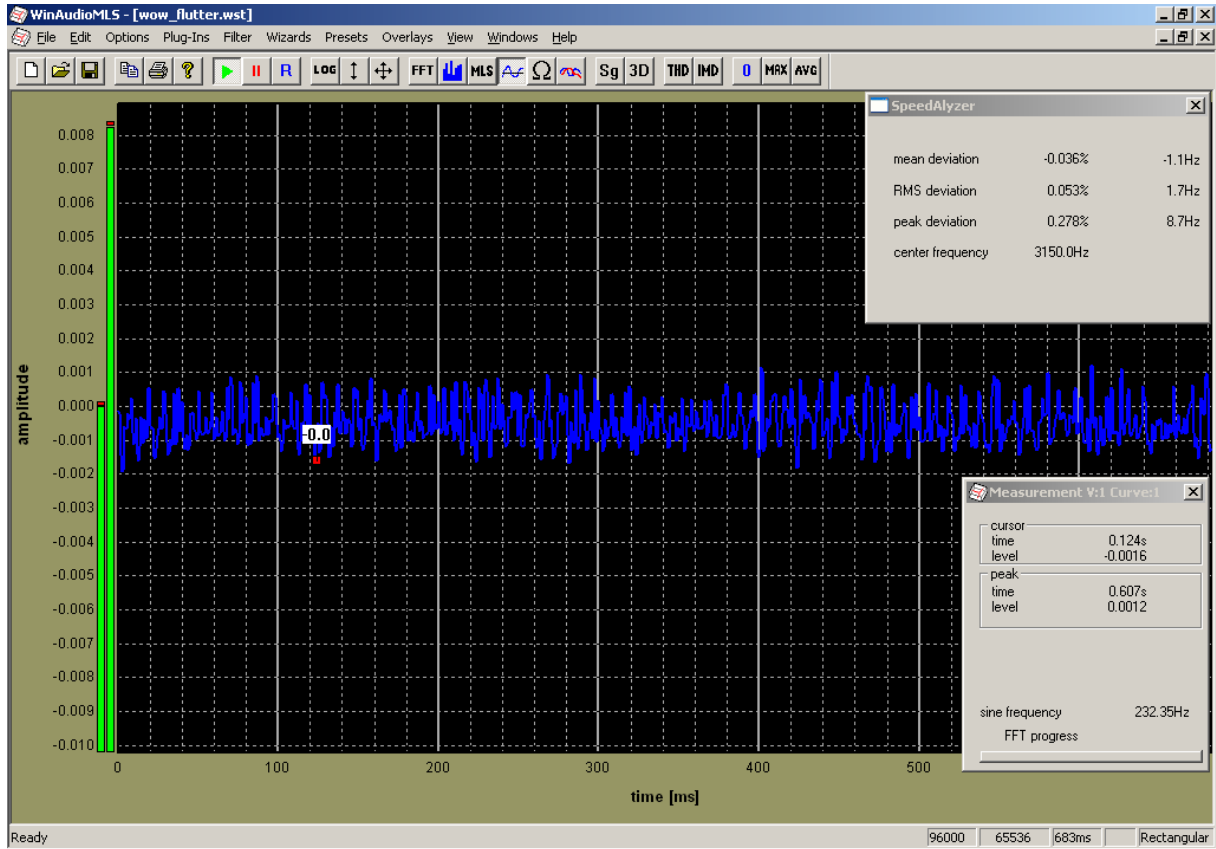


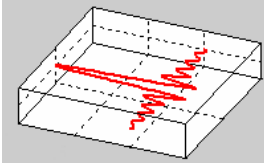


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The following measurement shows the same signal in the time domain. The y-axis shows the relative frequency deviation.





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1.8 Test signals

We offer a free tool that can generate arbitrary wow&flutter signals. You can enter the following parameters to the dialog box. The output is .wav file that can be played with any multimedia player. Of course you can also analyse this file with WinAudioMLS.

Parameter	Value	Unit
Sample Rate	44100	Hz
Mod. Frequency	4	Hz
Center Frequency	3150	Hz
Level	1	%
Duration	30	s
File Name	test.wav	

The settings above generate a .wav file named „test.wav“ with a length of 3 seconds. The modulation signal is a pure sine with 4Hz modulation frequency. The center frequency is 3150Hz. The peak level wow&level is 1%. This tool is ideal for training and calibration purposes.