

# Re: Audio Tachometer for 2 stroke engine

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*Source:* <http://sci.tech-archive.net/Archive/sci.electronics.design/2005-04/msg04876.html>

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- *From:* "Mook Johnson" <[mook@xxxxxxxx](mailto:mook@xxxxxxxx)>
  - *Date:* Wed, 27 Apr 2005 02:36:42 GMT
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While it is completely understood that hall or opto sensing would provide dead accurate RPM measurement and is in use now by other similar products, the downfall is that it requires wires to connect the external hall sensor to the package. the package cannot be placed close enough to the output shaft or flywheel to directly make the measurement. Wires are something I'm trying to avoid.

Don't assume I'm limited to a PIC processor. I'm mor than happy to throw a DSP at it and compute FFTs and FIR filter the input signals to get the answer.

The basis behind the original question is that I suspected that I could sample the signal and filter it and FFT it and the tallest peek would be the loudedt point which I would assume to be the engine noise. LOUD. But Ross is correct, the boat goes through hell while skimming across the water at 70+ MPH. Vibration, water spray, etc.

The groundrules for using this device is that a single boat on the water is run then brought in.

The exhaust of these engines is tuned (expansion chamber) to there are echos and reverbs all over.

Would be a interesting DSP problem, the information I'm after is in there but how do I get it out.

"Ross Herbert" <[rherber1SPAMEX@xxxxxxxxxxxxxxxx](mailto:rherber1SPAMEX@xxxxxxxxxxxxxxxx)> wrote in message [news:26qt61hq1vqu35ce2an5gne48dk84jq1up@xxxxxxxx](mailto:news:26qt61hq1vqu35ce2an5gne48dk84jq1up@xxxxxxxx)  
> On Wed, 27 Apr 2005 01:30:00 +0100, nospam <[nospam@xxxxxxxxxxxxxxxx](mailto:nospam@xxxxxxxxxxxxxxxx)>  
> wrote:  
>  
>> Ross Herbert <[rherber1SPAMEX@xxxxxxxxxxxxxxxx](mailto:rherber1SPAMEX@xxxxxxxxxxxxxxxx)> wrote:  
>>  
>>>> It likely doesn't need to filter out much at all. The rapid opening of a  
>>>> two stroke exhaust port to release the results of a recent explosion  
>>>> produces a huge pressure impulse. I would not be surprised to find it  
>>>> 10's  
>>>> of db larger than any other source although I am assuming these high

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>>>>performance models do not have silencers.  
>>  
>>>While this is true the fact remains that any spurious and random noise  
>>>source would interfere with the wanted sound. It is not simply a  
>>>matter of detecting the amplitude of the desired signal. Since an  
>>>electret is extremely sensitive to both sound and physical vibration,  
>>>and is physically mounted in the boat which is speeding (hopefully)  
>>>over the water, it will pick up every sound and vibration, including  
>>>harmonics and sub-harmonics, wanted or not. Filtering would not be as  
>>>easy as hoped for, I imagine.  
>>  
>>If someone fires a gun next to you head you are telling me you might not  
>>be  
>>able to count how many times because of someone rattling plates or having  
>>a  
>>conversation on the next table?  
>  
> This analogy is in no way comparable to the task the OP wants to  
> achieve.  
>  
>>  
>>If the impulse is 10 times larger than any other signal you don't need  
>>fancy circuitry to detect it and ignore everything else.  
>  
> Exactly. And a simple electret mic with op-amp filtering plus a PIC to  
> handle the data collection and readout is simply not good enough to  
> achieve this in practice.  
>  
>>  
>>>>My biggest worries would be the risk of hearing reflections of itself in  
>>>>a  
>>>>resonant exhaust system, and the dynamic range of the microphone, even  
>>>>mechanical damage to the microphone.  
>>  
>>>Aha!, you are tending to agree with the gist of my criticism.  
>>  
>>Not really just speculating that if you put a microphone somewhere near  
>>the  
>>end of the exhaust the impulse would be so loud that it would exceed the  
>>dynamic range of a normal microphone and possibly damage it. If I were  
>>doing the job one of the things I would try is using an element from a  
>>piezo sounder as a pickup.  
>  
> An electret mic and a piezo transducer ain't a lot different in this  
> environment.  
>  
>>  
>>>>The OP should record a sample from a running engine and see what it  
>>>>looks  
>>>>like. He might also consider using a directional microphone from the  
>>>>shore.

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>>  
>>>Assuming that one could design a system as proposed, the final test of  
>>>accuracy and reliability has to be realised. After extensive bench  
>>>testing it would need to be tried in practice on the water. If all  
>>>goes well, the tacho will record the rpm as intended, but, how will we  
>>>know if the readout is accurate?  
>>  
>>Because one can't see any mechanism in the system to give a consistently  
>>inaccurate readout and you already know approximately what the readout  
>>should be?  
>  
> Oh, it's that simple eh, "one can't see any mechanism", is that it?  
> You don't seem to understand that this is a totally unscientific  
> method of establishing facts and is nothing more than guessing.  
>  
>>  
>>>We would need to have some known  
>>>accurate system to compare the readings against, wouldn't we? What  
>>>this means is that you would also have to install a reference system,  
>>>one which is known to be free of all of the negative aspects I have  
>>>referred to,  
>>  
>>and how would you know that system is free from those aspects, and free  
>>from other negative aspects you didn't refer to?  
>  
> Simply because when any method of measurement is established it has to  
> be compared against a previous accepted standard and can be shown to  
> be as good or better in performance.  
>  
>>  
>>>and is tried and proven to accurately measure rpm of the  
>>>motor or drive shaft.  
>>  
>>And how did you prove this other system accurately measures the motor rpm?  
>  
> See above answer. To spell it out specifically... In the beginning  
> when tachometers were first designed they were totally mechanical with  
> a physical connection to the rotating part being counted, and using  
> proven mathematical relationships and engineering techniques.  
>>  
>>With another system you haven't proven either?  
>  
> If they aren't proven to work as intended then how do you suppose they  
> get to be used in industry and commerce to support the correct  
> maintenance and operation of mechanical plant using rotating parts  
> such as motors etc. In order for them to be accepted they first had to  
> be compared with what existed before.  
>  
>>  
>>At some point you have to say if it quacks like a duck it is a duck and in  
>>this case duck quacks are not that hard to recognise.

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- >
- > Again, a totally unscientific way of establishing fact from fiction.
- >
- >>
- >>>This implies that a known reliable non-contact method such as magnetic
- >>>hall-effect (pulse), or opto reflective method must be used as the
- >>>signal source because these methods are well established and widely
- >>>used to perform the same function in industry already. Having said
- >>>that, doesn't this suggest that if there is already a reliable system
- >>>of deriving the required rpm data with which to compare that obtained
- >>>by the new "audio based" system, then why do we need the new system in
- >>>the first place?
- >>
- >>Because the system the OP proposes can be stuck on (and removed from) any
- >>boat with no modifications to the boat other than adding a bit of sticky
- >>back velcro. That is why I suggested he considers listening from the shore
- >>which is even more convenient.
- >
- > If you look around you will readily find non-contact optical
- > tachometers which can also simply be "stuck on (and removed from any
- > boat" and which will do exactly what the OP wants. I don't intend to
- > do that for you but I have noted several items which would do the job.
- > Readily available small products capable of measuring to 100,000 rpm
- > sell for around AUD300+ depending upon capabilities required. On
- > systems such as high speed pcb drilling machines the tacho's can
- > measure to 300,000 rpm using optical means. Optical sensing eliminates
- > 99.999% of the possible causes of measurement error, which just isn't
- > the case for audible sensing.
- >
- > And your proposed method of "listening from the shore" is just as
- > hair-brained as the electret mic on the boat.

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• **References:**

- ◆ **[Audio Tachometer for 2 stroke engine](#)**  
    ◇ From: Mook Johnson
  - ◆ **[Re: Audio Tachometer for 2 stroke engine](#)**  
    ◇ From: BobG
  - ◆ **[Re: Audio Tachometer for 2 stroke engine](#)**  
    ◇ From: nospam
  - ◆ **[Re: Audio Tachometer for 2 stroke engine](#)**  
    ◇ From: nospam
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