Pro Tuner Knock Ears Kit 2014

Included:

- Two x 2 wire knock sensors with AMP style connector.
- Single 3 wire knock sensor lead with shield for connection to 1 knock sensor.
- Dual 3 wire knock sensor leads with shield for connection to 2 knock sensors.
- Dual sensor sensitivity adjustment for fine tuning of the knock sensors.
- Stereo listening through professional industrial quality headset and ipod style ear pieces.
- Dual overall volume control on headset.
- Selectable switch for 1 sensor use, converts to mono listening through headset.
- Cigarette power supply lead.
- Battery power supply lead with alligator clips for attachment to battery.
- Spares kit, assorted terminals for loom repairs.
- Plastic case with laser engraving.
- 5 year warranty on Knock Unit.
- 1 year conditional warranty on all other components

- Aircraft quality headsets
- Passive noise canceling
- Dual volume controls
- Foam ear pads

- 3 Core shielded cable
- Molex connector
- Power supply x 2

- 2 Wire knock sensors

What is Knock

Many of us have heard the term and also witnessed the final outcome of knock related engine failures. How then might we better understand this phenomenon? How might we then guard against it happening in our expensive road or race bred engines? These are good questions. A step to getting a hold of this concept will start with an understanding of normal combustion, where knock is not evident.

To begin, we shall concentrate on the ignition phase of the 4-stroke engine cycle. I will assume you are familiar with the Otto-cycle of intake, compression, combustion and exhaust strokes common to most engines we come into daily contact with, however the general principles apply to 2 stroke engines as well.

At the point of ignition, the mixture of fuel and air has been compressed by the compression stroke to a point where it can be efficiently ignited, usually by a single spark at just the right time. When the spark ignites the mixture, it normally causes the propagation of a flame front that moves like the ripple of a stone dropped in a pond, to envelope all of the fuel air mixture in the clearance volume at the top of the piston.

The key here is the orderly nature of flame propagation. It is not an explosion, which is an instant uncontrolled event. On the contrary, it is orderly and progressive, starting at one place (the spark gap) and proceeding until all the available mixture is burnt. This takes a finite amount of time. In order to extract the most work (power output) from each combustion event, the ignition is advanced to a number of degrees before top dead center to account to this delay. Exactly how many degrees of advance is optimum will depend on many factors, but the dominant one is engine speed. For a given (fixed) burn time, at high engine speeds the ignition will have to be advanced by more degrees than at low speeds, all other factors being equal. There is more to that story, as we shall find out, however the extent of this explanation shall suffice for now.

Remember now, how we talked about the orderliness of the combustion event? This is the crucial factor. The ready-to-burn mixture is ideally in a state of turbulence for good mixing and the when the spark sets it off; most of the combustion takes place away from the metal parts. In an optimum world, only a smallish portion of the heat of combustion finds its way to the cylinder walls and the other metal components such as the cylinder head chamber or the valves and it mostly does this where the burning gas touches the metal surfaces. (Remember this point).

So stable controlled combustion minimizes heat loss to the water jacket and allows the metal components to live without stress. This leaves a significant proportion of the heat left over to do what we want, and that is to expand the intake gas by making it hot and pressurized. Simple enough. The hot gas can then only become expanded when the piston moves down the bore, generates mechanical work turning the crankshaft and this wins you the race. The hot gas becomes cooler as it expands and the energy lost to the gas comes out at about 30% in exhaust heat, 30% in water jacket heat, and 30% (roughly) in energy to turn the crankshaft to push you forward and prepare any other cylinders on the crankshaft to fire.

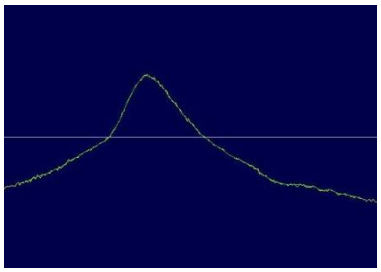
So what of knock then? In simple terms knock occurs when the orderly combustion process breaks down. It turns out that petrol and most hydrocarbon fuels have distinct limits of pressure and temperature at which they will sustain orderly combustion. What happens when these limits are reached is that the fuel mixture will self ignite (a bit like a diesel) so that there are pockets of self-ignition combustion distinct from the spark-originated combustion.

This causes considerable disarray in the combustion event. The combustion is no longer ordered and stable. It often happens that a particular part of the combustion chamber will trigger a separate self-ignited flame origin. This causes a localized pressure event that pushes or distorts the remaining un-burnt mixture with such force it will wobble backwards and forwards in the combustion chamber and makes the combustion chamber contents ring like a bell for an instant. While that ringing or washing backwards and forwards is happening, of course the mixture is continuing to burn. This causes the burning mixture to contact much more of the surrounding metal parts than it would normally do (more surface area is exposed) and so it imparts far more heat by conduction to those metal surfaces. What results is a kind of runaway process. The super-hot component (valve edge, squish nose, poorly cooled patch of chamber floor/piston crown) will then likely cause another unstable combustion event, and that will add more heat to these susceptible areas and before long,

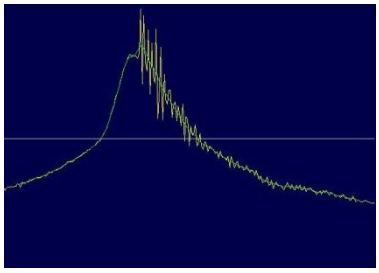
pinging/knock/detonation become the rule and engine destruction becomes inevitable if left alone. Other knock causes are also related to temperature such as exhaust gas contamination. Here exhaust backpressure may cause hot exhaust gas to leak back into the combustion chamber during valve overlap and kick off premature ignition, causing knock. However poor cooling distribution around the combustion chambers or high inlet charge temperatures are often the most dominant causes of knock for most designs.

Engine Knock Photos

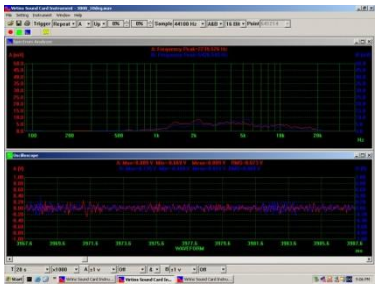
No Engine Knock
Image from cylinder pressure sensor
See the smooth rise in pressure
and the smooth decline in pressure
This is a normal pressure trace in a combustion chamber when no knock occurs



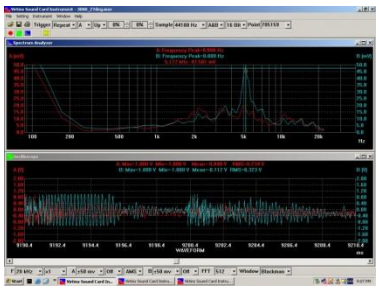
Hard Engine Knock
Image from cylinder pressure sensor
See the smooth rise in pressure then
the loss of control with cylinder pressure
The pressure in the combustion chamber almost doubles when hard engine knock occurs



No Knock at 3000 rpm. 17 degrees
Image generated by high end sound recording equipment
Red trace is engine background noise
Blue trace is no engine knock
Both traces are of similar appearance



Hard Knock at 3000 rpm. 27 degrees
Image generated by high end sound recording equipment
Red trace is engine background noise
Blue trace is hard engine knock
When engine has knock the noise is far louder than the engine background noise
You will see by the large blue spike that the engine knock happens in this example at 5.2Khz



How does THE KNOCK BOX help?

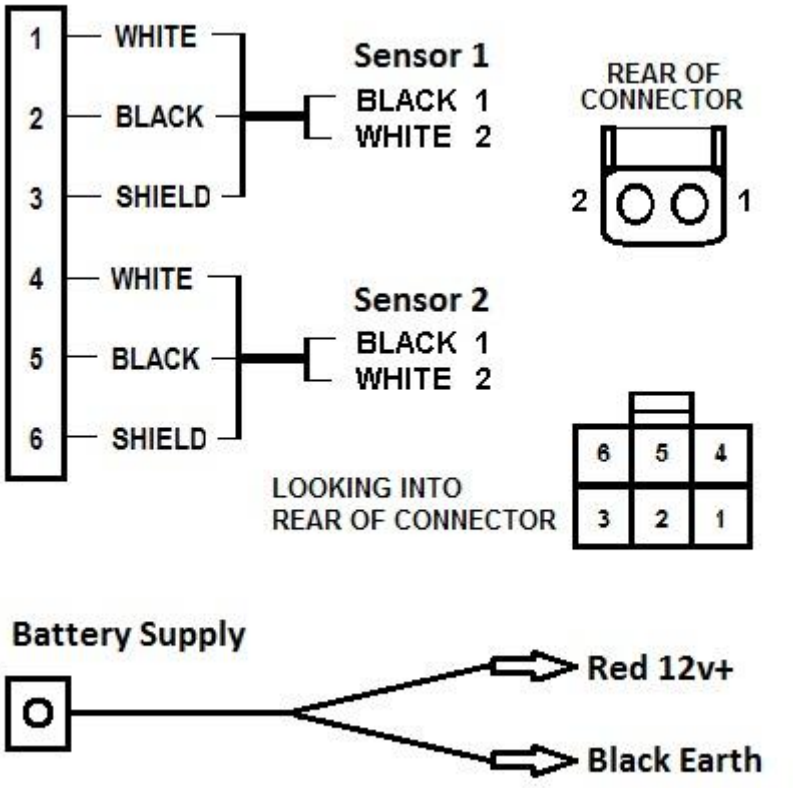
As I illustrated before, the ringing of the knock event is a resonance of the hot gas in the confined clearance volume. It has a resonant frequency that depends on the density of the gas and size of the enclosed volume and when this volume is disturbed in a knocking engine cycle, it will ring like a bell for a short instant.

For most practical engines this ringing frequency is broadly between 5 and 12 Kilohertz (about 5,000 to 12,000 cycles per second). Older people cannot hear much usefully above 12 KHz, however almost everyone with normal hearing can discriminate up to 10 KHz.

THE KNOCK BOX has sensors that fit to the engine block, usually in two widely spaced places to get better coverage. The engine tuner will advance the timing until best torque output is found, or he can hear a faint irregular spattering against the background noise of the regular sound of reciprocating engine components in the headphones. This widely spaced irregular spattering sound is the onset of knock and most un-tuned road engines will sustain light knock for extended periods without damage.

It is the irregularity of light knock that we are listening for, rather like the sound of the first drops of rain on a tin roof. Advancing the ignition to light knock has the same characteristic irregularity as sparse raindrops, then passing into more knock events until there is a storm of spatters as ignition is advanced. When there are so many knocking events that it sounds like a hailstorm, back off immediately! The idea is to listen for the onset of knock, (this first few spits per second) and then back off a degree of timing or so and run again to check the setting; but more of that later.

Wiring Diagram



General Tips

- Mount sensors on block as high as possible near cylinder head.
- Try not to mount near rockers as high tappet noise will occur.
- Keep wiring and sensors away from exhaust heat as much as possible and if needed make heat shield to protect them.
- If the two sensors are mounted in different positions, use the sensor balance to even out the sound, so that the sound is even in the headset.
- If 1 sensor is to be used only, select sensor 1 on sensor select switch and use sensor 1 connector only.
- Use the volume control to adjust the overall volume in the headset and set to a comfortable level.
- Disconnect power supply from battery when not in use or your battery will go flat.
- Treat knock sensors with the utmost care. Do not drop them.
- The unit has a selectable switch for 1 or 2 sensors.

Power Supply Specifications

- Powered from any 12 volt power supply.
- Fused on both positive and negative using 0.25 amp fuses.
- Over voltage protected.
- Reverse polarity protected.

Warranty

- THE KNOCK BOX unit and headset is covered by a 12 month warranty from date of sale.
- Wiring looms have a 12 month limited warranty depending on faults.
- The new knock sensors supplied by SRS KNOCK BOX have no warranty at all due to being sensitive electronic components.
- THE KNOCK BOX was designed for listening to engine noise.
- The user is totally responsible for any interpretation of noise that occurs while THE KNOCK BOX is in use.
- SRS KNOCK BOX takes no responsibility whatsoever for any damage that occurs while THE KNOCK BOX is in use.

WARNING - HALTECH OFF-ROAD USAGE POLICY

It is unlawful to tamper with your vehicle's emissions equipment.

Haltech products are designed and sold for sanctioned off-road/competition non-emissions controlled vehicles only. Using Haltech products for street/road use on public roads is prohibited by law. It is the responsibility of the installer and/or user of this product to ensure compliance with all applicable local and federal laws and regulations. Please check with your local vehicle authority before using any Haltech product

INSTALLATION OF HALTECH PRODUCTS

No responsibility whatsoever is accepted by Haltech for the fitment of Haltech Products. The onus is clearly on the installer to ensure that both their knowledge and the parts selected are correct for that particular application. Any damage to parts or consequential damage or costs resulting from the incorrect installation of Haltech products are totally the responsibility of the installer.

Always disconnect the battery when doing electrical work on your vehicle. Avoid sparks, open flames or use of electrical devices near flammable substances. Do not run the engine with a battery charger connected as this could damage the ECU and other electrical equipment. Do not overcharge the battery or reverse the polarity of the battery or any charging unit. Disconnect the Haltech ECU from the electrical system whenever doing any welding on the vehicle by unplugging the wiring harness connector from the ECU. After completing the ECU installation, make sure there is no wiring left un-insulated. Uninsulated wiring can cause sparks, short circuits and in some cases fire. Before attempting to run the engine ensure there are no leaks in the fuel system. All fuel system components and wiring should be mounted away from heat sources, shielded if necessary and well ventilated. Always ensure that you follow workshop safety procedures. If you're working underneath a jacked-up car, always use safety stands!

HALTECH LIMITED WARRANTY

Unless specified otherwise, Haltech warrants its products to be free from defects in material or workmanship for a period of 12 months from the date of purchase, valid in the original country of purchase only. Proof of purchase, in the form of a bill of sale or receipted invoice, which indicates that the product is within the warranty period, must be presented to obtain warranty service. Haltech suggests that the purchaser retain the dealer's dated bill of sale/receipt as evidence of the date of retail purchase. If the Haltech product is found to be defective as mentioned above, it will be replaced or repaired if returned prepaid along with proof of purchase. This shall constitute the sole liability of Haltech. To the extent permitted by law, the foregoing is exclusive and in lieu of all other warranties or representations, either expressed or implied, including any implied warranty of merchantability or fitness. In no event shall Haltech be liable for special or consequential damages.

PRODUCT RETURNS

Please include a copy of the original purchase invoice along with the unused, undamaged product and its original packaging. Any product returned with missing accessory items or packaging will incur extra charges to return the item to a re-saleable condition. All product returns must be sent via a freight method with adequate tracking, insurance and proof of delivery services. Haltech will not be held responsible for product returns lost during transit. The sale of any sensor or accessory that is supplied in sealed packaging is strictly non-refundable if the sealed packaging has been opened or tampered with. This will be clearly noted on the product packaging. If you do not accept these terms please return the sensor in its original unopened packaging within 30 days for a full refund.

Returning a sensor or accessory product within 30 days of purchase: Product may be returned for credit or full refund. (Any sealed packaging must not have been opened or tampered with)

Returning a sensor or accessory product after 30 days of purchase: Product may be returned for credit only (no refunds given) and is subject to a 10% Restocking fee. (Any sealed packaging must not have been opened or tampered with)